OBSEVANJE BENIGNIH BOLEZNI

Strokovno srečanje
7.3.2024

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strokovno srečanje Združenja za radioterapijo in onkologijo

Ljubljana, 7.3.2024

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PROGRAM SREČANJA

14:30-14:40	**UVOD**	
14:40-15:05	***Boris Jančar*** Onkološki inštitut Ljubljana	**Izkušnje zdravljenja benignih bolezni z obsevanjem na OI ljubljana v preteklosti**
15:05-15:30	***Angel Montero Luis*** CIOCC, HM Hospitales, Madrid, Španija	**Radiation therapy of benign disease – an overview**
15:30-15:55	***Angel Montero Luis*** CIOCC, HM Hospitales, Madrid, Španija	**How we do it in Spain (COVID-19, trigeminal neuralgia, osteoarticular disorder)**
15:55-16:05	**DISKUSIJA**	
16:05-16:30	**ODMOR**	
16:30-16:50	***Urška Kidrič Sivec*** Univerzitetni rehabilitacijski inštitut Ljubljana	**Obsevanje mišičnoskeletnega sistema – pogled fiziatra**
16:50-17:10	***Ivica Ratoša, Helena Barbara Zobec Logar*** Onkološki inštitut Ljubljana	**Obsevanje pri osteoartikularni bolečini**
17:10-17:25	***Uroš Smrdel*** Onkološki inštitut Ljubljana	**Obsevanje benignih bolezni v CŽS**
17:25-17:40	***Blaž Grošelj*** Onkološki inštitut Ljubljana	**Obsevanje žilnih malformacij izven CŽS**
17:40-17:55	***Jasna But Hadžić*** Onkološki inštitut Ljubljana	**Stereotaktična radioterapija telesa za zdravljenje refraktarne prekatne tahikardije**
17:55-18:10	***Janka Čarman*** Onkološki inštitut Ljubljana	**Obsevanje in amiloidoza**
18:10-18:20	**DISKUSIJA**	
18:20-18:30	**ZAKLJUČEK SREČANJA**	

OBSEVANJE BENIGNIH BOLEZNI NA ONKOLOŠKEM INŠTITUTU

Mb. Dupuytren
Mb.Lederhose

Spina calcanei
Mb Haglund
Heterotopna osifikacija

Keratoakantom
Epikondilitis (teniški komolec)
Keloidi
Mb Rendu Osler Weber

Hemangiom žilnice
Pterigij

Ščitnična orbitopatija
Dezmoidni tumorji
Lentigo maligna

Periartritis humeroscapularis
Osteoartrosis
Ginekomastija(preventivno)
Limfatična fistula
Kronični ekcem
Luskavica

OBSEVANJE BENIGNIH BOLEZNI

MB. DUPUYTREN
MB LEDDERHOSE

Zdravljenje z obsevanjem

Morbus Dupuytren ali Dupuytrenova bolezen (Db) je benigna progresivna fibroproliferativna bolezen fascije dlani in je sorodna fibromatozi podplatov (Mb. Ledderhose).

Obolenji nista izolirani ampak sta del sistemske prizadetosti vezivnega tkiva, ki se lahko izrazi tudi z fibroznimi depoziti na dorzalnih interfalangealnih sklepih (knuckle pads), uhljih, zapestjih, komolcih in penisu (Mb. Peyronie)

1614-Felix Platter –deformacija tetive fleksorja prsta
1777-Henry Cline-prizadetost fascije dlani
1843- Guillame Dupuytren - članek v reviji Lancet.
1897- Georg Ledderhose

Vzroka nastanka bolezni ne poznamo.

Bolezen je neozdravljiva.

POTEK BOLEZNI

NEKONTROLIRANA RAZRAST FIBROBLASTOV

1 faza: razrast **fibroblastov**.
Klinično: odebelitev fascije = značilen vozlič, invazija v kožo povzroči nagubanje in fiksacijo

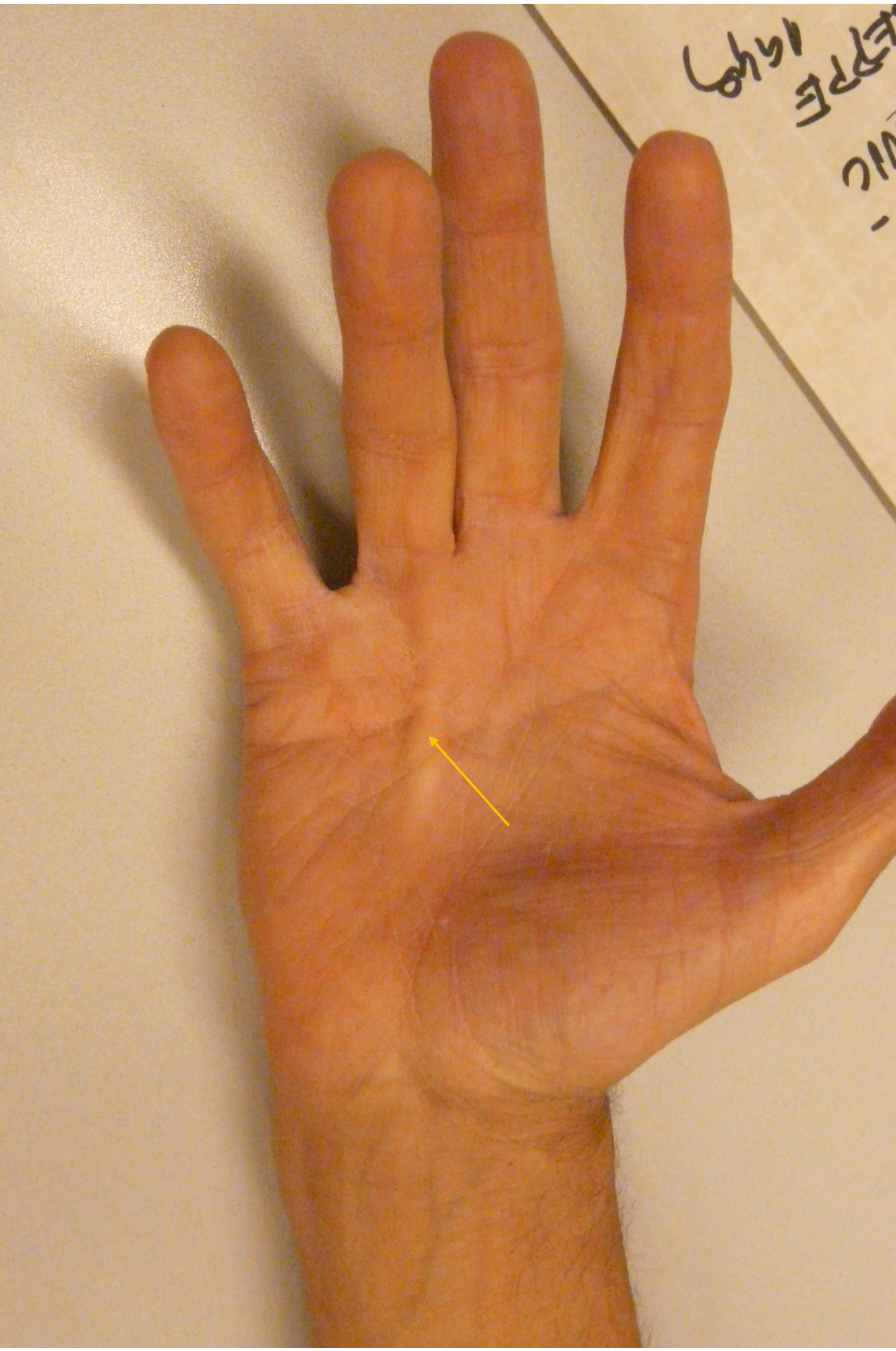
2. faza:diferenciacija fibroblastov v **mioblaste.**
Klinično: čvrsti fibrozni trakovi vzdolž tetiv, nastanek kontrakture

3.faza: nastanek kolagena tipa 1.
Ko trakovi dosežejo periost postane iztegovanje prstov omejeno in doseže končno stanje z fleksijsko kontrakturo prstov.

Klasifikacija: Tubiana R, (1966)

Stadij	Klinični znaki	Deficit ekstenzije
N	Vozliči, trakovi, nagubana koža, fiksacija	nič
N/1	Enako kot N ter deformacija prstov	1-10 °
1	Enako kot N ter deformacija prstov	11-45°
2	Enako kot N ter deformacija prstov	46-90°
3	Enako kot N ter deformacija prstov	91-135°
4	Enako kot N ter deformacija prstov	Več kot 135°


2a
2b
1a
1b
3
2c
4b
4a



Potek bolezni je zelo različen. Bolezen lahko napreduje zelo počasi , lahko tudi za krajši ali daljši čas stagnira, le zelo redko pride do spontane regresije.
Najbolj pogosto se bolezen začne na tetivi prstanca in mezinca.
Proces običajno ni boleč, zato lahko ostane dalj časa neopazen.

BREZ ZDRAVLJENJA BOLEZEN NAPREDUJE TAKO, DA PRI 30-50% (50 %) BOLNIKOV PO 5 LETIH (6LETIH) NASTANE FUNKCIONALNA OKVARA.

ZA OCENO USPEŠNOSTI ZDRAVLJENJA JE TOREJ POTREBNO SPREMLJANJE VSAJ 5 LET

MOŽNOSTI ZDRAVLJENJA PO STADIJIH

Stadij	Kontraktura v stopinjah	Opis	Zdravljenje
N	0	Vozliči	Obsevanje Kirurgija
N/1	0-10	Blaga kontraktura	Obsevanje Kirurgija
1	11- 45		Kirurgija Kolagenaza
2	46- 90		Kirurgija Kolagenaza
3	91- 135		Kirurgija
4	> 135		Kirurgija

ONKOLOŠKI INŠTITUT

Obsevanje od 2016 – 2023 **14 bolnikov** (10 m, 4 ž)- 58 let/53let

Vseh 14 bolnikov- stadij N

Mb Dupuytren- 17 rok (5 obe,7 ena (4-d, 3-l)

Mb Ledderhose - 7 nog : (3 obe, 1 L)

Sledenje : 6 mesecev - 7 let (povprečno 44 mesecev). Pri 4 bolnikih > 5 let

Pri vseh bolnikih je bil dosežen regres bolezni pri 2 celo popoln regres.

Pri vseh bolnikih je po regresu bolezen stabilna, do napredovanja bolezni ni prišlo pri nobenem.

OBSEVANJE BENIGNIH BOLEZNI

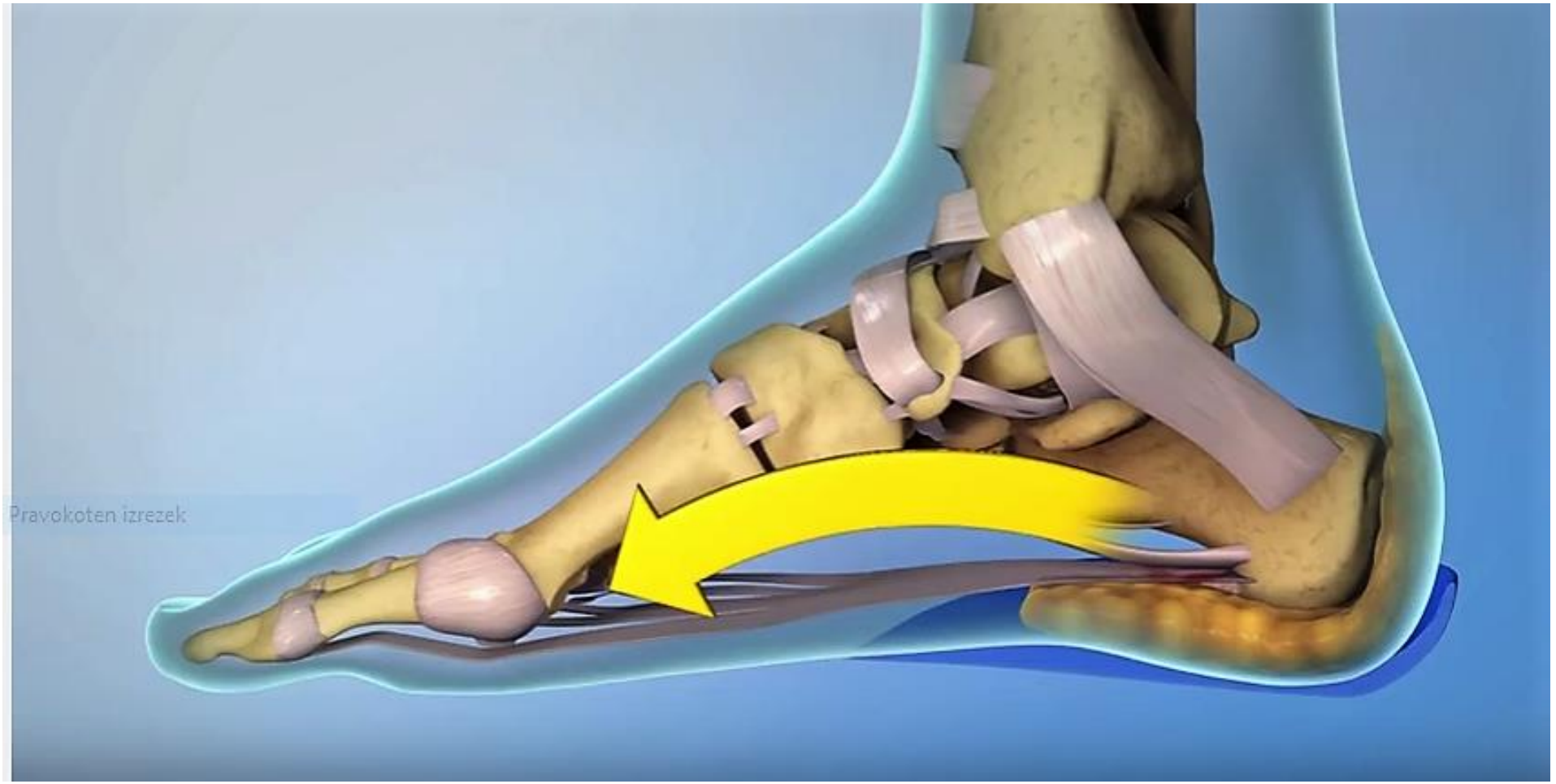
TRN PETNICE

MB. HAGLUND

OBSEVANJE BENIGNIH BOLEZNI

TRN PETNICE

Sinonimi: **Spina calcanei**
Calcaneodinia


Pravokoten izrezek

Nastanek

Vnetje plantarne aponevroze

Lok stopala se pri obremenitvi med prenosom teže od petnice proti srednjemu delu in prstom preveč spusti.

Stalna napetost mišic stopala in goleni
Kronična preobremenitev, vnetje pokostnice,
delno natrganje fascije
Pri tekačih je vzrok čezmerna pronacija (vzvračanje noge navznoter).
Na mestu največje obremenitve (sredina pete), nastane najprej hrustančna „ojačitev“ pete, ki nato zakosteni (trn petnice).

Mb. Haglund

Sinonimi:

Vnetje ahilove tetive
Retrokalkanealni bursitis
Posteriorna kalkanealna tuberoza
Mulholland deformacija

Zdravljenje

Skoraj vse vrste zdravljenja so zgolj izkustvene, raziskav je malo

Počitek, NSAR
Led-zmanjša akutno vnetje

Silikonski vložki pod peto- amortizacija
Peta- vložek, ki dvigne peto (pri visokem stopalnem loku)
Čevelj, ki stabilizira gleženj
Fizioterapija, masaža
Mišice -vaje za raztezanje

Eliminacija problema: Hoja brez obutve
Čevelj z mehko peto ali brez pete

Mb Haglund

Zdravljenje

Blokada- lokalna injekcija (analgetik+kortikosteroid)
Uz
Laser ?
Elektroterapija, Magnetoterapija
Extracorporeal shock therapy (udarni valovi)
Imobilizacija

Obsevanje

OBSEVANJE

Linearni pospeševalnik
Elektroni
Ortovoltni aparat

Obsevanje 3 x /teden

Odmerek sevanja:
5 Gy v 10 frakcijah
3 Gy v 6 frakcijah

HETEROTOPNA OSIFIKACIJA (HO)

Heterotopna osifikacija (HO) je nastanek zrelega lamelarnega kostnega tkiva, ki lahko vsebuje tudi kostni mozeg na nepravem mestu v mehkih tkivih.
Opisana je bila že v 19. stoletju in je bila znana pod različnimi nazivi kot so myositis osifikans, neurogeni osteom, osificirajoča fibromiopatija .

Poznamo tri vrste HO: travmatsko, nevrogeno in genetsko

Najpogostejša *je travmatska* HO, ki nastane kot pove ime, po zlomih, poškodbah, izpahih, operacijah in zelo obsežnih opeklinah.

Nevrogena **nastane po poškodbah hrbtenice in glave in czs.**
Genetska **HO je sestavni del nekaterih redkih genetskih bolezni , kot so fibrodysplasia ossicans progressiva, Albrightova hereditarna osteodistrofija.**

HO nastane zaradi nepravilne diferenciacije pluripotentne mezenhimalne celice v osteoblastno zarodno (stem) celico. Natančen mehanizem poteka ni znan.

HO je klinično asimptomatska in jo opazimo le na rtg posnetkih kosti. Simptomatska postane, ko povzroči bolečine ter zmanjšanje gibljivosti v prizadetem sklepu, kar lahko vodi do popolne zatrjenosti sklepa. Scintigram kosti lahko zazna HO že 3 tedne po poškodbi, na rtg posnetku pa je vidna po 4. do 6.tednih.

Približno tretjina je ocenjenih kot klinično pomembnih, kar se kaže kot bolečina v predelu sklepa, zmanjšana gibljivost, ki lahko napreduje do popolne zatrditve sklepa.

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Ko je HO že razvita je edino učinkovito zdravljenje operacija, zato je profilaksa nastanka HO zelo pomembna.

Nastanek HO preprečujemo na več načinov :

- nesteroidni antirevmatiki
- obsevanje

Najbolj znana profilaksa je z nesteroidnimi antirevmatiki (NSAR) , od katerih je najbolj pogosto uporabljan in preiskovan *indometacin*. NSAR delujejo tako, da inhibirajo diferenciacijo mezenhimske celice v kostno ter indirektno z inhibicijo remodeliranja kosti (preko prostaglandinskih receptorjev oz. inhibicijo sinteze prostaglandinov.)

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Int. J. Radiation Oncology Biol. Phys., Vol. 60, No. 3, pp. 888–895, 2004

RADIOTHERAPY VS. NONSTEROIDAL ANTI-INFLAMMATORY DRUGS FOR THE PREVENTION OF HETEROTOPIC OSSIFICATION AFTER MAJOR HIP PROCEDURES: A META-ANALYSIS OF RANDOMIZED TRIALS

EMILIOS E. PAKOS, M.D.,* AND JOHN P. A. IOANNIDIS, M.D.*†‡

*Clinical and Molecular Epidemiology Unit, Department of Hygiene and Epidemiology, University of Ioannina School of Medicine, Ioannina, Greece; †Biomedical Research Institute, Foundation for Research and Technology-Hellas, Ioannina, Greece; ‡Institute for Clinical Research, Department of Medicine, Tufts-New England Medical Center, Tufts University School of Medicine, Boston, MA

Purpose: To evaluate the efficacy of radiotherapy (RT) vs. nonsteroidal anti-inflammatory drugs (NSAIDs) in the prevention of heterotopic ossification (HO) after major hip procedures.

Methods and Materials: We conducted a meta-analysis of 7 randomized studies (*n*=1143) comparing RT with NSAIDs.

Conclusions: Although absolute differences may be small, postoperative RT is on average more effective than NSAIDs in preventing HO after major hip procedures. The risk of developing HO was less than half with RT than as compared with NSAID.

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RADIATION PROPHYLAXIS FOR HETEROTOPIC OSSIFICATION ABOUT THE HIP JOINT—A MULTICENTER STUDY

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Results: 114 institutions reported their clinical experience with prophylactic RT for the prevention of heterotopic ossification about the hip joint: 70 community hospitals, 23 university hospitals, and 21 private RT practices. In 1999, 5677 patients (5989 hips) had received prophylactic RT.

Conclusion: This patterns of care study comprises the largest number of cases reported for prophylactic hip RT to date. The results reveal that both preoperative (within 24 h) and postoperative RT (within 72 h) are effective in preventing heterotopic ossification after hip surgery.
Single-dose RT concepts, especially, can be recommended as an excellent treatment alternative for patients with contraindications to long-term steroid or nonsteroidal anti-inflammatory agents, and this approach has become standard in most German RT institutions.

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Radiotherapy Prevents Heterotopic Ossification in All Body Sites: Long-term Results of a National Multicenter Patterns of Care Study in 462 Cases

H. M. Seegenschmiedt[1], O. Micke[2], N. Willich[3] G. C. G. B. D/German Cooperative Group on Radiotherapy for Benign Diseases[4]
1 Alfried-Krupp Krankenhaus, Essen, Germany, 2 St. Franziskus Hospital, Bielefeld, Germany, 3 Westfalian University Munster, Munster, Germany, 4 DEGRO, Berlin, Germany

Purpose/Objective(s): German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD) conducted a multi-center cohort study to analyze the use of prophylactic radiotherapy (RT) to prevent heterotopic ossification (HO) in various body sites. This study summarizes the long-term outcome for all non-pelvic sites.

Materials/Methods: This PCS was conducted between **2002 and 2006** in all German RT institutions to assess the accrual pattern, the number of treated patients, the specific treatment indications and the applied RT schedules for prophylactic RT in all other body sites besides the hip to prevent HO after various types of injuries or surgical procedures.

Results: **114 RT institutions** applied prophylactic RT to prevent HO at any body site, mostly about the hip in conjunction with total hip arthroplasty (THA). Of those, 56 (49%) reported specific clinical experiences with prophylactic RT in other body regions besides the hip joint. A total of **462 cases** were collected with the following anatomical distribution: **105 shoulders; 242 elbows; 57 knees; 7 mandibular joints; and 52 other sites, including the upper and lower arm, femur, tibia and fibula, abdominal wall and other soft tissue sites with painful or functionally disturbing HO.**

Most of the patients (92%) reported a traumatic event prior to the occurrence of the local HO. Only 6/56 (11%) institutions applied preoperative RT (1 x 6 - 7 Gy), while 50/56 (89%) used various postoperative RT concepts (mostly 1 x 7 Gy).

The following clinical outcome was achieved at a minimum follow-up of 1 year: the overall reported **radiological failure rate 53/462 (11.5%) and the functional failure rate was 37/462 (8%);**

28 of 53 cases with new HO after partial or complete removal of HO and RT were salvaged with additional surgery plus secondary RT; 379 (82%) cases reached a functional improvement compared to the preoperative status; 46/462 remained in stable functional condition. One prognostic factor contributing to radiological failures was a time delay of .96 hours to initiate RT after completion of surgery.

Conclusions: This multicenter study comprises the world-largest number of cases reported so far for the use of prophylactic RT to prevent HO in non-pelvic body sites.

It proved that both pre and postoperative RT are very effective in all body sites to prevent HO and achieve a similar radiological and functional success as for the hip joint after THA.

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Heterotopna osifikacija

Profilaktično obsevanje

Linearni pospeševalnik
7Gy v eni frakciji

Predoperativno
Do 12 ur pred operacijo (optimalno 4 ure)

Pooperativno
Do 72 ur po operaciji

Pooperativno obsevanje je zaradi logističnih razlogov težje izvedljivo

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Predoperativno
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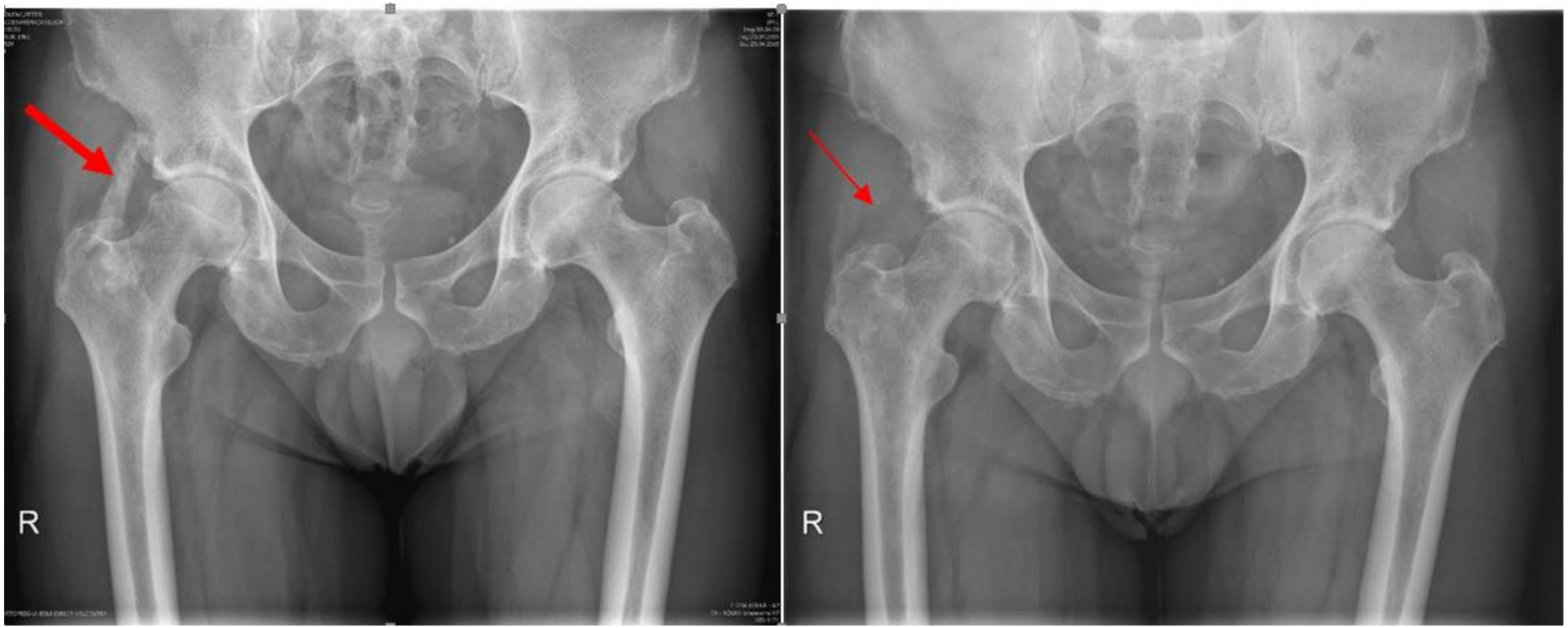
Do 72 ur po operaciji

Pooperativno obsevanje je zaradi logističnih razlogov težje izvedljivo

Bolniki	2008-2023	
Skupaj	45	M - 32 Ž - 13
Starost	26 - 91 let	Povprečno 56 let
Kolk	35	17-D, 12-L ,6 L+D
Kolk - oba	3	
Komolec	7	1 obsevan pooperativno
Gluteus	1	osifikat
Koleno	3	
Radius	1	
MTP-sklep-2. prst	1	



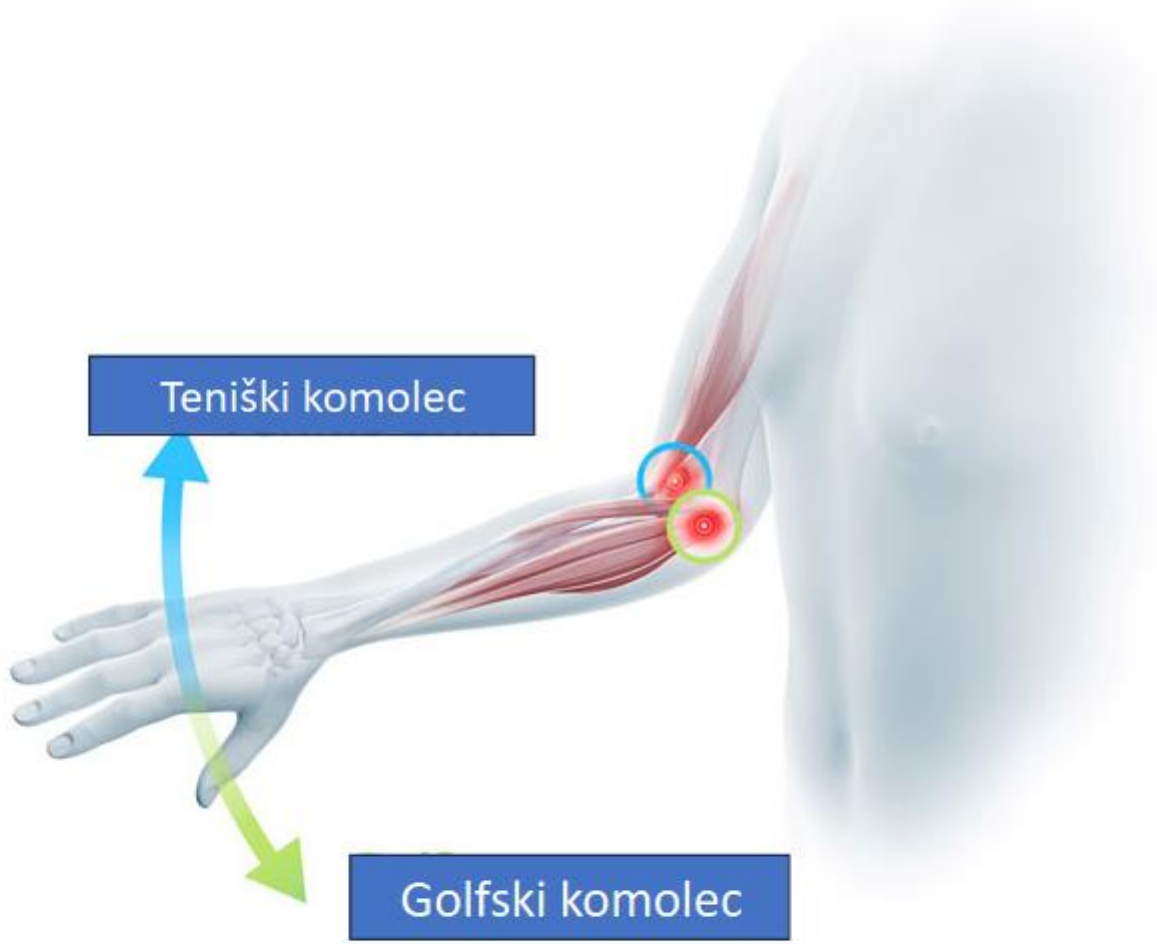
E.mail:

Kot ste želeli v enem od preteklih elektronskih sporočil Vam pošiljam povratno informacijo glede pacienta D.P. ki je bil dne 22.09.2015 obsevan in operiran zaradi heterotopnih osifikatov desnega kolka.
Pacient se dobro počuti, gibljivost v desnem kolku se je močno popravila, na rtg posnetkih pa ni videti ponovnih osifikatov. Prilagam tudi rtg posnetek.

Epicondylitis -idis [epikondilítis] ž → epikondilitis

Vir: Slovenski medicinski slovar - Univerza v Ljubljani, Medicinska fakulteta

~ lateralis humeri teniški → komolec;
~ medialis humeri golfski → komolec


Teniški komolec
Golfski komolec

Strahlenther Onkol 2014 · 190:293–297 DOI 10.1007/s00066-013-0504-1

O.J. Ott · S. Hertel · U.S. Gaipl · B. Frey · M. Schmidt · R. Fietkau

The Erlangen Dose Optimization trial for low-dose radiotherapy of benign painful elbow syndrome. Long-term results

Patients and methods.
Beetwen February 2006 and February 2010, 199 evaluable patients were recruited for this prospective trial. All patients received low-dose orthovoltage radiotherapy.

One course consisted of 6 fractions in 3 weeks.
In the case of insufficient pain remission after 6 weeks,
a second course was administered.

Low-dose radiotherapy proved to be a highly effective option for sustained pain control in the treatment of painful elbow syndrome

Therefore, for radiation protection purposes we recommend the standard use of single doses of 0.5 Gy and total doses of 3.0 Gy per radiation series in the treatment of benign painful elbow syndrome

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Re-irradiation for humeral epicondylitis

Retrospective analysis of 99 elbows

Matthias G. Hautmann[1] · Lukas P. Beyer[2] · Matthias Hipp[3] · Ulrich Neumaier[4] · Felix Steger[1] · Barbara Dietl[1] · Katja Evert[5] · Oliver Kölbl[1] · Christoph Süß[1]

Received: 16 March 2019 / Accepted: 27 June 2019 / Published online: 15 July 2019

Material and methods The analysis was performed on patients from three German radiotherapy institutions and included **99 re-irradiated elbows**. Pain was documented with the numeric rating scale (NRS). Evaluation of the NRS was done before and directly after each radiation therapy as well as for the follow-up of 24 months

Conclusion

Re-irradiation of humeral epicondylitis is an effective and safe treatment.
All subgroups showed a good response to re-irradiation for at least 24 months

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Zdravljenje

Počitek, hlajenje
NSAID
Fizioterapija
Uz
Udarni valovi (Extracorporeal shock therapy)

Obsevanje
Linearni pospeševalnik
Odmerek 3,0 Gy v frakcijah po 0,5 Gy

Keratoakantom

Tumor zraste iz epitela dlačnega folikla.
Značilna je hitra rast tumorja, ki v nekaj tednih zraste do kupolastega tumorja premera 1-2 cm. Po nekaj mesecih večina tudi spontano regrediira.
Klasifikacija tumorja se je v desetletjih spreminjala od benignega tumorja do dobro diferenciranega ploščatoceličnega karcinoma.
Ker je ločevanje benignega od dobro diferenciranega ploščatoceličnega karcinoma klinično in histološko zelo težavno, večina avtorjev meni, da je skrbno spremljanje (wait and see policy) preveč tvegano.

Priporočeno zdravljenje je ekscizijska biopsija z 4 mm varnostnim robom.

Keratoakantom

Starost 94 let

2 leti po obsevanju

Keloidi

Incidenca: 0,09 (VB) -16 % (Kongo)

Nastanek: operacija,poškodba,tetoviranje,prebadanje,ugriz,opeklina

Patogeneza ni povsem pojasnjena. Povečana proliferacija fibroblastov in tvorba kolagena, močno povečana sinteza rastnih dejavnikov (TGF-beta,VEGF,CTGF)

Možnosti zdravljenja

Operacija
Kortikosteroidi-obliž, injekcije
Silikonski gel
Laser
Krioterapija

Pri vseh zdravljenjih je več kot 50 % ponovitev (60-80%)

Kombinirano zdravljenje z operacijo in pooperativnim obsevanjem zmanjša verjetnost ponovne rasti keloida na 10-30 %.

Anamneza:
V levem uhlju je nekaj let nosil uhan. Po nastanku keloida je bil operiran leta 2003, nato 2004,2009, 2012 in 2017, dobival je tudi injekcije kortikosteroidov v uhelj. Keloid je vedno ponovno zrasel.

Operacija in pooperativno obsevanje 2019

Kontrola 3 leta po kombiniranem zdravljenju


Lilly

OBSEVANJE BENIGNIH BOLEZNI

7. marec 2024

Onkološki inštitut Ljubljana, Predavalnica v stavbi C

RADIOTHERAPY FOR NON-MALIGNANT DISORDERS: A PRACTICAL OVERVIEW

Angel Montero, MD, PhD

@Oncoangel

CENTRO INTEGRAL ONCOLÓGICO hm CIOCC

HOSPITAL UNIVERSITARIO hm sanchinarro

Facultad HM de Ciencias de la Salud de la Universidad Camilo José Cela

hm hospitales

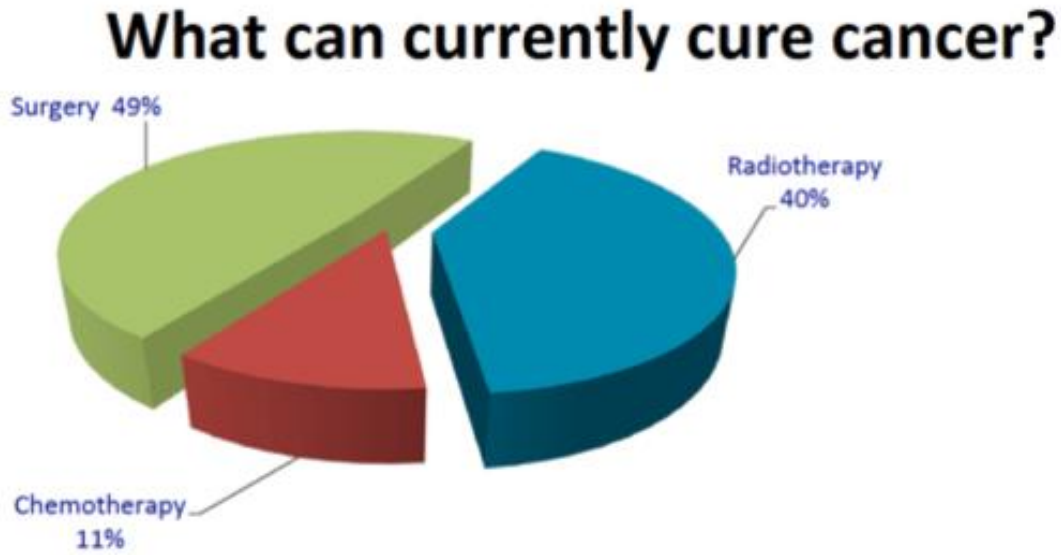
Universidad Camilo José Cela
SEK EDUCATION GROUP

Disclosure

I’ve been a radiation oncologist for more than 20 years…

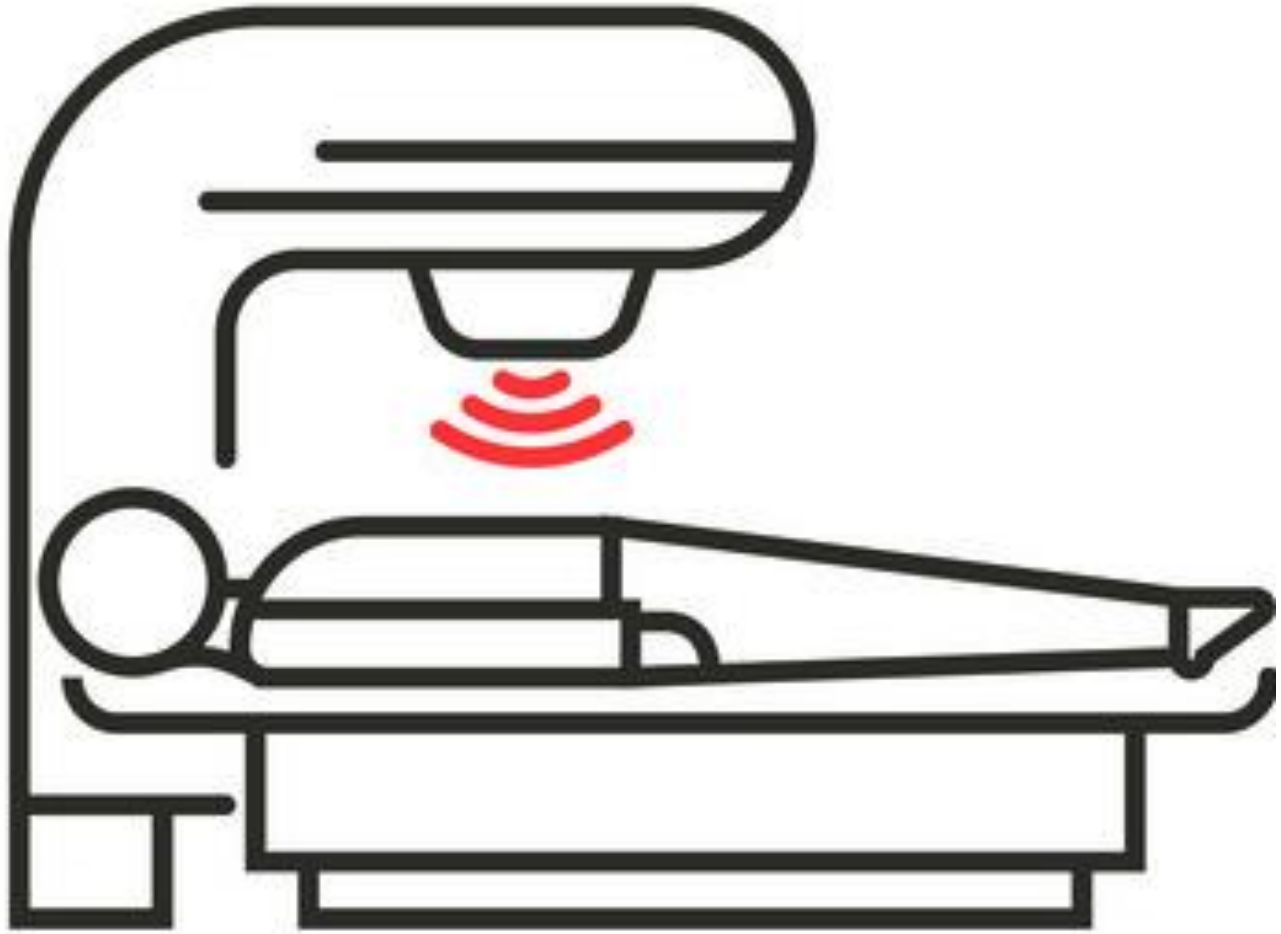
(…with all the biases and COIs that this implies…)

RADIATION THERAPY FOR CANCER TREATMENT: AN ACCEPTED STANDARD…



Professor Sir Mike Richards, NCRI 2011

BUT…



…RADIATION THERAPY FOR NON-MALIGNANT (BENIGN) CONDITIONS?!

hm hospitales

….AS OLD AS THE HILLS…

THE TREATMENT OF ARTHRITIS DEFORMANS WITH THE ROENTGEN RAYS.

A PRELIMINARY REPORT.*

J. M. ANDERS, M.D., JUDSON DALAND, M.D.
AND G. F. PFAHLER, M.D.

PHILADELPHIA.

We submit this preliminary report on the treatment of arthritis deformans with the Roentgen rays, and hope at a later date to make a more complete report on these and similar cases and then to be able to draw more definite conclusions.

CASE 1.—Mr. T[illegible], aged 47, a mason, was admitted to the wards of the Medico-Chirurgical Hospital under the care of Dr. Anders Oct. 26, 1905. The man's father died of miner's asthma, otherwise the family history is negative. His previous medical and social history have no bearing on the disease.

Present Illness.—This dates from July, 1902, when his feet, especially the joints of the toes, became swollen, tender and painful. This kept him from work one year; he then improved and was able to work four months. Since that time, which was fifteen months before admission to the hospital, he has

1906

* Read before the Philadelphia County Medical Society, March 14, 1906.

Radiation Treatment of Benign and Inflammatory Conditions

The radiation treatment of benign and inflammatory conditions occupies an important place in modern therapeutics. The number of lesions found to respond well to radiation therapy has gradually increased over a period of years until at present nearly half of the cases seen in the radiotherapy department are treated for benign or inflammatory conditions. This excludes the use of radiation in dermatology, where its efficacy has been well demonstrated and it is widely employed.

The [illegible] of non-malignant lesions successfully treated is among the largest, too long, in fact, to be presented in an editorial. If, however, we exclude the group in which there is only a small percentage of good results, along with those conditions about which there is lack of agreement as to the value of the treatment, we are still left with an impressive number of lesions which respond satisfactorily, and with which we should all be familiar.

RADIATION TREATMENT OF NON-MALIGNANT CONDITIONS

Inflammatory
1. Tuberculous lymphadenitis
2. Acute lymphadenitis
3. Nasopharyngeal lymphoid hypertrophy
4. Parotitis
   (*a*) acute postoperative
   (*b*) chronic suppurative
5. Enlarged mediastinal lymph nodes following various infections, especially whooping cough
6. Herpes
   (*a*) zoster
   (*b*) simplex
7. Plantar warts

Benign Tumors
1. Angiomas
2. Cystic hygromas
3. Giant-cell tumors of bone
4. Fibroid uteri
5. Pituitary adenomas
   (*a*) chromophil
   (*b*) chromophobe
   (*c*) basophil
6. Xanthomatosis

Other Conditions
1. Arthritis (Marie-Strümpell)
2. Bursitis
3. Cystic synovitis
4. Metrorrhagia (non-specific)
5. Keloids

HUGH F. HARE, M.D.
Lahey Clinic, Boston

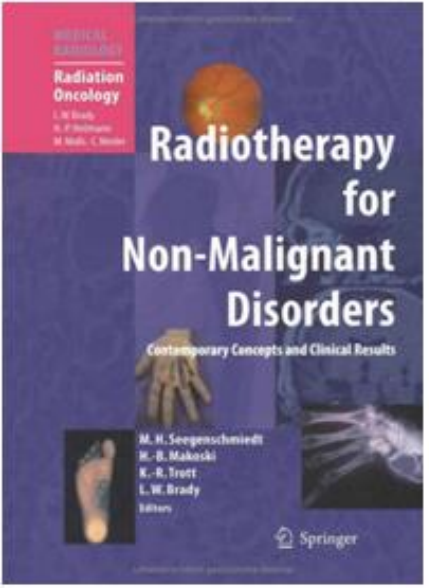
July 1946

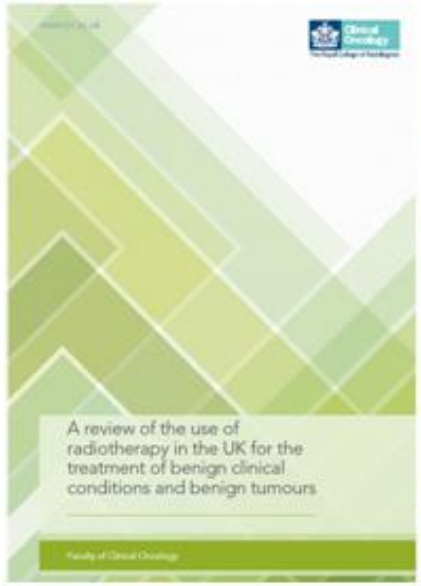
1946

Nr. 46. Sokolow: **Über Heilung des Gelenkrheumatismus durch Röntgenstrahlen bei Kindern.**
Der Berichterstatter macht Mitteilung über vier Krankheitsfälle von Gelenkrheumatismus bei Kindern, bei welchen durch Anwendung der Röntgenstrahlen ein sehr guter Erfolg bezüglich der Heilung erzielt wurde. Das mit einer wollenen Decke bedeckte Kind befand sich 50—60 cm von der Röhre und wurde den Strahlen 10—20 Minuten ausgesetzt. Im ersten Falle, an einem Mädchen von 9 Jahren, welche an heftigen Schmerzen und Anschwellung der rechten und linken Handwurzel, Finger und Kniegelenke litt, verschwanden die Schmerzen nach der zweiten Sitzung. Im zweiten Falle, bei einem Mädchen von 14 Jahren, welche an heftigen Schmerzen [illegible] Kniegelenken litt, verschwanden die Schmerzen nach der ersten Anwendung der Strahlen. Im dritten Falle, bei einem 5jährigen Mädchen, befand an heftigen Schmerzen und Geschwulst der Knie- und Beingelenke, verminderten sich diese bei der dritten Anwendung der Strahlen, bei welcher auch die Geschwulst der Gelenke augenfällig abnahm und die Nachmessung während der Strahlenwirkung dies bestätigte. Nach vier Tagen verminderte sich der Umfang an den Beingelenken um 3 cm. Der letzte Fall des Berichterstatters bezieht sich auf ein 13jähriges Mädchen, welches schon fünf Jahre an chronischem Rheumatismus und ebensoviele Jahre an Herzkrankheit litt, im Mai dieses Jahres verschlimmerte sich die Krankheit, wobei sich heftige Schmerzen und Anschwellung der Kniegelenke einstellten und auch Zusammenziehung unter einem Winkel von ungefähr 45°. Nach jeder Anwendung der Röntgenstrahlen vergrößerte sich der Winkel unter welchem die Knie gebogen waren, die Schmerzen verminderten sich und nach der vierten Anwendung der Strahlen verschwanden sie ganz.
Schmid-Monnard (Halle).

1898

Schmid-Monnard, C. (1898). Über Heilung des Gelenkrheumatismus durch Röntgenstrahlen bei Kindern. *Fortschritte auf dem Gebiet der Röntgenstrahlen, 1*, 209.





ESTRO
European Society for Therapeutic Radiology and Oncology

Radiotherapy and Oncology 68 (2003) 207

www.elsevier.com/locate/radonline

IMPORTANT ESTRO DATES

ESTRO MEETINGS 2003–2004

*1–3 April 2004 — 2nd ESTRO meeting on Benign Diseases, Nice, France

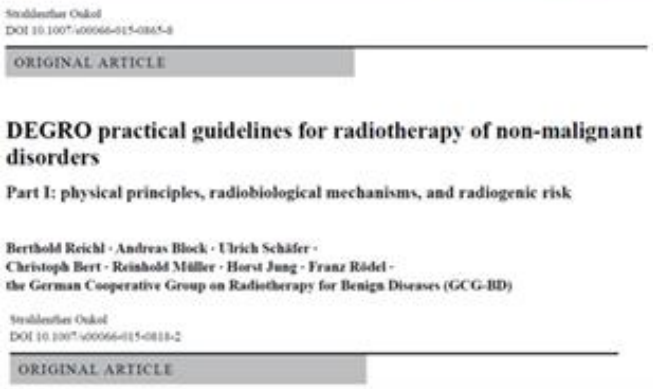
Radiotherapy and Oncology 83 (2007) 175–177
www.thegreenjournal.com

Radiotherapy of non-malignant disorders: Where do we stand?

Jan Willem Leer[a,*], Paul van Houtte[b], Heinrich Seegenschmiedt[c]

The ESTRO Nice conference on radiotherapy for non-malignant diseases was aimed at finding the current clinical evidence of radiotherapy in well-selected non-malignant disorders. In view of possible litigations for colleagues treating benign disorders, it is important that the professional community defines a consensus process and lays down a consensus statement on what is regarded acceptable and what not.

(A) There is sufficient evidence: the indication is accepted, those who do not do it may start doing it on a routine basis.
(B) The evidence is controversial: the indication can only be accepted in the context of clinical trial designed to confound clinical evidence.
(C) There is insufficient evidence: the indication is not accepted on a routine basis, and those who do it should stop doing it.


Strahlenther Onkol
DOI 10.1007/s00066-015-0865-8
ORIGINAL ARTICLE

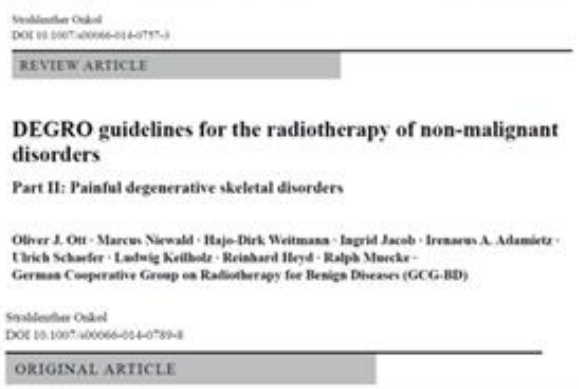
DEGRO practical guidelines for radiotherapy of non-malignant disorders

Part I: physical principles, radiobiological mechanisms, and radiogenic risk

Berthold Reichl · Andreas Block · Ulrich Schäfer · Christoph Bert · Reinhold Müller · Horst Jung · Franz Rödel · the German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD)

Strahlenther Onkol
DOI 10.1007/s00066-015-0818-2
ORIGINAL ARTICLE

DEGRO guidelines for the radiotherapy of non-malignant disorders


Strahlenther Onkol
DOI 10.1007/s00066-014-0757-3
REVIEW ARTICLE

DEGRO guidelines for the radiotherapy of non-malignant disorders

Part II: Painful degenerative skeletal disorders

Oliver J. Ott · Marcus Niewald · Hajo-Dirk Weitmann · Ingrid Jacob · Irenaeus A. Adamietz · Ulrich Schaefer · Ludwig Keilholz · Reinhard Heyd · Ralph Muecke · German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD)

Strahlenther Onkol
DOI 10.1007/s00066-014-0789-8
ORIGINAL ARTICLE

DEGRO practical guidelines for the radiotherapy

AN INCREASING CORE OF KNOWLEDGE ABOUT ITS UTILITY…

Radiotherapy for non-malignant disorders: state of the art and update of the evidence-based practice guidelines

[1]M H SEEGENSCHMIEDT, MD, PhD, [2]O MICKE, MD, PhD and [3,4]R MUECKE, MD, PhD; the German Cooperative Group on Radiotherapy for Non-malignant Diseases (GCG-BD)

Br J Radiol;88:20150080

Non-malignant indications for RT comprise about 10–30% of all treated patients in most academic, public and private RT facilities in Germany. Over the past decade, various so called patterns general and va their RT treatn Overall, there active RT facil these benign o

The largest grou indications for degenerative joi

Updated strategies in the treatment of benign diseases—a patterns of care study of the german cooperative group on benign diseases

Jan Kriz MD [a,*], Heinrich M. Seegenschmiedt MD, PhD [b], Amelie Bartels MD [a], Oliver Micke MD, PhD [c], Ralph Muecke MD [d,e], Ulrich Schaefer MD, PhD [f], Uwe Haverkamp MD, PhD [a], Hans T. Eich MD, PhD [a]

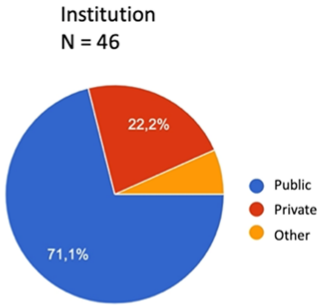
iving RT in 2014, those, 16,989 pa- e diseases, another 1563 (4%) for 7%) for functional eceived stereotac- irradiated because

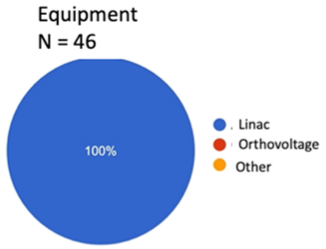
Oncology (2018) 3, 240–244

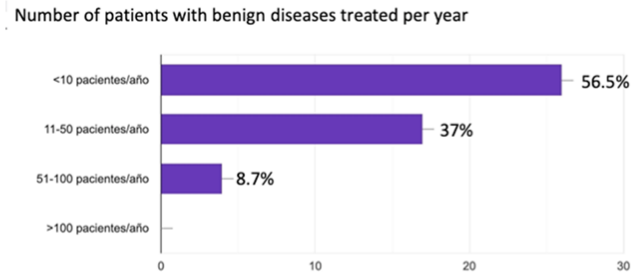
- 10-30% of ALL attended patients
- Available in ALL radiotherapy facilities (>300)
- Irradiated diseases:
  - 46% degenerative disorders
  - 40% osteoarthritis
  - 7% functional disorders
  - 4% hyperproliferative disorders
  - 2% CNS diseases

RADIATION THERAPY IN SPAIN FOR BENIGN DISORDERS: RESULTS OF THE 2019 VS. 2022 SURVEY

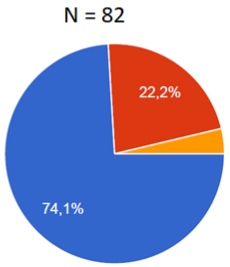
2019

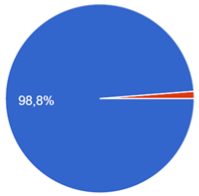


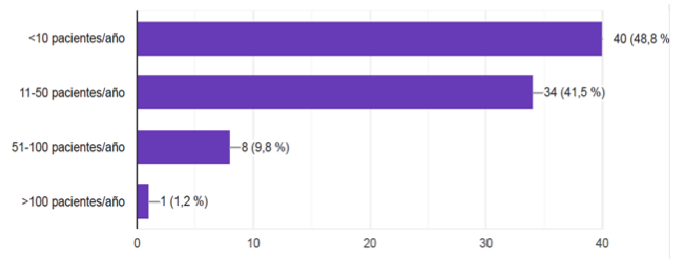


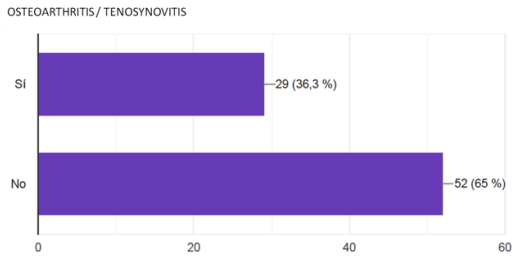


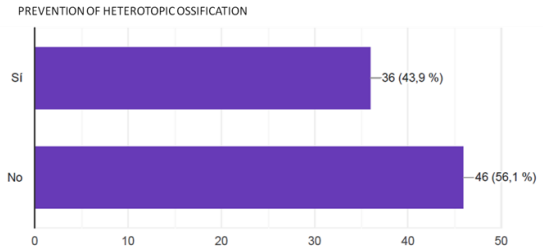
2022

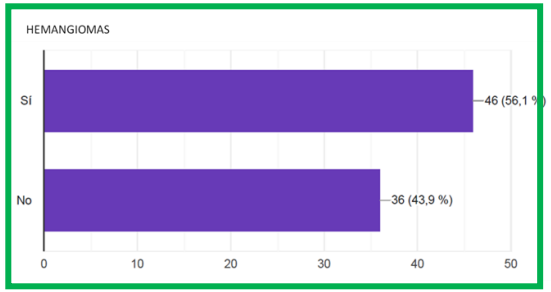


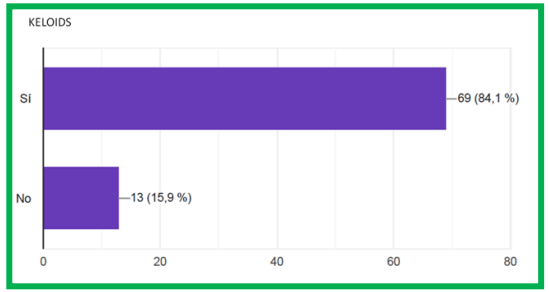


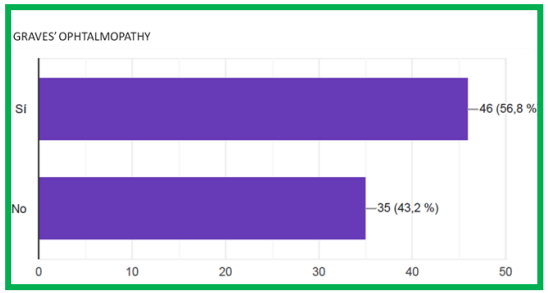


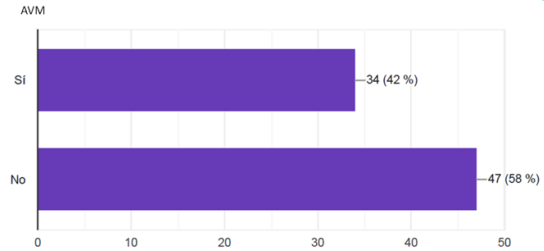


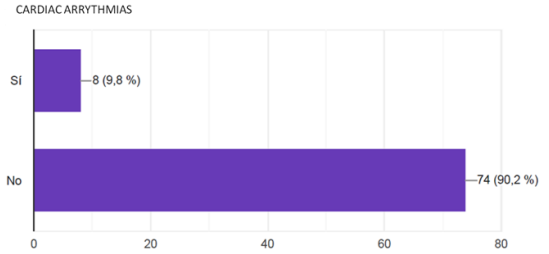


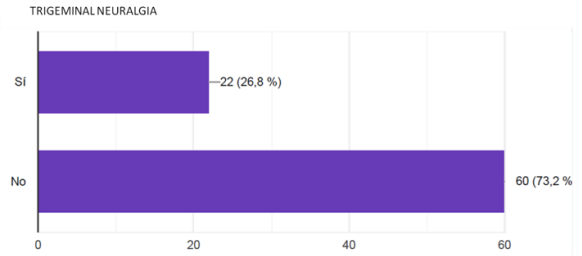












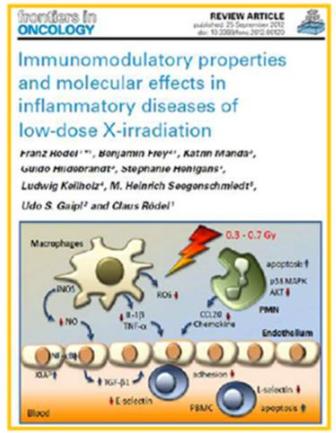
PROPOSED MECHANISMS OF RADIATION EFECTS:

1

Antiinflammatory

- ↓ leucocyte-endothelium interaction
- NOS inhibition
  - ↓ vasodilation
  - ↓ vascular permeation
  - ↓ pain

- 2-6 Gy
- Osteoarthritis
- Tendynopathy
- Enthesitis
- Alzheimer's disease
- ...

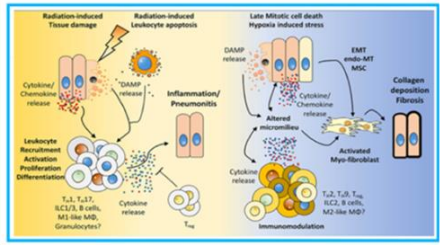


2

Immunomodulatory

- Circulating lymphocites
- Antigen stimulation

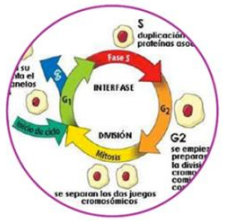
- 10 Gy
- Graves' ophtalmopathy
- ...



3

Antiproliferative

- Retarding mitotic cycle
- Proliferation inhibition

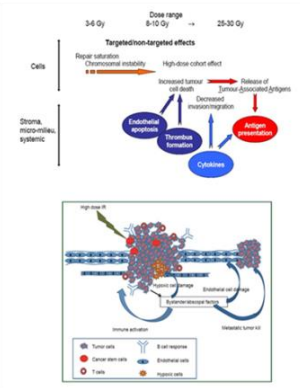


- ~10 Gy
- Keloids
- Heterotopic ossification
- AMD
- Dupuytren/Ledderhose
- ...

4

Ablative

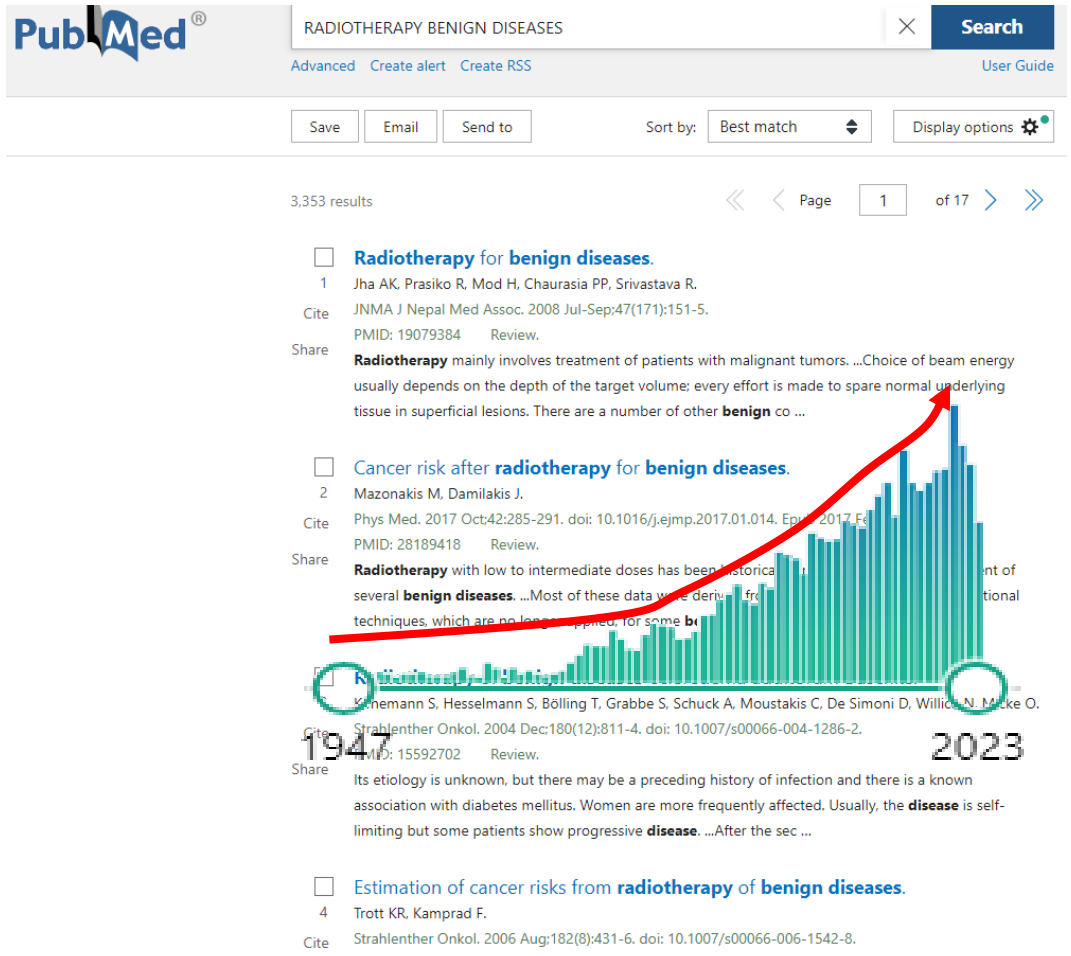
- Effect on cell compartiment
- Effect on microenviroment
- Overpasing traditional 'radioresistence'



- >20-25 Gy
- Cardiac arrythmias
- Trigeminal & other neuralgia
- CNS functional disorders
- ...

Courtesy from Dr. B. Álvarez

RADIATION THERAPY FOR BENIGN DISORDERS: A GROWING INTEREST…



SKELETAL DISORDERS

- Osteoarthritis
- Tendonitis
- Bursitis
- Enthesitis
- Fasciitis
- Heterotopic ossification
- …

SOFT-TISSUE DISORDERS

- Fibromatosis
- Dupuytren/Lederhose
- Peyronee
- Keloids
- Pterigion
- …

CARDIOVASCULAR DISORDERS

- Vasculopathy
- Hemangiomas
- AVM
- Intratable arrythmia
- …

CNS FUNCTIONAL DISORDERS

- Essential tremor
- Epilepsy
- Parkinson’s disease
- Alzheimer disease
- …

INFECTIOUS DISORDERS

- Necrotizing fasciitis
- Shingles
- COVID19 pneumonia
- …

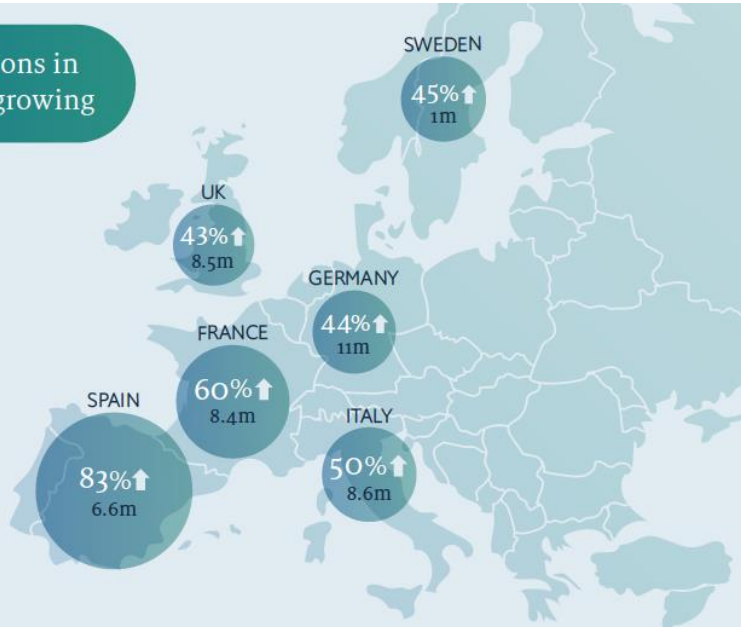
…IN A BROAD SPECTRUM OF DISORDERS…

Osteoarthritis affects millions in Europe and the burden is growing

In 2019, over 57 million people in Western Europe[1] had osteoarthritis (OA), and it caused the loss of over 2 million years of healthy life.[2] Numbers affected in the region have grown by 54% since 1990.

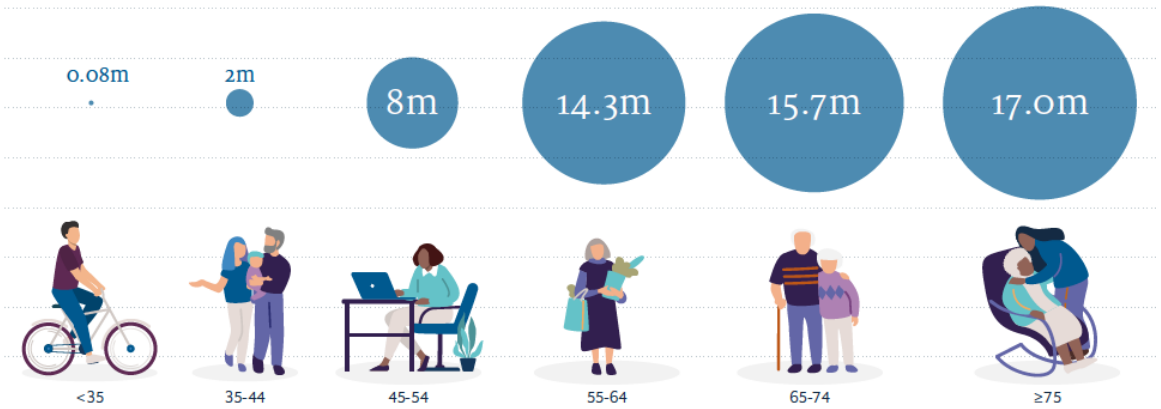
Increase since 1990

Numbers affected in 2019



Source: IHME, Global Burden of Disease Data 2019

OA does not just affect the elderly: 43% of those affected are under 65



Options for pharmacological symptom relief are limited

- No treatments can stop or reverse the joint damage associated with OA.
- Many people with OA also have other conditions, such as cardiovascular disease, which limit the pain medications they can take. Existing pain medications are not meant for long-term use.

27-54%

of people have pain despite taking prescription pain relief medication[6,10]

Only **30%**

are very satisfied with their current OA medication[11]

OA has a significant impact on people's quality of life and daily activities

Most people with OA have joint pain, and this impacts their ability to function normally. People who have more severe pain have more limitations to their activities[3] and worse mental health[4] and quality of life.[5]

91%

say OA limits their ability to do normal activities[3]

84%

have joint pain or tenderness[3]

Up to **60%**

have moderate to severe pain[6]

49%

report that OA affects their work[3]

37%

report that OA limits their social lives[3]

LOW-DOSE RADIATION THERAPY HAS PROVEN EFFECTIVENESS FOR OA PAIN RELIEF...

Strahlenther Onkol (2015) 191:1–6
DOI 10.1007/s00066-014-0757-3

REVIEW ARTICLE

DEGRO guidelines for the radiotherapy of non-malignant disorders

Part II: Painful degenerative skeletal disorders

Oliver J. Ott · Marcus Niewald · Hajo-Dirk Weitmann · Ingrid Jacob · Irenaeus A. Adamietz · Ulrich Schaefer · Ludwig Keilholz · Reinhard Heyd · Ralph Muecke · German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD)

Shoulder syndrome

Response rates (complete and partial response: CR and PR) usually reached 58–100% 2–3 months after radiotherapy [14, 17]. In 7928 retrospectively evaluated patients, Heyd et al. [6] reported response rates of 55% with CR, and 33% with PR; 12% [illegible] benefit. Early treatment less than 6 mo[illegible] pain seemed to be more effective than with chronic pain. Data about a higher success rate for patients with calcifications were inconsistent.

58-100%

Elbow syndrome

Between 1923 and 2011, the outcome after low-dose radiotherapy for elb[illegible]en reported in more than 2000 patients v[illegible]e and prospective analyses. Approximately 82% of the patients experienced significant pain reduction. The CR and PR rates were 45% (range 5–94%) and 35% (range 7–73%) [13].

~80%

Trochanteric bursitis

Glatzel et al. [3] reported on 34 patients who were treated with total dose[illegible] fractions of 1.0 Gy. After 3 months, 38%[illegible]% had a PR. Olschewski and Klein [12] reported on another 26 patients. They found an overall response rate of 73%, with 23% CR and 50% PR rates.

73%

Gonarthrosis

Low-dose radiotherapy is an effective therapeutic option for painful Kellgren stage 2–3 arthrosis of the knee joint and can be recommended even if surgical interventions are not possible or desirable or if other conservative treatment methods are asso[illegible]e side effects or contraindicated. The[illegible]6 patients treated with low-dose radiotherapy for painful arthrosis of the knee joint have been published. Of these patients, 5069 were surveyed within the framework of a German patterns of care study performed in 2010 [10]. A response to radiation therapy in terms of a marked and complete reduction of pain was shown in 58–91% of the irradiated patients.

58-91%

Plantar fasciitis

Retrospective analyses reported on CR rates in 12–81%, and PR rates in 7–74% [9, 15, 18]. In a randomized trial, Heyd et al. [7] randomly compared two dose regimens: 3.0 Gy/0.5 Gy vs. 6.0 Gy/1.0 Gy in 130 patients. Radiotherapy led to a highly significant reduction of pain symptoms in both groups, and[illegible]men was equally effective. In another r[illegible]ewald et al. [11] evaluated the efficacy of two other dose concepts in 62 evaluable patients: 6.0 Gy/1.0 Gy vs. 0.6 Gy/0.1 Gy. After one year, compared to the very low-dose arm the higher-dose arm led to a significant advantage in terms of pain control.

~80%

Coxarthrosis

Considering the results of the retrospective studies, low-dose radiotherapy may be an effective therapeutic option for painful Kellgren stage 2–4 arthrosis of the hip joint, even if surgical interventions are not possible or desirable, or if other conservative [illegible]re associated with excessive side effe[illegible]d. The results from 895 patients treated with low-dose radiotherapy for painful arthrosis of the hip joint have been published. A response to radiation therapy in terms of a marked and complete reduction of pain was shown in 24–89% of the irradiated patients [19].

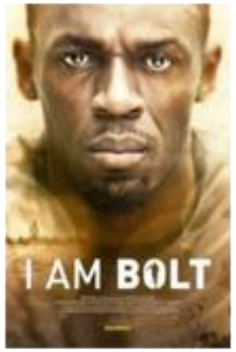
24-89%

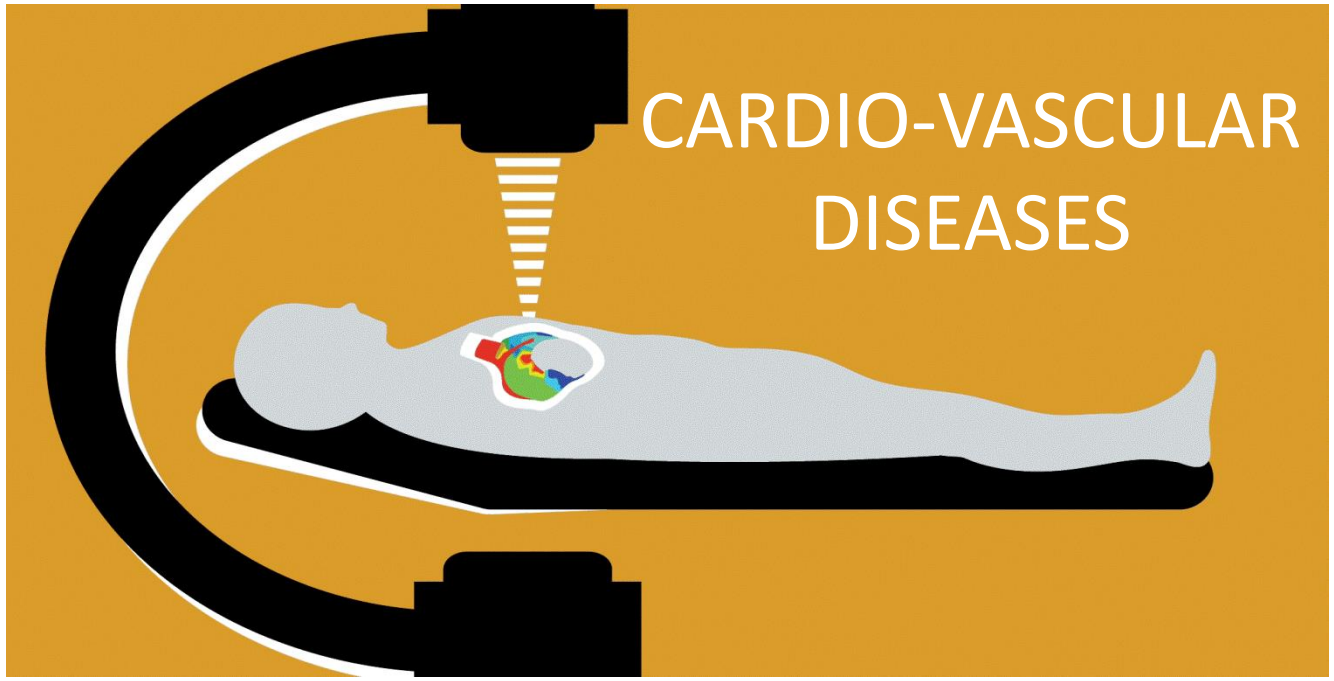
Arthrosis of the hand and finger joints

Considering the results of the retrospective studies, low-dose radiotherapy may be an effective therapeutic option for painful arthrosis of the hand and finger joints, even if other conservative treatment methods are associated with excessive side effe[illegible]d. The results from 809 patients treated[illegible]otherapy for painful arthrosis of the hand and finger joints have been published. A response to radiation therapy in terms of a marked and complete reduction of pain was shown in 63–75% of the irradiated patients [4].

63-75%

…AND MANY WERE ABLE TO PROVE IT!!





ORIGINAL ARTICLE

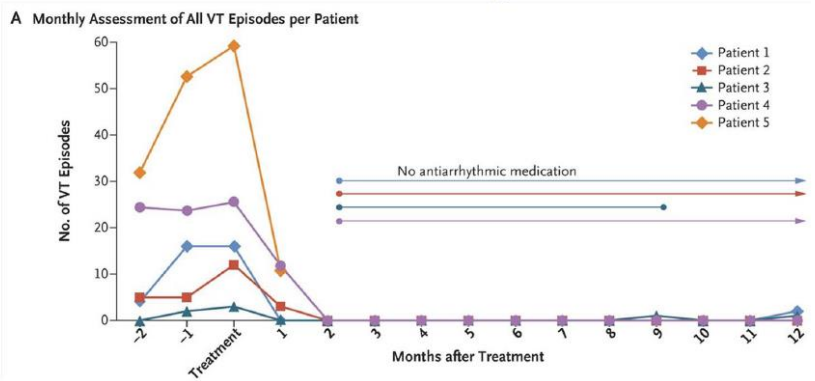
Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia

Phillip S. Cuculich, M.D., Matthew R. Schill, M.D., Rojano Kashani, Ph.D., Sasa Mutic, Ph.D., Adam Lang, M.D., Daniel Cooper, M.D., Mitchell Faddis, M.D., Ph.D., Marye Gleva, M.D., Amit Noheria, M.B., B.S., Timothy W. Smith, M.D., D.Phil., Dennis Hallahan, M.D., Yoram Rudy, Ph.D., and Clifford G. Robinson, M.D.

5 patients w/refractory VT treated off-label for clinical need in 2015

Single SBRT treatment, 25 Gy

Average treatment time 14 min



3 month pre treatment = **6577** 6 week blanking = **680** Next 10.5 months = **4**

Non-invasive Cardiac Radiation for Ablation of Ventricular Tachycardia: a New Therapeutic Paradigm in Electrophysiology

Eun-Jeong Kim,* Giovanni Davogustto,* William G Stevenson and Roy M John

Division of Cardiovascular Medicine, Department of Medicine, Vanderbilt University Medical Center, Nashville, TN, USA
**Both authors contributed equally to this work*

Abstract

Non-invasive ablation of cardiac tissue to control ventricular tachycardia (VT) is a novel therapeutic consideration in the management of ventricular arrhythmias associated with structural heart disease. The technique involves the use of stereotactic radiotherapy delivered to VT substrates. Although invasive mapping can be used to identify the target, the use of non-invasive ECG and imaging techniques combined with multi-electrode body-surface ECG recordings offers the potential of a completely non-invasive approach. Early case series have demonstrated a consistent decrease in VT burden and sufficient early safety to allow more detailed multicenter studies. Such studies are currently in progress to further evaluate this promising technology.

Keywords

Ventricular tachycardia, ablation, non-invasive, stereotactic body radiation therapy

Disclosure: William Stevenson is coholder of a patent for the needle ablation electrode consigned to the Brigham and Women's Hospital. Roy John has received lecture honoraria from Biosense Webster and Medtronic.
Received: 13 February 2018 **Accepted:** 20 February 2018 **Citation:** *Arrhythmia & Electrophysiology Review* 2018;**7**(1):8–10. DOI: 10.15420/aer.7.1.EO1
Correspondence: Roy M John, MBBS, PhD, FRCP, Division of Cardiology, Department of Medicine, Vanderbilt University Medical Center, 2220 Pierce Avenue, 383 Preston Research Building, Nashville, TN 37232-6300, USA. E: roy.john@vanderbilt.edu

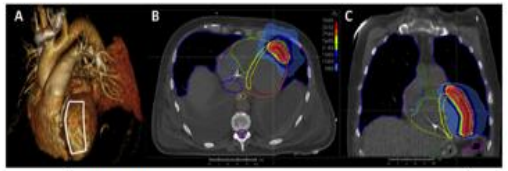
ASTRO ANNUAL MEETING 2019

Longer Term Results from a Phase I/II Study of EP-guided Noninvasive Cardiac Radioablation for Treatment of Ventricular Tachycardia (ENCORE-VT)

Clifford Robinson, MD

Risen from the dead: Cardiac stereotactic ablative radiotherapy as last rescue in a patient with refractory ventricular fibrillation storm

Eberhard P. Scholz, MD, PhD,*†‡ Katharina Seidensaal, MD,§ Patrick Naumann, MD,§ Florian André, MD,† Hugo A. Katus, MD, PhD,*†‡ Jürgen Debus, MD, PhD§



Conclusion

We present a case with favorable outcome in a patient suffering from severe postischemic VF storm in which stereotactic radiotherapy was paralleled by a rapid decline of arrhythmia burden. This case further strengthens stereotactic radiotherapy as a bailout strategy in patients with refractory ventricular arrhythmias. However, caution is warranted and patients should therefore be selected carefully, since data on long-term toxicity are scarce.

Heart Rhythm Case Reports, Vol 5, No 6, June 2019

Clinical Oncology 35 (2023) 611–620

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journal homepage: www.clinicaloncologyonline.net

Original Article

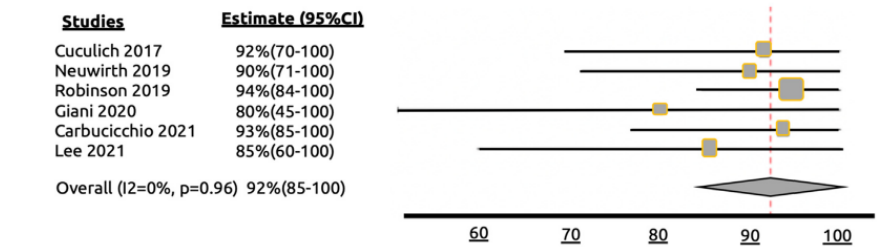
A Meta-analysis of the Efficacy and Safety of Stereotactic Arrhythmia Radioablation (STAR) in Patients with Refractory Ventricular Tachycardia

G.A. Viani *†, A.G. Gouveia ††, J.F. Pavoni §, A.V. Louie ¶, J. Detsky ¶, D.E. Spratt ||, F.Y. Moraes †**

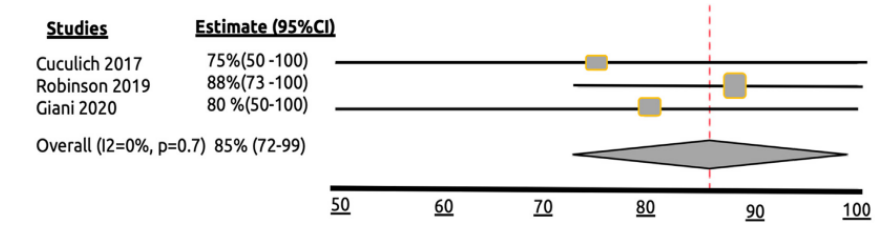
Conclusion

The current limited body of evidence suggests that STAR is effective and safe for treating patients with refractory ventricular tachycardia. STAR reduced the consumption of AAD and the number of ICD shocks. The current meta-analysis supports the ongoing nine trials and other future prospective studies using STAR for patients with refractory ventricular tachycardia.

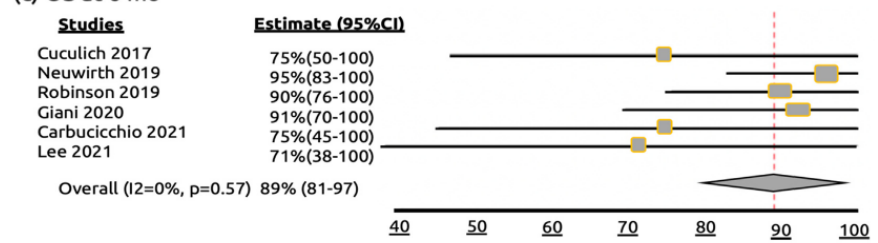
(a) % of VT burden reduction at 6 months



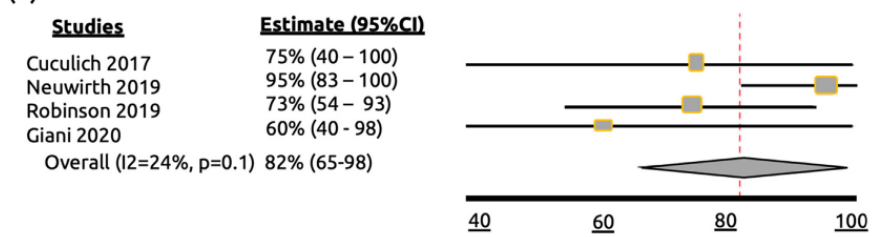
(b) % patients using < 2 AAD at 6 months



(c) OS at 6 mo

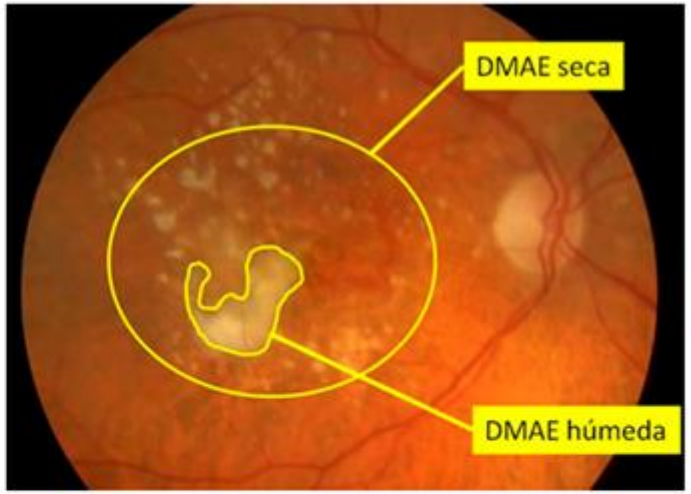


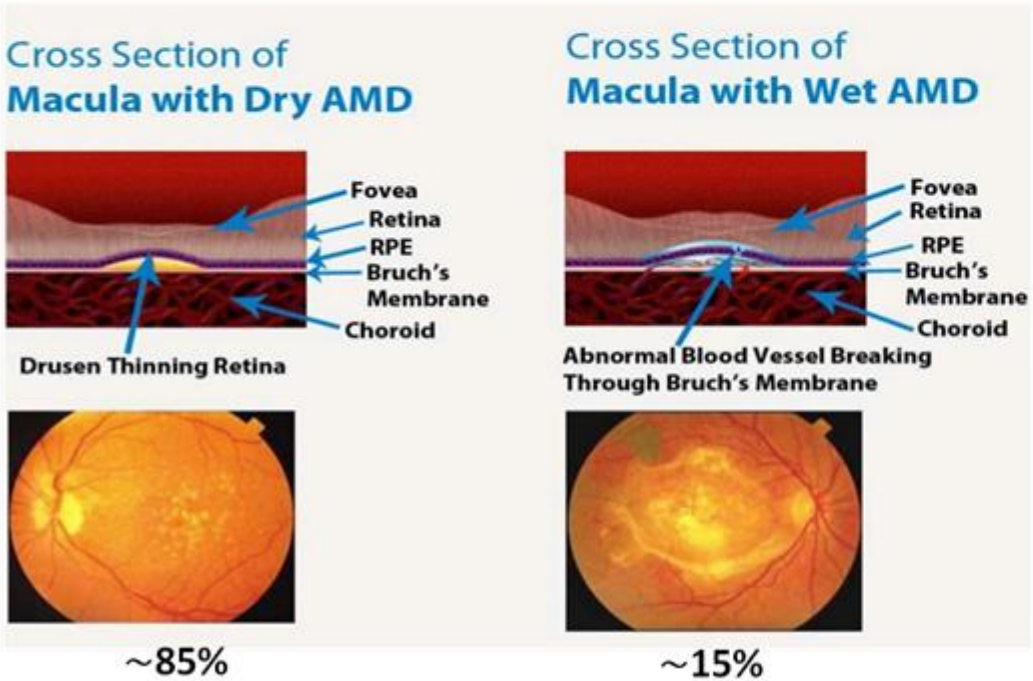
(d) OS at 12 mo

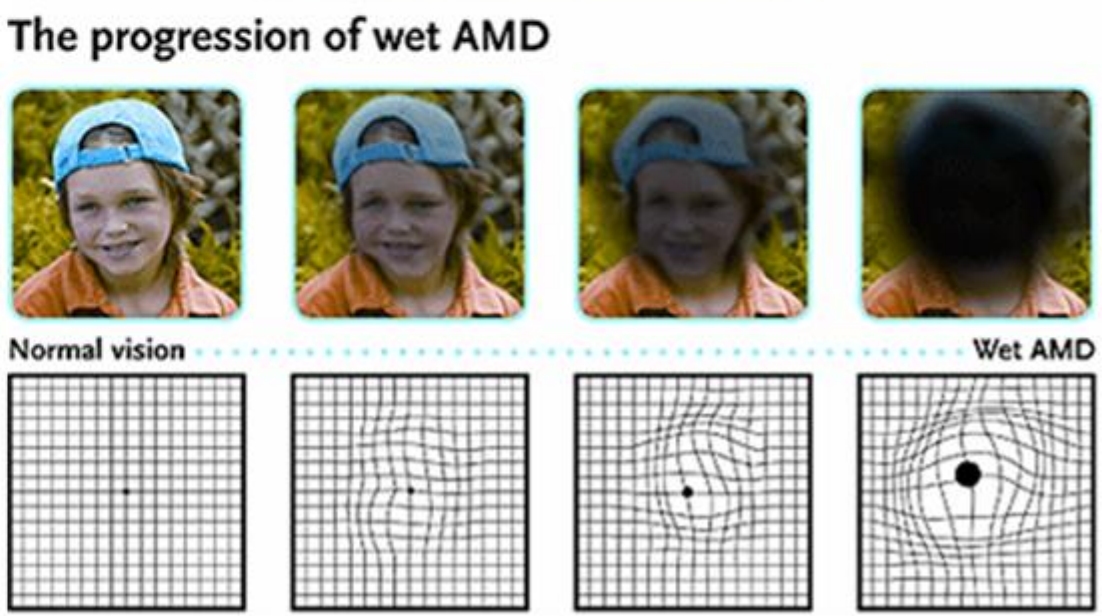


AGE-RELATED MACULAR DEGENERATION

- Leading cause of blindness in the Western world after cataracts
- >50yo
- Female>male
- Dry-AMD: better pognosis







International Journal of Radiation Oncology biology • physics
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Critical Review

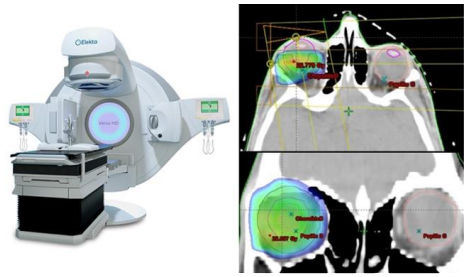
Radiation Therapy for Neovascular Age-related Macular Degeneration

Amar U. Kishan, MD,* Bobeck S. Modjtahedi, MD,† Lawrence S. Morse, MD, PhD,† and Percy Lee, MD‡

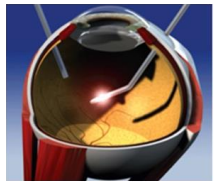
*Harvard Medical School, Boston, Massachusetts; †Department of Ophthalmology and Vision Sciences, University of California, Davis, Sacramento, California; and ‡Department of Radiation Oncology, David Geffen School of Medicine at UCLA, Los Angeles, California

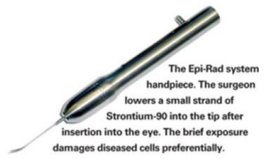
Received Jun 13, 2012. Accepted for publication Jul 15, 2012

In the enormity of the public health burden imposed by age-related macular degeneration (ARMD), much effort has been directed toward identifying effective and efficient treatments. Currently, anti-vascular endothelial growth factor (VEGF) injections have demonstrated considerably efficacy in treating neovascular ARMD, but patients require frequent treatment to fully benefit. Here, we review the rationale and evidence for radiation therapy of ARMD. The results of early photon external beam radiation therapy therapy, and brachytherapy. The evidence suggests that these 3 modern modalities can provide a dose-dependent benefit in the treatment of ARMD. Most importantly, preliminary data suggest that all 3 can be used in conjunction with anti-VEGF therapeutics, thereby reducing the frequency of anti-VEGF injections required to maintain visual acuity. © 2013 Elsevier Inc.

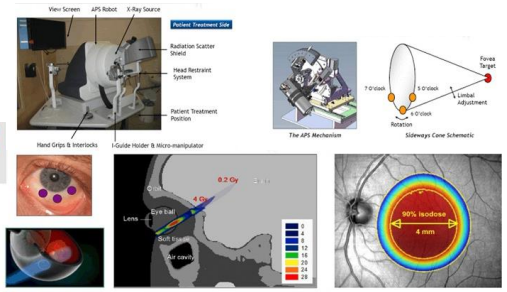


MV



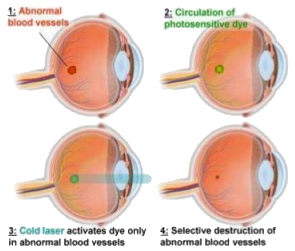


BT

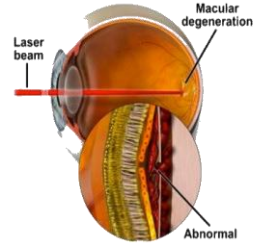


kV

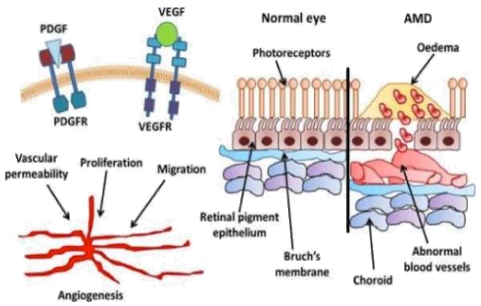
Photodynamic therapy



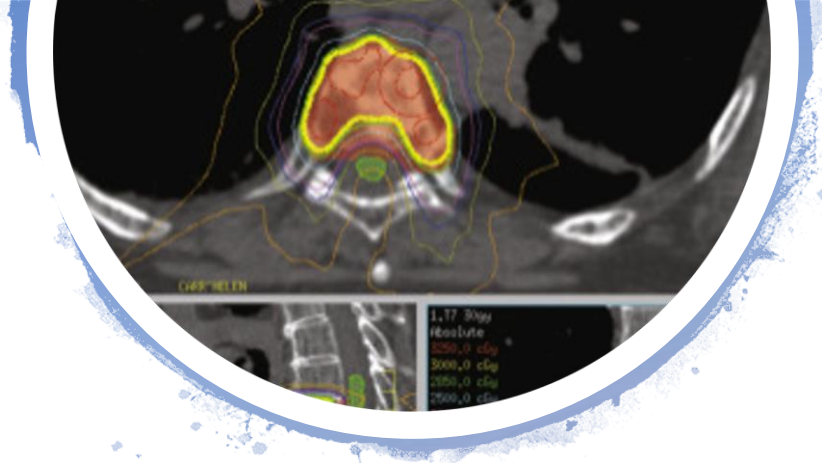
Focal laser for wet AMD



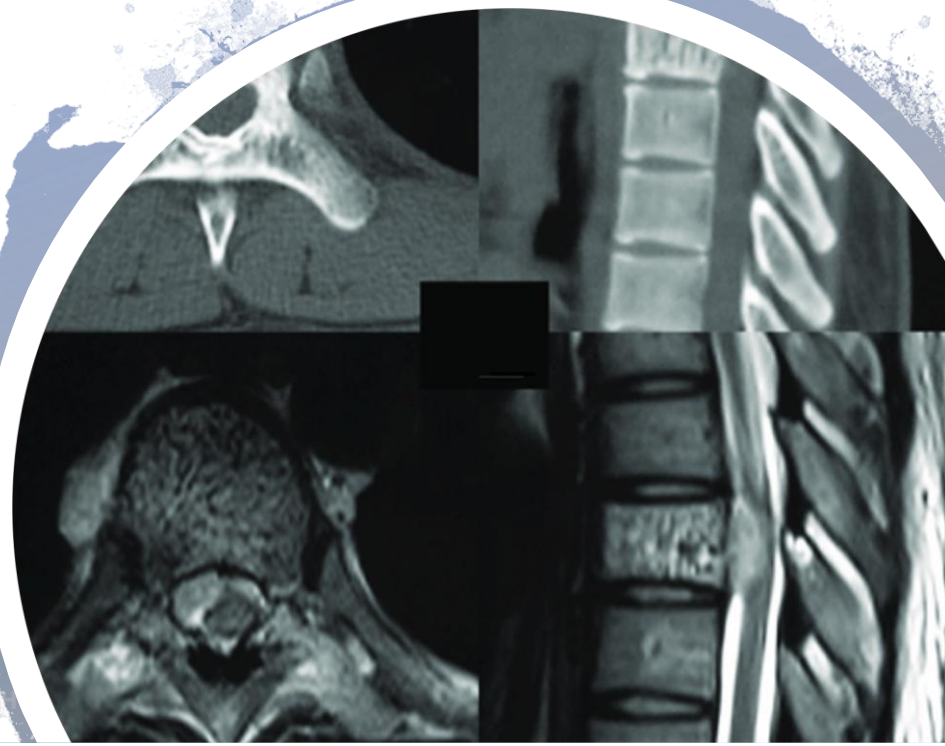
VEGF

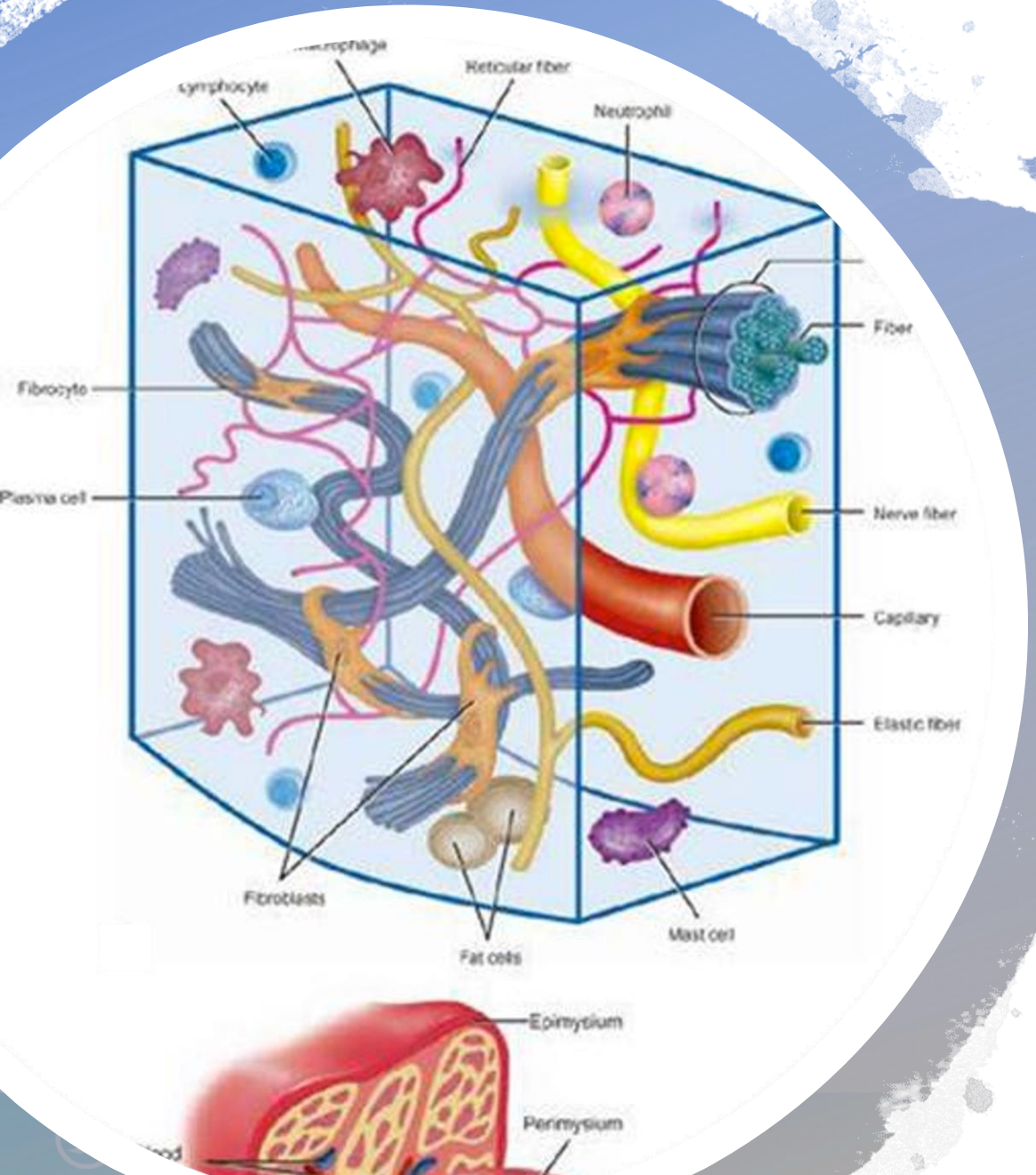


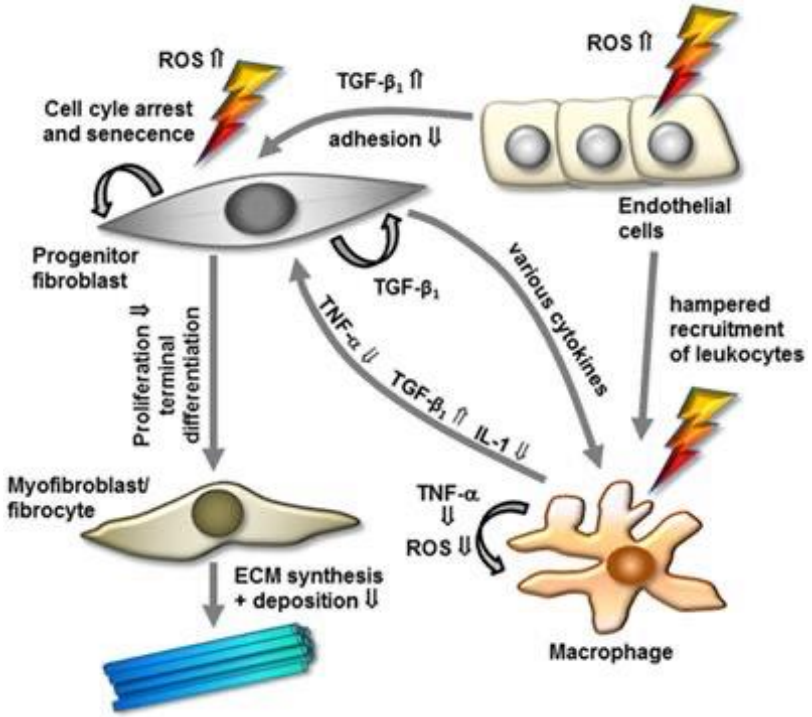
Vertebral Hemangiomas



- Benign lesions characterised by aberrant vessels in vertebral bodies.
- More frequent in women
- Affect 10-12% of the population
- 0.9-1.2% symptomatic (pain and neurological symptoms)
- Treatment: in symptomatic patients only
  - Surgery: laminectomy, vertebrectomy
  - Embolisation, ethanolisation
  - Vertebroplasty
  - RT effective in pain relief, dose-related response (Rades IJROBP 2003)20-34 Gy: 39%36-40 Gy: 82% dose-response







CONNECTIVE TISSUE HYPERPROLIFERATIVE DISORDERS

Heterotopic Ossification

ELSEVIER

Int. J. Radiation Oncology Biol. Phys., Vol. 60, No. 3, pp. 888–895, 2004

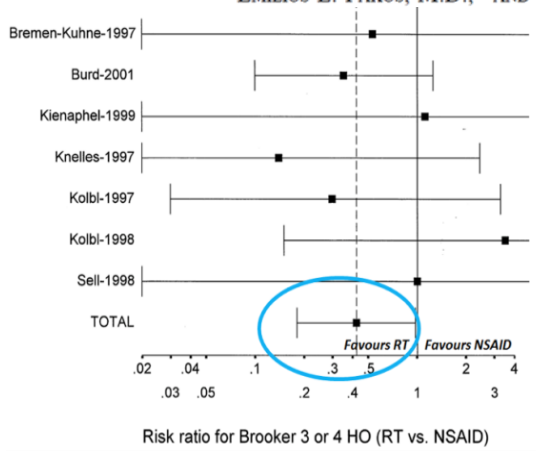
0360-3016/04/$–see front matter

doi:10.1016/j.ijrobp.2003.11.015

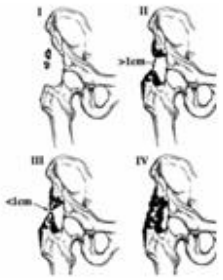
CLINICAL INVESTIGATION Benign Disease

RADIOTHERAPY VS. NONSTEROIDAL ANTI-INFLAMMATORY DRUGS FOR THE PREVENTION OF HETEROTOPIC OSSIFICATION AFTER MAJOR HIP PROCEDURES: A META-ANALYSIS OF RANDOMIZED TRIALS

EMILIOS E. PAKOS, M.D.,* AND JOHN P. A. IOANNIDIS, M.D.*†‡



Risk ratio for Brooker 3 or 4 HO (RT vs. NSAID)



Graves' Ophtalmopathy

Orbital radiation therapy for Graves' ophthalmopathy: Measuring clinical efficacy and impact

Ezra Hahn MD [a], Normand Laperriere MD, FRCPC [a], Barbara-Ann Millar MBChB, FRCPC [a], James Oestreicher MD [b], Hugh McGowan MD [b], Hatem Krema MD [b], Harmeet Gill MD [b], Dan DeAngelis MD [b], Jeff Hurwitz MD [b], Nancy Tucker MD [b], Rand Simpson MD [b], Caroline Chung MD, FRCPC, CIP [a,*]

[a]*Department of Radiation Oncology, University of Toronto, Toronto, Ontario, Canada*
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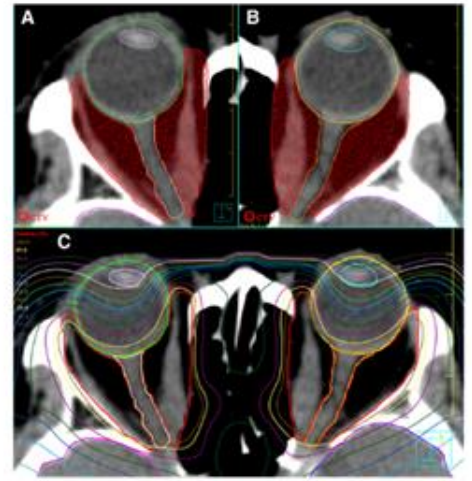
Received 14 January 2014; revised 20 February 2014; accepted 26 February 2014



Abstract

Purpose: Graves' ophthalmopathy (GO) is an autoimmune condition primarily managed with prolonged courses of glucocorticoids, which can be associated with significant side effects. Orbital radiation therapy (RT) is an alternative treatment that has shown variable efficacy in improving orbital and visual symptoms. In this study, the therapeutic benefit of RT was evaluated in terms of patient's ability to taper their corticosteroid requirements, which may better reflect the proposed mechanism of RT and provide a clinically relevant response endpoint.

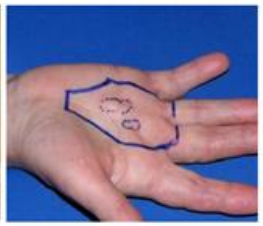
Methods and materials: This is a retrospective review of consecutive patients treated with orbital RT for GO between 2000 and 2010 at a single tertiary hospital with a dedicated ocular radiation therapy clinic. The primary measure of treatment response was defined as the ability to taper glucocorticoids following RT without any further exacerbation of orbitopathy symptoms. Additional endpoints including ocular symptoms (diplopia, proptosis, visual acuity, extraocular movement) and need for surgical intervention were reported.

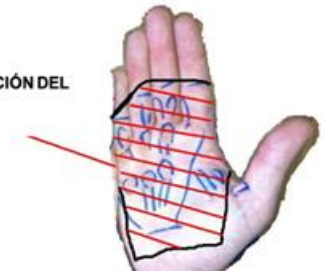
Results: Of 86 eligible patients, with a mean follow-up of 9.3 months, 81 (94%) patients responded to RT. Of patients taking corticosteroids at baseline, 91% were able to taper off corticosteroids completely and the remaining patients had decreased their doses by 83%. Diplopia, visual acuity, and extraocular movements improved in 29%, 81%, and 58% of patients, respectively. The median reduction in proptosis was 2.5 mm and 2 mm in the left

Conclusions: Orbital RT is a generally well-tolerated treatment that helps minimize the dose and duration of corticosteroid therapy for patients with GO while improving ocular symptoms, including proptosis and diplopia. Prospective research should consider using corticosteroid requirement as a measure of response to orbital RT for GO.

Morbus Dupuytren/Ledderhose

- Proliferative connective tissue disorder affecting the plantar fascia (Dupuytren's) or plantar fascia (Ledderhose)
- Subcutaneous fibrous cords and nodules leading to retraction of the toes.
- Affects 1-3% of the European population, related to CLD, alcoholism,...
- Treatment: corticosteroids, allopurinol, NSAIDs, surgery...
- **Radiotherapy: 15 Gy /3Gy/fx) x 2 courses 3-6 weeks apart; stabilisation or improvement in 80-90%.**





Radiotherapy and Oncology 185 (2023) 109718

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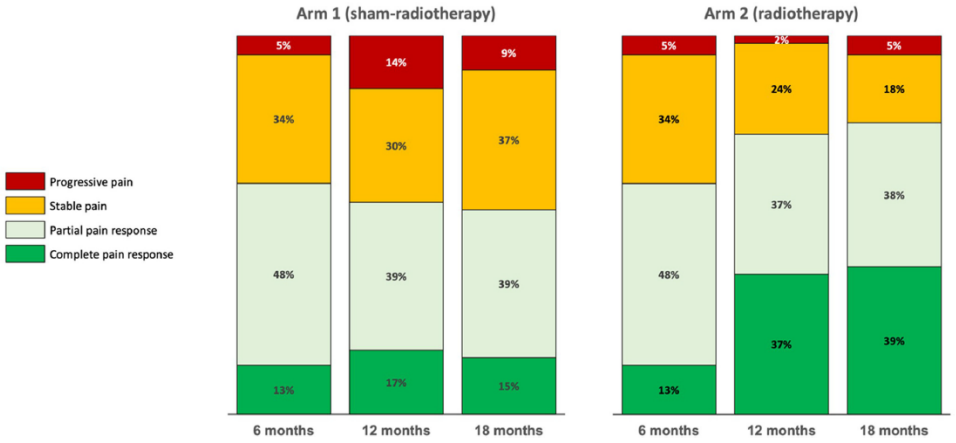
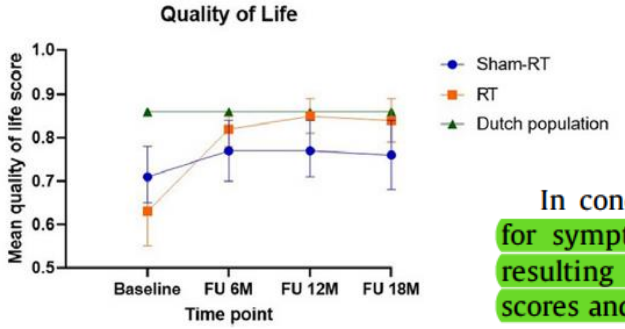
Original Article

Radiotherapy for Ledderhose disease: Results of the LedRad-study, a prospective multicentre randomised double-blind phase 3 trial ☆

Anneke de Haan [a,*], Johanna G.H. van Nes [b], M. Willemijn Kolff [c], Peter-Paul van der Toorn [d], A. Helen Westenberg [e], Annelies E. van der Vegt [f,1], Henk Groen [g], Jelle Overbosch [h], Hans Paul van der Laan [a], Paul M.N. Werker [i], Johannes A. Langendijk [a], Roel J.H.M. Steenbakkers [a]





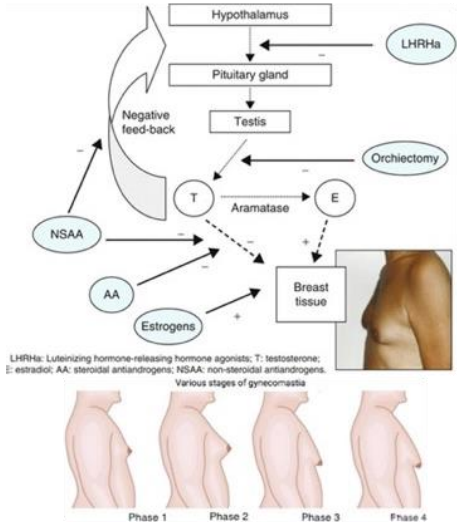
In conclusion, compared to sham-radiotherapy, radiotherapy for symptomatic Ledderhose disease is an effective treatment, resulting in a significant pain reduction, improvement of QoL scores and bare feet walking abilities, without increased toxicity.

Hidradenitis suppurative

- Chronic inflammatory-proliferative skin disorder appearing as folliculitis with ulcerated and oozing papules and pustules.
- Affects 1% of the population; localized in folds (axilla, groin, neck, buttocks,...)
- Evolves to fibrosis, contracture, distortion of the tissues.
- Radiation therapy 3-8Gy (0.5-2Gy/fx) effective and safe in reducing incidence and complications.

Gynecomastia

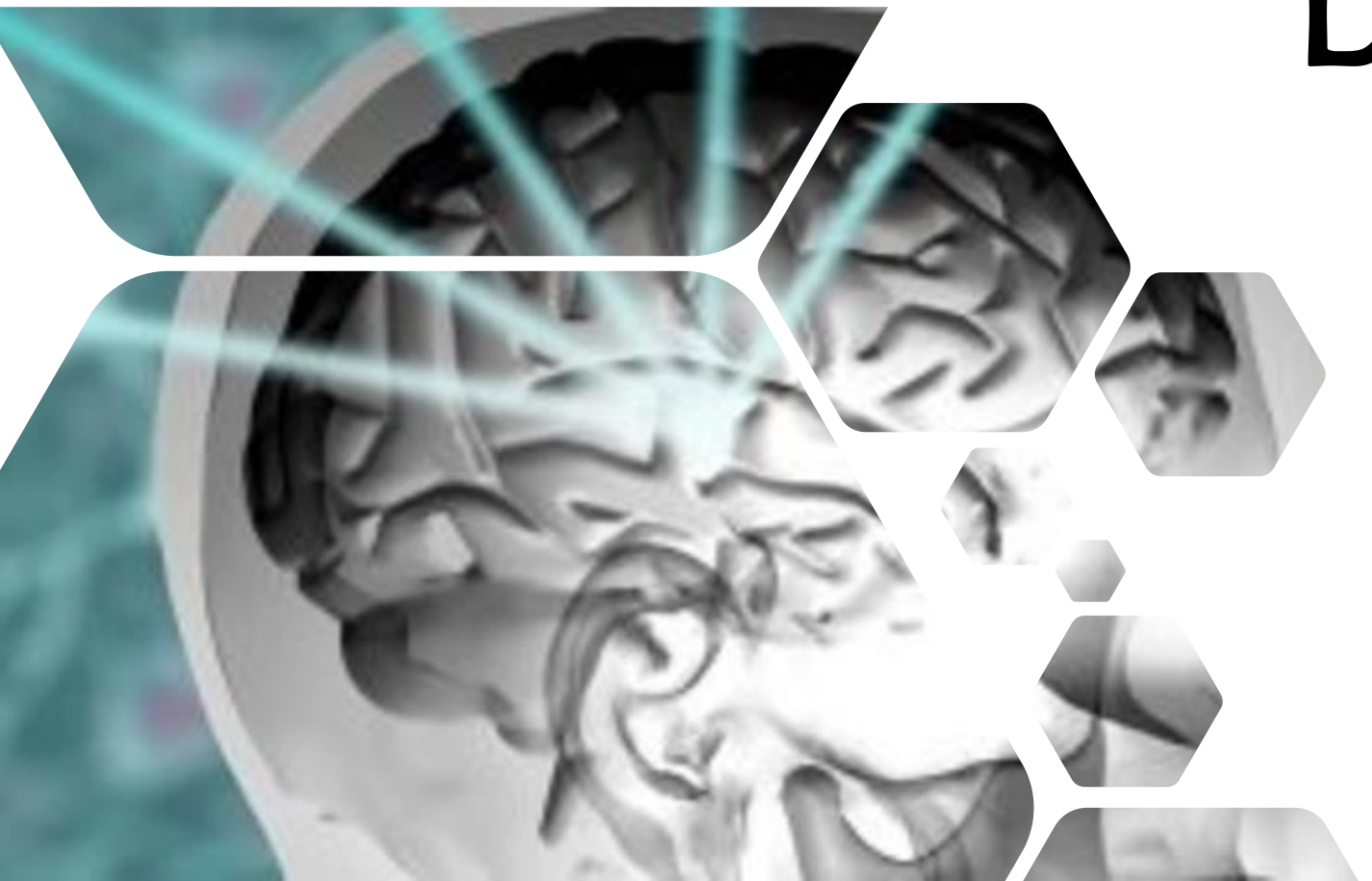
- Benign proliferation of mammary glandular tissue in men due to androgen/estrogen imbalance.
- Associated with hypogonadism, hepatopathies, Leydig's tumors…
- Also in patients under ADT: 3-13% with GnRH analogues but 40-70% with bicalutamide 150mg/24h.
- Radiotherapy:
  - Prophylaxis: 10 Gy ↓ risk 50-60%.
  - Therapeutic: 2 x 6 Gy ↓ pain and intensity 35-45%.



Keloids

- Excessive tissue proliferation in the healing process
- Typically after surgery, piercings or aggressions with bladed weapons or firearms.
- Treatment: surgery but 80'% relapse
- Radiotherapy: EBRT or BT reduces the risk of relapse after surgery.
  - Start <24h after surgery (ideally <90 minutes).
  - Also useful as exclusive treatment in inoperable/irresectable patients.

CNS FUNCTIONAL DISORDERS



Outcomes from stereotactic surgery for essential tremor

Robert Francis Dallapiazza,[1] Darrin J Lee,[1] Philippe De Vloo,[1] Anton Fomenko,[1] Clement Hamani,[1] Mojgan Hodaie,[1] Suneil K Kalia,[1] Alfonso Fasano,[2,3,4] Andres M Lozano[1]

Table 1 A comparison of surgical outcomes for ET

	DBS	FUS	GKRS	RF
Experience	1093 patients since 1998	151 patients since 2013	360 patients since 2007	278 patients since 1986
Level of Evidence, (OCEM)	Level 2	Level 1	Level 4	Levels 2–4
Tremor control, 12-month follow-up	Unilateral: 53.4%–62.8% Bilateral 66%–78%	Unilateral: 35%–75% Bilateral: no data	Unilateral: 48%–63% Bilateral: no data	Unilateral: 74%–90% Bilateral: no data
Tremor control, long-term follow-up	Unilateral: 60%–75% Bilateral 75%	Unilateral: 56%	Unilateral: 3%–63%	Unilateral: 74%–90%
Quality of life improvements	57.9%–82%	37%–73%	65%	47%
Complications (range, transient and permanent)	Unilateral, bilateral			
Dysarthria	11%–39%, 22%–75%	3%	1%–3%	4.6%–29%
Ataxia/gait	9%–17%, 56%–86%	23%	0%–17%	5%–27%
Paraesthesia	5%, 5.9%	14%–25%	1%–9%	6%–42%
Hemiparesis	4.5%, 6.7%	2%–7%	0%–8%	0%–34%

ET, essential tremor; DBS, deep brain stimulation; FUS, focused ultrasound; GKRS, gamma knife radiosurgical thalamotomy; RF, radiofrequency.

Tremor symptoms	Treatments
Unilateral tremor	1. Unilateral DBS 2. Unilateral FUS, GK or RF thalamotomy
Bilateral tremor	1. Bilateral DBS (Single or staged surgery) 2. Unilateral DBS for dominant or more affected upper extremity with delayed staging for secondary DBS 3. Unilateral DBS followed by RF or GK thalamotomy

Patients unwilling or unable to undergo DBS	Treatments
Significant medical comorbidities	• GKRS thalamotomy
Skull favorable for FUS	• FUS thalamotomy
Infection of DBS system	• RF, GKRS, or FUS thalamotomy

- Out-patient treatment
- 130-160 Gy in a single fraction
- Tremor control @12months: 48-53%
- QoL improvement in 65%

J Neurol Neurosurg Psychiatry 2019;**90**:474–482.

Stereotactic Radiosurgery for Trigeminal Neuralgia: A Retrospective Multi-Institutional Examination of Treatment Outcomes

Raj Singh [1], Joanne Davis [2], Sanjeev Sharma [3]

Conclusions

SRS is an effective treatment option for TN patients in community settings. Initial pain relief following SRS was achieved in a vast majority of TN patients with associated minor toxicities observed in less than 20% of all patients.

2016 Singh et al. Cureus 8(4): e554. DOI 10.7759/cureus.554

Frameless Image-Guided Radiosurgery for Initial Treatment of Typical Trigeminal Neuralgia

Joseph C. T. Chen[1], Javad Rahimian[2], Rombod Rahimian[2], Alonso Arellano[2], Michael J. Miller[2], Michael R. Girvigian[2]

Table 2. Recent Radiosurgery Series Examining Results from Initial Treatment of Trigeminal Neuralgia Using Frame and Frameless Techniques

Study	Device/Method	DMax/Collimator	*N*	Follow-up (Months)	% Good Response	% BNI-PS = I, II	Dysesthesia
Fariselli 2009 (6)	CyberKnife/IGRS	55–75 Gy/5 mm	33	23	94	27	0
Huang 2008 (8)	Gamma Knife/frame	79 Gy/4 mm	89	60	77.5	56	0
Brisman 2000 (1)	Gamma Knife/frame	75 Gy/4 mm	82	12	87	NR	2%
Kondziolka 1998 (10)	Gamma Knife/frame	70–80 Gy/4 mm	23	12	96	74	0
Present study	Novalis/IGRS	90 Gy/4 mm	44	15	91	52	0

DMax, maximum dose; IGRS, image-guided radiosurgery.

WORLD NEUROSURGERY, DOI:10.1016/J.WNEU.2010.07.001

Good symptomatic response in 77-96%

Stereotactic radiosurgery for functional disorders

Gerhard M. Friehs, M.D.,[1,2] Michael C. Park, M.D., Ph.D.,[1] Marc A. Goldman, M.D.,[1] Vasilios A. Zerris, M.D., M.P.H., M.MSc.,[1] Georg Noren, M.D., Ph.D.,[1] and Prakash Sampath, M.D.[2]

*Parameters of radiosurgery for movement disorders**

Parameter	Movement Disorder: PD	Movement Disorder: Dystonia
target	GPi	Vim or GPi
max. dose (Gy)	120–180	160
outcome		
% improved	up to 50–85%	100%
% w/ complications	up to 50%; some severe	rare

*Radiosurgery for pain disorders**

Parameter	Pain Disorder: TN	Cluster Headaches	Cancer Pain	Chronic Pain Syndromes
target	TREZ	TREZ	pituitary gland & stalk	medial thalamus	pituitary stalk
max. dose (Gy)	70–90	80	160	140–180	160
outcome					
% improved	up to 90	30	100	up to 66	21
% w/ complications	up to 25	90; significant	none	significant	42

*Radiosurgery for epilepsy**

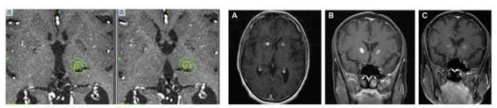
Parameter	Type or Cause of Epilepsy: MTLE	Hypothalamic Hamartoma	DA-GTCS
target	amygdala, hippocampus	hypothalamic lesion	corpus callosum
max. dose (Gy)	48–50	50	100–140
outcome			
% improved	65	70–90	40–60
% w/ complications	45, mild	rare	none

Radiosurgery for the Treatment of Psychiatric Disorders: A Review

Marc Lévèque[1], Romain Carron[1,2,3], Jean Régis[1,2,4]

AUTOR	N	TRASTORNO	PTV	DOSIS RT	RESULTADO
Leksell 1985	1	SAD	ALIC	120 Gy	Pobre
Mindes 1987	7	SAD	ALIC	160 Gy	45% bueno; 27% parcial; 27% pobre
Lippitz 1999	9	OCD	ALIC	NS	78% bueno
Del Valle 2006	9	Heteroagresión 6; OCD 2, SAD 1	ALIC; LL	NS	67% bueno, 33% parcial
Rück 2008	9	OCD	ALIC	180-200 Gy	40% bueno
Lopes 2009	5	OCD	ALIC	180 Gy	40% moderada; 20% nula
Slavin 2009	4	OCD	ALIC	180 Gy	75% parcial: 25% nula
Kondziolka 2011	3	OCD	ALIC	140-150 Gy	100% parcial

SAD: severe anxiety disorder; OCD: obsessive-compulsive disorder; ALIC: anterior limb of the internal capsule; LL: limbic leukotomy



World Neurosurg. (2013) 80, 3/4:S32.e1-S32.e9.

ALZHEIMER'S DISEASE

Respiratory Medicine (2012) 106, 1063–1069

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/rmed

SHORT COMMUNICATION

External beam radiation therapy is safe and effective in treating primary pulmonary amyloidosis

Shaohua Ren [a,*], Gang Ren [b]

[a] Department of Respiratory Medicine, Lishui Central Hospital, No. 2 Dengta Street, Zhejiang Province 323000, PR China
[b] Molecular Imaging Program at Stanford (MIPS), Department of Radiology, Stanford University, California, CA 94305-5344, USA

Received 4 November 2010; accepted 20 February 2012
Available online 8 March 2012

KEYWORDS
Primary pulmonary amyloidosis;
Tracheobronchial amyloidosis;
External beam radiation therapy

Summary
The aim of the prospective study was to explore the safety and effectiveness of external beam radiation therapy (EBRT) in three patients with biopsy proven primary pulmonary amyloidosis, including two tracheobronchial amyloidosis patients and one primary parenchymal amyloidosis patient. All three patients were treated to 24 Gy in 12 fractions utilizing CT simulation and 3-D planning. All three patients had significant improvement in clinical symptoms, radiological imaging as well as pulmonary function tests. The improvement in the clinical symptoms was evident in 2 days. Toxicities related to EBRT were not observed during the follow-up range from 42 to 54 months. EBRT to 24 Gy was safe and effective in the three patients with primary pulmonary amyloidosis, and resulted in rapid relief of pulmonary symptoms.

Clinical Investigation: Thoracic Cancer

International Journal of Radiation Oncology • biology • physics
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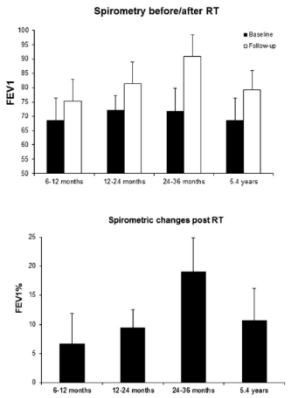
Long-Term Results of Conformal Radiotherapy for Progressive Airway Amyloidosis

Minh Tam Truong, M.D.,* Lisa A. Kachnic, M.D.,* Gregory A. Grillone, M.D.,† Harry K. Bohrs, B.S.,* Richard Lee, M.D.,* Osamu Sakai, M.D., Ph.D.,‡ and John L. Berk, M.D.§

Departments of *Radiation Oncology, †Otolaryngology, ‡Radiology, and §Medicine, Amyloid Treatment and Research Program, Boston University School of Medicine, Boston Medical Center, Boston, MA

Received May 9, 2011, and in revised form Jul 26, 2011. Accepted for publication Jul 28, 2011

Summary
Ten patients with symptomatic airway amyloidosis were followed for a median of nearly 7 years after 20 Gy external beam radiotherapy. RT appeared effective in controlling progressive airway amyloidosis of the larynx and tracheobronchial tree in 8 of 10 patients by stabilizing amyloid deposits and improving pulmonary function. It did so with no obvious late morbidity.



International Journal of Radiation Oncology*Biology*Physics

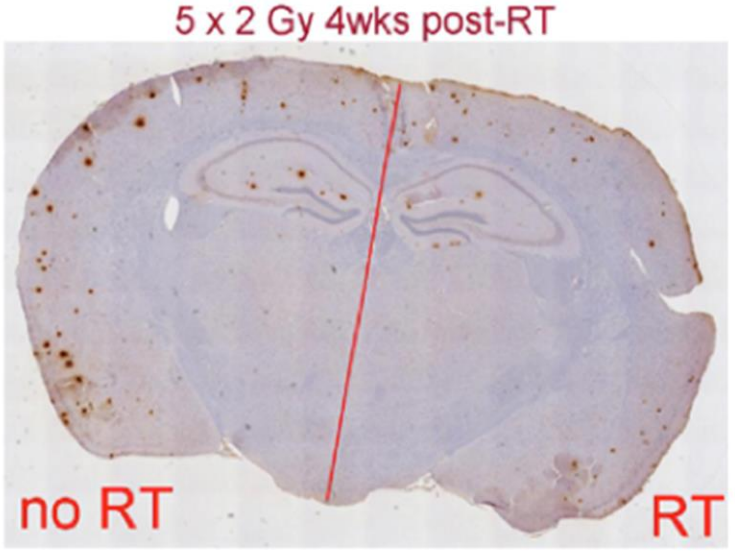
Volume 84, Issue 3, Supplement, 1 November 2012, Pages S107–S108

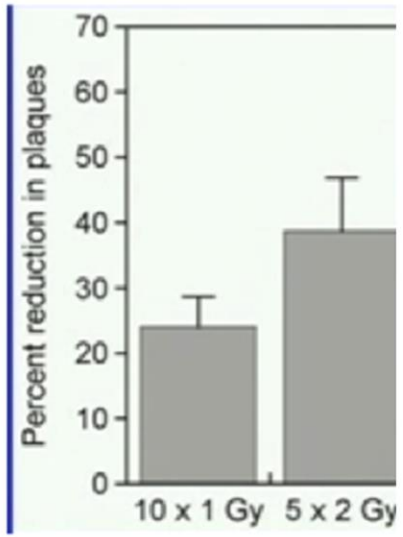
Proceedings of the American Society for Radiation Oncology 54th Annual Meeting

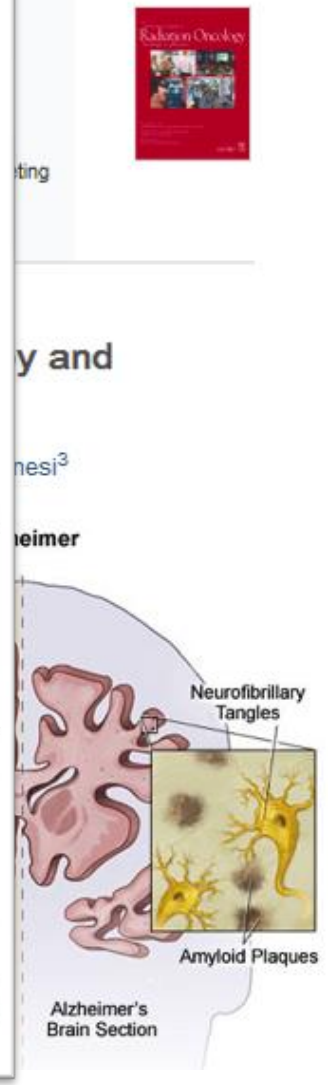
ASTRO's 54th Annual Meeting

Ionizing Radiation May Lead to Downregulation of Amyloid Precursor Proteins Causing Significant Reductions in β-Amyloid Plaque Burden in a Murine Model for Alzheimer's Disease

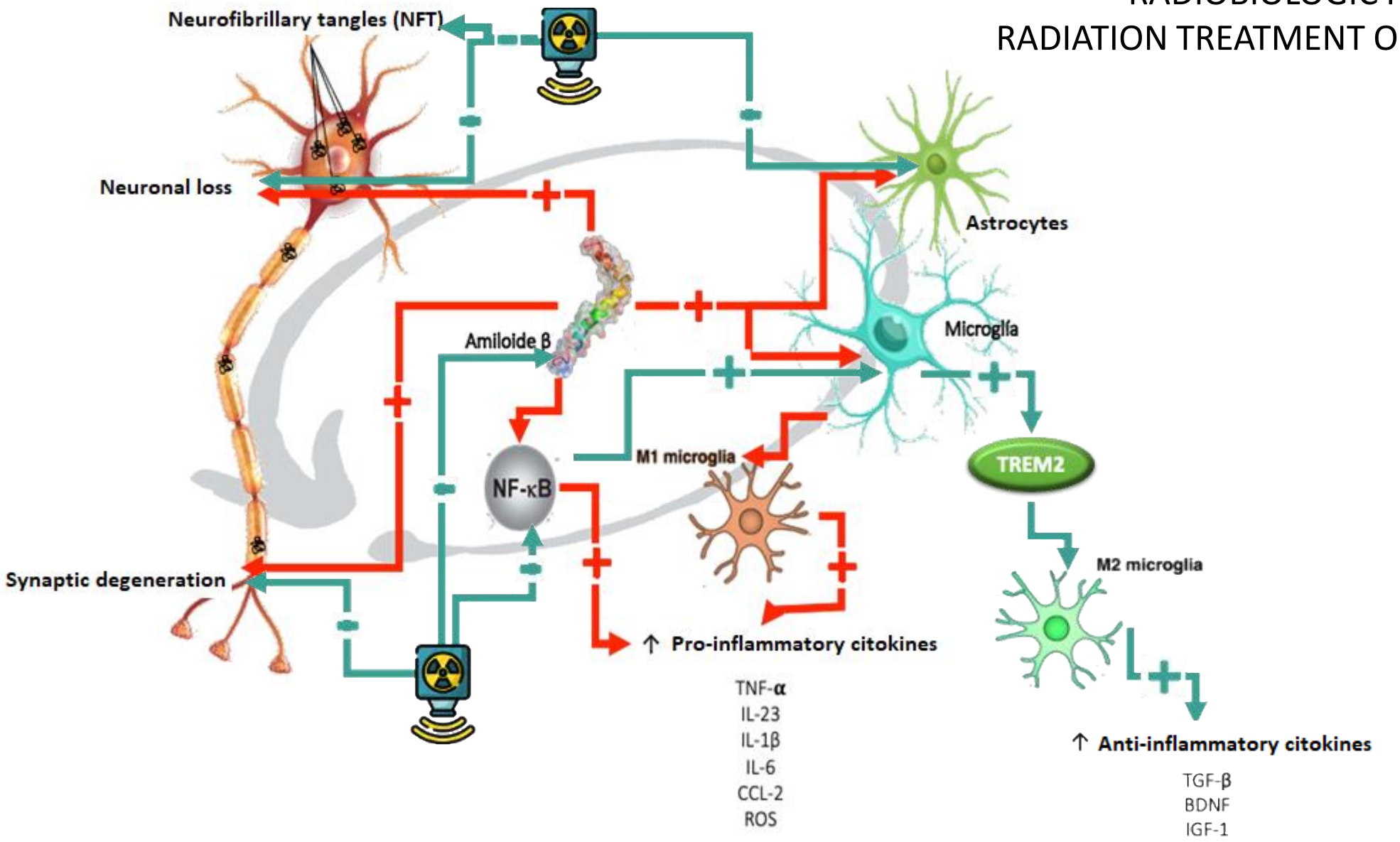
M.C. McGee[1], J. Fontanesi[2], D.B. Michael[1], B. Thibodeau[1], T. Maerz[1], A. Hanna[1], I.S. Grills[1], G.D. Wilson[1], A.A. Martinez[3], B. Marples[1]







RADIOBIOLOGIC RATIONALE FOR RADIATION TREATMENT OF ALZHEIMER'S DISEASE



Modified from Kim et al. Int. J. Mol. Sci. 2020, 21, 3678; y Kim et al. Int. J. Mol. Sci. 2020, 21, 4532

ONGOING TRIALS OF RADIATION THERAPY FOR ALZHEIMER'S DISEASE

Estudio	NCT	Study	N	Inclusion criteria	Symptomatology	WBI	Primary objectives	Secondary objectives
Wlliam Beaumont Hospital	NCT02359864	Phase I	30	>55 yo MMSE: 10-20 Rosen Modified Hachinski Ischemic Score ≤4	Diagnostic criteria for Alzheimer's disease NINCDS-ADRDA.	A: 10Gy/5fx B: 20Gy/10fx	Safety and toxicity (CTCAE)	Evolution of neurocognitive test and PET at 12 months
University of Virginia Commonwealth	NCT02769000	Phase II	30	>55 yo Rosen Modified Hachinski Ischemic Score ≤4	Diagnostic criteria for Alzheimer's disease NINCDS-ADRDA. Florbetapir F 18 confirmatory PET	A: 10Gy/5fx B: 20Gy/10fx	Safety and toxicity (CTCAE)	Evolution neurocognitive test at 12 months
University of Geneva	NCT03352258	Phase III	20	18-80 yo	Prodromal phase AD or mild/moderate symptoms	A: no RTE B: 10Gy/5fx	Safety Reduction in amyloid deposits by PET at 8-12 weeks	Evolution neurocognitive test at 6 months
Kyung Hee University	NCT04203121	Fase III	10	50-90 yo MMSE: 10-24	Mild/moderate AD symptoms	A: 9Gy/5fx B: 5,4Gy/3fx	Safety Evolution neurocognitive test, MRI and PET at 6 months	Changes in amyloid deposits at 6 months by variations in 18-flutemetamol-PET (SUV variation >5%)

2023: FIRST CLINICAL RESULTS IN HUMANS

ELSEVIER

International Journal of Radiation Oncology*Biology*Physics

Volume 117, Issue 1, 1 September 2023, Pages 87-95

CLINICAL INVESTIGATION

Low-Dose Whole Brain Radiation Therapy for Alzheimer's Dementia: Results From a Pilot Trial in Humans

C. Leland Rogers MD *, Sarah K. Lageman PhD †, James Fontanesi MD ‡, George D. Wilson PhD ‡, Peter A. Boling MD †, Surbhi Bansal MD †, John P. Karis MD §, Marwan Sabbagh MD §, Minesh P. Mehta MD ‖, Timothy J. Harris MD, PhD †

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https://doi.org/10.1016/j.ijrobp.2023.03.044 Get rights and content

Purpose

We report neurocognitive, imaging, ophthalmologic, and safety outcomes following low-dose whole brain radiation therapy (LD-WBRT) for patients with early Alzheimer dementia (eAD) treated in a pilot trial.

Methods and Materials

Trial-enrolled patients were at least 55 years of age, had eAD meeting NINCDS-ADRDA (National Institute of Neurological and Communicative Disorders and Stroke–Alzheimer's Disease and Related Disorders Association) Alzheimer's Criteria with confirmatory fluorodeoxyglucose and florbetapir positron emission tomography findings; had the capacity to complete neurocognitive function, psychological function, and quality-of-life assessments; had a Rosen modified Hachinski score ≤4; and had estimated survival >12 months.

Results

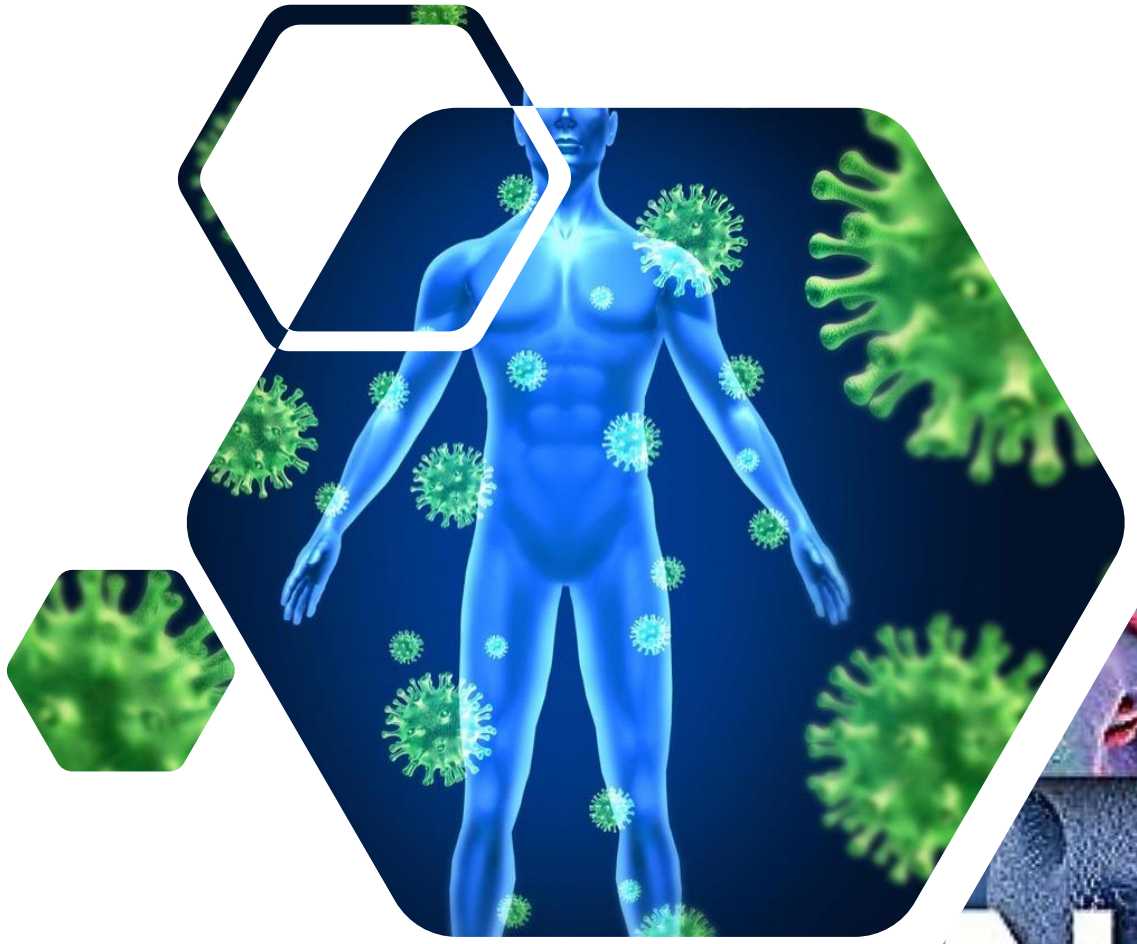
Five patients were treated with LD-WBRT (2 Gy×5 over 1 week; 3 female; mean age, 73.2 years [range, 69-77]). Four of 5 patients had improved (n=3) or stable (n=1) Mini-Mental State Examination (second edition) T-scores at 1 year. The posttreatment scores of all 3 patients who improved increased to the average range. There were additional findings of stability of naming and other cognitive skills as well as stability to possible improvement in imaging findings. No safety issues were encountered. The only side effect was temporary epilation with satisfactory hair regrowth.

Conclusions

Our results from 5 patients with eAD treated with LD-WBRT (10 Gy in 5 fractions) demonstrate a positive safety profile and provide preliminary, hypothesis-generating data to suggest that this treatment stabilizes or improves cognition. These findings will require further evaluation in larger, definitive, randomized trials.

N = 5
WBI 5 x 2Gy
At 12 months (MMSE-2):
3 improved
1 stabilizated
1 worsened

Int J Radiat Oncol Biol Phys, volume 108, issue 3, supplement , e747, november 01, 2020, https://doi.org/10.1016/j.ijrobp.2020.07.162



INFECTIOUS DISEASES

BEDSIDE MEDICINE FOR BEDSIDE DOCTORS

An Open Forum for brief discussions of the workaday problems of the bedside doctor. Suggestions for subjects for discussion invited.

November, 1931

THE USE OF RADIOTHERAPY IN ACUTE PYOGENIC INFECTIONS

JOHN D. LAWSON, M. D. (Woodland Clinic, Woodland).—The treatment of acute pyogenic infections through the use of radiotherapy is not new, but recently has received considerable attention with the result that it has come into more general usage.

The more common acute infections in which roentgen therapy has been utilized with success are erysipelas, furunculosis, carbuncles, cellulitis, lymphadenitis, lymphangitis, parotitis, and acute pelvic inflammatory disease. In all of these conditions we find a rather remarkable response to the use of this physical agent, provided the disease has not progressed to suppuration.

If necrosis has already occurred and the lesion has become entirely localized, it has not been our experience that any favorable results are obtained. If, however, extension is continuing about a necrotic area the effect of radiotherapy is quite satisfactory as it will inhibit further progression.

In the treatment of acute pyogenic infections by means of roentgen rays the point of first importance is the selection of cases. This mode of therapy will certainly come into disrepute if attempts are made to produce results in instances where necrosis and suppuration have already occurred.

and included in the irradiated area. If radiation is limited to the lesion itself a high percentage of patients will have further extension, whereas if the application includes the larger area this will not occur.

It has not been our practice to reirradiate within forty-eight hours, but if the lesion has progressed and there is still no evidence of necrosis at the end of that time the same dosage is repeated.

As stated before, the results obtained in this field are such as would convince the most skeptical, and it has been routine at the Woodland Clinic for several years to refer all acute nonsuppurative pyogenic infections to the radiotherapy department for treatment.

* * *

MOSES SCHOLTZ, M. D. (1930 Wilshire Boulevard, Los Angeles).—The term "radiotherapy" colloquially implies x-rays and radium, and strictly speaking it should also comprise the superficial actinic modality of the ultra-violet ray. Pyogenic infections of the skin naturally divide into two groups, superficial and deep. The superficial infections of the skin are represented by various types of pyodermias, such as pyogenic intertrigos, impetiginous streptococcic dermatitides, perleche, and common impetigos.

ROENTGEN TREATMENT OF ACUTE CERVICAL LYMPHADENITIS *

L. CHARLES ROSENBERG, M.D.
NEWARK, N. J.

Acute cervical lymphadenitis in children, secondary to infections of the upper respiratory tract, is frequently encountered, particularly in the locality about Newark. Many of the cases under observation proceeded to the stage of suppuration. Some radical deviation, therefore, from the usual course of treatment was considered. Attention was turned to the increasing number of reports in the current literature in which the treatment of patients who had various acute and chronic inflammations with roentgen rays was discussed favorably.

This type of treatment could also be expected to have a favorable effect on acutely inflamed lymphatic glands. Further justification for the application of roentgen therapy in cases of acute cervical lymphadenitis was the favorable experience of many German authors.

Until recently, the value of treating acutely inflamed tissue by the x-rays was not appreciated. Lawson,[1] in discussing this subject, emphasized the fact that too much attention was paid to malignant and allied conditions, to the utter neglect of some phases of radiology which would yield more satisfactory results. Much of the lack of enthusiasm for x-ray therapy at the present time is due to the poor results obtained when it was still in its infancy. The reasons for the early failures are obvious. At that time, the nature and the danger of handling x-rays were not known. Instruments were lacking for the accurate measurement of dosage, which today is considered highly important in the proper treatment of acutely inflamed tissue. Furthermore, results were not expected with the small doses that are now given. Experience taught that large doses aggravated acute infections; consequently, the conclusion was drawn that roentgenization was contraindicated in acute inflammatory conditions. Holzknecht,[2] in a consideration of the subject, predicted "a radical change in the therapy of acute and subacute coccus inflammations through the introduction of roentgen therapy."

As time elapsed, the interest of the medical profession was directed almost entirely to the possibilities of roentgen therapy in the treatment of persons who had malignant conditions. It was only in the field of

* Submitted for publication, Sept. 17, 1928.

1. Lawson, John D.: Treatment of Pyogenic Infection by Roentgen Irradiation, Radiology **6**:153 (Feb.) 1926.

2. Holzknecht, G.: Roentgen Treatment of Spontaneous, Post-Traumatic and Post-Operative Coccus Infections and Suppurations, Am. J. Roentgenol. **15**:332 (April) 1926.

THE TREATMENT OF TUBERCULOUS ADENITIS BY ROENTGEN RAYS AND RADIUM.[1]

BY RUSSELL H. BOGGS, M.D.,
ROENTGENOLOGIST, ALLEGHENY GENERAL HOSPITAL; DERMATOLOGIST AND ROENTGENOLOGIST, COLUMBIA AND PITTSBURGH HOSPITAL, PITTSBURGH, PA.

FORMERLY radiotherapy was used in the treatment of tuberculous adenitis to avoid deformity and unsightly scars; today this treatment is advised because more permanent cures are obtained than by any other method. At present surgeons of experience are not operating primarily for tuberculous adenitis. If they operate it is only to remove fibrous nodes after the tuberculous foci have been destroyed by roentgen rays or radium. Then a dissection of the cervical glands is always contra-indicated. Radiotherapy alone will cure over 90 per cent. of the cases.

Experience has proved that tuberculous adenitis is not primarily a surgical disease. The reason that it took years to prove that cervical adenitis was better treated by radiotherapy was really our fault in being too slow in reporting the cases, and a surgeon would see only a few cases, in the most of which the treatment was inefficient and incomplete. As before stated, in only a small percentage of cases, 5 to 10 per cent., is it advisable to remove fibrous nodules after radiation. If such nodules are removed and examined, little or no tuberculous material would be found, the fibrous stroma of the glands remaining.

In the treatment of tuberculous adenitis the first and most important consideration is that it is a local manifestation of a constitutional disease.

Most of the laryngologists are referring tuberculous adenitis for radiation as a routine procedure, and many will not remove diseased tonsils if the cervical glands are enlarged until the glands have been given a thorough course of treatment, either by roentgen rays or radium. Radiation of the enlarged cervical glands is important before removing the tonsils of children under fifteen years of age, and particularly so if under the age of five or six, as the lymphatic vessels are wide open, and in the removal of the tonsils before radiation there is danger of producing a general infection if tuberculosis is present.

In the past the treatment of tuberculous glands depended largely upon the physician first consulted. The treatment given has been the hygienic, medical, roentgen ray and radium and light therapy, vaccine and surgical. Tuberculin has given unsatisfactory results, and since radiation produces a systemic effect similar to successful

[1] Read before the Westmoreland County Medical Society, Greensburg, Pa., November 9, 1926.

Twelve-Year Review of X-Ray Therapy of Gas Gangrene[1]

JAMES F. KELLY, M.D., F.A.C.R., and D. ARNOLD DOWELL, M.D.

Omaha, Nebraska

THE FIRST REPORT on the x-ray treatment of gas gangrene was made in December 1931, before the Radiological Society of North America at the Seventeenth Annual Meeting in St. Louis (1). The mortality rate for gas gangrene up to that time had been 50 per cent or higher and that figure was attained only by the sacrifice of many arms and legs. The mortality rate in the group of 8 cases then reported was 25 per cent, and no additional tissue was removed in any case after x-ray therapy was begun.

a disease as gas gangrene with its forme high mortality and morbidity. The x-ra however, has definitely removed gas ga grene from that group of diseases in whic experimental therapy is any longer ju tifiable.

Chemotherapy has failed in our vicinit and also in other places, as was to be e pected, since in a well developed case gas gangrene there is definite interferen in the circulation to the infected area ar consequently in the most serious cases th chemical fails to reach the diseased tissue

Radiology, Oct 1941

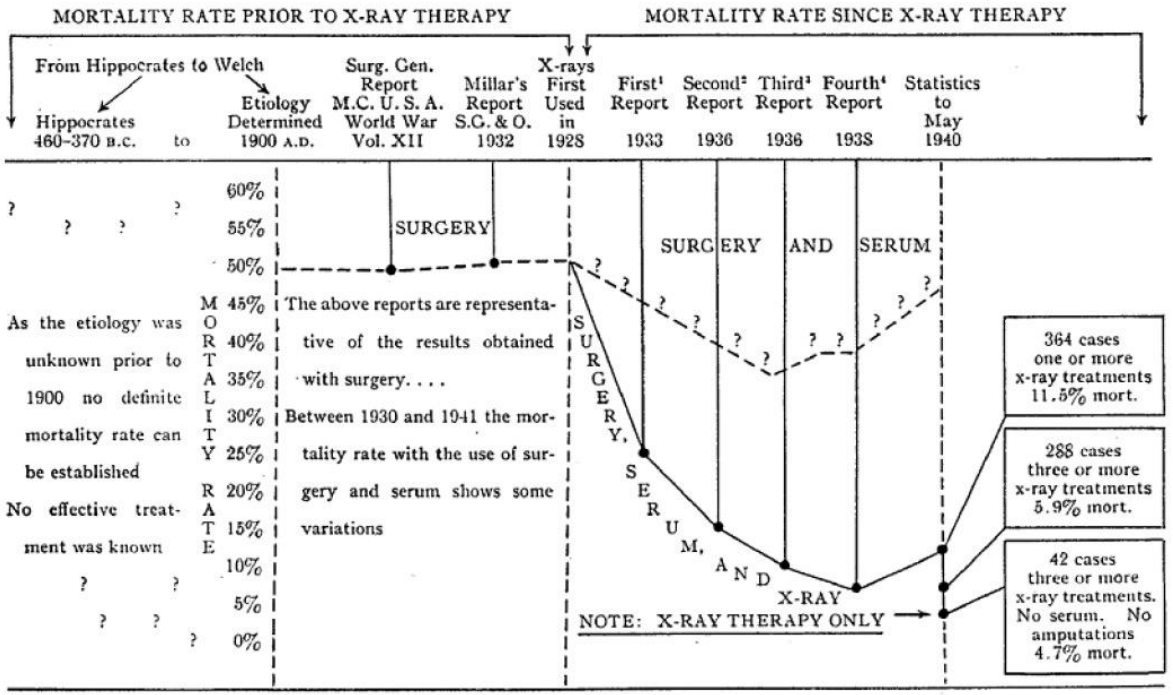


Fig. 1. End of gas gangrene as a serious infection (if x-ray therapy is used).

Radiology, Oct 1941

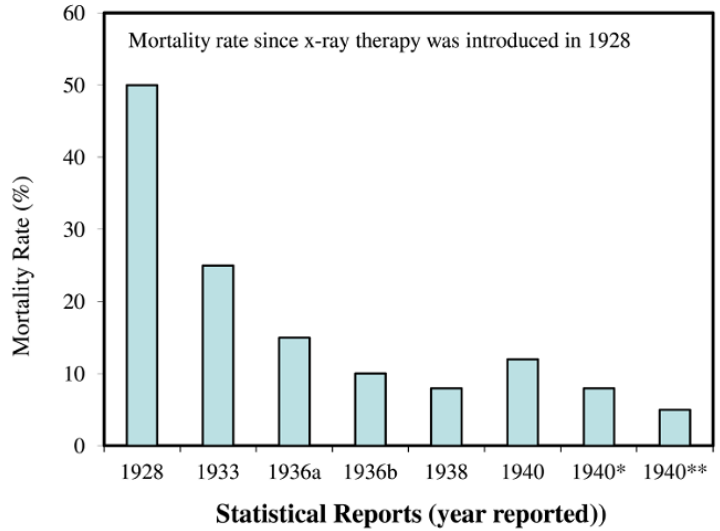
Dose-Response, 10:626-643, 2012
Formerly Nonlinearity in Biology, Toxicology, and Medicine

ISSN: 1559-3258
DOI: 10.2203/dose-response.12-016.Calabrese

InternationalDose-ResponseSociety

THE ROLE OF X-RAYS IN THE TREATMENT OF GAS GANGRENE: A HISTORICAL ASSESSMENT

Edward J. Calabrese, Gaurav Dhawan □ Department of Public Health, Environmental Health Sciences, University of Massachusetts



Standard techniques from 1942:

1) 1-3 treatments per day;
2) distance, 40 cm;
3) kV must be adequate to thoroughly penetrate the tissues involved;
4) 60-120 cGy with 1-3 mm Al filter for prophylaxis and 150 cGy with Cu filter for therapy; and
5) after 500 cGy (a dose which can cause skin erythema), a maximum of 25 cGy/d

LOW-DOSE RADIOTHERAPY FOR PNEUMONIA: OLDIE BUT GOLDIE??

YALE JOURNAL OF BIOLOGY AND MEDICINE 86 (2013), pp.555-570.

REVIEW

How Radiotherapy Was Historically Used To Treat Pneumonia: Could It Be Useful Today?

Edward J. Calabrese, PhD*, and Gaurav Dhawan, MPH

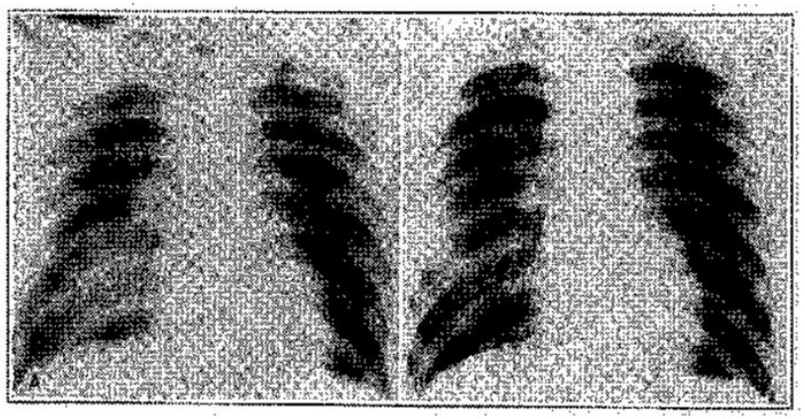


Fig. 7 (case 4).—*A*, the lungs on the second day of pneumonia, with consolidation chiefly in the right lower lobe. The sputum contained pneumococci not type, I, II, III. *B*, the ninth day; the lungs are almost clear.

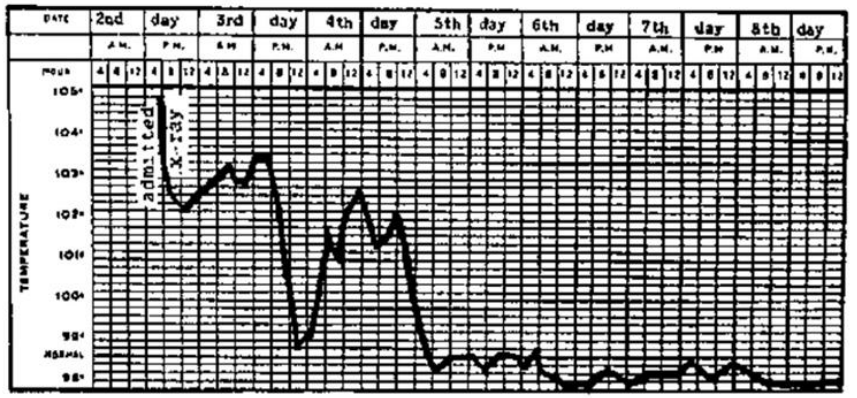


Fig. 8 (case 4).—Temperature curve for the second to eighth days.

836 cases of pneumonia treated with low-dose radiotherapy between 1905-1946

I. J. Radiation Oncology ● Biology ● Physics Volume 63, Number 2, Supplement, 2005

2333 Radiotherapy for Herpes Zoster (HZ) in the Acute Phase: A Retrospective Study with Long Follow-Up

M.T. Suleiman,[1] S. Bieri,[1] C. Luthi[2]

[1]*Radio-Oncology, Hospital of Sion, Sion, Valais, Switzerland,* [2]*Health Observatory, Sion, Valais, Switzerland*

Purpose/Objective: A retrospective study has been undertaken to study the efficiency and safety of radiotherapy for the treatment of HZ in the acute phase as well as to identify predictor factors for the occurrence of post herpetic neuralgia (PHN) and the risk of malignant tumour.

Materials/Methods: One hundred and eight patients were treated between January 1975 and November 2003 in the acute phase (1–30 days from the onset of rashes), 54 (50%) patients were in the group A (1–7 days), and 54 (50%) patients were in the group B (8–30 days). The median age was 66.5 years (range 17–89) for group A, and 67.5 years (range 30–88) for group B.

The patients were asked to rank any discomfort connected to the dermatome concerned as none, noticeable, mild, moderate, or severe. The corresponding numerical values were also defined for the patients: no pain= 0, noticeable= 1, mild pain= 2 moderate pain= 3 and severe pain= 4. The follow-up was conducted by the radiation oncologist or by general practitioners.

Results: Assessment of acute pain.

Proportions of patients with pain at the end of RT were 77.1% for group A and 82.4% for group B.

Assessment of Postherpetic Neuralgia.

At three months, six months and at least one year after the end of RT, the PHN were 25%, 20.8%, and 12 % for group B, 10.3%, 10.3% and 6.7% for group A. No patients show severe pain at > 6 months.

Results of the multivariate analyses showed that, when controlling for age and gender, the risk of having pain three months after treatment was 2.67 higher in patients of group B compared to patients from group A. Further, this risk decreased to around 2 after 6 months and one year or more. Radiotherapy had an important effect on pain in both, patients older than 60 years and younger patients, with 100% pain free.

Conclusions: This is the first retrospective cohort study in unselected patients which were treated with radiotherapy(RT). To our knowledge, this study has the longest follow-up to date. This study shows that RT is very efficient in treating HZ, at least as much antiviral drugs. RT is safe and no malignant tumor related RT was observed. In the future our results should be controlled in a randomized trial with or without antiviral therapy in high risk patients. The combination treatment with the well known antiproliferative and the anti-inflammatory effects of radiation might improve the PHN.

- Treatment of acute infection and prevention of post-herpetic neuralgia (n=108)
- 624 cGy; 6 fractions; 104 cGy/fx
- Radiotherapy before 8th day decreases risk of post-herpetic neuralgia

LET'S TALK ABOUT...

e-ISSN 2083–4640
ISSN 1507–1367

REVIEW ARTICLE

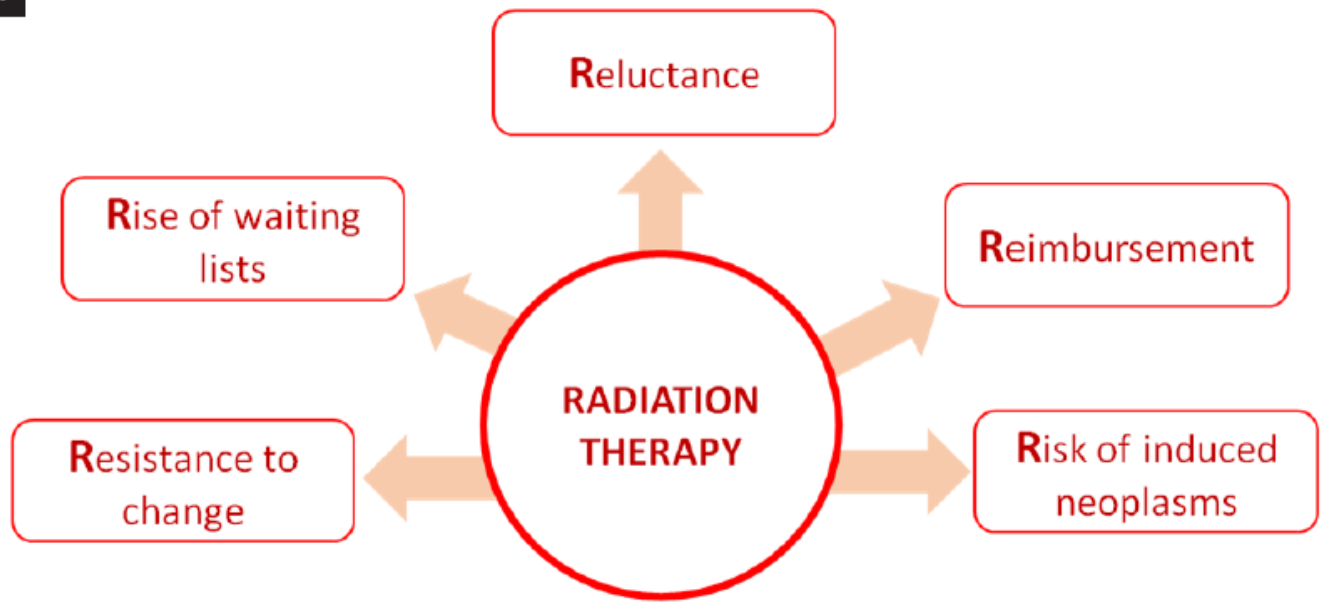
Reports of Practical Oncology and Radiotherapy
2023, Volume 28, Number 1, pages: 74–78
DOI: 10.5603/RPOR.a2023.0001
Submitted: 06.09.2022
Accepted: 15.12.2022

The 5Rs dilemma of radiotherapy for non-malignant diseases: 5Rs to darken OR 5Rs to shine

Angel Montero[1,2], Beatriz Alvarez[1,2]

[1]Department of Radiation Oncology, HM Hospitales, Madrid, Spain
[2]Faculty of Health Sciences, Universidad Camilo José Cela, Madrid, Spain

A



ZERO TOXICITY DOES NOT EXIST…

TOXICITY:
BEYOND RADIOTHERAPY…

REVIEW ARTICLE

Radiotherapy for benign disease; assessing the risk of radiation-induced cancer following exposure to intermediate dose radiation

[1]STEPHANIE R MCKEOWN, MA, PhD, [2]PAUL HATFIELD, FRCR, PhD, [3]ROBIN JD PRESTWICH, FRCR, PhD, [3]RICHARD E SHAFFER, MRCP, FRCR and [4]ROGER E TAYLOR, FRCP, FRCR

Types	*Absolute Lifetime Risk*
Sarcoma	<0.0001% for 1Gy and a 100-cm² field
Skin (basal cell carcinoma)	0.1% for 100-cm² field
Brain tumor	0.2% after 20 Gy for endocrine orbitopathy
Thyroid carcinoma	1% per Gy for children <10 years
Breast carcinoma (WBRT)	<5% for one breast, 1 Gy, age <35 ; <3% for age 35-45); 0% >45
Lung carcinoma	1% within 25 years after a mean lung dose of 1 Gy

McKeown SR et al. Br J Radiol. 2015;88(1056):20150405.

Strahlentherapie und Onkologie — Current Discussion

Estimation of Cancer Risks from Radiotherapy of Benign Diseases

Klaus-Rüdiger Trott[1], Friedrich Kamprad[2]

Strahlenther Onkol 2006;182:431–6
DOI 10.1007/s00066-006-1542-8

By contrast, in radiotherapy of epicondylopathia humeri, heel spur and other disorders in the extremities, no critical organ except skin is in the primary treatment beam. Direct risk estimates for the approximately 100-cm² skin area treated to a mean dose of 3 Gy would result in a lifetime local basalioma risk of 0.006%.

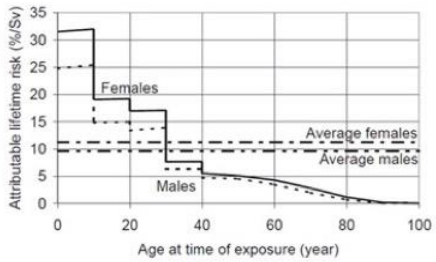
The different indications for radiotherapy of benign diseases are associated with widely differing radiation risks. The main factor determining risk is the site of treatment. For all peripheral indications such as Dupuytren's contracture, tennis elbow or heel spur, radiation risks are very small, indeed, and comparable to those from common diagnostic X-ray examinations.

Radiotherapy and Oncology 76 (2005) 270-277
www.thegreenjournal.com

Radiation carcinogenesis

Estimation of the carcinogenic risk of radiotherapy of benign diseases from shoulder to heel

Jan Th. M. Jansen[a,*], Johan J. Broerse[a,b], Johannes Zoetelief[a], Claudia Klein[c], M. Heinrich Seegenschmiedt[c]



Attributable lifetime risk for induction of a fatal tumour, at high doses and dose rates, from a single dose at various ages of exposure and both genders, according to the International Commission on Radiological Protection [2]

REVIEW ARTICLE

Is Anesthesia Dangerous?

André Gottschalk, Hugo Van Aken, Michael Zenz, Thomas Standl

Association between anesthesia-related deaths and age or patients' ASA status (adapted from [5])

	Mortality/100 000 anesthesiological procedures	95% confidence interval
Age		
0–7 years	0.6	0.12–3.2
8–15 years	1.2	0.3–3.2
16–39 years	0.52	0.24–0.93
40–75 years	5.2	2.7–8.1
≥ 75 years	21	8.3–34

TOXICITY DEPENDS ON THE CHARACTERISTICS OF THE RADIATION THERAPY, NOT THE RADIATION ITSELF.

e-ISSN 2083–4640
ISSN 1507–1367

REVIEW ARTICLE

Reports of Practical Oncology and Radiotherapy
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The 5Rs dilemma of radiotherapy for non-malignant diseases: 5Rs to darken OR 5Rs to shine

Angel Montero[1, 2], Beatriz Alvarez[1, 2]

[1]Department of Radiation Oncology, HM Hospitales, Madrid, Spain
[2]Faculty of Health Sciences, Universidad Camilo José Cela, Madrid, Spain

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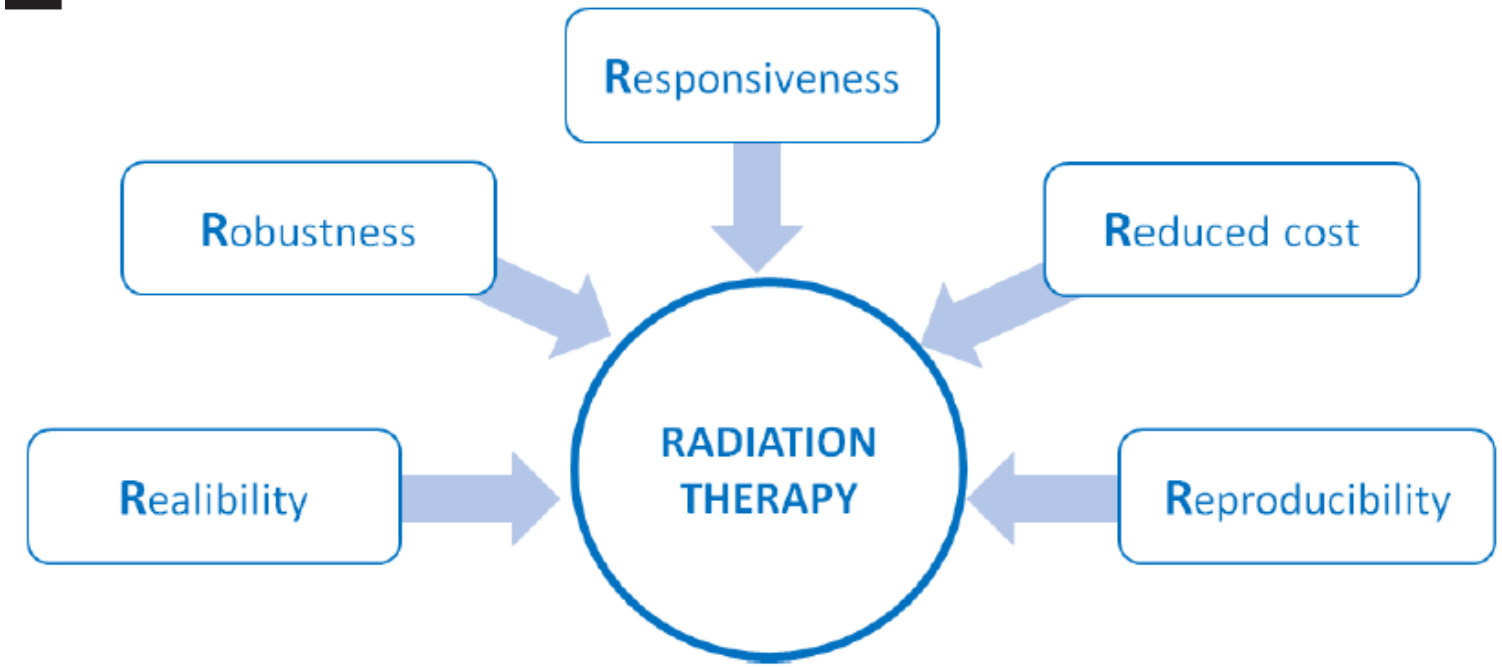
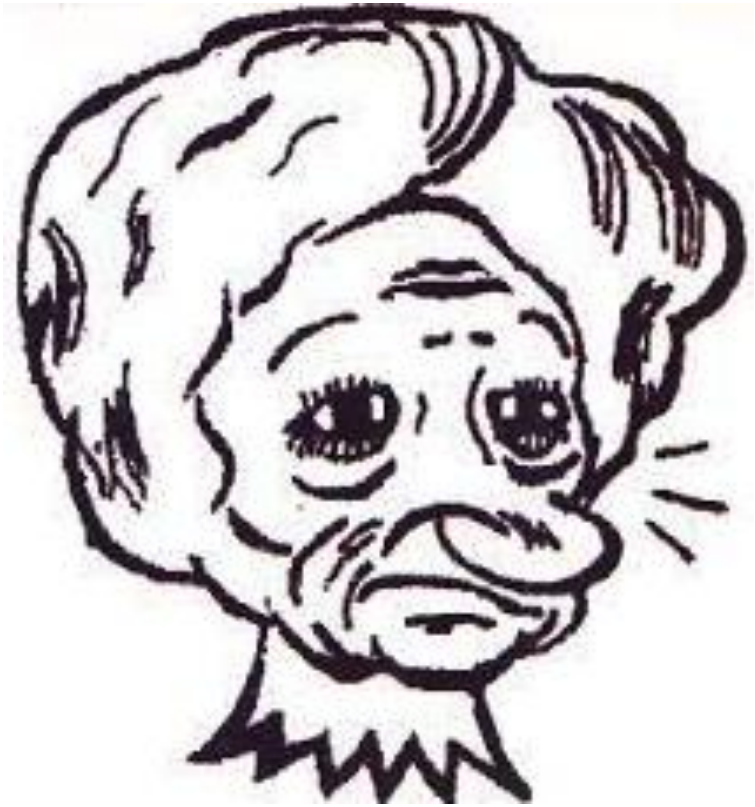


HOW DO WE WANT TO LOOK AT RADIATION THERAPY FOR BENIGN DISEASES?

EFFECTIVENESS

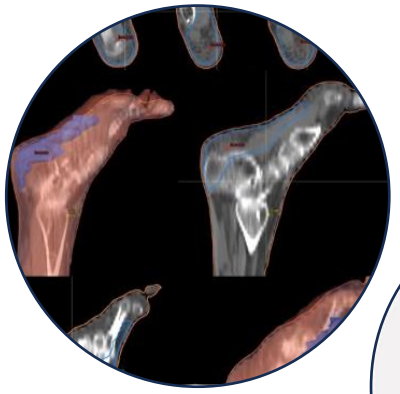


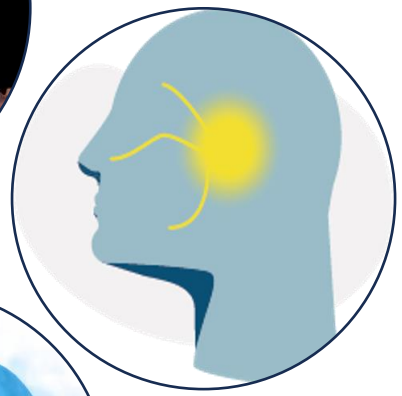
TOXICITY

CENTRO INTEGRAL ONCOLÓGICO
hm CIOCC
hm hospitales

www.radioterapiahm.com

angel.monteroluis@gmail.com





OBSEVANJE BENIGNIH BOLEZNI

7. marec 2024

Onkološki inštitut
Ljubljana,
Predavalnica
v stavbi C

Facultad HM de Ciencias de la Salud
de la Universidad Camilo José Cela

hm hospitales

Universidad Camilo José Cela
SEK EDUCATION GROUP

A. Montero Luis
Hospital Universitario HM Sanchinarro
@Oncoangel

HOW DO WE DO IT ?

hm hospitales

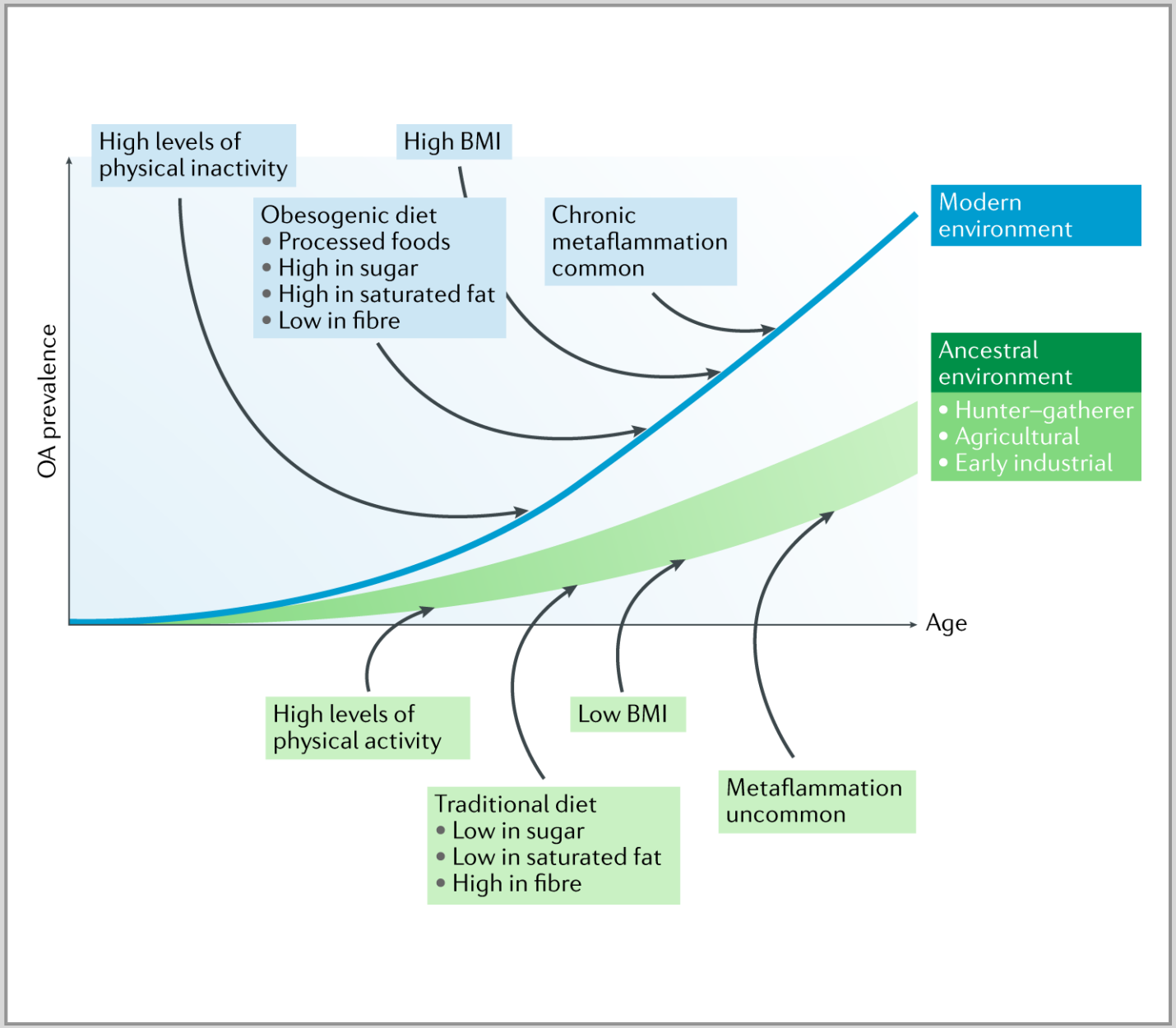
Department of Radiation Oncology

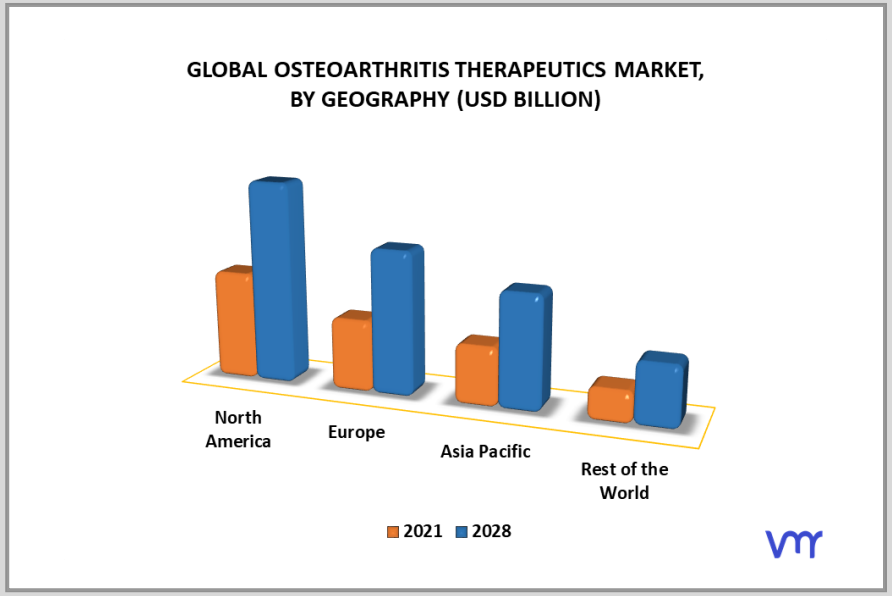
HOSPITAL UNIVERSITARIO
hm sanchinarro

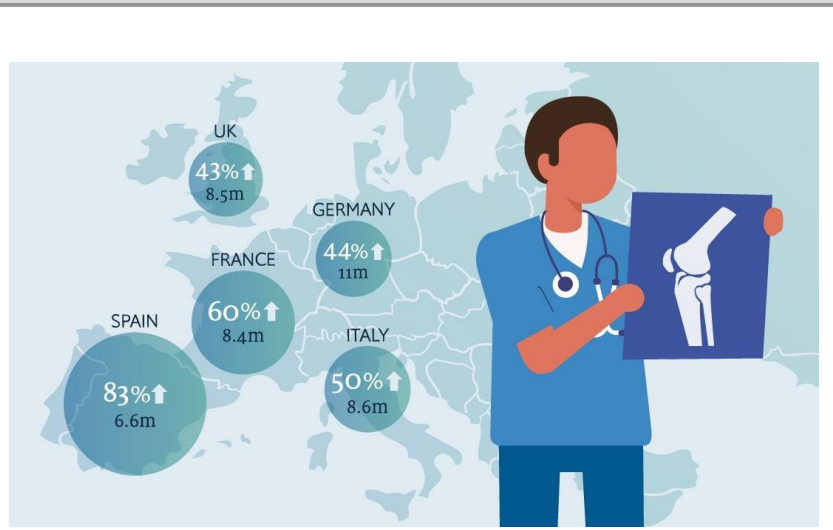
- 4 LINACS (+1 ongoing MR-LINAC)
- 2 DEDICATED CT
- HDR BRACHYTHERAPY
- 11 ATTENDING PHYSICIANS
- 8 MEDICAL PHYSICS
- 4 RO RESIDENTS
- ~2000 NEW PAX/YEAR

HOSPITAL UNIVERSITARIO
hm puerta del sur

OSTEOARTHRITIS: A HIGHLY PREVALENT DISEASE IN EUROPE...







…AS WELL AS IN SPAIN

Episer 2016
Sociedad Española de Reumatología

- Osteoarthritis (OA) affects **7 million people** in Spain
- Responsible for **30% of temporary disability**

18% of females

9,6% of males

(1). Estudio EPISER: Prevalencia e impacto de las enfermedades reumáticas

LOCATION	EPISER 2016
Cervical Spine OA	10,10 (IC al 95%: 9,07-11,24)
Lumbar Spine OA	15,52 (IC al 95%: 14,30-16,83)
Coxarthrosis	5,13 (IC al 95%: 4,40-5,99)
Gonarthrosis	13,83 (IC al 95%: 12,66-15,11)
Hand OA	7,73 (IC al 95%: 6,89-8,67)

Sociedad Española de Reumatología · Semergen · Lacer

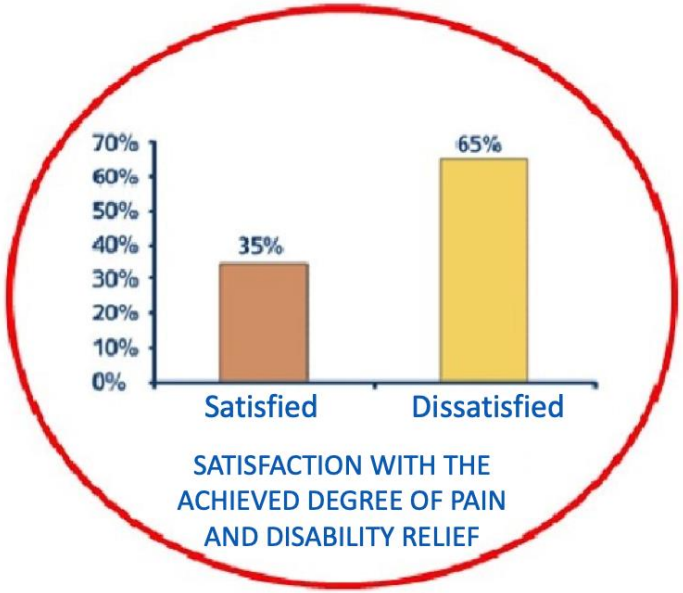
ArtRoCad

Arthritis & Rheumatism (Arthritis Care & Research)
Vol. 61, No. 2, February 15, 2009, pp 158–165
DOI 10.1002/art.24214

ORIGINAL ARTICLE

Economic Burden of Knee and Hip Osteoarthritis in Spain

ESTIBALIZ LOZA,[1] JUAN MIGUEL LOPEZ-GOMEZ,[2] LYDIA ABASOLO,[1] JESÚS MAESE,[3] LORETO CARMONA,[3] ENRIQUE BATLLE-GUALDA,[2] AND THE ARTROCAD STUDY GROUP



SATISFACTION WITH THE ACHIEVED DEGREE OF PAIN AND DISABILITY RELIEF

REVIEW ARTICLE

DEGRO guidelines for the radiotherapy of non-malignant disorders

Part II: Painful degenerative skeletal disorders

Oliver J. Ott · Marcus Niewald · Hajo-Dirk Weitmann · Ingrid Jacob · Irenaeus A. Adamietz · Ulrich Schaefer · Ludwig Keilholz · Reinhard Heyd · Ralph Muecke · German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD)

Shoulder syndrome

Response rates (complete and partial response: CR and PR) usually reached 58–100% 2–3 months after radiotherapy [14, 17]. In 7928 retrospectively evaluated patients, Heyd et al. [6] reported response rates of 55% with CR, and 33% with PR; 12% [illegible] benefit. Early treatment less than 6 mo[illegible] pain seemed to be more effective than with chronic pain. Data about a higher success rate for patients with calcifications were inconsistent.

58-100%

Elbow syndrome

Between 1923 and 2011, the outcome after low-dose radiotherapy for elb[illegible]en reported in more than 2000 patients w[illegible]e and prospective analyses. Approximately 82% of the patients experienced significant pain reduction. The CR and PR rates were 45% (range 5–94%) and 35% (range 7–73%) [13].

~80%

Trochanteric bursitis

Glatzel et al. [3] reported on 34 patients who were treated with total dose [illegible] fractions of 1.0 Gy. After 3 months, 38% [illegible]% had a PR. Olschewski and Klein [12] reported on another 26 patients. They found an overall response rate of 73%, with 23% CR and 50% PR rates.

73%

Gonarthrosis

Low-dose radiotherapy is an effective therapeutic option for painful Kellgren stage 2–3 arthrosis of the knee joint and can be recommended even if surgical interventions are not possible or desirable or if other conservative treatment methods are ass[illegible]e side effects or contraindicated. The[illegible]6 patients treated with low-dose radiotherapy for painful arthrosis of the knee joint have been published. Of these patients, 5069 were surveyed within the framework of a German patterns of care study performed in 2010 [10]. A response to radiation therapy in terms of a marked and complete reduction of pain was shown in 58–91% of the irradiated patients.

58-91%

Plantar fasciitis

Retrospective analyses reported on CR rates in 12–81%, and PR rates in 7–74% [9, 15, 18]. In a randomized trial, Heyd et al. [7] randomly compared two dose regimens: 3.0 Gy/0.5 Gy vs. 6.0 Gy/1.0 Gy in 130 patients. Radiotherapy led to a highly significant reduction of pain symptoms in both groups, and [illegible]men was equally effective. In another r[illegible]ewald et al. [11] evaluated the efficacy of two other dose concepts in 62 evaluable patients: 6.0 Gy/1.0 Gy vs. 0.6 Gy/0.1 Gy. After one year, compared to the very low-dose arm the higher-dose arm led to a significant advantage in terms of pain control.

~80%

Coxarthrosis

Considering the results of the retrospective studies, low-dose radiotherapy may be an effective therapeutic option for painful Kellgren stage 2–4 arthrosis of the hip joint, even if surgical interventions are not possible or desirable, or if other conservative [illegible]are associated with excessive side effe[illegible]d. The results from 895 patients treated with low-dose radiotherapy for painful arthrosis of the hip joint have been published. A response to radiation therapy in terms of a marked and complete reduction of pain was shown in 24–89% of the irradiated patients [19].

24-89%

Arthrosis of the hand and finger joints

Considering the results of the retrospective studies, low-dose radiotherapy may be an effective therapeutic option for painful arthrosis of the hand and finger joints, even if other conservative treatment methods are associated with excessive side effe[illegible]d. The results from 809 patients treated [illegible]otherapy for painful arthrosis of the hand and finger joints have been published. A response to radiation therapy in terms of a marked and complete reduction of pain was shown in 63–75% of the irradiated patients [4].

63-75%

How To Do It?

LOW-DOSE RADIATION THERAPY HAS PROVEN EFFECTIVENESS FOR OA PAIN RELIEF...

THE FIRST (?) ATLAS FOR RADIATION PTV DEFINITION…

hm hospitales

BJR

https://doi.org/10.1259/bjr.20200809

Received: 03 July 2020 | Revised: 26 May 2021 | Accepted: 08 June 2021

Cite this article as:
Alvarez B, Montero A, Hernando O, Ciervide R, Garcia J, Lopez M, et al. Radiotherapy CT-based contouring atlas for non-malignant skeletal and soft tissue disorders: a practical proposal from Spanish experience. *Br J Radiol* 2021; **94**: 20200809.

GUIDELINES & RECOMMENDATIONS

Radiotherapy CT-based contouring atlas for non-malignant skeletal and soft tissue disorders: a practical proposal from Spanish experience

[1]BEATRIZ ALVAREZ, MD, [1]ANGEL MONTERO, PhD, [1]OVIDIO HERNANDO, MD, PhD, [1]RAQUEL CIERVIDE, MD, PhD, [2]JUAN GARCIA, MD, PhD, [1]MERCEDES LOPEZ, MD, [1]MARIOLA GARCIA-ARANDA, MD, [1]XIN CHEN, MD, [2]INES FLORES, MD, [1]EMILIO SANCHEZ, MD, [1]JEANNETTE VALERO, MD, PhD, [2]ALEJANDRO PRADO, MD, [1]ROSA ALONSO, MD, [1]LEYRE ALONSO, MD, [2]PEDRO FERNANDEZ-LETON, MD and [1]CARMEN RUBIO, MD, PhD

[1]Department of Radiation Oncology, HM Hospitales, Madrid, Spain
[2]Department of Medical Physics, HM Hospitales, Madrid, Spain

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E-mail: *angel.monteroluis@gmail.com*

Beatriz Alvarez and Angel Montero have contributed equally to this study and should be considered as co-first authors.

SCAN ME!


WHY AN ATLAS?
(FOR BENIGN TARGET VOLUMES DEFINITION)

THERE ARE ATLAS FOR (ALMOST) EVERY RADIOTHERAPY LOCATION…

hm hospitales

…AND EVEN ON-LINE TOOLS FOR TARGET DELINEATION…

FIELD^{RT}

BJR https://doi.org/10.1259/bjr.20210356

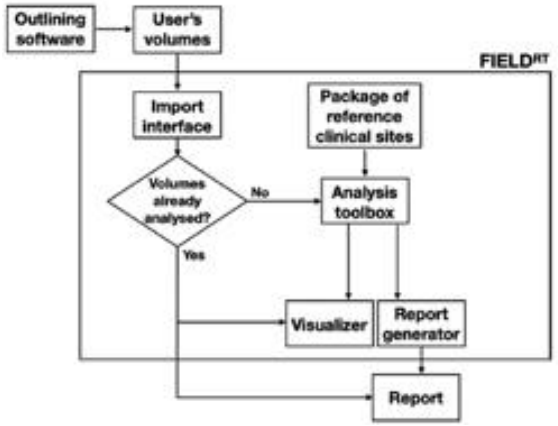
Received: 17 March 2021 | Revised: 05 July 2021 | Accepted: 19 July 2021

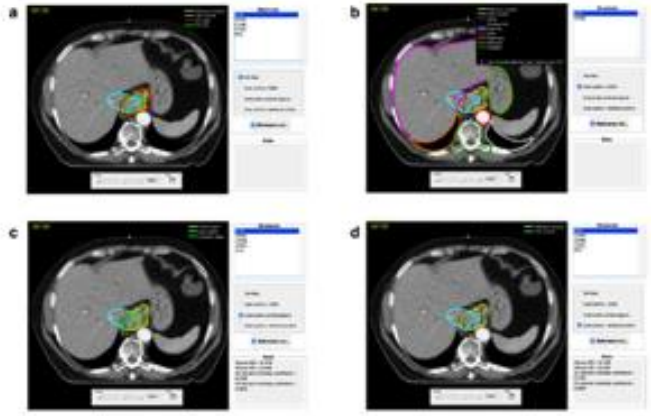
Cite this article as:
Piazzese C, Evans E, Thomas B, Staffurth J, Gwynne S, Spezi E. FIELD^{RT}: an open-source platform for the assessment of target volume delineation in radiation therapy. *Br J Radiol* 2021; **94**: 20210356.

FULL PAPER

FIELD^{RT}: an open-source platform for the assessment of target volume delineation in radiation therapy

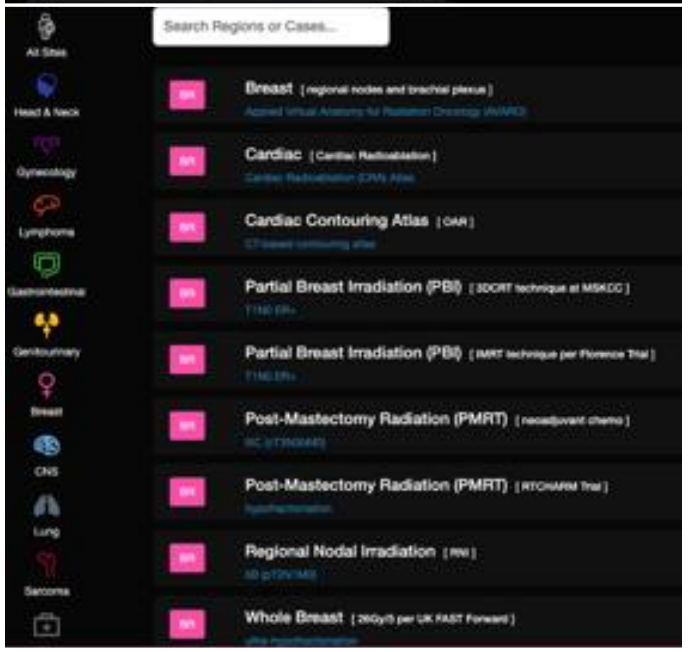
[1,2,3]CONCETTA PIAZZESE, PhD, [3]ELIN EVANS, MD, [4]BETSAN THOMAS, MD, [3]JOHN STAFFURTH, MD, [4]SARAH GWYNNE, MD and [2,3]EMILIANO SPEZI, PhD





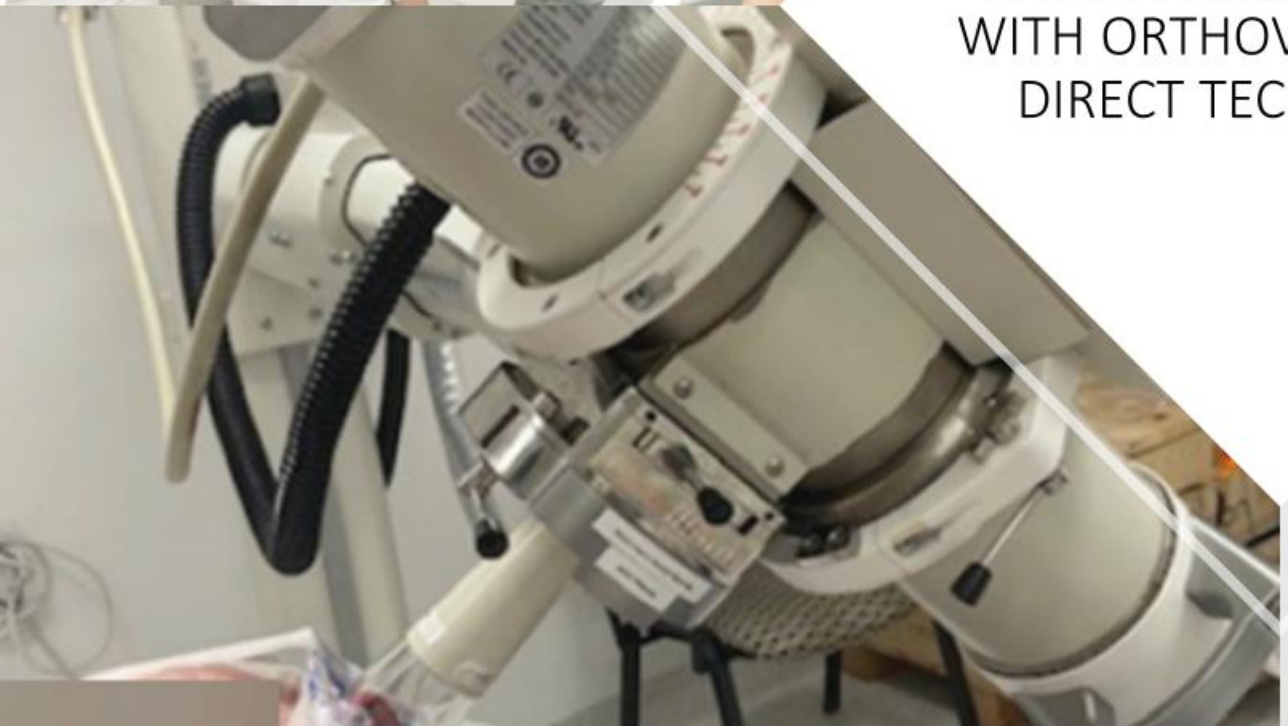
https://github.com/concettapiazzese/FIELDRT-GitHub

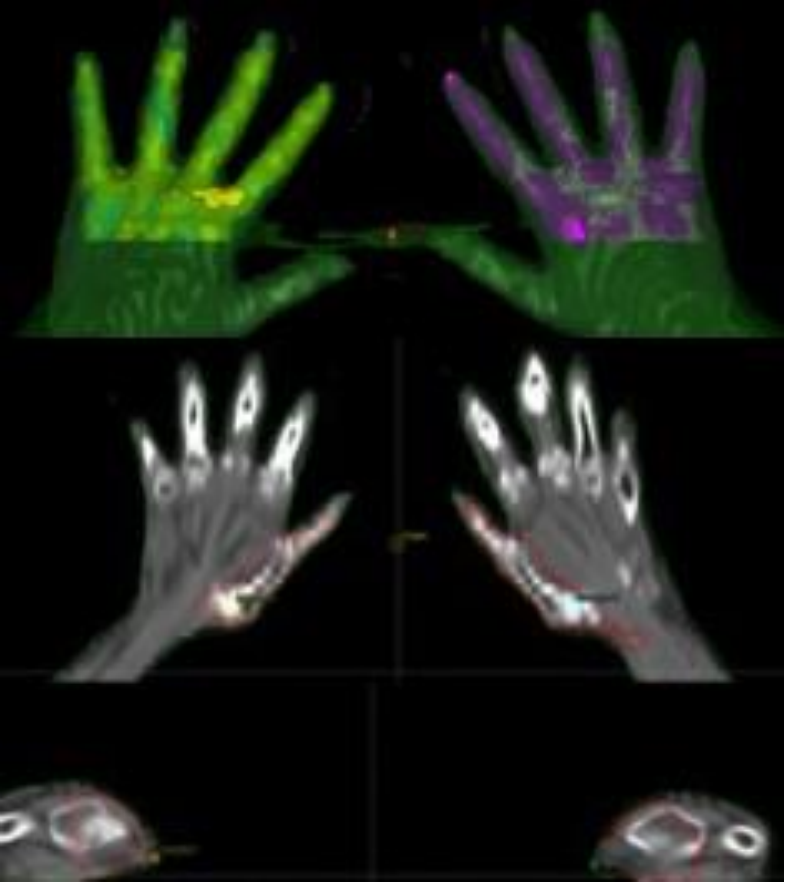
eContour

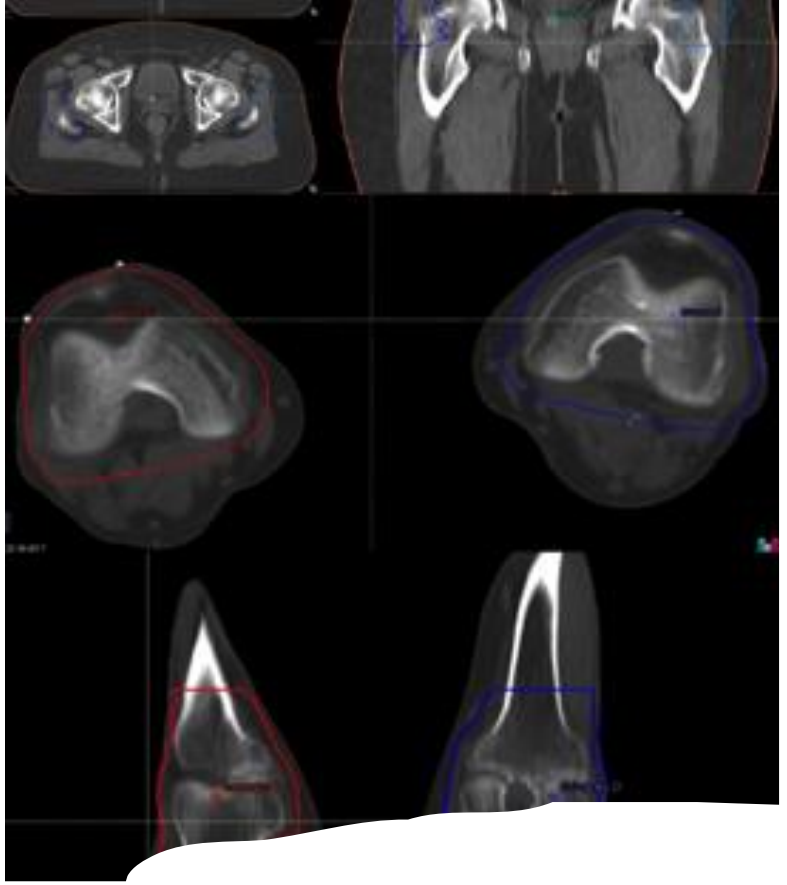


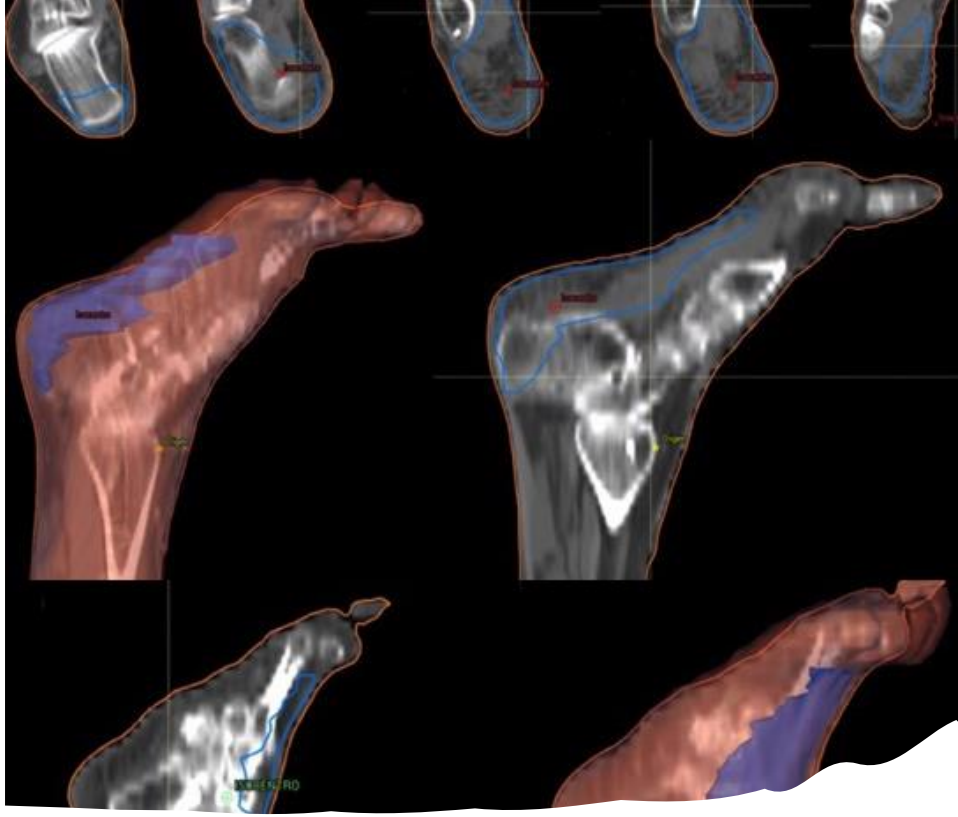
https://econtour.org/

A LOT OF INFORMATION EXISTS REGARDING LDRT WITH ORTHOVOLTAGE AND DIRECT TECHNIQUES…









…BUT LESS WITH OTHER RADIATION TREATMENT TECHNIQUES

Int. J. Radiation Oncology Biol. Phys., Vol. 52, No. 2, pp. 496–513, 2002

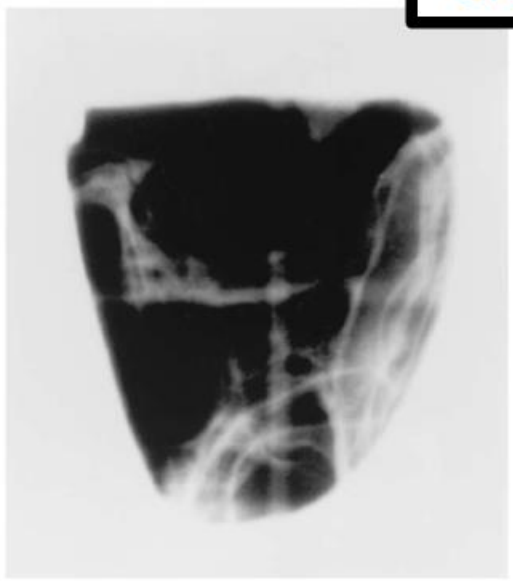
0360-3016/02/$–see front matter

PII S0360-3016(01)01814-4

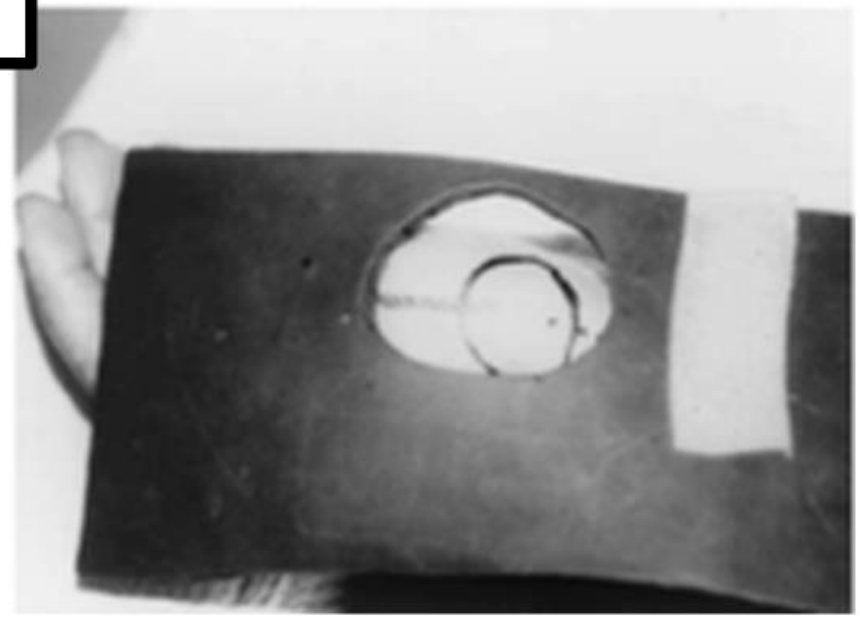
CLINICAL INVESTIGATION **Benign Disease**

CONSENSUS GUIDELINES FOR RADIATION THERAPY OF BENIGN DISEASES: A MULTICENTER APPROACH IN GERMANY

OLIVER MICKE, M.D.,* M. HEINRICH SEEGENSCHMIEDT, M.D., PH.D.,† AND THE GERMAN WORKING GROUP ON RADIOTHERAPY OF BENIGN DISEASES



Most of published experiences relies on direct/2D techniques



- **There were no available atlas** for the delineation of volumes in radiotherapy of benign musculoskeletal diseases.
- We have devised pragmatic guides, intended for **daily practice**.
- Using current immobilization, delimitation and planning techniques **available in any Radiation Oncology department**.
- But above all, an understandable, reproducible, simple and **easy to use guide** for all those interested in OA LDRT.

- These are **recommendations**, never intended to be mandatory!
- There are **other equally valid techniques and procedures** for LDRT in benign musculoskeletal diseases
- The key and fundamental thing is to **adapt your actions to your availability**

If the only tool you have is a hammer, **you tend to see every problem as a nail**

Abraham Maslow

...but remember

Osteoarthritis and Cartilage Open 1 (2020) 100016

Contents lists available at ScienceDirect

Osteoarthritis and Cartilage Open

journal homepage: www.elsevier.com/journals/osteoarthritis-and-cartilage-open/2665-9131

Experimental Protocol

Radiotherapy for ostheoarticular degenerative disorders: When nothing else works☆

Beatriz Álvarez [a,2,*], Ángel Montero [a,1,2], Francisco Aramburu [c], Enrique Calvo [c], Miguel Ángel de la Casa [b], Jeannette Valero [a], Ovidio Hernando [a], Mercedes López [a], Raquel Ciérvide [a], Mariola García-Aranda [a], Silvia Rodríguez [c], Emilio Sánchez [a], Xin Chen [a], Rosa Alonso [a], Paloma García de la Peña [c], Carmen Rubio [a]

Clinical and Translational Oncology
https://doi.org/10.1007/s12094-021-02710-w

RESEARCH ARTICLE

Low-dose radiation therapy for hand osteoarthritis: shaking hands again?

B. Álvarez[1] · A. Montero[1] · R. Alonso[1] · J. Valero[1] · M. López[1] · R. Ciérvide[1] · E. Sánchez[1] · O. Hernando[1] · M. García-Aranda[1] · J. Martí[2] · A. Prado[2] · X. Chen-Zhao[1] · C. Rubio[1]

Reumatología Clínica (English Edition)
Volume 17, Issue 10, December 2021, Pages 624-625

Letter to the Editor

Radiotherapy treatment in benign osteoarticular disease

Tratamiento con radioterapia en enfermedad osteoarticular benigna ☆

Francisco Aramburu [a], Angel Montero [b], José Luis Cabrera Alarcón [c], Paloma García de la Peña-Lefevre [d]

Is it time to redefine the role of low-dose radiotherapy for benign disease?

Angel Montero,[1] Sebastia Sabater,[2] Franz Rödel,[3] Udo S Gaipl,[4] Oliver J Ott,[4] Michael Heinrich Seegenschmiedt,[5] Meritxell Arenas[6]

Ann Rheum Dis 2018;**0**:1–2. doi:10.1136/annrheumdis-2018-214873

REPORTS OF PRACTICAL ONCOLOGY AND RADIOTHERAPY 18 (2013) S14–S15

Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: http://www.elsevier.com/locate/rpor

Refresher course: Arthropathy and other benign conditions

Radiotherapy for non-malignant diseases

Angel Montero Luis

hm hospitales

Osteoarthritis and Cartilage Open 1 (2020) 100016

Contents lists available at ScienceDirect

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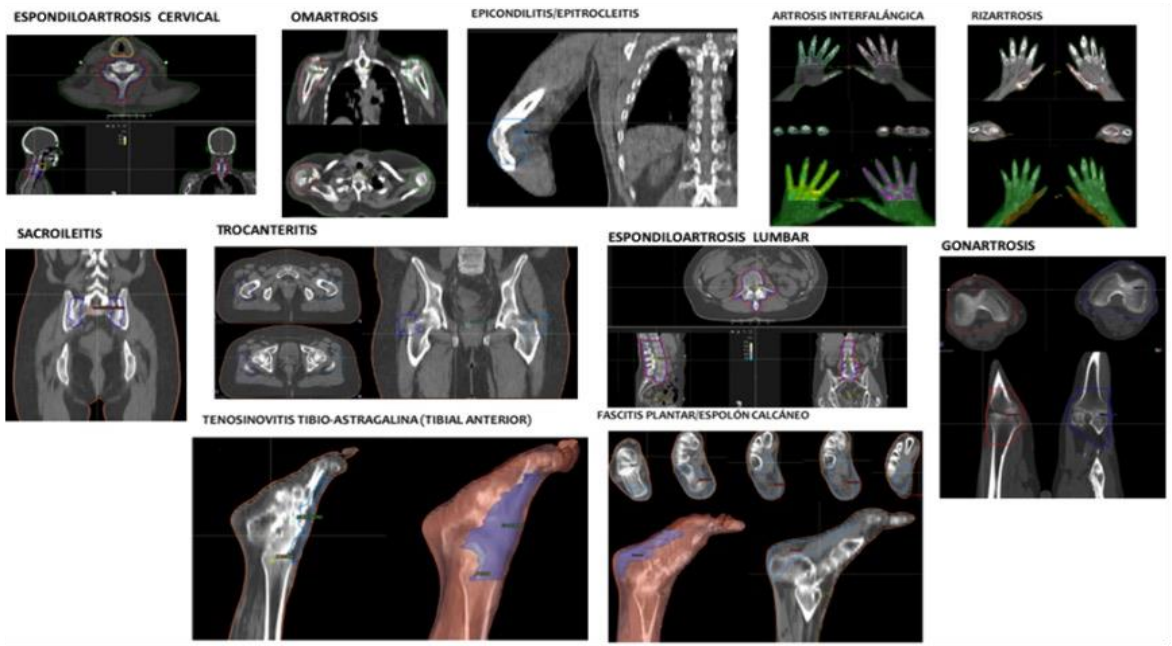
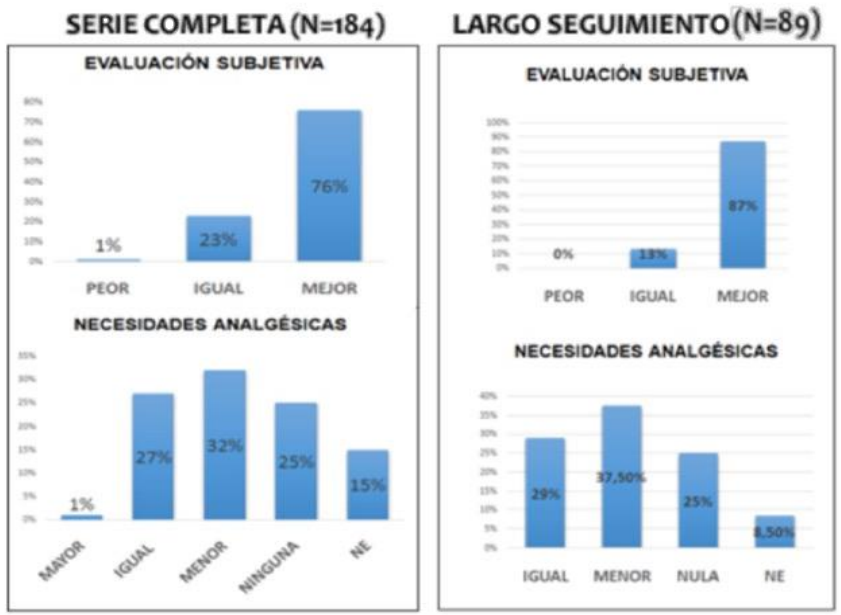
[a] Radiation Oncology, Hospital Universitario HM Sanchinarro, Madrid, Spain
[b] Radiophysics, Hospital Universitario HM Sanchinarro, Madrid, Spain
[c] Rheumatology, Hospital Universitario HM Sanchinarro, Madrid, Spain

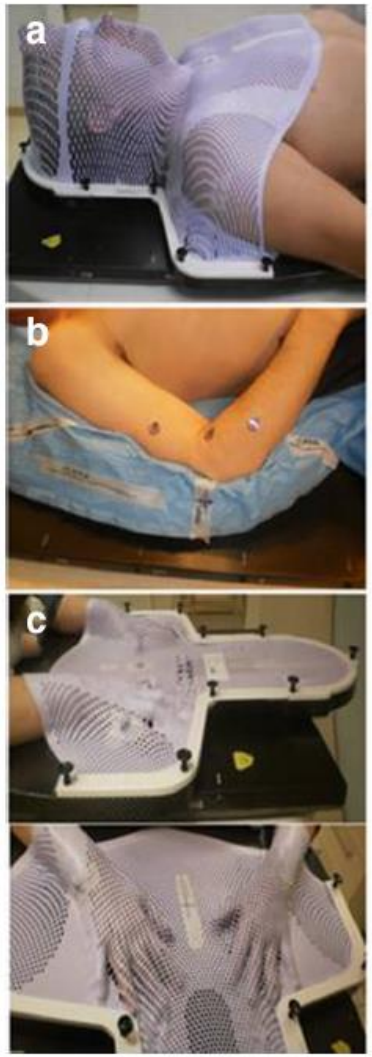


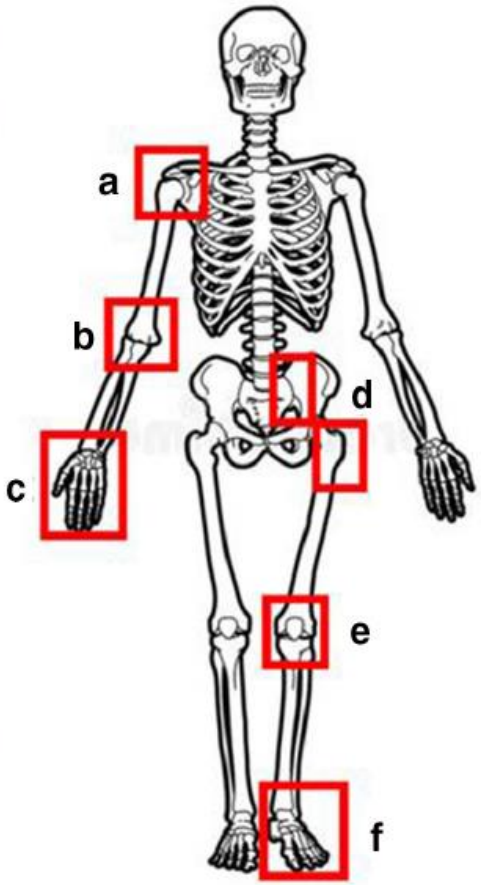
Periodo: Abril 2015-Enero 2018
N = 184 tratamientos (108 pacientes) completados en Enero-2018
85% mujeres
Largo seguimiento N=89
Edad: mediana 64 años (42-89 años)



IMMOBILIZATION

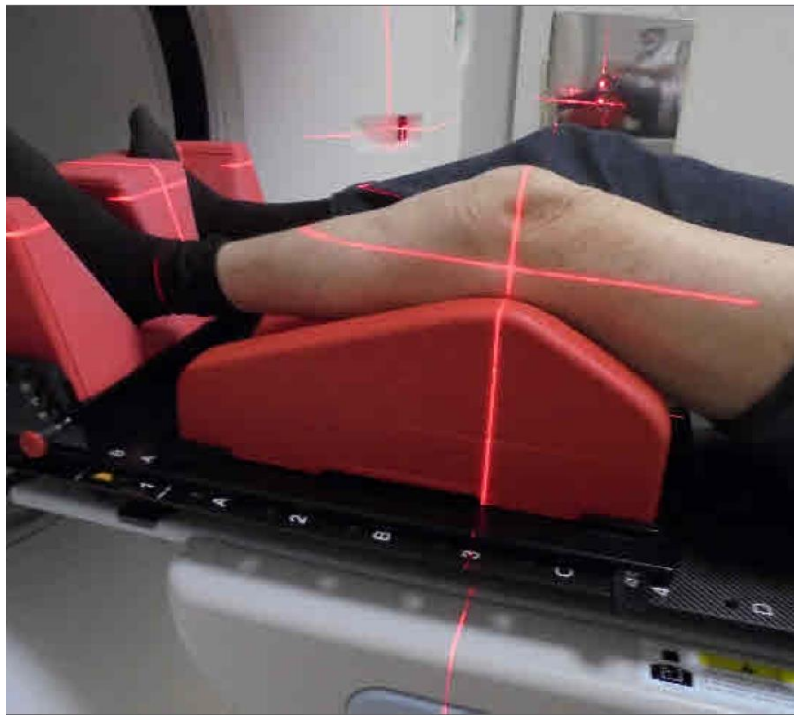
- Thermoplastic masks
- Vacuum cushions
- AccuForm cushions
- Foam cushions, support cushions & wedges





SIMULATION CT

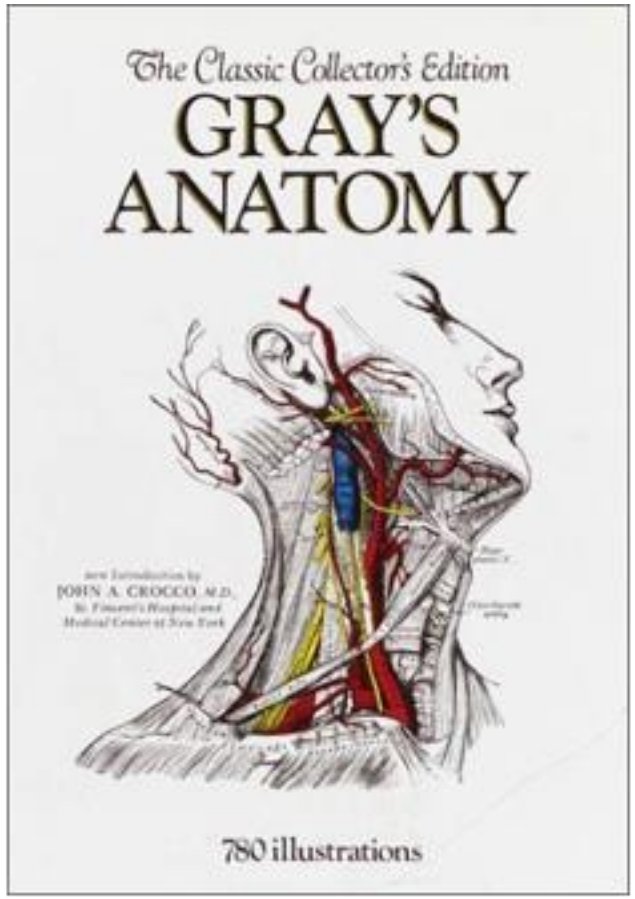
- Dedicated CT for Radiation Oncology
- 2-5 mm thickness slices, depending upon target location

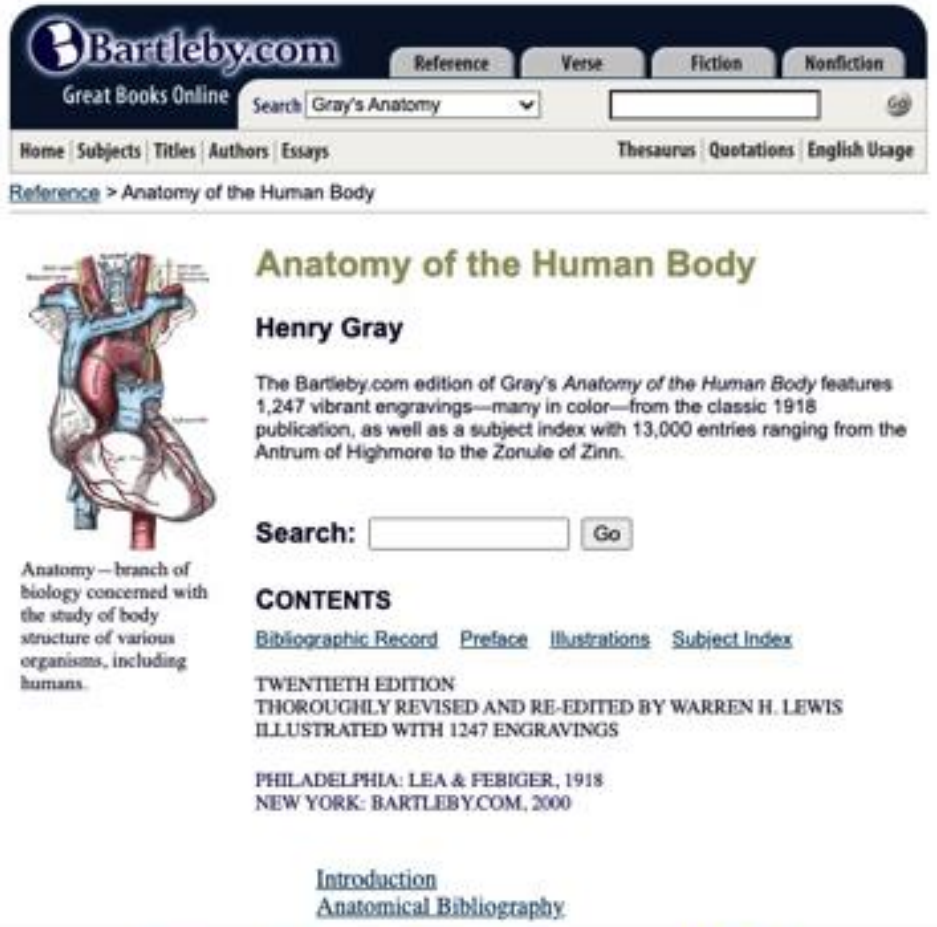


TARGET DELINEATION

- **Target volumes** should include the entire joint and articular cartilage, the specific joint capsule, the neighbouring bone and/or muscular insertion zone, and the peritendinous bursae and surrounding soft tissue structures

ANATOMIC CORRELATION



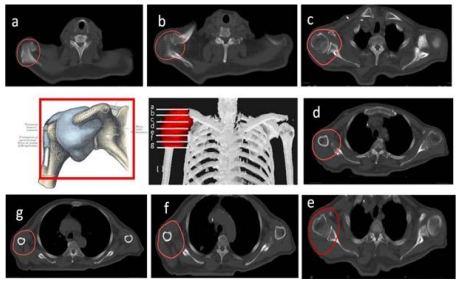


The Bartleby.com edition of Gray's *Anatomy of the Human Body,* 20th Ed.
Philadelphia: Lea&Febiger, 1918; New York: Bartleby.com, 2000

https://www.bartleby.com/107/

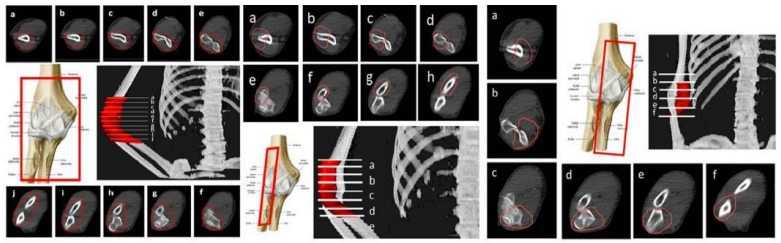
TARGET VOLUME DELINEATION: FROM HEAD TO TOE…

PAINFUL SHOULDER



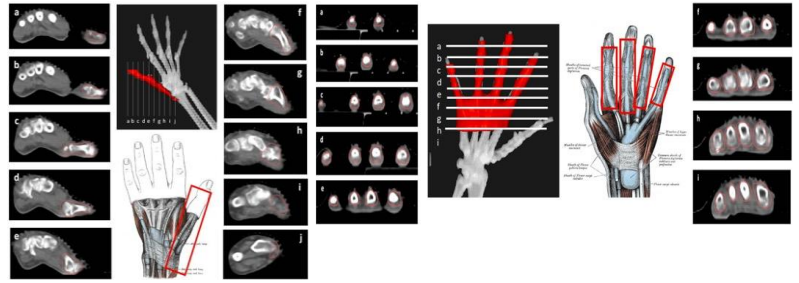
Entire shoulder joint and adjacent structures: acromion, glenohumeral joint, and the coracoid process; acromioclavicular ligament, coraco-acromial ligament, coraco-humeral ligament, transverse ligament and the superior-middle-inferior glenohumeral ligaments
Synovial bursae around the shoulder: subacromial-subdeltoid (between the joint capsule and the deltoid muscle), subacromial (between the capsule and the acromion), subcoracoid (between the capsule and the coracoid process of the scapula), coracobrachial(between the subscapularis muscle and the tendon of the coracobrachialis muscle), subscapular (between the capsule and the tendon of the subscapularis muscle), and the supra acromial bursa.
Tendons that attach to the muscles: teres minor, infraspinous, subscapular and supraspinous and to the origin of the deltoid, the long head of the biceps brachii muscle, trapezius insertion, pectoralis minor insertion and short head of the biceps brachii muscle

EPICONDYLITIS HUMERI



Radial epicondylitis (tennis elbow syndrome): include 1–2 cm above the lateral humeral epicondyle, including its trochlea and condyle, the radius head, neck and tuberosity plus 1 cm distally.
Ulnar epicondylitis (golf elbow syndrome): include 1–2 cm above the medial epicondyle, the ulna olecranon process, ulna coronoid process and its tuberosity, plus 1 cm distally.
Synovial bursaes: around the olecranon (superficial, subtendinous and intratendinous bursae) or the cubital fossa (bicipitoradial and interosseous bursae)
Ligaments and tendon insertions: articular capsule, and the lateral, collateral, radial collateral, annular, accessory collateral and ulnar collateral ligaments

HAND OSTEOARTHRITIS

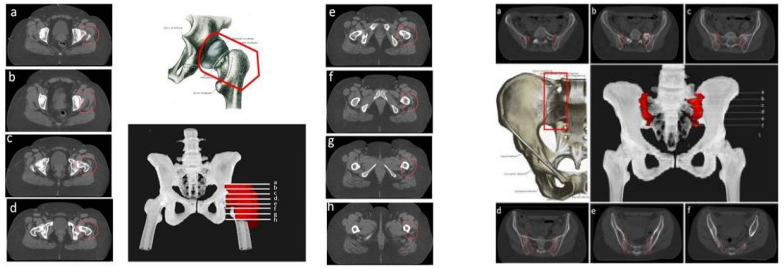


Finger joint OA: proximal and distal phalanges in the involved joint within 1 cm around the soft tissues in the second to fifth fingers.
Thumb OA: half of the metacarpal bone, the joint with the trapezoid bone and continue around 1 cm through the radial bone.

To avoid damaging the fingernails, the distal segment of the fingers should be excluded.

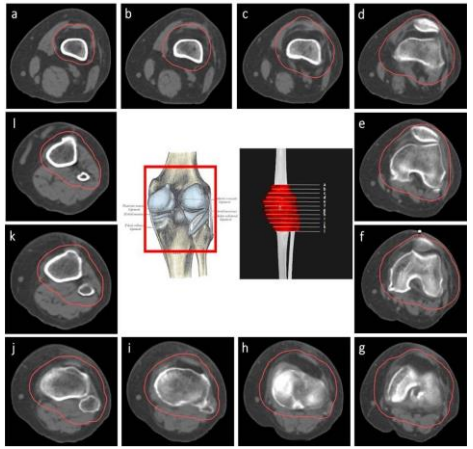
PELVIS&HIP OSTEOARTHRITIS

Greater trochanteric pain syndrome (trocahanteric bursitis): trochanteric bursa (superficial and posterior to the greater trochanter of the femur and subjacent to the iliotibial band), the gluteus medius bursa (between the gluteus medius muscle and the greater trochanter) and the gluteus minimus bursa (located beneath the gluteus minimus tendón at the anterosuperior edge of the greater trochanter) and the musculature surrounding the trochanter.
Sacroiliitis: include the whole joint between the sacral and iliac bones with a margin ≥1 cm on each side, including the sacroiliac ligaments.
Coxarthrosis: whole joint between the iliac bone (acetabulum) and the femoral head, and 1 cm distally through the femoral head.



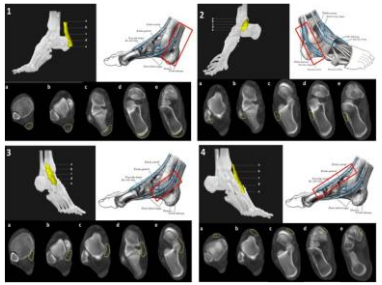
KNEE OSTEOARTHRITIS

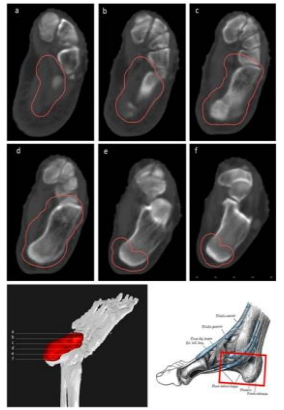
Gonarthritis: whole knee joint (lateral and medial supracondylar ridges, capitulum, medial and lateral epicondyles, popliteal fossa, femoral trochlea, lateral and medial tibial condyles, tibial tuberosity, fibula head and the patella bone), the entire synovial capsuleand surrounding soft tissues and musculature, including the main knee bursae (prepatellar, infrapatellar [deep and superficial], suprapatellar, Pes Anserine, semimembranosus (popliteal), and the iliotibial and medial collateral ligament bursae).



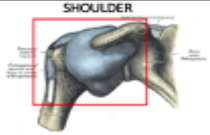
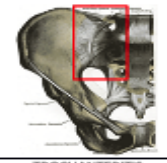
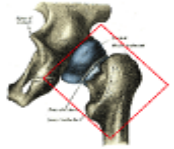
ANKLE&FOOT

Plantar fasciitis: the entire calcaneus, and the region of the plantar aponeurosis, including insertion of the plantar fascia and the Achilles tendón.
Tendonitis (Achilles tendinopathy and other tendinopathies: tibialis posterior, flexor hallux longus, flexor digitorum brevis, peroneus longus and brevis, tibialis anterior, extensor hallux longus, extensor digitorum brevis): include the tendons and synovial sheaths appropriate to each anatomic location





SUMMARY: TARGET VOLUMES LIMITS

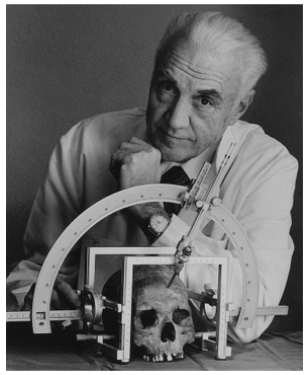
	SUPERIOR	INFERIOR	MEDIAL	LATERAL	PROXIMAL	DISTAL
SHOULDER 	POST: 1 cm above acromion ANT: coracoid process	1.5 cm under lesser tubercle	POST: 1.5 cm scapula ANT: 1.5 cm. clavicle	Lateral side of humeral head, neck and epiphysis and 1 cm of surrounding soft tissues		
ELBOW 	1.5 cm above trochlea and capitellum	1.5 cm below radial and ulnar tuberosities	1.5 cm around bone edges into surrounding soft tissues	1.5 cm around bone edges into surrounding soft tissues		
RHIZARTHROSIS 			1cm around of the soft tissues surrounding the bones	1cm around of the soft tissues surrounding the bones	Half of the metacarpal bone, the joint with the trapezoid bone and 1 cm through the radial bone	Proximal third of the distal phalanx
FINGERS 2-5 	2 mm inside the dorsal skin	2mm inside the ventral skin	1cm around of the soft tissues surrounding	1cm around of the soft tissues surrounding	- Distal third of the most proximal phalanx (arthrosis) - Common synovia vaina (Flex – tendinosis) - Beginning of corresponding bursa leaning on the ulna and radius (Exten – tendinosis)	- Proximal third of the most distal phalanx (arthrosis) - Distal phalanx (Flex-tendinosis) - Distal or proximal phalanx (Exten. tendinosis)
SACROILIAC 	1 cm above sacroiliac joint	1 cm below sacroiliac joint	1 cm into sacral bone	1 cm into iliac bone		
TROCHANTERITIS 	Trochanter, femoral head and neck	Below lesser trochanter	1cm around of the soft tissues surrounding	1cm around of the soft tissues surrounding		

	SUPERIOR	INFERIOR	MEDIAL	LATERAL	PROXIMAL	DISTAL
	2 cm above femoral condyles	2 cm below tibial condyles and fibula head	3cm around of the soft tissues surrounding	3cm around of the soft tissues surrounding	1 cm above lateral and medial femoral epicondyle	Lateral and medial tibial condyles and fibula head
PLANTAR FASCIA 			3cm around of the soft tissues surrounding	3cm around of the soft tissues surrounding	Metacarpal-phalanx joint	Calcaneus tuberosity
ACHILLES TENDON 			3cm around the tendon	3cm around the tendon	Lateral and medial malleolus	Calcaneus tuberosity, subcutaneous calcaneus bursa, subtendinous calcaneus bursa
T.A. + E.T 			3cm around the tendon	3cm around the tendon	2cm above medial malleolus	- Plantar side of 1st metacarpal and 1st cuneiform bone (insertion of the T.A.) - Plantar side of distal phalanges (insertion of E.T.)
T.P. + E.T 			3cm around the tendon	3cm around the tendon	2cm above lateral malleolus	- Plantar side of 2nd, 3rd, 4th metacarpal and 2nd, 3rd cuneiform bones (insertion of the T.P.) - Dorsal side of distal phalanges (insertion of E.T.)
PERONEUS MUSCLES 			3cm around the tendon	3cm around the tendon	2cm above lateral malleolus	5th metatarsal bone, lateral side

T.A.: tibialis anterior. F.T.: flexor tendons of the toes. T.P.: tibialis posterior. E.T.: extensor tendons of the toes.

hm hospitales

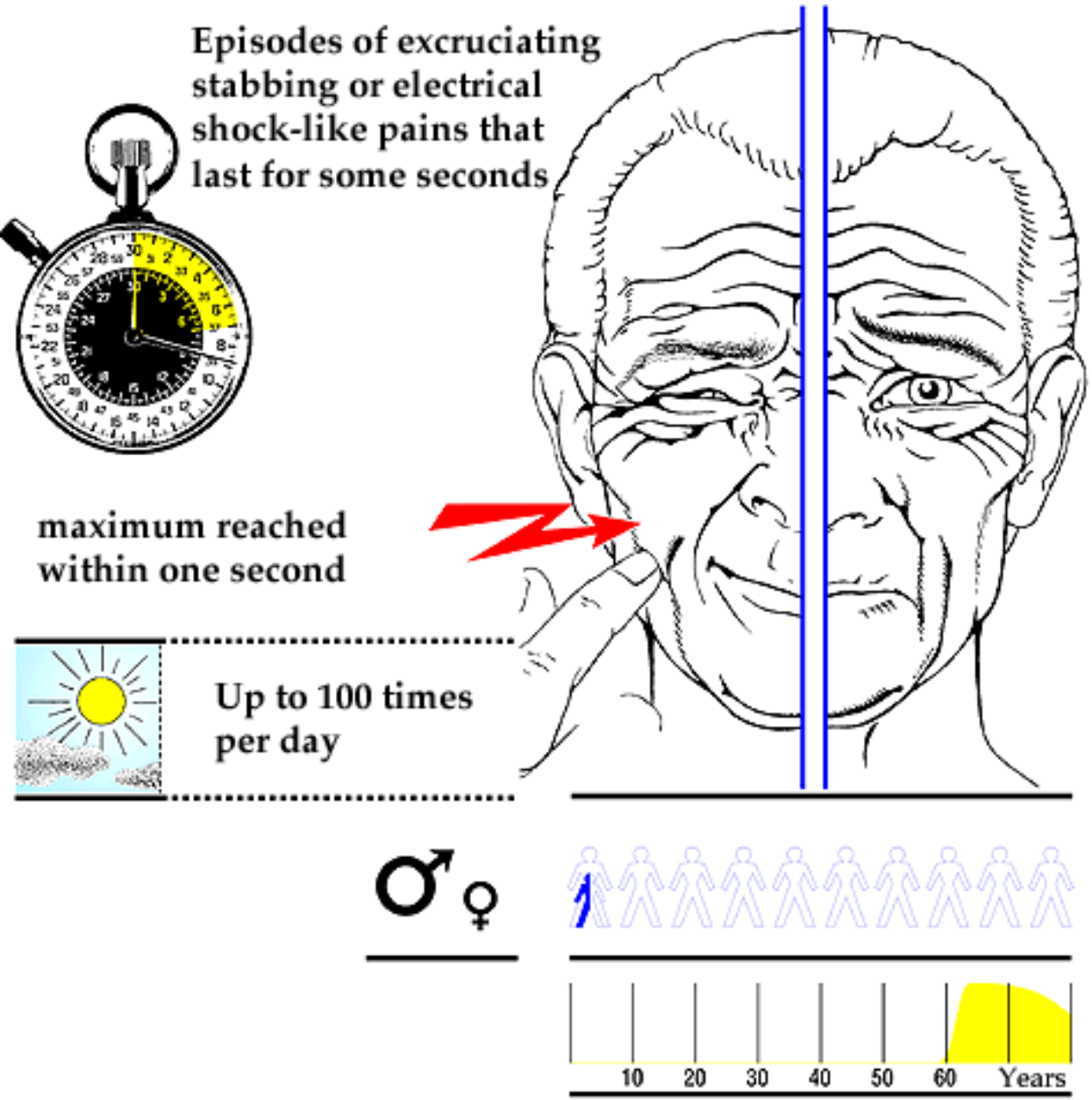
TRIGEMINAL NEURALGIA



"One can accept death, but one cannot accept the deep, devastating pain. Sharp, intractable pain is like hell 'without escape, without hope and without Heliotrope when Venom burns.' Standing at the bedside without ever having experienced pain, it is impossible to imagine the patient's agony, and it is impossible to understand that a short time without pain can be extreme happiness."

Lars Leksell

Brain Fragments, 1982.



8

/10,000/year incidence

5th

cranial nerve

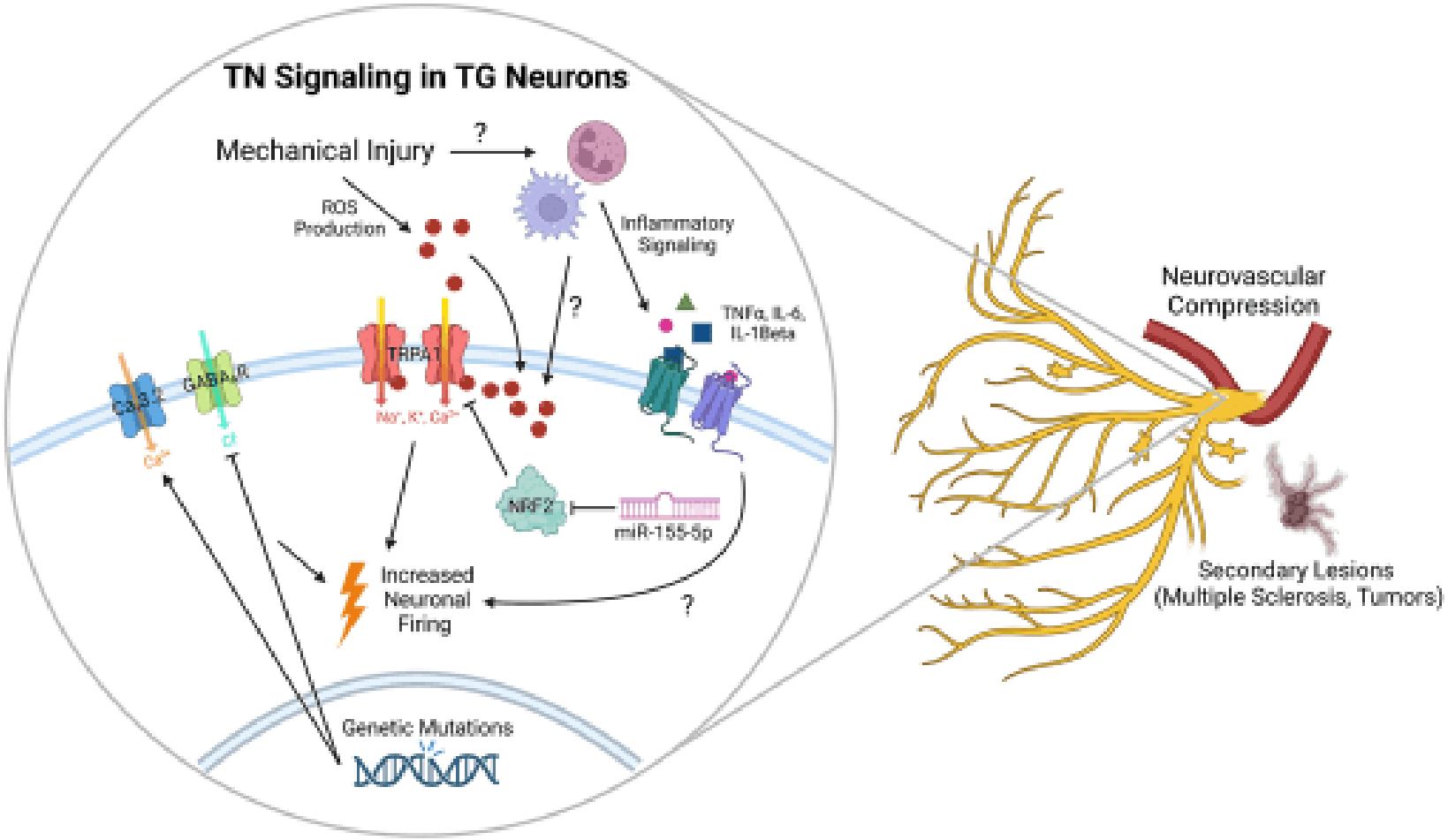
95%

due to vascular compression

3%

bilateral

PATHOPHYSIOLOGY OF TRIGEMINAL NEURALGIA: A MOLECULAR REVIEW



J Neurosurg 139:1471–1479, 2023

Trigeminal Neuralgia

Idiopathic

carbamazepine or oxcarbazepine
lamotrigine
gabapentin or pregabalin
baclofen
botulinum toxin type A

Internal neurolysis
Gamma knife surgery
Glycerol rhizolysis
Radiofrequency thermocoagulation
Balloon compression
Trigeminal MVD*

Classical

Trials of following 3 groups:
carbamazepine or oxcarbazepine
lamotrigine
gabapentin or pregabalin

Trigeminal MVD

baclofen
botulinum toxin type A
other drugs**

Gamma knife surgery
Glycerol rhizolysis
Radiofrequency thermocoagulation
Balloon compression
Internal neurolysis***

Secondary

Treat underlying cause.
If TN symptoms remain:

carbamazepine or oxcarbazepine
lamotrigine
gabapentin or pregabalin
baclofen
botulinum toxin type A

Gamma knife surgery
Glycerol rhizolysis
Radiofrequency thermocoagulation
Balloon compression
Trigeminal MVD****

Stereotactic Radio-Surgery

STEREOTAXIC RADIOSURGERY IN TRIGEMINAL NEURALGIA

Lars Leksell

From the Department of Neurosurgery, Karolinska Institutet, Stockholm, Sweden

Acta Chir Scand 137: 311–314, 1971

GAMMKNIFE RESULTS

Study (year)	Number of patients	Mean or median follow-up period (months)	Pain relief (%)	Complications (%)	Recurrence (%)
Young, et al. (1998)[66]	110	19.8	95.5	2.7	3.3
Maesawa, et al. (2001)[35]	220	22	78.6	10.2	13.6
Pollock, et al. (2002)[42]	117	26	75	37	16
Petit, et al. (2003)[67]	112	30	77	7.3	29
Sheehan, et al. (2005)[68]	136	19	70	19	24
Urgosik, et al. (2005)[38]	107	60	96	20	25
Longhi, et al. (2007)[40]	170	37.4	90	8.75	18
Fountas, et al. (2007)[48]	106	34.3	89.6	16	32.1
Kondziolka, et al. (2010)[5]	503	24	89	10.5	42.9
Hayashi, et al. (2011)[69]	130	38	98	24	18.0
Marshall, et al. (2012)[44]	448	20.9	86	44	40
Young, et al. (2013)[47]	315	68.9	85.6	32.9	14.3
Lucas, et al. (2014)[70]	446	21.2	84.5	42	45.1
Régis, et al. (2016)[6]	497	43.8	91.75	21.1	34.4
Taich, et al. (2016)[49]	263	24	79	NA	39.8
Martínez Moreno, et al. (2016)[71]	117	66	91	32.5	19
Zhao, et al. (2018)[50]	247	49.7	87.9	31.9	3.6
Gagliardi, et al. (2018)[72]	166	64.7	78	24	31.2
Lee, et al. (2018)[73]	108	17	80	55	22

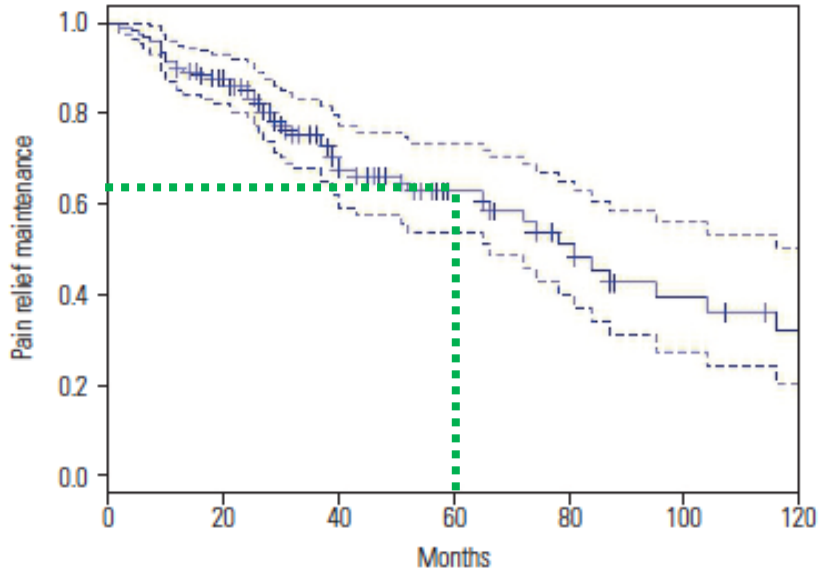


Fig. 2. Predicted pain relief maintenance period after Gamma Knife radiosurgery. Solid line represents predicted pain relief maintenance period and dotted line represents 95% confidence interval.

PAIN RELIEF: 70-98%
COMPLICATIONS (hypesthesia): 2-55%
PAIN RECURRENCE: 3-45%

Park SH, et al. Yonsei Med J. 2020 doi: 10.3349/ymj.2020.61.2.111.

IMMOBILIZATION:

- A fixed frame and facial masks from Brainlab

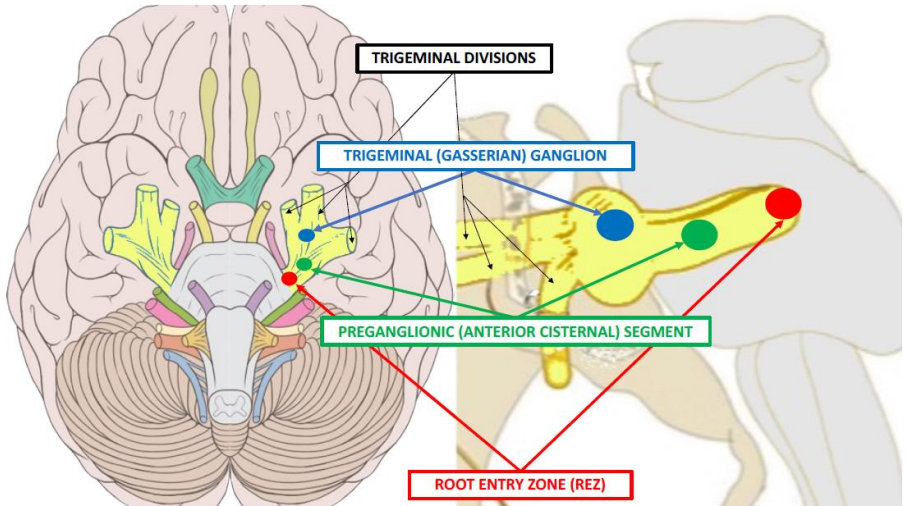
DEFINITION OF VOLUMES:

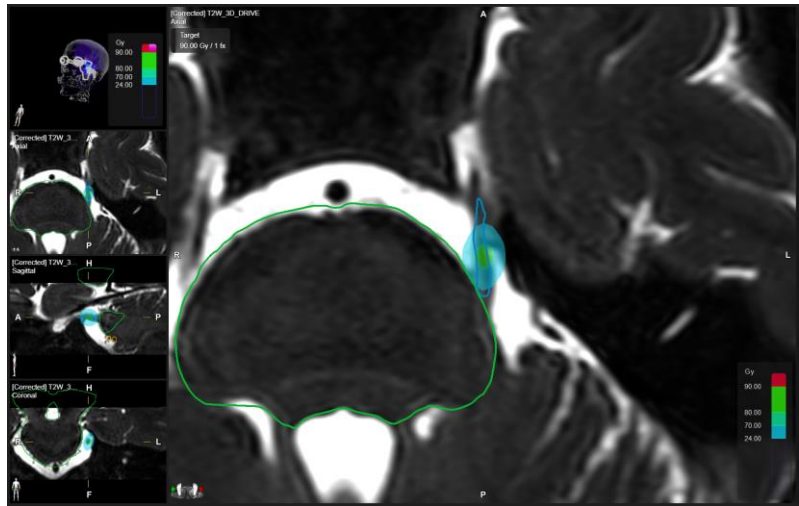
- Fusion of CT and MRI with T1 sequences with or without gadolinium and T2 CISS or FIESTA sequences

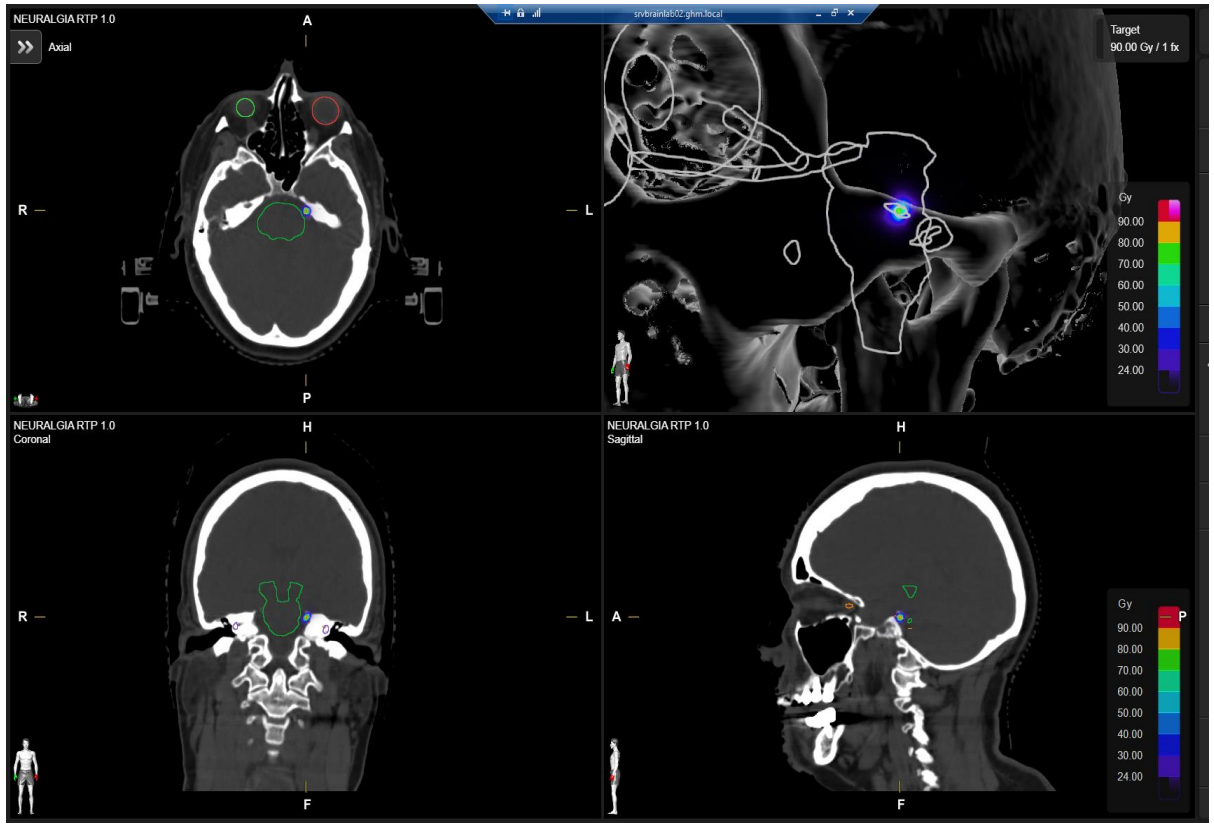
- A circular cone 4 mm diameter is used to deliver dose to isocenter

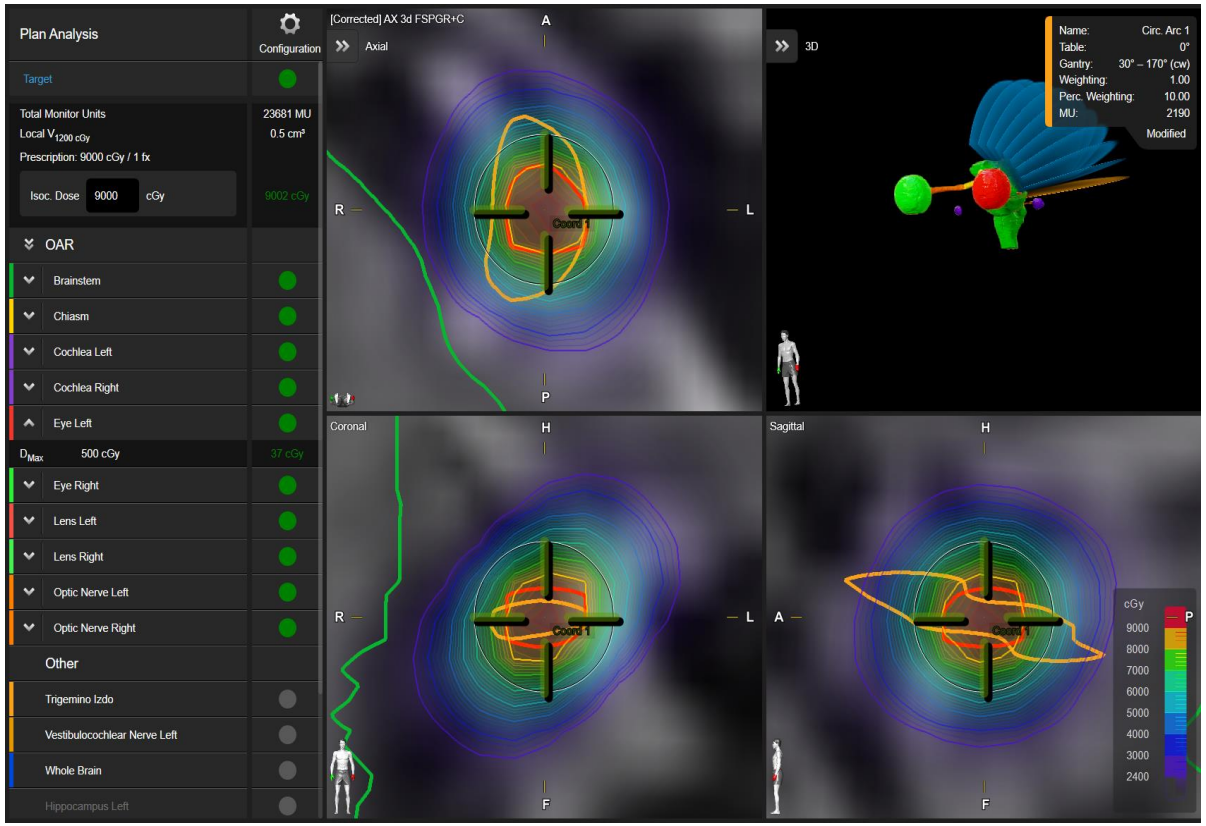
- Prescription point of the dose: in the so-called **retro-Gasserian area or anterior cistern**. Optionally, on the **REZ** or Observe-Redlich zone, at the point where the trigeminal nerve leaves the brainstem.

- For pain relief, anterior cisternal or REZ achieves similar pain control rates although the **anterior location is associated with lower rates of secondary hypesthesia**









DOSES:

- Minimum effective dose is estimated at 70 Gy (level II evidence), and the **maximum effective dose at 90 Gy** (level III evidence).
- Single fractionation is recommended over hypofractionation (level II evidence).

COVID-19 and Pneumonia

LOW-DOSE RADIOTHERAPY FOR PNEUMONIA: OLDIE BUT GOLDIE??

YALE JOURNAL OF BIOLOGY AND MEDICINE 86 (2013), pp.555-570.

REVIEW

How Radiotherapy Was Historically Used To Treat Pneumonia: Could It Be Useful Today?

Edward J. Calabrese, PhD*, and Gaurav Dhawan, MPH

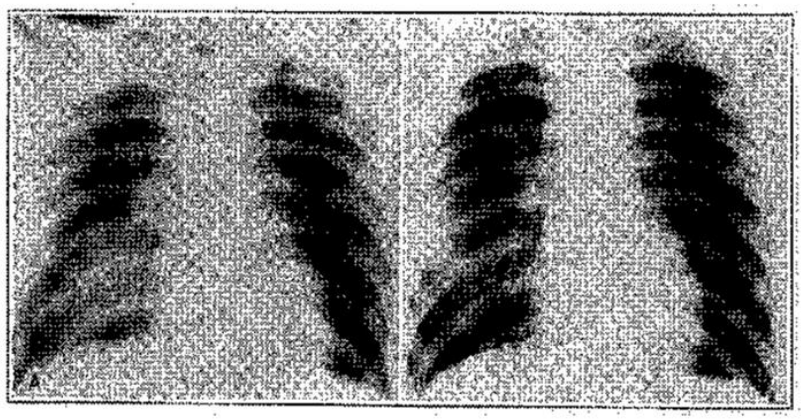


Fig. 7 (case 4).—*A*, the lungs on the second day of pneumonia, with consolidation chiefly in the right lower lobe. The sputum contained pneumococci not type, I, II, III. *B*, the ninth day; the lungs are almost clear.

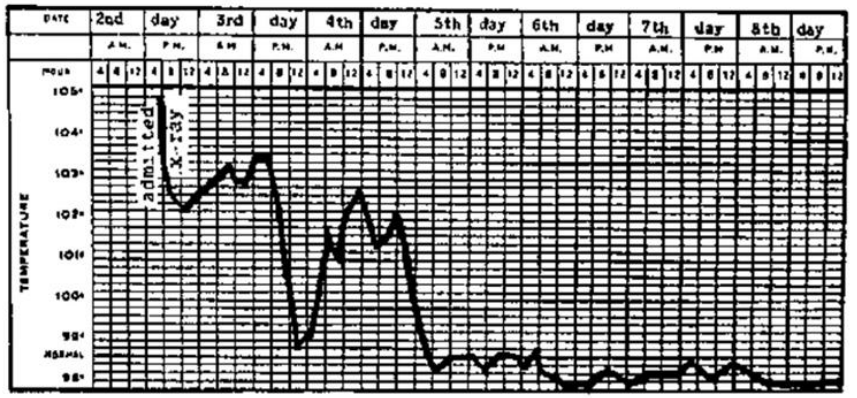


Fig. 8 (case 4).—Temperature curve for the second to eighth days.

836 cases of pneumonia treated with low-dose radiotherapy between 1905-1946

20-MARCH-2020 WHY NOT RADIOTHERAPY?

1104-11 Townsgate Drive
Vaughan, ON, L4J 8G4
Canada, 416 837 8865
jerrycuttler@rogers.com

March 20, 2020

Dr. Stephen M. Hahn, MD
Commissioner of FDA
United States Department of Health and Human Services
Silver Spring, MD, 20993

Dear Dr. Hahn

0.5 Gy chest X-ray as a potential remedy for COVID-19 disease

I urge you to consider a chest X-ray treatment of about 50 rad or 0.5 Gy. Since the 1920s, this was an effective remedy for a wide range of inflammatory and infectious diseases, including various types of pneumonia.[1] Therapeutic X-ray exposures were phased out in the mid-1940s when pharmaceutical remedies became available and were adopted as the preferred method of treatment. Such remedies are not yet available for COVID-19, so please consider radiotherapy. It is an old, but proven treatment for diseases that produce lung inflammation.

One exposure is expected to induce an anti-inflammatory phenotype that would begin to relieve the symptoms within a few hours. A recovery from unresolved pneumonia is usually observed within several days of the treatment. Table 1 in a historical review on treatment of pneumonia with radiotherapy shows a cure rate of 83% in 863 cases.[2] My recent article provides evidence that low doses of ionizing radiation upregulate innate adaptive protection systems.[3]

I recommend a short clinical trial of this radiotherapy for pneumonia in old patients, to confirm its efficacy, followed by a clinical trial of the same therapy for COVID-19. This could be carried out at the Hines VA Medical Center, with Chief Radiation Oncologist Dr. James S. Welsh as the principal investigator. I am willing to participate as a co-investigator. The trials could be started quite soon. Information on efficacy would be available days after the start of treatments.

If these studies demonstrate that old patients with COVID-19 recover quickly, this therapy could be introduced immediately. Appropriate radiation devices are already available in most hospitals.

Sincerely

Dr. Jerry M. Cuttler, DSc

Copy: Dr. James S. Welsh, MD

References:

1. Calabrese EJ, Dhawan G, Kapoor R, Kozumbo WJ. Radiotherapy treatment of human inflammatory diseases and conditions: optimal dose. *Hum Exp Toxicol.* 2019;38(8):888-898.
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3. Cuttler JM. Application of low doses of ionizing radiation in medical therapies. *Dose Response.* 2020;18(1):1-17.

"STUDY THE PAST IF YOU WOULD DEFINE THE FUTURE."

CONFUCIUS

Strahlenther Onkol (2020) 196:679–682
https://doi.org/10.1007/s00066-020-01631-7

REVIEW ARTICLE

Low-dose radiation therapy for COVID-19 pneumopathy: what is the evidence?

Franz Rödel[1] · Meritxell Arenas[2] · Oliver J. Ott[3] · Claudia Fournier[4] · Alexandros G. Georgakilas[5] · Soile Tapio[6] · Klaus-Rüdiger Trott[7] · Udo S. Gaipl[8]

International Journal of Radiation Biology

Flying by the seat of our pants: is low dose radiation therapy for COVID-19 an option?

Dörthe Schaue & William H. McBride

Strahlenther Onkol (2020) 196:736–737
https://doi.org/10.1007/s00066-020-01634-8

LETTER TO THE EDITOR

Low-dose radiotherapy for SARS-CoV-2 pneumonia

Deep Chakrabarti[1] · Mranalini Verma[1]

Radiotherapy and Oncology 147 (2020) 212–216
Contents lists available at ScienceDirect
Radiotherapy and Oncology
journal homepage: www.thegreenjournal.com

COVID-19 Rapid Communication

Low dose radiation therapy as a potential life saving treatment for COVID-19-induced acute respiratory distress syndrome (ARDS) ☆

Gaurav Dhawan[a,*], Rachna Kapoor[b], Rajiv Dhawan[c], Ravinder Singh[d], Bharat Monga[e], James Giordano[f,g], Edward J. Calabrese[h]

Cancer/Radiothérapie 24 (2020) 179–181
Disponible en ligne sur ScienceDirect www.sciencedirect.com
Elsevier Masson France EM|consulte www.em-consulte.com

Editorial

Irradiation pulmonaire à faible dose pour l'orage de cytokines du COVID-19 : pourquoi pas ?

Low dose lung radiotherapy for COVID-19-related cytokine storm syndrome: Why not?

Clinical and Translational Oncology
https://doi.org/10.1007/s12094-020-02401-y

EDITORIAL

Low-dose radiation therapy: could it be a game-changer for COVID-19?

A. Montero[1] · M. Arenas[2] · M. Algara[3]

Radiotherapy and Oncology 147 (2020) 221

Contents lists available at ScienceDirect

Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

COVID-19 Rapid Letter

Is low dose radiation therapy a potential treatment for COVID-19 pneumonia? ☆

Charles Kirkby [a,b,c], Marc Mackenzie [d]

[a] Department of Medical Physics, Jack Ady Cancer Centre, Lethbridge; [b] Department of Oncology; [c] Department of Physics and Astronomy, University of Calgary; and [d] Department of Oncology, University of Alberta, Edmonton, Canada

Fatal cases of COVID-19 are characterised by acute respiratory distress syndrome (ARDS), sepsis, pneumonia and respiratory failure [1]. The high transmission rate of the virus and the corresponding rapid escalation in the number of infections has resulted in unprecedented strains on healthcare systems worldwide, particularly as healthcare workers struggle to treat COVID-19 pneumonia.

We would like to draw the radiotherapy community's attention to the potential for low doses (<100 cGy) of low LET radiation to treat viral pneumonia as a possible therapy for COVID-19 patients. It was not uncommon in the early twentieth century to treat pneumonia with X-rays. A review showed low doses from kilovoltage X-rays reduced pneumonia mortality from roughly 30 percent to 10 percent on average [2]. Doses reported were generally in the 20 – few hundred Roentgen range, which given the attenuation through chest wall would likely have resulted in mean lung doses in the tens to <100 cGy range. Some reports noted rapid symptom relief on the order of hours [3,4] Animal models suggested LDRT could reduce the acute phase of pneumonia by half [5]. In light of the current mortality rates associated with COVID-19 pneumonia, it is therefore reasonable to re-examine this old treatment.

Pneumonia arises as an inflammatory immune response to infection when the alveoli become inflamed and secrete fluid compromising their gas exchange function. In a viral infection, viruses trigger immune cells to synthesize pro-inflammatory cytokines and chemokines [6], inciting the immune response. Historical evidence points to the induction of an anti-inflammatory phenotype induced by low doses of radiation as a potential explanation for the observed effects [2]. While doses ≥200 cGy tends to exert pro-inflammatory effects, triggering common toxicities observed in radiation therapy, more recent work shows low doses (<100 cGy) incite anti-inflammatory properties [7,8] such as decreasing levels of pro-inflammatory cytokines like IL-1β [9], or inhibiting leukocyte recruitment [10]. Therefore, it stands to reason that an LDRT treatment of 30–100 cGy to the lungs of a patient with COVID-19 pneumonia could reduce the inflammation and relieve the life-threatening symptoms.

A single fraction 30–100 cGy treatment could easily be delivered on a conventional megavoltage radiation therapy unit. Routinely, much higher, single fraction doses are delivered in a palliative context with fast-tracked patients going through the full workflow process of education, scanning, planning and treatment delivery in a matter of hours. Proof of principle simulations suggest that a POP treatment with a megavoltage beam could easily ensure 99% of the whole lung volume received between 90% and 120% of a 70 cGy prescribed dose. And because of the low doses, common radiotherapy toxicities would be avoided.

While a large scale up of such LDRT treatments would not be without obstacles (e.g. existing strain on radiotherapy resources, separating COVID-19 patients and cancer patients, etc.), we believe clinical trials to further investigate the efficacy of whole lung LDRT would present a very low risk to COVID-19 pneumonia patients, and have the potential to reduce mortality and alleviate COVID-19 related strains on healthcare systems.

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[10] Arenas M, Gil F, Gironella M, et al. Time course of anti-inflammatory effect of low-dose radiotherapy: Correlation with tgf-beta(1) expression. Radiother Oncol 2008;86:399–406.

☆ The Editors of the Journal, the Publisher and the European Society for Radiotherapy and Oncology (ESTRO) cannot take responsibility for the statements or opinions expressed by the authors of these articles. Practitioners and researchers must always rely on their own experience and knowledge in evaluating and using any information, methods, compounds or experiments described herein. Because of rapid advances in the medical sciences, in particular, independent verification of diagnoses and drug dosages should be made. For more information see the editorial "Radiotherapy & Oncology during the COVID-19 pandemic", Vol. 146, 2020.

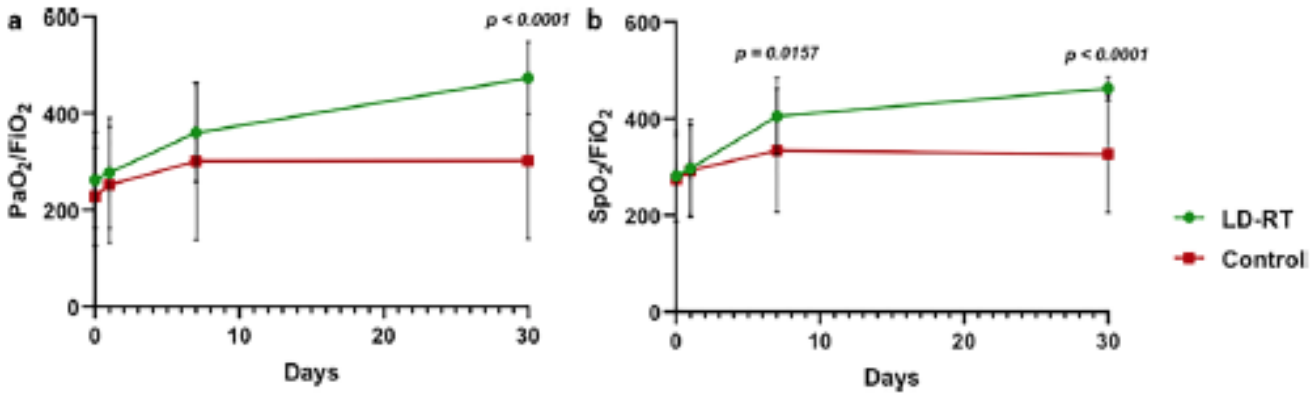
E-mail address: charles.kirkby@ahs.ca (C. Kirkby)

CLINICAL TRIALS OF LOW-DOSE RADIOTHERAPY FOR COVID-19 PNEUMONIA

Row	Saved	Status	Study Title	Conditions	Interventions	NCT Number	Locations
1	☐	Recruiting	COVID-19 Pneumonitis Low Dose Lung Radiotherapy (COLOR-19)	• COVID-19	• Radiation: Single fraction whole lung radiotherapy	NCT04377477	• Radiation Oncology Department, ASST SpedaliCivili, Brescia Brescia, Italy
2	☐	Not yet recruiting	Low Dose Whole Lung Radiotherapy for Older Patients With COVID-19 Pneumonitis	• COVID-19 Pneumonitis	• Radiation: Low dose whole lung radiotherapy for older patients with COVID-19 pneumonitis	NCT04493294	
3	☐	Recruiting	Low Dose Radiotherapy for COVID-19 Pneumonitis	• Covid19	• Radiation: Radiotherapy	NCT04420390	• Servicio de Oncología Radioterápica. Hospital Clínico San Carlos Madrid, Spain
4	☐	Recruiting	Low Dose Whole Lung Radiation Therapy for Patients With COVID-19 and Respiratory Compromise	• COVID-19	• Radiation: Radiation therapy	NCT04427566	• Arthur G. James Cancer Hospital and Solove Research Institut at Ohio State University Medici Center Columbus, Ohio, United States
5	☐	Active, not recruiting	Low Dose Radiotherapy in COVID-19 Pneumonia	• COVID • SARS (Severe Acute Respiratory Syndrome)	• Radiation: Low Dose Radiotherapy	NCT04390412	• Imam Hossein Hospital Tehran, Iran, Islamic Republic of
6	☐	Recruiting NEW	Anti-inflammatory Effect of Low-Dose Whole-Lung Radiation for COVID-19 Pneumonia	• COVID-19 Pneumonia	• Radiation: Low Dose Radiotherapy	NCT04534790	• Social Secure Mexican Institute Leon, Guanajuat Mexico
7	☐	Not yet recruiting	Low-Dose Radiotherapy For Patients With SARS-COV-2 (COVID-19) Pneumonia	• Covid-19 • Sars-CoV2 • Pneumonia	• Radiation: Low dose radiation 35 cGy • Radiation: High dose radiation 100 cGy	NCT04466683	
8	☐	Recruiting	Lung Irradiation for COVID-19 Pneumonia	• SARS-CoV 2	• Radiation: Phase 1 • Radiation: Phase 2	NCT04393948	• Brigham and Women's Hospital Boston, Massachusetts, United States
9	☐	Not yet recruiting	Low Dose Pulmonary Irradiation in Patients With COVID-19 Infection of Bad Prognosis	• COVID • Pneumonia, Viral	• Radiation: Lung Low Dose Radiation	NCT04414293	• Hospital Provincia de Castellon Castellón De La Plana, Castellon, Spain
10	☐	Recruiting	Radiation Eliminates Storming Cytokines and Unchecked Edema as a 1-Day Treatment for COVID-19	• Pneumonia • Coronavirus Infection in 2019 (COVID-19) • Severe Acute Respiratory Syndrome (SARS) Pneumonia	• Radiation: Low Dose Radiation Therapy	NCT04366791	• Emory University Hospital Midtown/Winship Cancer Institute Atlanta, Georgia, United States
11	☐	Recruiting	Low Dose Anti-inflammatory Radiotherapy for the Treatment of Pneumonia by COVID-19	• Pneumonia, Viral	• Radiation: Low-dose radiotherapy • Drug: Hydroxychloroquine Sulfate • Drug: Ritonavir/lopinavir • (and 5 more...)	NCT04380818	• Hospital Sant Joan de Reus Reus, Tarragona, Spain • Hospital Del Mar Barcelona, Spain • Hospital Universitario Madrid Sanchinarro Madrid, Spain
12	☐	Recruiting	Ultra Low Doses of Therapy With Radiation Applicated to COVID-19	• Pneumonia, Viral • Cytokine Storm	• Radiation: Ultra-Low-dose radiotherapy • Device: ventilatory support with oxygen therapy • Drug: Lopinavir/ritonavir • (and 6 more...)	NCT04394182	• Hospital La Milagrosa, GenesisCare Madrid, Spain • Hospital Vithas Valencia Consuelo Valencia, Spain
13	☐	Active, not recruiting	Low Dose Radiation Therapy for Covid-19 Pneumonia	• COVID-19 • Pneumonia	• Radiation: Low dose radiation therapy	NCT04394793	• All India Institute of Medical Sciences, New Delhi New Delhi, Delhi, India

- 13 estudios, 7 países
- 1 finalizado
- 8 en reclutamiento

NIH U.S. National Library of Medicine
ClinicalTrials.gov



Strahlenther Onkol (2021) 197:429–437
https://doi.org/10.1007/s00066-020-01743-4

ORIGINAL ARTICLE

COVID-19 pneumonia treated with ultra-low doses of radiotherapy (ULTRA-COVID study): a single institution report of two cases

Elena Moreno-Olmedo[1] · Vladimir Suárez-Gironzini[1] · Manuel Pérez[2] · Teresa Filigheddu[2] · Cristina Mínguez[3] · Alba Sanjuan-Sanjuan[4] · José A. González[5] · Daniel Rivas[6] · Luis Gorospe[7] · Luis Larrea[8] · Escarlata López[1]

Radiotherapy and Oncology 171 (2022) 25–29

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Radiotherapy and Oncology

journal homepage: www.thegreenjournal.com

Original Article

Low-dose Radiation Therapy in the Management of COVID-19 Pneumonia (LOWRAD-Cov19). Final results of a prospective phase I–II trial

Noelia Sanmamed[a,b,*], Pino Alcantara[b,e,c], Sara Gómez[d], Ana Bustos[d], Elena Cerezo[a], Miren Gaztañaga[a,b], Anxela Doval[a], Juan Corona[a,c], Gabriel Rodriguez[c], Noemi Cabello[f], Mercedes Duffort[g], Francisco Ortuño[h], Javier de Castro[h], Amanda López[h], Manuel Fuentes[i], Alvaro Sanz[j], Manuel Vazquez[a,b,c]

[a] Radiation Oncology Department; [b] Investigation Institute, Clínico San Carlos Hospital, Madrid, Spain; [c] Faculty of Medicine. Complutense University of Madrid; [d] Radiology Department; [e] Medical Physics Department; [f] Internal Medicine Department; [g] Internal Medicine Department, Infanta Leonor Hospital; [h] Intensive Care Unit; [i] Preventive Department, Clínico San Carlos Hospital, Madrid; and [j] Medical Oncology Department, Río Hortega Hospital, Valladolid, Spain

Strahlenther Onkol (2021) 197:1010–1020
https://doi.org/10.1007/s00066-021-01803-3

ORIGINAL ARTICLE

Could pulmonary low-dose radiation therapy be an alternative treatment for patients with COVID-19 pneumonia? Preliminary results of a multicenter SEOR-GICOR nonrandomized prospective trial (IPACOVID trial)

M. Arenas[1,2,3] · M. Algara[4,5,6] · G. De Febrer[1,7] · C. Rubio[8] · X. Sanz[4,6,9] · M. A. de la Casa[8] et al.
C. Vasco[1,7] · J. Marín[5,10] · P. Fernández-León[11] · J. Villar[4,12] · L. Torres-Royo[1,2,3] · P. Villares[13] · I. Membrive[4,5] · J. Acosta[1,2,3] · M. López-Cano[13] · P. Araguas[1,2,3] · J. Quera[4,6,9] · F. Rodríguez-Tomás[1,2,3] · A. Montero[8]

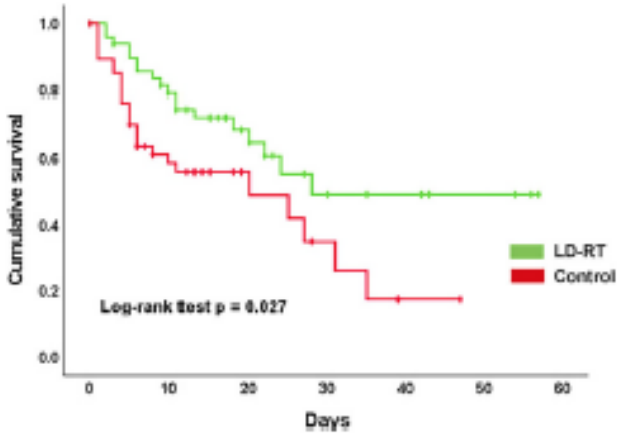
Strahlenther Onkol (2023) 199:847–856
https://doi.org/10.1007/s00066-023-02067-9

ORIGINAL ARTICLE

Treatment of COVID-19 pneumonia with low-dose radiotherapy plus standard of care versus standard of care alone in frail patients

The SEOR-GICOR IPACOVID comparative cohort trial

M. Arenas[1,4] · B. Piqué[2] · L. Torres-Royo[1,4] · J. C. Acosta[1,4] · E. Rodríguez-Tomàs[1,3,4] · G. De Febrer[5] · C. Vasco[5] · P. Araguas[1,4] · J. A. Gómez[1,4] · B. Malave[1,4] · M. Árquez[1,4] · M. Algara[6,7,8] · A. Montero[9] · M. Montero[10] · J. M. Simó[11] · X. Gabaldó[11] · D. Parada[2] · F. Riu[2] · S. Sabater[12] · J. Camps[3,4] · J. Joven[3,4]



TAKE-HOME MESSAGE

"...the so called benign diseases may not be so benign as the term suggests, in truth, they may be characterized by those malignant conditions wich are well known for cancerous conditions, i. e. loss of organ function and quality of life, which justify use of radiotherapy..."

M. H. Seegenschmiedt

Thoughts about Benign and Not so Benign Diseases

BenignNews 2001

Thanks!

JUST
DO
IT

UČINKOVITO OBVLADOVANJE TUMORJA JE KLJUČNO

ZAČNITE Z ZDRAVILOM XTANDI

XTANDI je prvo in edino peroralno zdravilo z dokazano učinkovitostjo v prvem redu zdravljenja, ki je indicirano za zdravljenje rHORP, nrKORP z velikim tveganjem in rKORP brez simptomov ali z blagimi simptomi.[1,2]

rHORP = razsejani hormonsko občutljiv rak prostate; nrKORP = nerazsejani proti kastraciji odporen rak prostate; rKORP = razsejani proti kastraciji odporen rak prostate

SAMO ZA STROKOVNO JAVNOST

Pred predpisovanjem, prosimo, preberite celoten povzetek glavnih značilnosti zdravila.

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Datum priprave: februar 2024, MAT-AB-XTD-2024-00015

Reference: 1. Povzetek glavnih značilnosti zdravila XTANDI (enzalutamid). **2.** Mottet N et al. European Association of Urology 2021.

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enzalutamid

Obsevanje mišičnoskeletnega sistema – pogled fiziatra

mag. Urška Kidrič Sivec, dr. med., spec. FRM

URI Soča, Oddelek za rehabilitacijo pacientov z okvaro hrbtenjače

Fiziatrična obravnava mišičnoskeletne patologije

- Radioterapija
  - V fiziatrični literaturi je možnost uporabe radioterapije navedena le pri heterotopnih osifikacijah (HO)
  - Radioterapevtske indikacije na področju mišičnoskeletnega sistema so širše

Heterotopne osifikacije

- Definicija: tvorba zrele lamelarne kostnine v nekostnih tkivih, kjer se kostno tkivo praviloma ne pojavlja
- Sopomenki
  - Myositis ossificans (v prečno-progastih mišicah)
  - Ektopična osifikacija
- Značilnosti:
  - Metabolno aktivna
  - Nima periosta
  - Ne atrofira
  - Vnetje in proliferacija

HO

- Vzroki
  - Genetski (fibrodisplazija ossifikans progresiva…)
  - Negenetski
    - Neposredna poškodba tkiva (operacija, travma) 40% (2-7%)
    - Poškodba CŽS 10-53% (od teh je 10-20% simptomatskih)
    - Opekline (večja površina opekline, večja pojavnost HO)
- Lokalizacija
  - Kolk (medenica, poškodba hrbtenjače)
  - Koleno (operacije, poškodba hrbtenjače)
  - Komolec (operacije, opekline, nezgodna možganska poškodba)
  - Rama (operacije, nezgodna možganska poškodba)

HO

- Epidemiologija
  - Moški pogosteje (m:ž=3:2, m=2.5xž)
  - Med 20 in 30 letom
- Klinična slika
  - 2-12 tednov po poškodbi ali operaciji
  - Omejena gibljivost sklepa
  - Oteklina
  - Rdečina
  - Bolečina
  - Povišana telesna temperatura
  - Laboratorijsko povišani vnetni parametri, povišana AF

HO

- Klasifikacija
  - Kolk – razdelitev po Brookerju (I-IV glede na razdaljo med HO in sklepom)
  - komolec – Hastings in Graham (I-III)
- Zdravljenje
  - Vzdrževanje gibljivosti
  - Operativna odstranitev po maturaciji (nevarnost ponovitve)
- Preprečevanje
  - NSAID – indometacin
  - Radioterapija

Radioterapija (RT) pri HO

- Priporočila britanskega združenja (Royal College of Radiologists), marec 2023
  - RT in NSAID sta učinkovita v preprečevanju HO, NSAID so cenejši (stopnja priporočila A)
  - Razmislek o RT pri pacientih, pri katerih je jemanje NSAID kontraindicirano ali obstaja povečano tveganje za nastanek obsežnejše HO, izogib uporabe pri mlajših pacientih (<50 let)
  - Aplikacija 4 ure pred op. ali znotraj 96 ur po op. (stopnja priporočila A)
  - Učinkovito 1x obsevanje s 7 Gy (stopnja priporočila A-C), zmanjšano tveganje za RIC (stopnja priporočila D)
  - Velja kot preventiva nastanka **HO v kolku**

Obsevanje pri osteoartikularni bolečini

(osteoartroza, periartritis)

doc. dr. Ivica Ratoša, dr. med.

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OSTEOARTROZA (OA)

1–2 %

- **OA je najpogostejša sklepna in revmatska bolezen s prevalenco 17.3 %**[3] (50 % vseh radiološko odkritih OA je asimptomatskih)
- **EKONOMSKO BREME OA**: **1,0–2,5 %** bruto domačega proizvoda v zahodnem svetu; v Sloveniji ≈ 0,4 %.[1,2]
- **Slovenija (2016-2020):** neposredni in posredni stroški bolezni mišičnoskeletnega sistema in vezivnega tkiva v povprečju znašajo okoli 195 milijonov EUR oz. 5,1% vseh izdatkov za zdravstvo.[2]
- **Stroški zdravil** za zdravljenje šestih izbranih diagnoz: 17,5 milijonov EUR, kar predstavlja 23,9 % vseh izračunanih neposrednih stroškov v proučevanem obdobju. [2]

GLAVNE DIAGNOZE (osnovni vzroki)	MKB-10
M16	Artroza kolka (koksartroza)
M17	Artroza kolena (gonartroza)
M25	Druge motnje sklepa, ki niso uvrščene drugje
M54	Bolečina v hrbtu (dorzalgija)
M75	Okvare (lezije) rame
M79	Druge motnje mehkega tkiva, ki niso uvrščene drugje

Vir: MKB 10, 2005

ZDRAVILA ≈25 % vseh stroškov

1) Hiligsmann M et al (2013) Health economics in the field of osteoarthritis: an expert's consensus paper from the European society for clinical and economic aspects of osteoporosis and osteoarthritis (ESCEO). Semin Arthritis Rheum 43(3):303–313
2) Ekonomske posledice bolezni mišično-skeletnega sistema in vezivnega tkiva v Sloveniji v obdobju 2016-2020 https://nijz.si/wp-content/uploads/2023/01/Porocilo_BMSVT_2020.pdf
3) https://www.ortopedija-mb.si/veliki_sklepi%202010.pdf

OA: mehanizmi nastanka in življenjsko tveganje

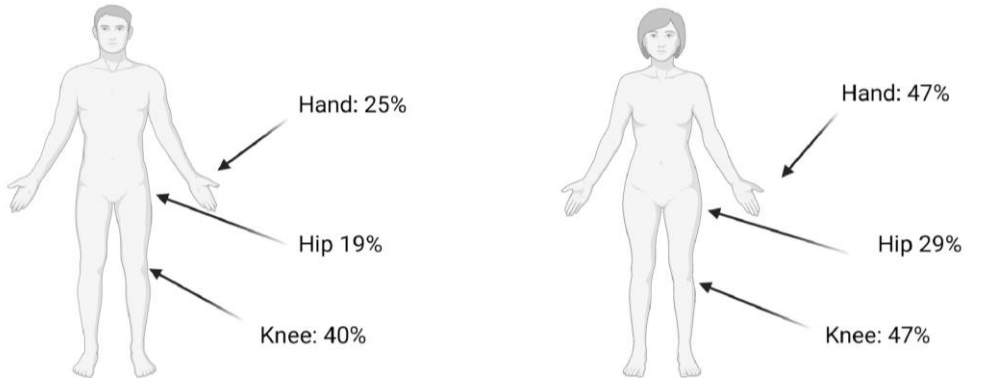
- Pravi mehanizmi nastanka OA še niso znani.
- Primarni OA velikih sklepov je navadno **posledica nesorazmerja** med mehanskimi obremenitvami in sposobnostjo hrustanca, da se na te obremenitve primerno odzove.

- **Glavne značilnosti**: prezgodnje popadanje **<u>sklepnega hrustanca (primarno mesto dogajanja)</u>**, kasneje se pojavi vnetje, kateremu lahko sledijo sekundarne spremembe, ki se pojavljajo na sklepnih in obsklepnih strukturah, kot so sinovialna membrana, fibrozna ovojnica, subhondralna kost (s tvorbo skleroze, subhondralnih cist in osteofitov), kite in mišice.

PATOGENEZA (3 prekrivajoči stadiji):

1. Razgradnja hrustančnega matriksa.
2. Odgovor hondrocitov s povečano tvorbo komponent matriksa.
3. Progresivna izguba hrustančnega tkiva zaradi nezmožnosti hondrocitov pri popravi sprememb na hrustancu.

Življenjsko tveganje za OA: M proti Ž



DEJAVNIKI TVEGANJA:

STAROST: 90 % bolnikov > 45 let

SPOL

- **HORMONSKI VPLIV** (Ž menopavza↑)
- **ANATOMIJA SKLEPA**: M↓ proti Ž↑

GENETIKA

HIPERTENZIJA, HIPERHOLESTEROLEMIJA

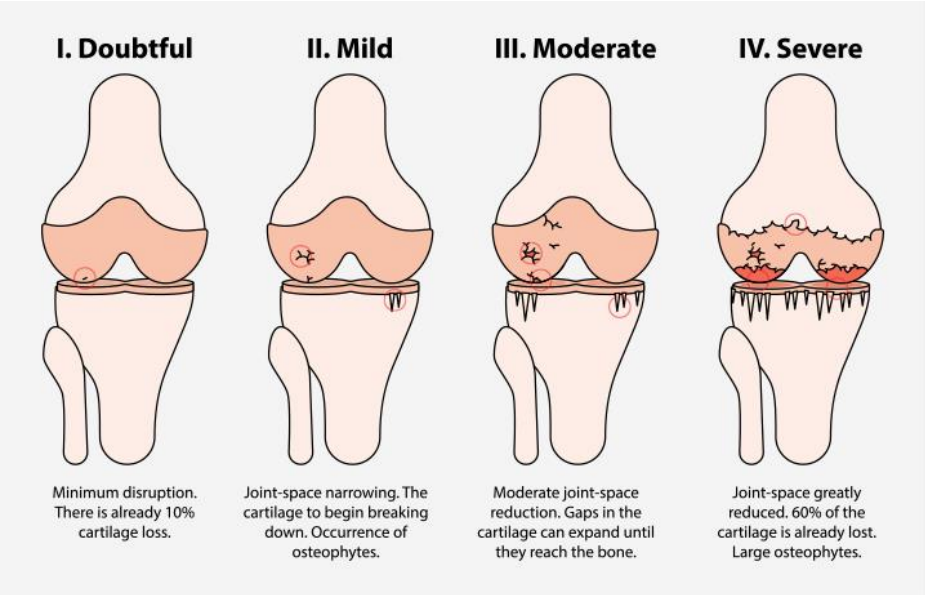
https://www.ortopedija-mb.si/veliki_sklepi%202010.pdf

Dove APH, et al. The Use of Low-Dose Radiation Therapy in Osteoarthritis: A Review. Int J Radiat Oncol Biol Phys. 2022; 114(2):203-220. doi: 10.1016/j.ijrobp.2022.04.029

OA: Obvladovanje težav: farmakološki in nefarmakološki ukrepi

50 % OA:
asimptomatskih

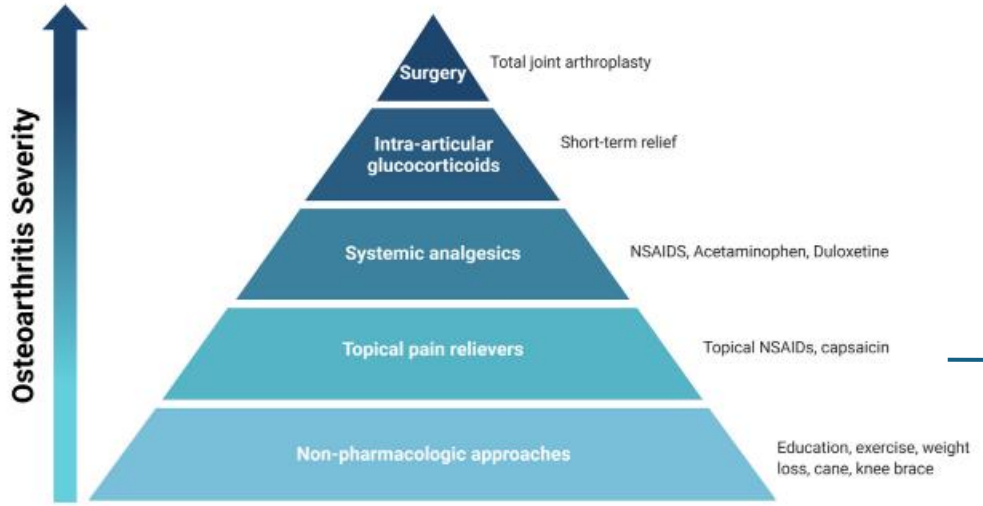
50 % OA:
bolečina, omejena gibljivost in ↓QoL



Neučinkovitost ostalih konzervativnih ukrepov?

CILJI zdravljenja z RT?

Povrnitev funkcije in izboljšanje kakovosti življenja.



ZDRAVILA:

\+ Učinkovitost

— Neželeni učinki NSAID (ledvica, srčno-žilni sistem, prebavila...)

Dove APH, et al. The Use of Low-Dose Radiation Therapy in Osteoarthritis: A Review. Int J Radiat Oncol Biol Phys. 2022; 114(2):203-220. doi: 10.1016/j.ijrobp.2022.04.029
https://www.pthealth.ca/conditions/osteoarthritis/

Delovanje LD-RT

proti-vnetni učinek (TD 2,5 do 7,5 Gy)

DOZA?
In vitro:
maksimalni proti-vnetni učinek z dnevno dozo 0,3-0,7 Gy.[1,2]

TRAJANJE UČINKA?
In vitro:
učinek do 48 ur, nato izgine po 72 urah.[2]

proti-proliferativni učinek (TD 8-10 Gy)

Vpliv na deleče celice (mitoza), ↓proliferacija celic.[3]

Imunomodulatorni učinek (TD >10 Gy)

Regulacija limfocitov, supresija lokalnega avtoimunega dogajanja.[3]

1) Rödel F, et al. Radiobiological mechanisms in inflammatory diseases of low-dose radiation therapy. Int J Radiat Biol. 2007 Jun;83(6):357-66.
2) Arenas M, et al. Anti-inflammatory effects of low-dose radiotherapy. Indications, dose, and radiobiological mechanisms involved. Strahlenther Onkol. 2012 Nov;188(11):975-81.
3) Torres Royo L, et al. Low-Dose radiation therapy for benign pathologies. Rep Pract Oncol Radiother. 2020 Mar-Apr;25(2):250-254.

RADIOBIOLOŠKI mehanizmi nizko-doznega obsevanja

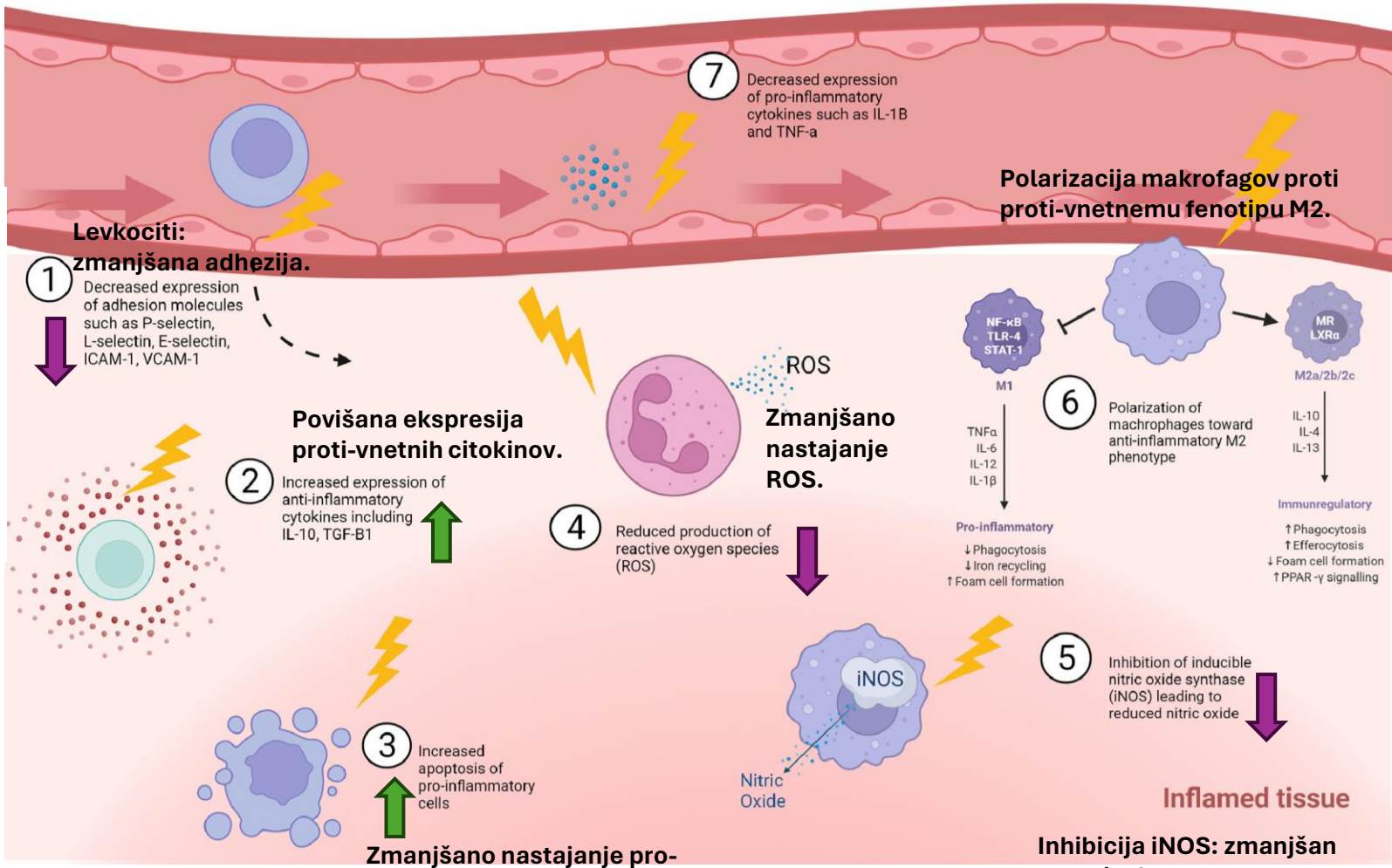
Dnevna doza 0,3 do 0,7 Gy (TD 2,5 do 7,5 Gy)

proti-vnetni učinek

Differences between the effects of irradiation at low and high doses.

Low irradiation doses (<1 Gy)	High irradiation doses (>2 Gy)
Anti-inflamatory properties IL-10, TGF-β1, IL-4, NF-κB, HO-1, HSP70 L-Selectin, E-Selectin, AP-1, ROS, iNOS Apoptosis	Pro-inflamatory cytokines production IL-1, TNF-α, IL-6, IL-8, IL-12 ROS, iNOS

AP-1: Activator Protein- 1; HO-1: Heme oxygenase-1; HSP70: Inductible Heat Shock protein 70; IL: Interleukine;
NF-κB: Nuclear factor-κB; ROS: Reactive Oxygen Species; TGF-β1: Transforming Growth Factor-β1; TNF- α: Tumor Necrosis Factor- α; iNOS: Inductible Nitric Oxide Synthase.



Modulacija vnetnih mehanizmov & poti, ki vključujejo **endotelijske celice**, **levkocite** in **makrofage** (=centralna vloga).

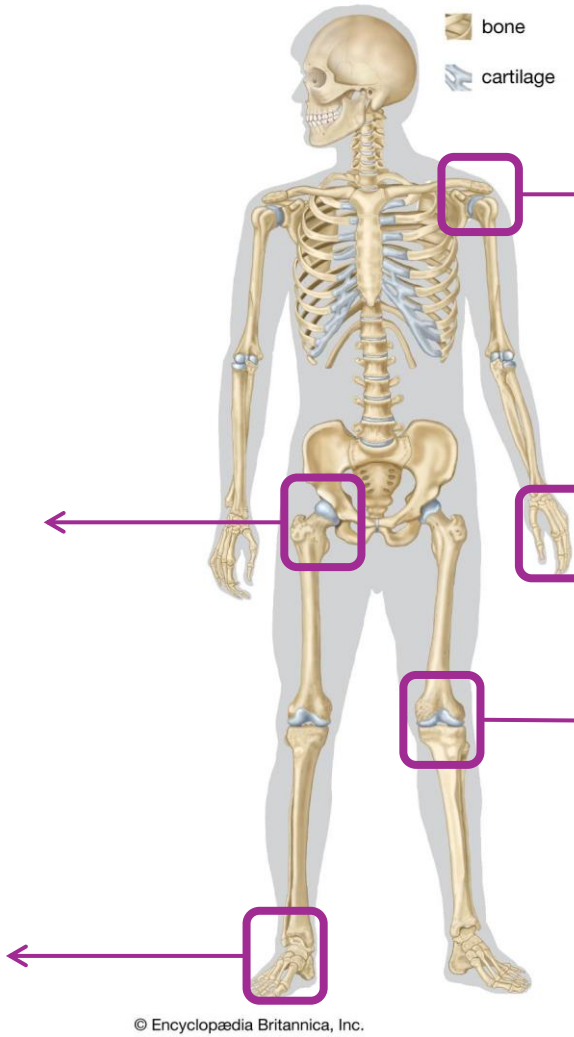
Dove APH, et al. The Use of Low-Dose Radiation Therapy in Osteoarthritis: A Review. Int J Radiat Oncol Biol Phys. 2022; 114(2):203-220. doi: 10.1016/j.ijrobp.2022.04.029
Torres Royo L, et al. Low-Dose radiation therapy for benign pathologies. Rep Pract Oncol Radiother. 2020 Mar-Apr;25(2):250-254. doi: 10.1016/j.rpor.2020.02.004.

Povzetek učinkovitosti zdravljenja OA in periartritrisa z obsevanjem

(odgovor na bolečino: delni in kompletni odgovor skupaj, ≈ 3 mesece po RT)

9 retrospektivnih raziskav (n=4178)
6 prospektivnih (n=1209)
3 randomizirane kontrolirane raziskave (n=340)

24–100 %



RAMENSKI SKLEP: 58–100 %
Utesnitveni sindrom rame
(2 do 3 mesece po RT)

ARTROZA KOLKA: 24–89 %

TROHANTERIČNI BURZITIS: 46–73 % (3 mesece po RT)

MALI SKLEPI ROK: 63–94 %

ARTROZA KOLENA: 29–91 %

OA STOPALA in GLEŽNJA: 75 % (6 mesecev po RT) izboljšanje gibljivosti sklepov: 56 %

Ott OJ, et al.; German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD). DEGRO guidelines for the radiotherapy of non-malignant disorders. Part II: Painful degenerative skeletal disorders. Strahlenther Onkol. 2015 Jan;191(1):1-6.

Micke O, et al. Radiotherapy for calcaneodynia, achillodynia, painful gonarthrosis, bursitis trochanterica, and painful shoulder syndrome - Early and late results of a prospective clinical quality assessment. Radiat Oncol. 2018 Apr 19;13(1):71.

Álvarez B, et al. Radiotherapy for ostheoarticular degenerative disorders: When nothing else works. Osteoarthr Cartil Open. 2019

Dove APH, Cmelak A, Darrow K, McComas KN, Chowdhary M, Beckta J, Kirschner AN. The Use of Low-Dose Radiation Therapy in Osteoarthritis: A Review. Int J Radiat Oncol Biol Phys. 2022 Oct 1;114(2):203-220.

RT in degenerativne bolezni sklepov ter obsklepnih tkiv II.

- N = 703 (461 Ž in 242 M); povprečna starost 63.3 leta (28-96)
- Srednji čas sledenje 33 mesecev (3-60)
- **Frakcionacija 12 x 0.5 Gy ali 6 x 1.0 Gy**

Srednje vrednosti VAS pred in takoj po RT:

Table 2 Median VAS-values before and immediately on completion of RT

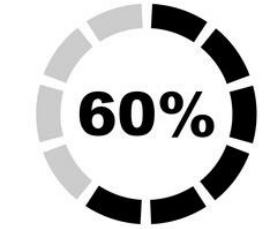
Diagnosis	Median VAS value before RT (interquartile range)	Median VAS value immediately on completion of RT (interquartile range)	*P*-Value
Calcaneodynia	7.0 (5.425-8)	4.0 (2.5-6)	< 0.001
Achillodynia	6.0 (5-7.125)	4.0 (2-5)	< 0.001
★ Gonarthrosis	6.0 (5-8)	4.5 (3-6)	< 0.001
★ Bursitis trochanterica	7.0 (6-8)	5.0 (3.725-7.125)	< 0.001
★ Shoulder Syndrome	7.0 (5-8)	5.0 (3-6)	< 0.001
All patients	7.0 (5-8)	4.5 (3-6)	< 0.001

Table 3 Good Response (%) immediately on completion of RT and during follow up

Diagnosis	Good Reponse on completion of RT	Good Reponse - Follow up	*P*-Value
Calcaneodynia	46.0% (131/286 patients)	80.7% (113/140 patients)	< 0.001
Achillodynia	39.1% (18/46 patients)	88.9% (24/27 patients)	=0.001
Gonarthrosis	30.9% (43/139 patients)	29.2% (33/113 patients)	=0.612
Bursitis trochanterica	27.1% (19/70 patients)	46.3% (31/67 patients)	=0.012
Shoulder Syndrome	32.7% (53/162 patients)	60% (54/90 patients)	< 0.001
All patients	37.6% (264/703 patients)	58.4% (255/437 patients)	< 0.001

Izboljšan odgovor na RT po > 3 m

Dober odgovor na bolečino po obsevanju za celotno skupino:
Takoj po zaključenem obsevanju: 264/703 (37,6 %)
Statistično značilno izboljšanje v daljšem sledenju, vsaj 3 mesece: 255/437 (58,4 %) (p < 0.001).
Brez razlik v dalješ sledenju in samo 30-odstotna učinkovitost: osteoartroza kolenskega sklepa.



Micke O, et al. Radiotherapy for calcaneodynia, achillodynia, painful gonarthrosis, bursitis trochanterica, and painful shoulder syndrome - Early and late results of a prospective clinical quality assessment. Radiat Oncol. 2018 Apr 19;13(1):71. doi: 10.1186/s13014-018-1025-y.

9 retrospektivnih raziskav (n=4178)

6 prospektivnih (n=1209)

3 randomizirane kontrolirane raziskave (n=340)

LDRT in podatki iz RCT

1

OA malih sklepov rok, N = 56
≥50 let
VAS ≥5, konzervativni ukrepi neuspešni
R: 1:1
6 x 1 Gy vs 6 x 0 Gy

3-m-FU: **28 % vs 31 %**
(NS)

2

OA kolenskih sklepov, N = 55
≥50 let
VAS ≥5, konzervativni ukrepi neuspešni
R: 1:1
6 x 1 Gy vs 6 x 0 Gy

6-m-FU: **41 % vs 35 %**
12-m-FU: **52 % vs 44 %**
(NS)

3

OA malih sklepov rok in kolenskih sklepov, N = 236 obsevanj
≥18 let (srednja starost 68 let); simptomi vsaj 3 m, R: 1:1
6 x 0,5 Gy (3 Gy) vs 6 x 0,05 Gy (0,3 Gy)

3-m-FU: odgovor: **59 %** (obe skupini) (NS); Slab nabor bolnikov → raziskava predčasno zaključena.

?

- LDRT: učinkovit samo na **določeni stopnji** razvoja OA?
- **Majhen vzorec**: nezadosten, za zaznavo 40-odstotne razlike med skupinama
- **40 do 50 % bolnikov potrebuje ponovno obsevanje** za odgovor na zdravljenje (v raziskavah ni bilo ponovnega obsevanja)
- V raziskavah 1 in 2: shema zdravljenja 1 Gy/ dan → nova dognanja → **proti-vnetni učinek izrazitejši pri 0,5 Gy/ dan**.

NS = statistično neznačilno

1) Minten MJMet al. Lack of beneficial effects of low-dose radiation therapy on hand osteoarthritis symptoms and inflammation: a randomised, blinded, sham-controlled trial. Osteoarthritis Cartilage. 2018 Oct;26(10):1283-1290.
2) van den Ende CHM, et al. Long-term efficacy of low-dose radiation therapy on symptoms in patients with knee and hand osteoarthritis: follow-up results of two parallel randomised, sham-controlled trials. Lancet Rheumatol. 2020 Jan;2(1):e42-e49.
3) Niewald M, et al; working group "Benign diseases" of the DEGRO (German Society for Radiation Oncology). ArthroRad trial: multicentric prospective and randomized single-blinded trial on the effect of low-dose radiotherapy for painful osteoarthritis depending on the dose-results after 3 months' follow-up. Strahlenther Onkol. 2022 Apr;198(4):370-377.

DEGRO: Priporočila

PREDPIS DOZE

Table 1 DEGRO guideline recommendations for the radiotherapy of painful degenerative skeletal disorders

Skeletal disorder	Total doses/ series [Gy]	Single doses/ fraction [Gy]	Frequency of fractions	LoE	GR
Shoulder syndrome	3.0–6.0	0.5–1.0	2–3/week	4	C
Elbow syndrome	3.0–6.0	0.5–1.0	2–3/week	2c	B
Trochanteric bursitis	3.0–6.0	0.5–1.0	2–3/week	4	C
Plantar fasciitis	3.0–6.0	0.5–1.0	2–3/week	1b	A
Gonarthrosis	3.0–6.0	0.5–1.0	2–3/week	2c	B
Coxarthrosis	3.0–6.0	0.5–1.0	2–3/week	4	C
Hand and finger joint arthrosis	3.0–6.0	0.5–1.0	2–3/week	4	C

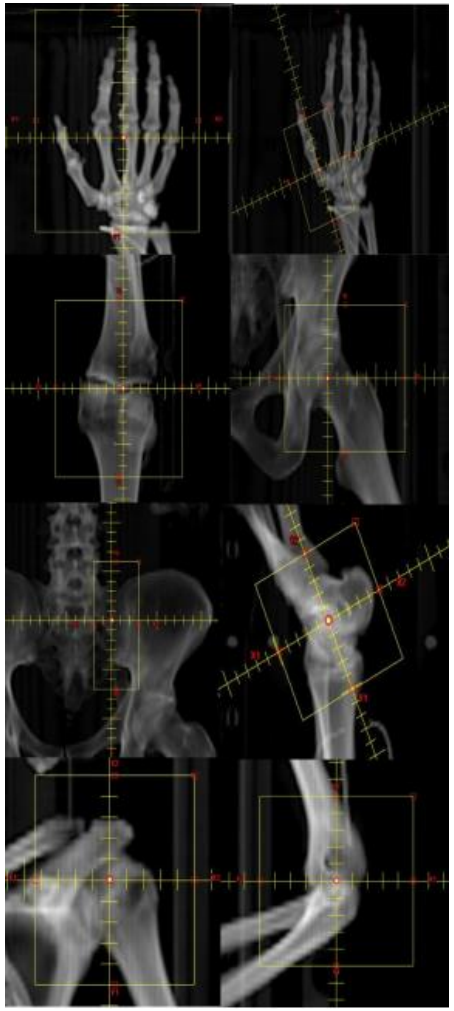
Gy Gray, *LoE* Oxford Level of Evidence, *GR* Grade of Recommendation

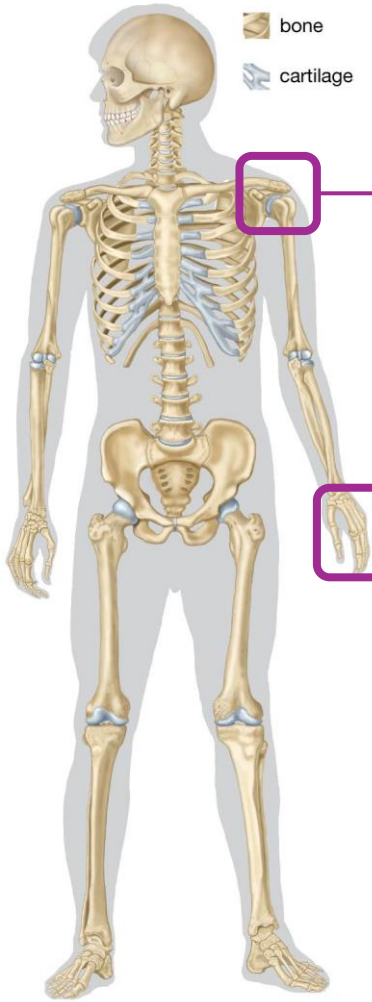
OSTALA PRIPOROČILA

- Zaradi splošne zaščite pred ionizirajočim sevanjem, je RT priporočena, v kolikor so **ostale možnosti zdravljenja** OA **izčrpane**.
- **Bolniki** < 40 let – obsevanje izjemoma, po skrbni presoji koristi obsevanja in neželenimi učinki.
- **Obsevalni snop**: kV ali MV.
- **Perzistirajoča bolečina** ali slabši odgovor na RT: obsevanje se lahko **ponovi čez 6 do 12 tednov**.
- **Pozor** – velikost obsevalnega polja, pacemaker, zarodne mutacije in vpliv obsevanja

Ott OJ, et al.; German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD). DEGRO guidelines for the radiotherapy of non-malignant disorders. Part II: Painful degenerative skeletal disorders. Strahlenther Onkol. 2015 Jan;191(1):1-6.
Torres Royo L, Antelo Redondo G, Árquez Pianetta M, Arenas Prat M. Low-Dose radiation therapy for benign pathologies. Rep Pract Oncol Radiother. 2020 Mar-Apr;25(2):250-254

DEGRO: Priporočila





KAJ še paziti pri načrtovanju obsevanja?

RAMA: zaščita pljuč & dojke

MALI SKLEPI ROK: zaščita nohtov

Tarčni volumni/CTV:

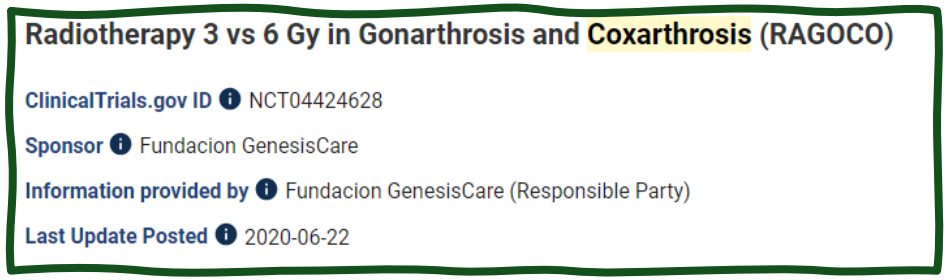
❖**Entezopatije**: narastišče mišice in prileżna kostnina.

❖**Artroza**: sklepni hrustanec, prileżna kostnina, sinovijska ovojnica v celoti, prileżne mišice oz narastišča mišic, periartikularno vezivno tkivo.

! Odgovornost in skrbnost pri izvedbi zdravljenja je enaka kot pri zdravljenju malignih bolezni.
Priporoča se skrbno sledenje po zaključenem zdravljenju.

Ott OJ, et al.; German Cooperative Group on Radiotherapy for Benign Diseases (GCG-BD). DEGRO guidelines for the radiotherapy of non-malignant disorders. Part II: Painful degenerative skeletal disorders. Strahlenther Onkol. 2015 Jan;191(1):1-6.

RAZISKAVE v TEKU



Lokacija: **Španija**
Randomizacija, predvideno število vključitev: **338**
Low dose radiotherapy A: **6 x 0,5 Gy**
Low dose radiotherapy B: **6 x 1,0 Gy**
Primarni cilj: **kontrola bolečine (8-12 tednov) in kakovost življenja**

Lokacija: **Južna Koreja**
Randomizacija, predvideno število vključitev: **114**
Low dose radiotherapy A: **6 x 0,5 Gy**
Low dose radiotherapy B: **6 x 0,05 Gy**
Sham radiotherapy: **6 x 0 Gy**
Primarni cilj: **kontrola bolečine (4-8-12 tednov) in MRI radiološke spremembe**

REVMATOIDNI ARTRITIS

Revmatoidni artritis: kronična avtoimuna bolezen, prizadane 0.4–1.3% svetovne odrasle populacije[1]

LDRT (nizko-dozna RT):

- nižji nivo protiteles anti-kolagen tip II IgG
- Nižji nivo vnetnih citokinov - IL-1β, IL-6 and TNF-α (vsi trije nivoji LDRT)

[1] Sparks JA. Rheumatoid arthritis.Ann Intern Med 2019;170:ITC1–16.

Predklinična raziskava:

JOURNAL ARTICLE

Preventive and therapeutic effects of low-dose whole-body irradiation on collagen-induced rheumatoid arthritis in mice

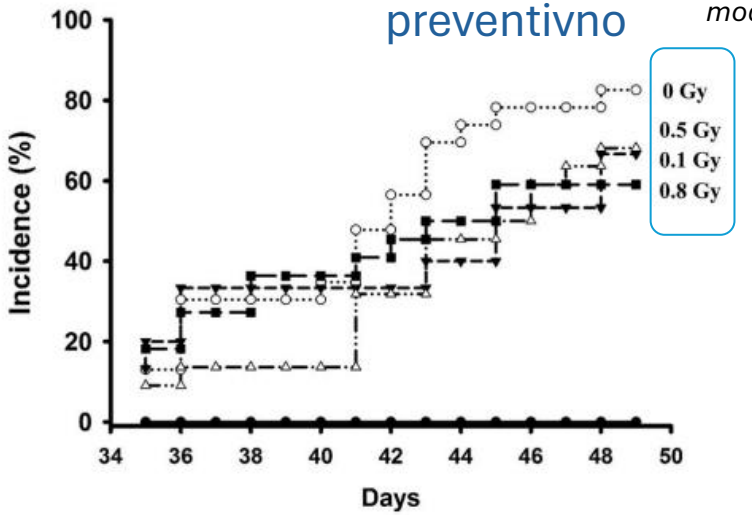
Ji Young Kim, Yeong Ro Lee, Young Ae Lee, Chin-Hee Song, So Hyun Han, Seong Jun Cho, Seon Young Nam

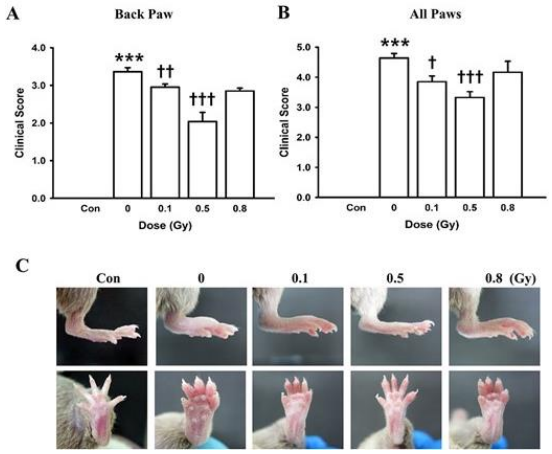
Journal of Radiation Research, rrad101, https://doi.org/10.1093/jrr/rrad101
Published: 28 December 2023 **Article history**

collagen-induced RA (CIA) mouse models

preventivno

terapevtsko





RT: ↓ incidence RA iz 34 % na 13% (0,5 Gy)

RT: ↓ simptomov za 41 % (0,8 Gy)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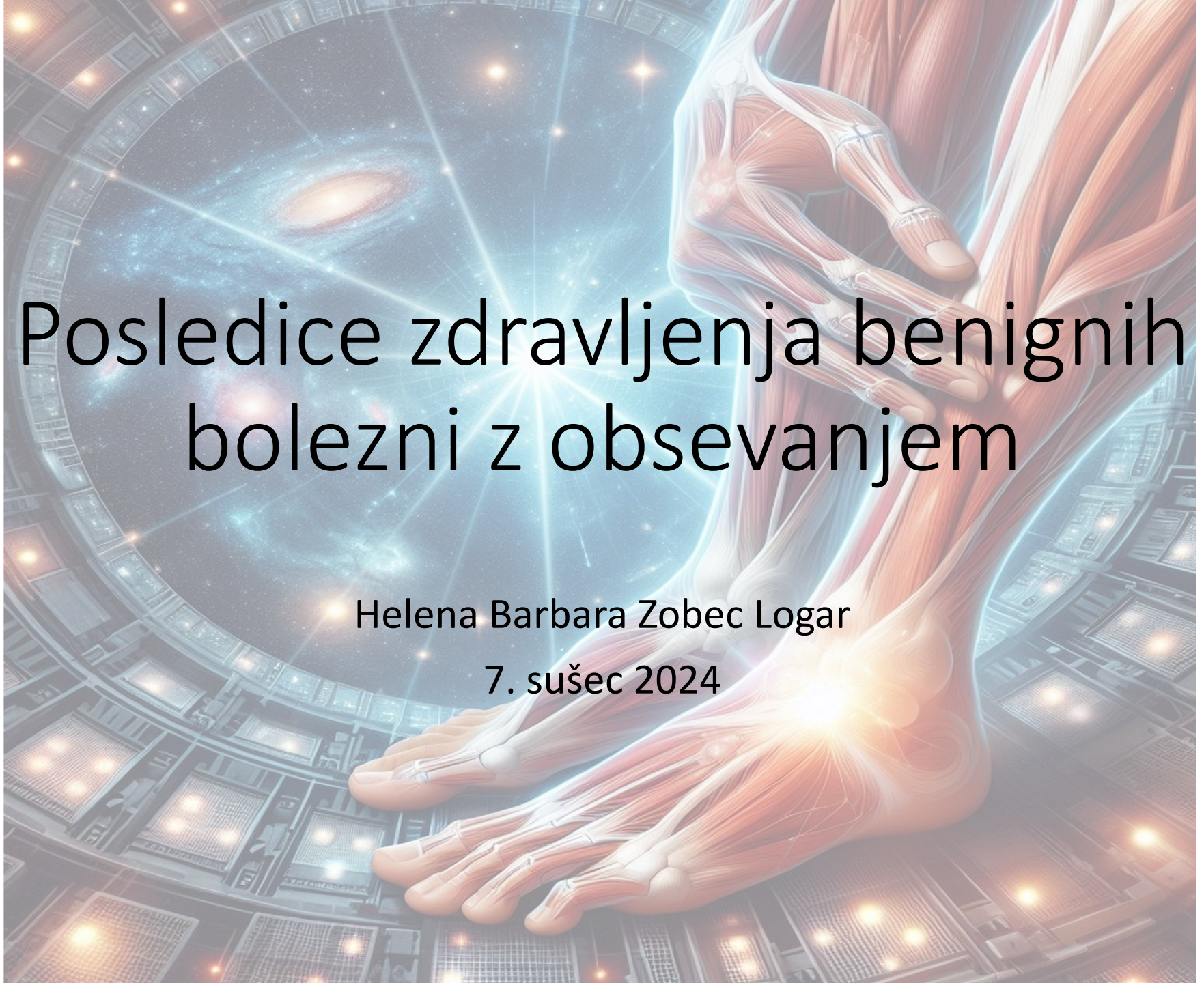


Posledice zdravljenja benignih bolezni z obsevanjem

Helena Barbara Zobec Logar

7. sušec 2024

Doze pri obsevanju benignih bolezni

Zelo nizke TD	**< 2 Gy**
NizkeTD	**2 - 10 Gy**
Srednje TD	**10 – 40 Gy**
Visoke TD	**> 50 Gy**

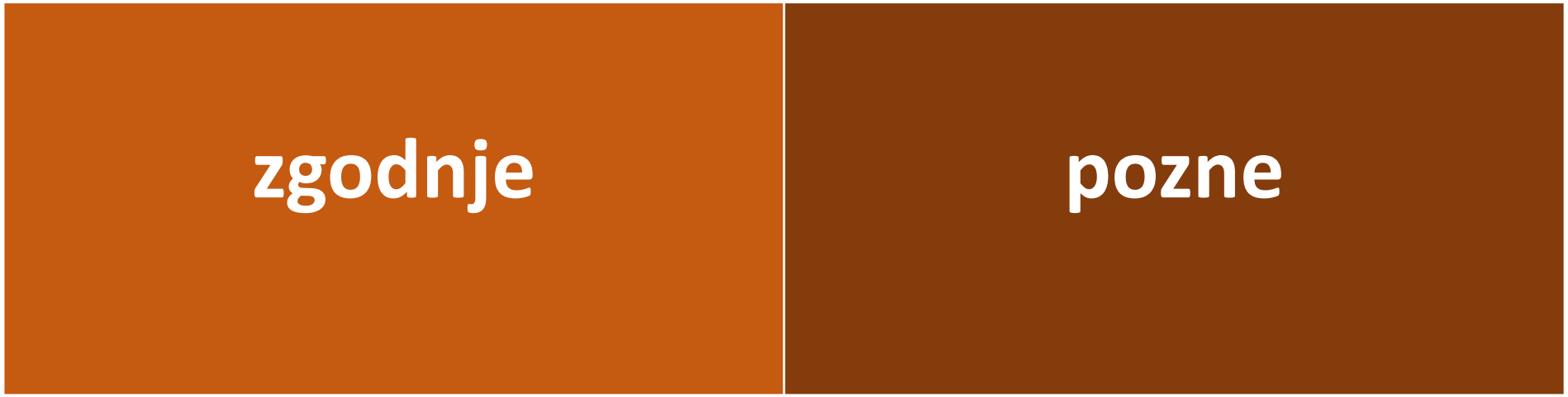
Doze pri obsevanju benignih bolezni

Zelo nizke TD	**< 2 Gy**
NizkeTD	**2 - 10 Gy**
Srednje TD	**10 – 40 Gy**
Visoke TD	**> 50 Gy**

Doze pri obsevanju benignih bolezni

Zelo nizke TD	**< 2 Gy**	**multiple d/fr, redko 1 fr**
NizkeTD	**2 - 10 Gy**	**Benigne bolezni**
Srednje TD	**10 – 40 Gy**	**Pogosta TD pri benignih boleznih**
Visoke TD	**> 50 Gy**	**Benigni tumorji (Schwannom, gangliom, adenom, trigeminalna nevralgija)**

Posledice zdravljenja z obsevanjem



Nižja kot je doza, manjše je tveganja za posledice zdravljenja z obsevanjem.

Posledice zdravljenja z obsevanjem

pozne

Tveganje za nastanek poznih posledic je majhno. Večina bolnikov ne bo imela nobenih poznih posledic.

Pozne posledice zdravljenja z obsevanjem

- žile - kapilare
- parenhimski organi
- očesna leča

Posledice zdravljenja z obsevanjem

pozne

Nastanek sekundarnega raka je najpomembnejša pozna posledica po obsevanju benignih bolezni.

1 %

0,5 %

3%

Sekundarni raki

Redek zaplet obsevanja benignih bolezni

Pomembno!

- starost
- mesto obsevanja
- velikost polja
- komorbidnost

Sekundarni raki

- raziskav za benigne tumorje je malo,
- za nastanek sekundarnih rakov je potreben daljši čas spremljanja,
- tehnološki napredek pri izvedbi obsevanja.

  - ankilozantni spondilitis ~ tveganje za levkemijo
  - peptični ulkus ~ tveganje za rak pljuč, želodca in levkemijo
  - tinea capitis ~ tveganje za nemelanomski rak kože

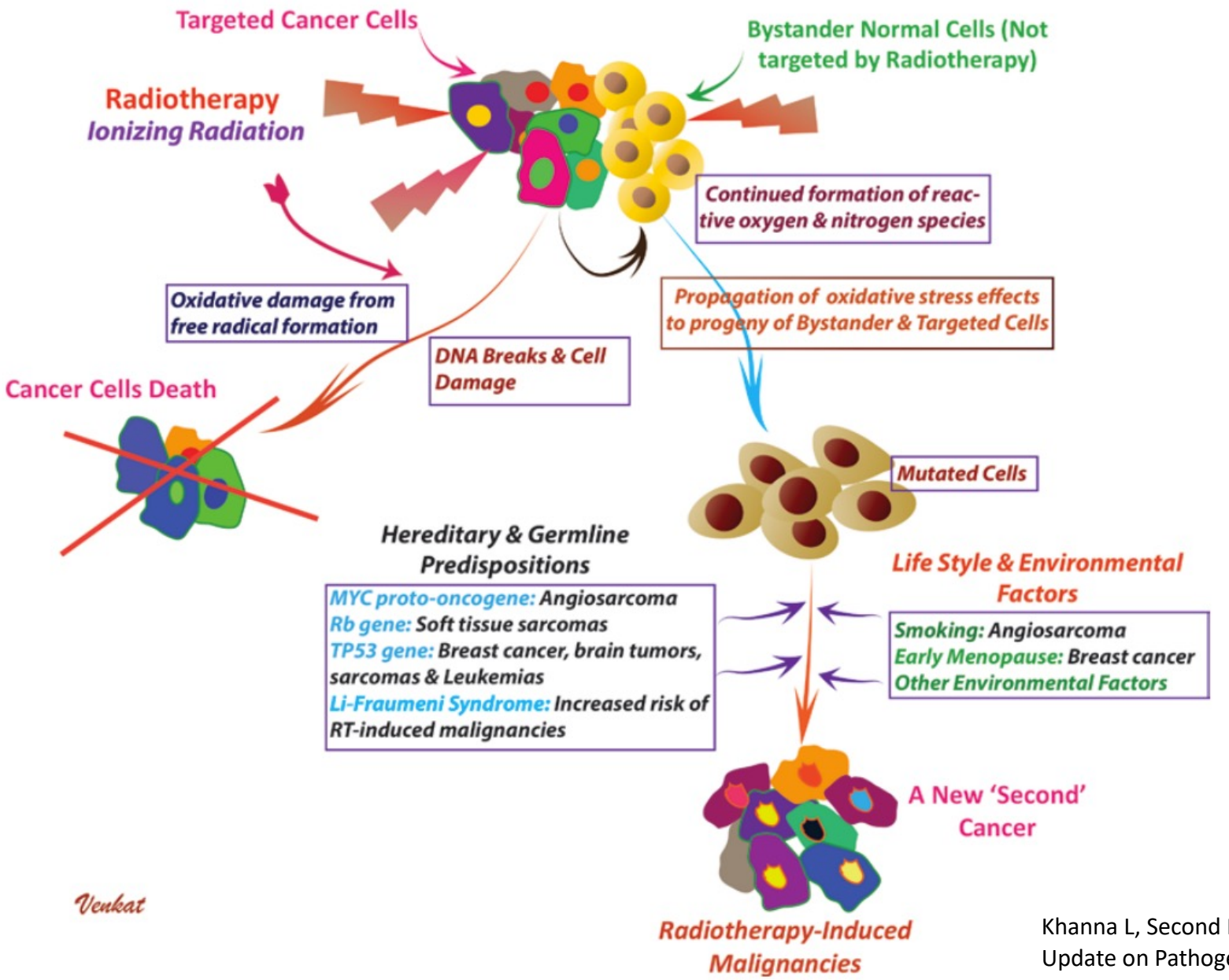
Recommendations for using radiotherapy for benign disease in the UK 2023

Sekundarni raki

Redek zaplet obsevanja benignih bolezni

Recommendations for using radiotherapy for benign disease in the UK 2023

Sekundarni raki povzročeni z obsevanjem etiologija in patogeneza



Khanna L, Second Malignancies after Radiation Therapy: Update on Pathogenesis and Cross-sectional Imaging Findings 2021

Zaključek

- Sekundarni raki so redek zaplet obsevanja benignih bolezni

Pomembno!

- starost > 40 let
- mesto obsevanja
- velikost polja

Spodbujanje zdravega načina življenja – opustitev kajenja!

Onkološki inštitut
Institute of Oncology
Ljubljana

Obsevanje benignih bolezni v CŽS

Ljubljana 7.3.2024

Benigni tumorji CŽS

- Indolentni
- Dolg potek
- Redko so življenje ogrožujoči

- RADIOTERAPIJA
  - Samo ena od možnih opcij
  - Pretehtati kakšno je tveganje zdravljenja
    - Starost
    - Rast
    - Možne posledice

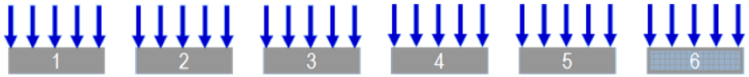
spremljanje	operacija
radioterapija	sistemska terapija

Radioterapija tehnični aspekt

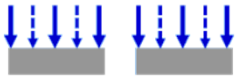
- Na kakšen način
  - Fotonska radioterapija
    - Radiokirurgija
    - Lokalna RT visoke natančnosti
    - Konvencionalna RT
  - Protoni in težji delci
    - Prednosti
      - Hiter padec odmerka za tarčo
      - Ogljikovi ioni velik RBE
    - Slabosti
      - Dostopnost
      - Dozimetrične nejasnosti
      - Mora biti adaptivna/diagnostika

Radioterapija tehnični aspekti

- Frakcionirana vs hipofrakcionirana vs radiokirurgija



45 – 60 Gy v 25 – 33 odmerkih



20 – 30 Gy v 3 – 10 odmerkih

10 – 25 Gy v enem odmerku = radiokirurgija

- Toksičnost je različna
  - Odvisno od mesta, odmerka
- Vprašanje namena
  - Hitrost povnitve funkcije (če še)
- Krajša terapija bolj ugodna za bolnika

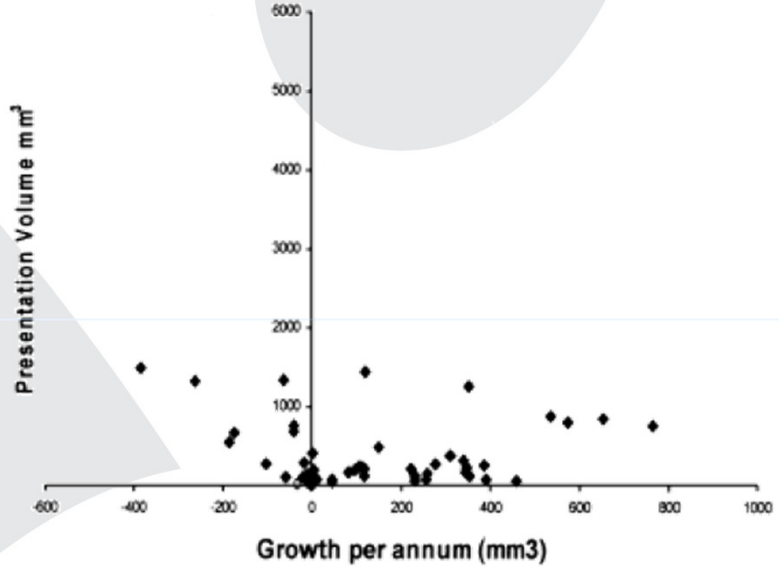
Tumor cerebelo-pontinega kota

SINONIMI: AKUSTIČNI NEVRINOM, ŠVANOM

- Eden redkih tumorjev, kjer je diagnoza večinoma radiološka
- Ni sistemske terapije, opcije so spremljanje, RT ali operacija

Tumor cerebelo-pontinega kota

Tumorji APC rastejo počasi oziroma pogosto ne rastejo



Herdwadker et al 2005
Manchester

Bolniki z tumorji APC 1977- 2005
Do 2 cm
1989 bolnikov
729 na opazovanju
552 vsaj 2 MR 230 intrameatalni, 322 ekstra
Ekstrameatalni 226 (70%) nespremenjenih, 3 (1%) manjši, 93 (29%) zrastlo

Stangerup et al 2006, Copenhagen

Pri sporadičnih tumorjih APC je preferirano spremljanje

Tumor cerebelo-pontinega kota

RADIOTERAPIJA

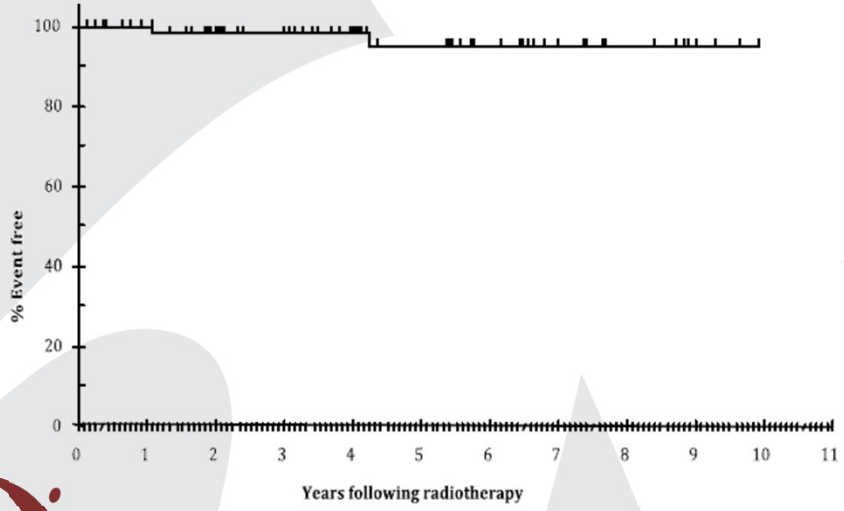
Način je odvisen od velikosti

do 1,5 cm v najdaljšem premeru 13 Gy v enem odmerku

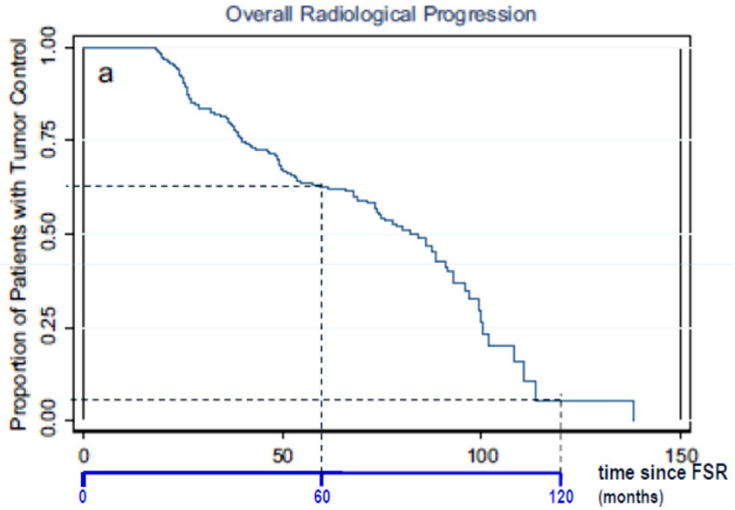
večji 45 do 54 Gy v 25 do 30 odmerkih

ali

20 do 30 Gy v 6 do 10 odmerkih



Powell et al 210, IJROBP
Royal Marsden Hospital
Standardna frakcionacija



Kapoor et al 2010, IJROBP
Johns Hopkins
Hipofrakcionacija

Tumor cerebelo-pontinega kota

Novejši rezultati zdravljenja tumorjev APC s hipofrakcionacijo

	1 × 12 Gy 12 Gy	1 × 13 Gy 13 Gy	5 × 4.4 Gy 22 Gy	5 × 5 Gy 25 Gy	30 × 1.8 Gy 54 Gy
$EQD2_2$	42	48.75	35.2	43.75	54
$EQD2_3$	36	41.6	32.56	40	54

Hearing preservation assessment

		Gardner-Robertson	Ability to use Telephone
1	Serviceable	I–II	Yes
3	Non-serviceable	III–V	No

Table 3
Related symptoms before and after hypofractionated stereotactic radiation therapy

		Before radiation therapy	After radiation therapy
Hearing ability	Serviceable	95	86
	Non-serviceable	33	42
Tinnitus		67	42
Vestibular dysfunction		62	30

Reference	No. patients	Total dose	No. fractions	Median tumour volume cm^3 (minimum–maximum)	Median follow-up (months)	Local control
Song	31	25	5	1.1 (0.1–8.74)		100.00%
Williams	131	25	5	1.5 (0.05–8.8)	23	100.00%
Anderson	37	20	5	0.89	43.1	90.5%/5 years
Wong	31	25	5	3.12	40.6	97.00%
Kapoor	376	25 ($n = 340$)	5	0.89	56	97.00%
Karam	37	25 ($n = 35$)	5	1.03 (0.14–7.60)	51	91%/3 years
		21 ($n = 2$)	3			
Poen	29	25	5	1.47 (0.56–4.13)	48	96.30%
Present study	128	22	5	1.29 (0.11–6.8)	52	95% 5 years

Gawish et al, Clinical Oncology 2023

Tumor cerebelo-pontinega kota

Radiokirurgija in lokalna RT visoke natančnosti sta ravno tako učinkoviti metodi pri tumorjih APC

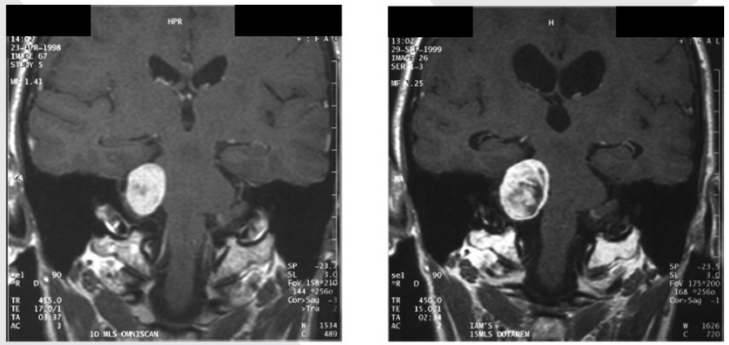
Author, year	RT	No. of pts	FU median (months)	Dose/dose per fr (median)	Volume median (cc)	PFS (%)	Hearing preservation (%)	Facial preservation (%)	Trigeminal preservation (%)
Murphy, 2010	SRS	103	43.2	13	1.95	91.5–5 y	NA	99	95
Chopra, 2007	SRS	216	68	13	1.3	98.3–10 y	44	94.9	100
Friedman, 2006	SRS	295	40		2.2	12.5	NA	99.3	99.3
Myrseth, 2005	SRS	103	36	12.2	NA	93	32	NA	94.8
Combs, 2005	FSRT	106	48.5	57.6/1.8	3.9	LC 96.6	94	96.6	97.7
Koh, 2007	FSRT	60	31.9	50/2	4.9	LC 100	77.3	100	100

Stereotactic radiosurgery can be offered using either a Cobalt unit (Gamma Knife) or a Linear Accelerator (X-knife) with comparable results.

Kalogeridi et al, Neurosurgical Review 2020

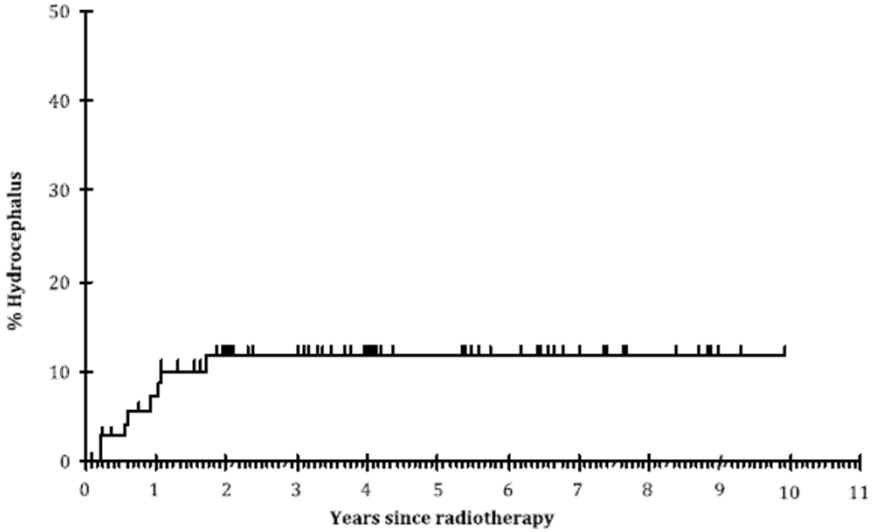
Tumor cerebelo-pontinega kota

Tumorji se lahko prehodno povečajo, pri večjih lahko nastane hidrocefalus



23/4/1998 29/9/1999

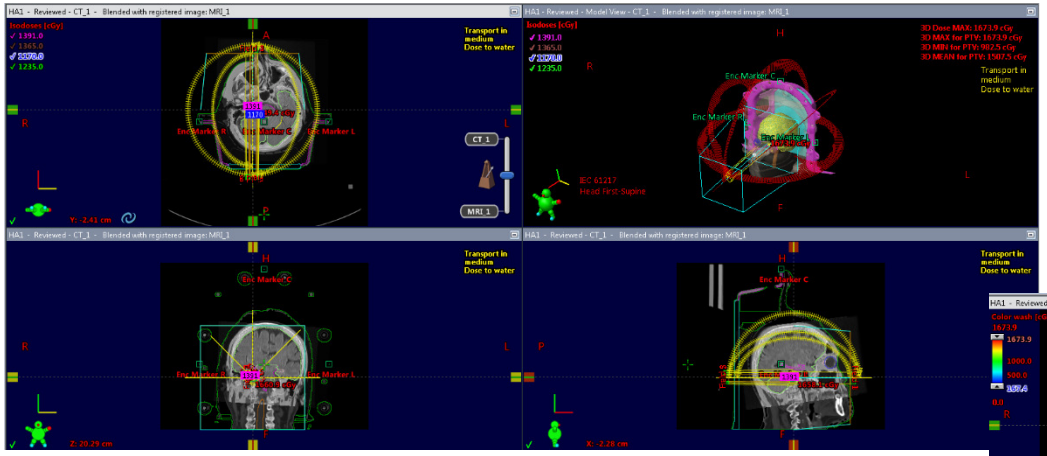
Brada, 2013, ESTRO course on Brain Tumours

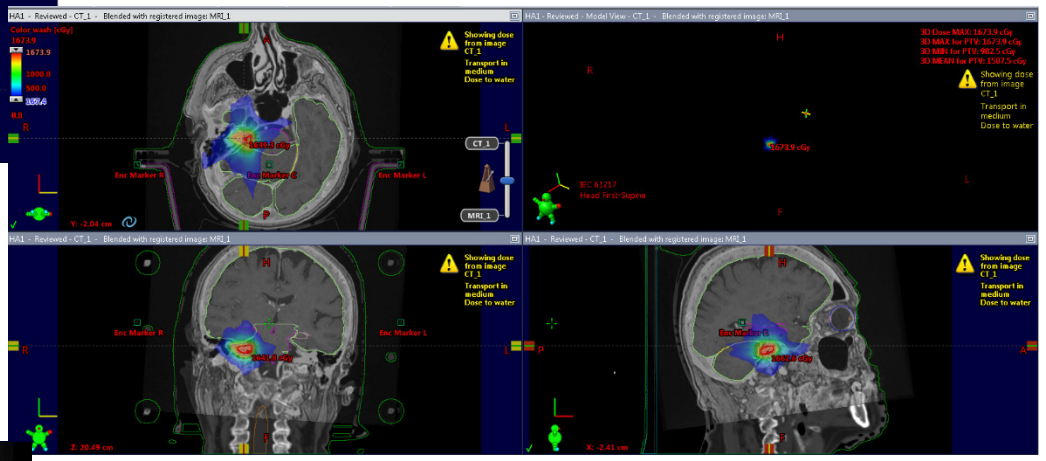


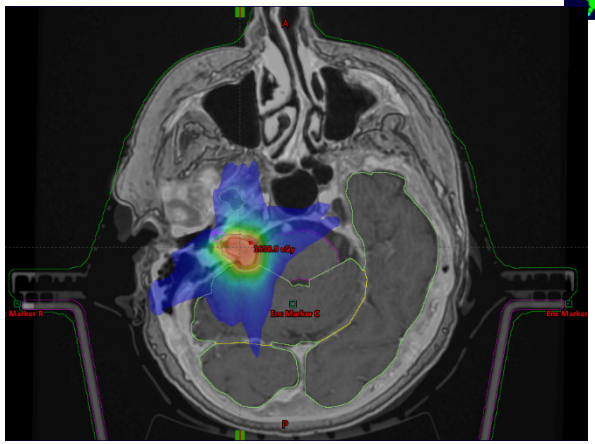
Powell et al 210, IJROBP
Royal Marsden Hospital
Standardna frakcionacija

No OI zdravimo tumorje APC od 2007, v tem času še nismo imeli primera s hidrocefalusom

Tumor cerebelo-pontinega kota







Adenom hipofize

Od 10 -25% vseh intrakranialnih neoplazem (NIH) so neoplazme hipofize

Največ je adenomov (okoli 17 % intrakranialnih neoplazem)

Večina je asimptomatskih

Lahko hormonsko aktivni, lahko motnje vidnega polja, redkejo drugo (temporalna epilepsija, poškodbe možganskih živcev, hidrocefalus, CSF rinoreja)

Hormonsko akivni različne prezentacije glede na vrsto

- prolaktinomi – amenorjea, galaktoreja…
- ACTH adenomi – miopatija, redistribucija maščobe…
- somatotropni – akromegalija, spremembe glasu…
- tirotropni – palpitacije, tremor, hujšanje…

Adenom hipofize

Zdravljenje

- kirurgija
- medikamentozna terapija
- radioterapija
- kombinacija zgornjih
- radiokirurgija

Radioterapija – neinvazivna, lahko dodatek k drugim terapijam, je pa klinični in biokemični odgovor počasen

Adenom hipofize

Ni kvalitetnih randomiziran raziskav

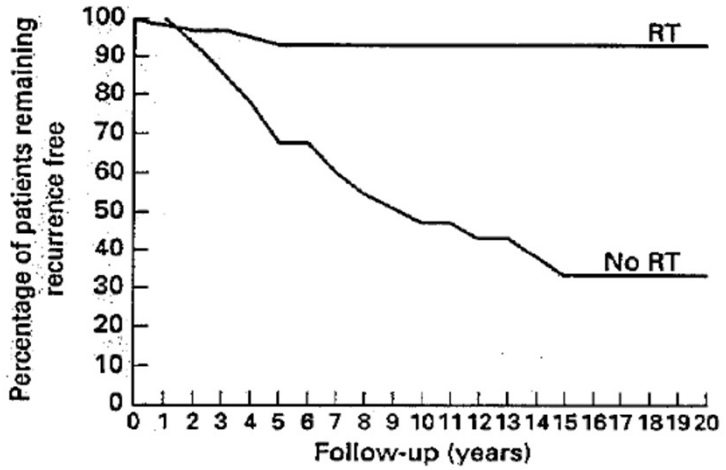
Podatki iz retrospektivnih serij

po operaciji in/ali medikamentozni terapiji

primerjava glede preživetja in kontrole tumorja

Ni podatkov o tem kdaj RT iz randomiziranih preiskav

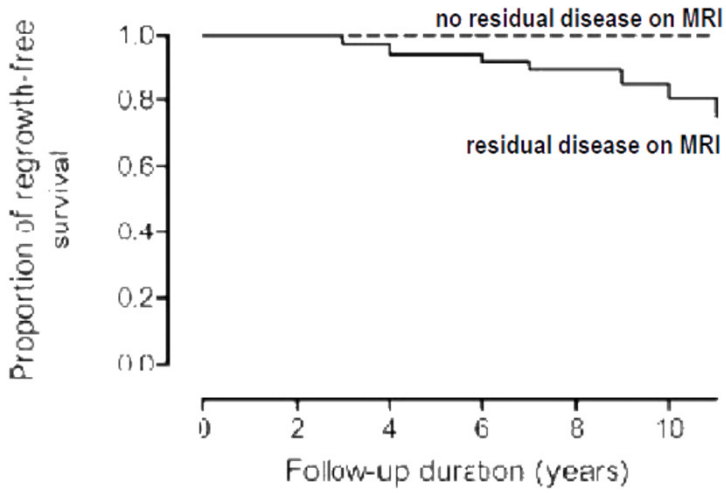
Progression after surgery



2 centre policy (non-randomized), 126 patients

Gittoes et al 1998

Progression after surgery



109 pts with non-functioning adenoma, median FU 6 years

Dekkers et al 2008

Adenom hipofize

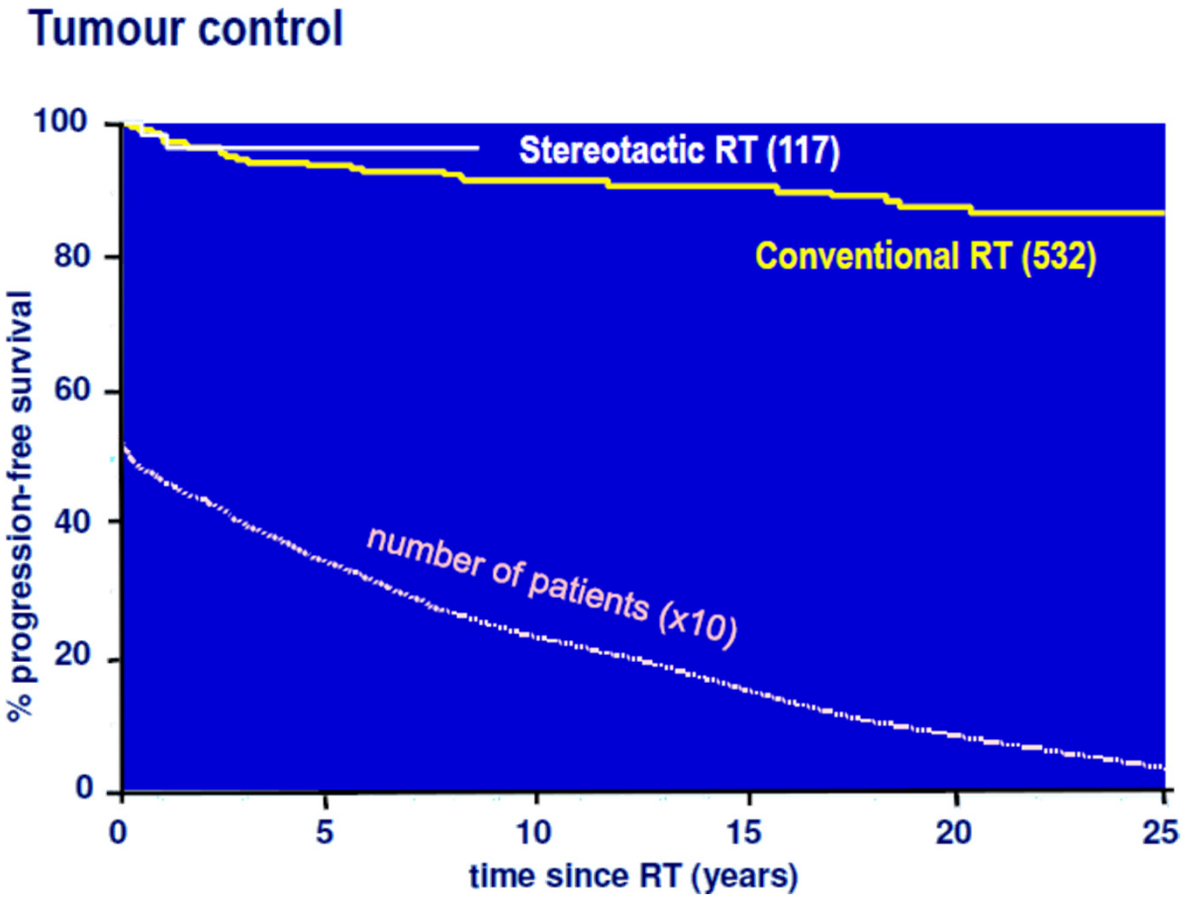
Indikacije za radioterapijo

- nesekretorni
  - tumor, ki raste
  - po operaciji
  - predvidevamo, da bo ogrozil funkcioniranje
- sekretorni
  - povišana vrednost hormonov po operaciji
  - za ukinitev medikamentozne terapije

Poleg klasične RT lahko tudi s SRT (lokalna RT visoke natančnosti(45 – 50 Gy # 25 – 30 frakcij)) ali
SRS (10 – 25 Gy # 1 frakcija)

Adenom hipofize

Primerjava klasične in RT visoke natančnosti



Brada 2013

Systematic review of published literature

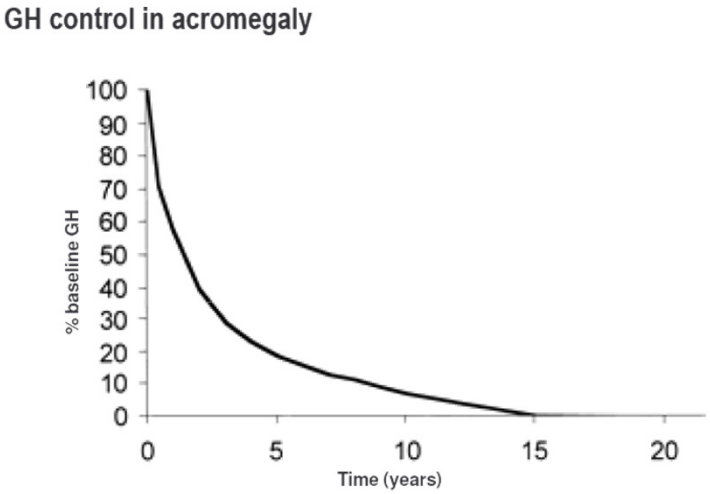
Nonfunctioning pit. adenoma	Number of patients	5 year PFS
Weighted mean	393	92%

Brada M, Jankowska P 2008 Gamma knife radiosurgery in nonfunctioning p.a.

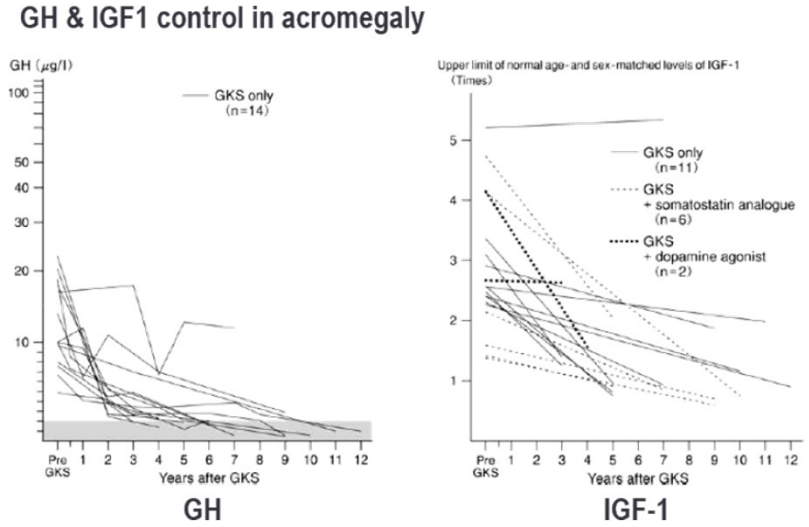
SRT in klasična RT podobno učinkoviti, SRS je slabša

Adenom hipofize

Pri hormonsko aktivnih adenomih, je pomembna tudi biokemična kontrola



Barrande et al 2000



Iwai et al 2010

Stereotaktična RT je podobno učinkovita konvencionalni RT

Radiokirurgija nima boljših učinkov kot frakcionirana RT

Adenom hipofize

Pri zdravljenju adenomov hipofize je pomembna tudi toksičnost, ki je:

nevrološka

vid – poškodba redka[1]

poškodba temporalnega režnja – novejše tehnike znižajo odmerek na temporalni reženj[2]

kognitivne motnje – raziskave niso dale jasne povezave med kognitivnimi motnjami in RT[3]

endokrina insuficienca – 30 – 60 % bolnikov po 10 letih[4]

sekundarni tumorji[5]

cerebrovaskularni dogodki[6]

1.Brada et al 1993
2. Becker et al 2002
3. Brummelman et al 2011
4. Minitti et al 2009
5. Tsang et al 1992
6. Erfurth 2002

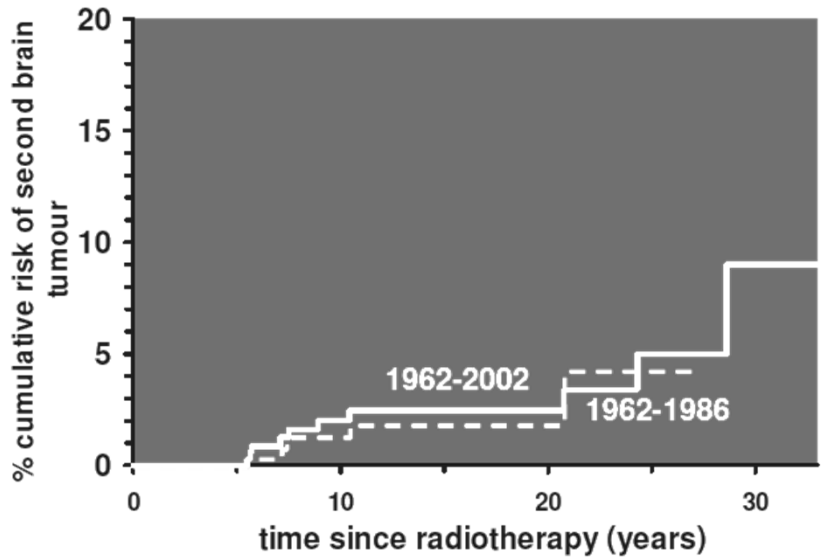
Adenom hipofize

Sekundarni tumorji večinoma meningeomi, pa tudi gliomi

Incidenca narašča s časom od RT

Mlajši bolniki bolj ogroženi

RR = 3,34 (95% CI 1,06 – 10,6) gliomi, RR = 4,06 (95% CI 1,51 – 10,9) meningeomi



Brada et al 1992
Minniti et al 2005

Adenom hipofize

Bolniki z adenomi hipofize so že v osnovi bolj ogroženi zaradi cerebro-vaskularnih incidentov

Retrospektivna raziskava – 31/342 bolnikov, ki so bili obsevani zaradi adenoma hipofize je umrlo zaradi cerebrovaskularnega dogodka (srednje opazovano obdobje 21 let)[1]

- vsi dogodki v obsevanem področju
- prisotnost bolezni hipofize in hormonske terapije sicer otežuje analizo, saj tudi ti faktorji povečujejo tveganje

Stereotaktična RT ima potencial zmanjšati tveganje za ICV, sekunarne tumorje, morda za kognitivne motnje

Radiokirurgija je pri večjih tumorjih bolj toksična

1. Erfurth et al 2002

Kraniofaringeom

Nevroepitelijski tumorji, iz ostankov primitivnega kraniofaringealnega voda ali Rathkejevega žepa

Histološko benigni, povzročajo invalidnost in so lahko fatalni

Radikalna kirurgija – zlati standard – mutilantna

- optični aparat
- hipotalamično – hipofizna os
- diabetes insipidus

Ni vloge sistemskega zdravljenja

Radioterapija že dolgo uporabljana metoda

Kraniofaringeom

De Vile et al 1996 – RT zmanjša verjetnost progresa (p=0,004)

KRANIOPHARINGEOM 2000, 88% manj progresov po RT (p=0,001)

Reference	Patient age (years) Median (range)	Surgery + deferred radiotherapy/ surgery + postoperative radiotherapy/ primary radiotherapy alone/ radiotherapy at recurrence (number of patients treated, extent of surgery)	Progression-free survival		Overall survival
	Median 14.0 (3–57)	Radiotherapy at recurrence No subsets of patients with surgery + deferred radiotherapy/surgery + postoperative radiotherapy/primary radiotherapy alone: NA data	79% at 5 years 72% at 10 years 72% at 20 years		77% at 5 years 77% at 10 years 68% at 20 years
	Median 19.0 (3–68)	Surgery + postoperative radiotherapy (173 patients, 3% GTR, 14% STR, 51% PR, 9% biopsy, 22% cyst aspiration) No subsets of patients with Surgery + deferred radiotherapy and radiotherapy at recurrence: NA data	83% at 10 years 79% at 20 years		77% at 10 years 66% at 20 years
	Median 7.5 (0.8–21)	Surgery + deferred radiotherapy (15 patients, 53% GTR, 47% STR) Surgery + postoperative radiotherapy (37 patients, 5% GTR, 27% STR, 68% biopsy/VP shunt/cyst aspiration) Primary radiotherapy alone (9 patients)	31% at 10 years 86% at 10 years 100% at 10 years	Surgery + deferred radiotherapy versus primary radiotherapy alone ($P = 0.01$) Surgery + deferred radiotherapy versus surgery and postoperative radiotherapy ($P = 0.001$)	100% at 10 years 86% at 10 years 100% at 10 years
	Median 7.4 (2–15)	No subsets of patients with surgery + deferred radiotherapy Surgery + postoperative primary radiotherapy alone (19 patients, 58% STR; 42% no surgery) Radiotherapy at recurrence (18 patients)	NA data 84% at 5 years 79% at 10 years 71% at 5 years 65% at 10 years	NS	NA data 89% at 5 years 82% at 10 years 92% at 5 years 70% at 10 years
	Median 6.5 (1–11) 32 children (<16 years) 89 adults (>16 years)	Surgery and deferred radiotherapy (66 patients, GTR) Surgery and deferred radiotherapy (30 patients, STR) Surgery and postoperative radiotherapy (22 patients, STR) No subsets of patients with radiotherapy at recurrence	83% at 5 years 81% at 10 years 47% at 5 years 41% at 10 years 90% at 5 years 90% at 10 years NA data	$P < 0.0001$	NR
	Median 29.0 (5–69)	Surgery and postoperative radiotherapy (24 patients, 5% GTR, 86% STR, 9% biopsy) No subsets of patient with surgery and deferred radiotherapy and radiotherapy at recurrence: NA data	95% at 5 years 89% at 10 years 54% at 20 years		100% at 10 years 92% at 20 years

Reference	Patient age (years) Median (range)	Surgery + deferred radiotherapy/ surgery + postoperative radiotherapy/ primary radiotherapy alone/ radiotherapy at recurrence (number of patients treated, extent of surgery)	Progression-free survival		Overall survival	
	Median 8.6 (1–15)	Surgery and deferred radiotherapy (15 patients, 53% GTR, 47% STR) Surgery and postoperative radiotherapy (15 patients, 33% STR, 67% biopsy/cyst aspiration)	40% at 5 years 93% at 5 years		73% at 5 years 93% at 5 years	
		No subsets of patients with radiotherapy at recurrence	NA data		NA data	
	Median 8.5 (1.5–24.8)	Surgery and deferred radiotherapy (57 patients, 77% GTR, 16% STR, 7% unknown) Surgery and postoperative radiotherapy (18 patients, 100% STR) Radiotherapy at recurrence (24 patients)	42% at 10 years 84% at 10 years 84% at 10 years	Surgery and deferred radiotherapy versus surgery and postoperative radiotherapy: $P = 0.004$ Surgery and postoperative radiotherapy versus radiotherapy at recurrence: NS	86% at 10 years 83% at 10 years NR	Surgery and deferred radiotherapy versus surgery and postoperative radiotherapy: NS
	Median 26.0 (2.5–83)	Surgery and deferred radiotherapy (16 patients, GTR) Surgery and deferred radiotherapy (51 patients, PR) Surgery and postoperative radiotherapy (33 patients, PR) No subsets of patients with radiotherapy at recurrence	100% at 5 years 100% at 10 years 100% at 20 years 47% at 5 years, 38% at 10 years, 32% at 20 years 82% at 5 years, 77% at 10 years, 77% at 20 years NA data	$P < 0.0001$	NR	
	28 children (<16 years) 59 adults (>16 years)	No subsets of patients with surgery and deferred radiotherapy	NA data	NS	NA data	NS
		Surgery and postoperative radiotherapy (44 patients, surgery extension unknown) Radiotherapy at recurrence	79% at 10 years 73% at 20 years 77% at 10 years 60% at 20 years		89% at 10 years 76% at 20 years 80% at 10 years 66% at 20 years	
	Median 29.0 (2–64)	No subsets of patients with surgery and deferred radiotherapy Surgery and postoperative radiotherapy (25 patients, 20% GTR; 52% STR; 28% PR, biopsy, cyst aspiration) Radiotherapy at recurrence (25 patients)	NA data 91% at 10 years 91% at 10 years	NS	NA data 85% at 10 years 90% at 10 years	NS

(continued on next page)

Reference	Patient age (years) Median (range)	Surgery + deferred radiotherapy/ surgery + postoperative radiotherapy/ primary radiotherapy alone/ radiotherapy at recurrence (number of patients treated, extent of surgery)	Progression-free survival		Overall survival	
	Median 9.0 (2–14)	Surgery and deferred radiotherapy (20 patients, 70% GTR, 30% STR) Surgery and postoperative radiotherapy (11 patients, 100% STR/biopsy) Radiotherapy at recurrence (12 patients)	32% at 10 years 100% at 10 years 78% at 10 years	Surgery and deferred radiotherapy versus surgery and postoperative radiotherapy $P < 0.001$ Surgery and postoperative radiotherapy versus radiotherapy at recurrence: NS	NR	
	Median 30 (11–52) ≤3 years ($n = 8$) 3 < age ≤18 years ($n = 39$) >18 years ($n = 75$)	Surgery and deferred radiotherapy (30 patients, GTR) Surgery and deferred radiotherapy (37 patients, STR) Surgery and postoperative radiotherapy (46 pts, STR) No subsets of patients with radiotherapy at recurrence	75.2% at 2 years 36.2% at 2 years 73.3% at 2 years NA data	GTR versus STR + radiotherapy (NS) STR versus STR + radiotherapy ($P < 0.001$) GTR versus STR ($P < 0.001$)	96.2% at 10 years 80.8% at 10 years 95.8% at 10 years	GTR versus STR + radiotherapy (NS) STR versus STR + radiotherapy ($P < 0.050$) GTR versus STR (NS)

GTR, gross total resection; STR, subtotal resection; PR, partial resection.

Ianalfi et al 2013

Kraniofaringeom

Optimalna doza, in doza/frakcijo?

Radiotherapy dose and fractionation regimens in relation to progression-free and overall survival

Reference	Median (range) radiotherapy dose, Gy	Radiotherapy technology planning and/or delivery equipment	Progression-free survival or local control rates at last follow-up
	50 (18–50)	Two-dimensional radiotherapy Van der Graaf generator 2 MV (4 patients) LINAC 6 MV (21 patients)	79% at 5 years 72% at 10 years 72% at 20 years
	56 (6–70)	Two-dimensional radiotherapy Van der Graaf generator 2 MV (55 patients)	74% at 10 years 72% at 20 years
	50 (50–66)	Two-dimensional radiotherapy LINAC 6 MV (118 patients)	88% at 10 years 82% at 20 years NS
	Children mean dose 55.8 (52.5–65.2) Adult mean dose 62.4 (43.2–70)	Cobalt	56% with dose ≤54 Gy 84% with dose >55 Gy Median follow-up 17 years (8–28)
	54.6 (50.4–65.9)	Two-dimensional radiotherapy LINAC 6–18 MV	100% at 10 years (radiotherapy alone) 86% at 10 years (surgery + radiotherapy)
	50 (40–56)	Two-dimensional radiotherapy LINAC	62% at 10 years
	50 (45–56)	Cobalt 60 machine (16 patients) Two-dimensional radiotherapy LINAC ≥ 17 MV (15 patients), Two-dimensional radiotherapy LINAC 4 MV (6 patients)	78% at 5 years, 76% at 5 years, 65% at 10 years 56% at 10 years with dose ≥55 Gy 79% at 5 years, 45% at 10 years with dose <55 Gy ($P < 0.05$)
	Mean 54.4 (45–63) 59.7 (36–70) with various fractionation NTD 55.3 (28–83)	NR Cobalt 60 machine (1 patient) Two-dimensional radiotherapy LINAC 6–18 MV (23 patients)	92% at 5 years and at 10 years 95% at 5 years 89% at 10 years 54% at 20 years
	54 (44–55.8)	Two-dimensional radiotherapy LINAC (26 patients) Two-dimensional radiotherapy LINAC/FSRT boost (1 patient) Three-dimensional CRT (11 patients) FSRT (2 patients) NR (2 patients)	84% at 10 years
	50 (35–54)	NR	Gross total resection + radiotherapy: 100%; partial resection + radiotherapy: 82% at 5 years Gross total resection + radiotherapy: 100%; partial resection + radiotherapy: 77% at 10 years Partial resection + radiotherapy: 77% at 20 years
	42.5 (34.7–52.5) with various fractionation NTD: 54.5 (range NR)	Planning technology details NR LINAC 4 MV	78% at 10 years 66% at 20 years
	54 (45–58)	Two-dimensional radiotherapy LINAC 6–10 MV	96% at 5 years 91% at 10 years
	NR (54–55.8)	Three-dimensional CRT (4 patients) FSRT (7 patients) LINAC 6–10 MV	100% at 5 years 83% at 10 years and at 15 years
	50.4 (45–54)	FSRT LINAC 6 MV Circular collimator (5 patients) MLC (11 patients)	75% at 3 years
	54 (54–55.8)	Three-dimensional CRT	90% at 3 years
	52.2 (50.4–56)	FSRT LINAC 6–15 MV MLC	100% at 5 years 100% at 10 years
	50 Gy (50–55)	FSRT LINAC 6 MV Customised block (32 patients) MLC (7 patients)	97% at 3 years 92% at 5 years

NR, not reported; NTD, normalised total dose (biologically equivalent dose given in 2 Gy/fraction; LINAC, linear accelerator system; CRT, conformal radiotherapy; FSRT, fractionated stereotactic radiotherapy; multileaf collimator.

Ianalfi et al 2013

Kraniofaringeom

Vprašanje se postavlja glede tarčnih volumnov in robov

Radiotherapy target volume definitions in three-dimensional conformal radiotherapy (CRT)/fractionated stereotactic radiotherapy (FSRT) series

Reference	Radiotherapy technology planning	Target Volumes
	FSRT CC (5 patients) MLC (11 patients) Computed tomography planning + MRI fusion	GTV: post-surgery residual lesion including both solid and cystic component CTV = GTV CC: PTV: GTV + 0 mm (minimum margin) PTV: GTV + 5–12 mm (maximum margin) MLC: PTV: GTV + 4–8 mm
	Three-dimensional CRT Computed tomography planning + MRI fusion	GTV: tumour bed, residual tumour, or both (including the solid and cystic components) CTV = GTV + 1 cm PTV = CTV + 3–5 mm
	FSRT Computed tomography planning + MRI fusion	GTV: post-surgery residual lesion including both solid and cystic component CTV = GTV PTV = CTV + 2 mm
	FSRT Computed tomography planning + MRI fusion	GTV: post-surgical tumour bed and any residual solid and cystic component CTV = GTV + 2 mm PTV = CTV + 3 mm CTV = GTV + 2 mm PTV = CTV + 3 mm

CC, circular collimator; MLC, multileaf collimator; MRI, magnetic resonance imaging; GTV, gross tumour volume, CTV, clinical target volume; PTV, planning target volume.

cistična in solidna komponenta

robovi se s slikovnim vodenjem ožajo

Ianalfi et al 2013

Kraniofaringeom

Stranski učinki zdravljenja

- okvara vida
  - po radikalni operaciji do 54%
  - 2D RT do 24%
  - od 3DCRT do 2,5%
  - omejitev odmerka na 54 Gy v fr po 1,8 – 2 Gy
  - okvara se povečuje posebej nad 60 Gy
- endokrina okvara
  - lahko izražena že pred zdravljenjem
  - poveča se po operaciji
  - po RT hujša pri otrocih, odvisna od odmerka
  - hipotalamična disfunkcija glavni vzrok za morbiditeto in mortaliteto

Ianalfi et al 2013

Kraniofaringeom

Nevrološka okvara je pogosto prisotna že prej

Malo podatkov o kognitivnem funkcioniranju

kognitivni upad sovpada s starostjo in delom možgan, ki so prejeli > 45 Gy

z novejšimi tehnikami ga opisujejo na okrog 2,5 – 5 % (opisan, brez formalnega testiranja)

Kardiovaskularna toksičnost je redko opisovana

premalo poročana?

Sekundarni tumorji

poročano je bilo le o 5 sekundarnih tumorjih (verjetno jih je več)

Ianalfi et al 2013

Meningeom

Najpogostejši primarni tumor CŽS

Večina je benignih

EANO smernice

Key Points

1. Observation is the first option in incidental, asymptomatic, suspected meningiomas.
2. Surgical resection is the first option for growing or symptomatic tumors.
3. Radiosurgery or fractionated radiotherapy may be complementary therapies or even alternative approaches to surgery in certain situations.
4. Molecular diagnostics are developing rapidly. Tissue asservation for molecular diagnostics and future targeted therapies is highly recommended.

Meningeom

SRS

alternativa operaciji, majhnih dobro omejenih tumorjev, pri starejših oziroma operacije nesposobnih bolnikih

13 Gy v 1 frakciji

Kombinirano zdravljenje s subtotalno resekcijo in SRS

ohranjanje možganskih živcev

Hipofrakcionirana radiokirurgija (18 – 25 Gy v 2 – 5 frakcijah)

Frakionirana RT 54 Gy v 30 frakcijah

standardni način RT

Meningeom

SRS

alternativa operaciji, majhnih dobro omejenih tumorjev, pri starejših oziroma operacije nesposobnih bolnikih

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Frakionirana RT 54 Gy v 30 frakcijah

standardni način RT

Meningeom

Vsi zgoraj opisani pristopi omogočajo lokalno kontrolo okoli 90 % po 10 letih.

Glede na kraj vznika se pri bolnikih z meningeomi lahko pokaže katerikoli od že prej opisanih stranskih učinkov.

Incidenca stranskih učinkov je običajno nekoliko nižja kot pri kraniofaringeomih in adenomih hipofize

Hvala za pozornost

Obsevanje žilnih malformacij izven CŽS

Blaž Grošelj
Onkološki inštitut Ljubljana

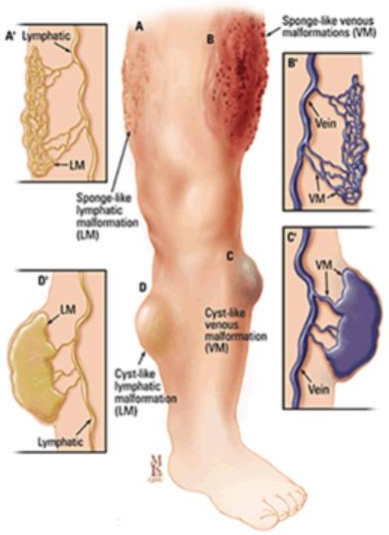
Obsevanje benignih bolezni, OIL 7.2.2024

Žilne malformacije

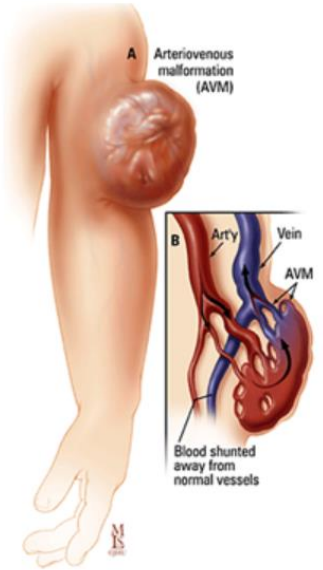
- Arterio-venske malformacije
- Malformacije limfatičnega žilja
- Veno-limfatične malformacije
- Venske malformacije

- Prisotne od rojstva (fetalni razvoj)
- Dedne? Sindromi
- *Embolizacija, kirurška odstranitev*

Nizko pretočne:



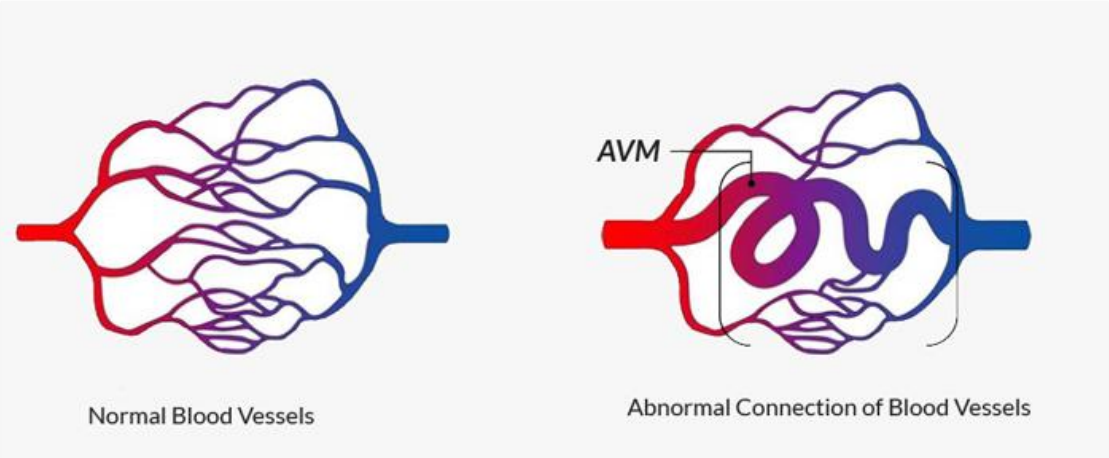
Visoko pretočne:



https://www.hopkinsmedicine.org/health/conditions-and-diseases/vascular-malformations

Arteriovenous malformation | Source: American Stroke Association

Arterio-venske malformacije



↑CO → CHF

https://www.hopkinsmedicine.org/health/conditions-and-diseases/vascular-malformations

Arteriovenous malformation | Source: American Stroke Association

Case Report

Concurrent thalidomide and radiation therapy for extensive arterio-venous malformations

Ales Blinc[1], Tanja Golli[2], Alenka Cerar Vodnik[3], Samo Zver[4]

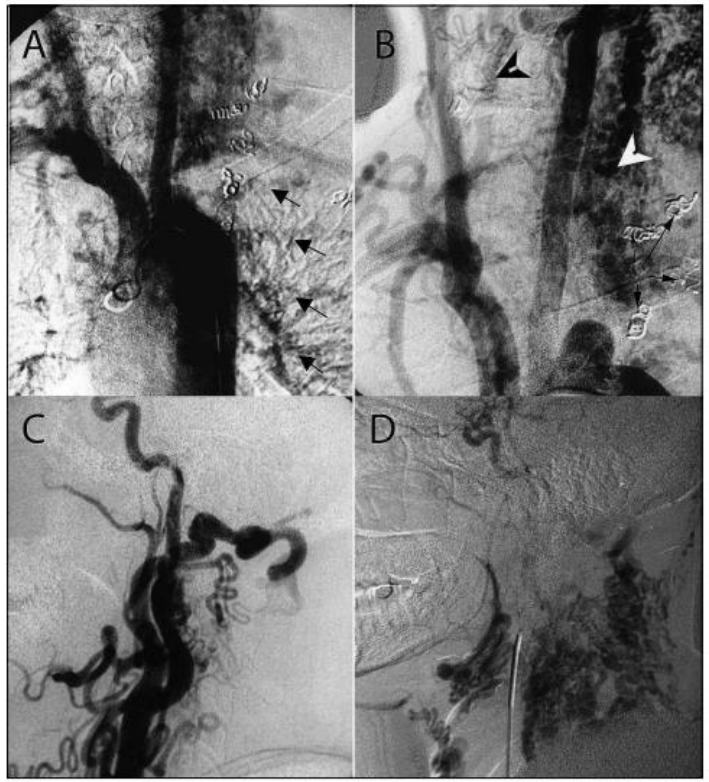


Figure 1: The extent of our patient's AVM in May 2000. A) Angiogram of the aortic arch showing the abnormal arteries feeding from the left external carotid artery, both vertebral arteries and several intercostal arteries (arrows), while the left subclavian artery had been ligated; B) extensive abnormal vasculature arising from the left vertebral and external carotid arteries (white arrowhead), less extensive abnormal vasculature arising from the right vertebral artery (black arrowhead), and embolization coils from a previous treatment attempt (arrows); C) early arterial phase of the left carotid angiogram showing abnormal arteries arising from the external carotid and its branches; D) late phase of the left carotid angiogram showing the extent of the cervical AVM.

RT 45 Gy
+ Talidomid (jutranja slabost, pomiritev …)

1957-1961

Zaviralec IL produkcije

Blinc A, et al. Thromb Haemost 2008; 99: 235–237

Predstavitev primera

74-letni moški

Zdravljen zaradi AV malformacije v medenici

+ thalidomid → Nesteroidni zaviralec androgenega receptorja

Sočasno visokorizični karcinom prostate

AV malformacija v progresu

→ V predavanju bo predstavljen klinični primer, kontrolne slike in potek zdravljenja.


astellas

Onkološki Inštitut
Institute of Oncology
Ljubljana

Stereotaktična radioterapija telesa za zdravljenje refraktarne prekatne tahikardije

Jasna But Hadžić

7.3.2024

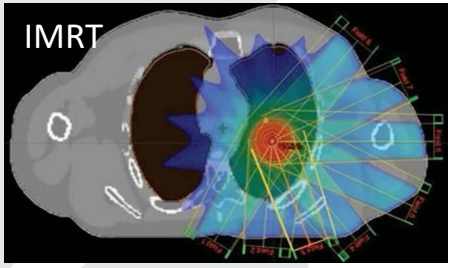
STAR – STereotactic Arrhythmia Radioablation

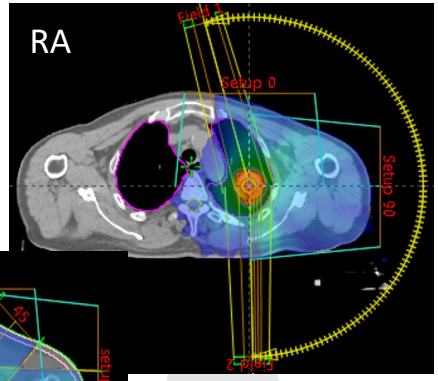
VT = ventrikularna tahikardija

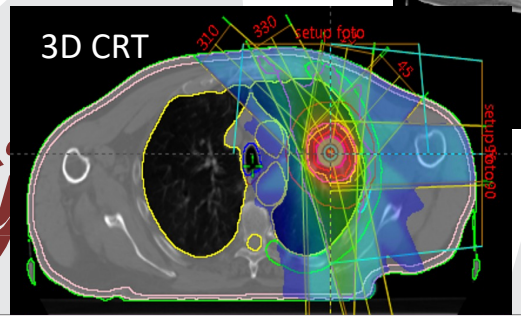
SBRT = stereotactic body radiation therapy
SABR = stereotactic ablative body radiation therapy

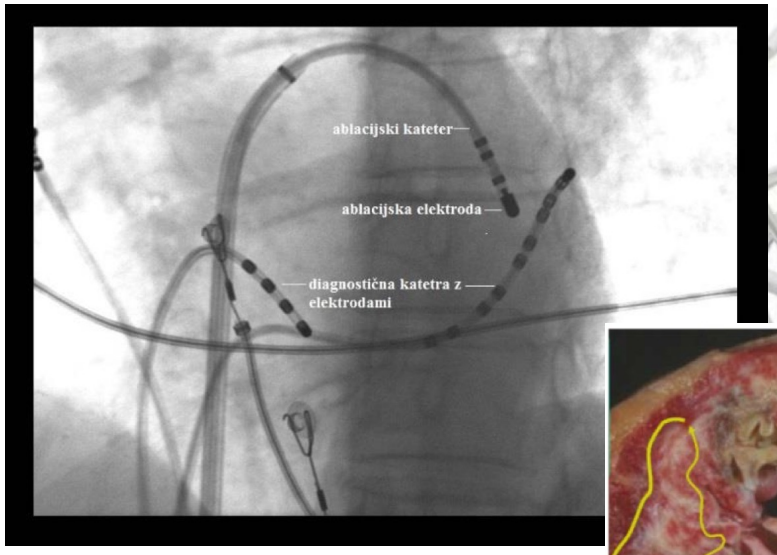
- Nizko število frakcij (1-8)
- Visoka doza na frakcijo (6-34 Gy)
- Ozki robovi
- BED ≥ 100 Gy
- Visoko konformna izodozna porazdelitev doze

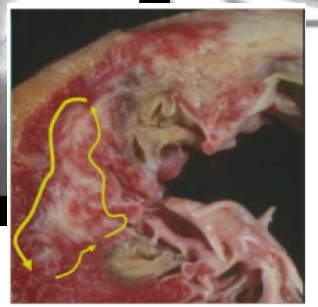
- Nenormalni električni signali iz prekatov
- Frekvenca ≥ 200 utripov/min
- Brazgotine po AMI
- Antiaritmiki
- Kateterska ablacija
- ICD











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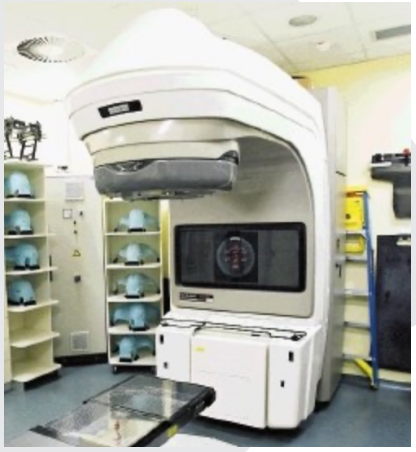


1x 25Gy na tarčo

SBRT – alternativni pristop k aritmogenemu tkivu

- ablativna doza
- visoko natančna
- v 1 frakciji
- neinvazivna

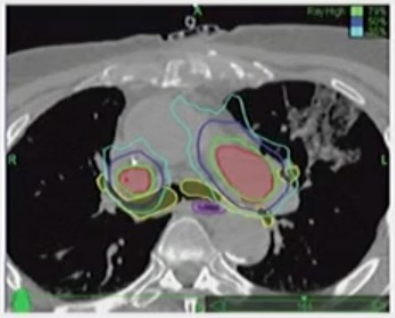
Prednost pred RFA

- transmuralne lezije
- Homogeno uničenje tarče
- Nizko tveganje

SBRT srca – literatura

A Case Report

Stereotactic Radiosurgery for a Cardiac Sarcoma: A Case Report



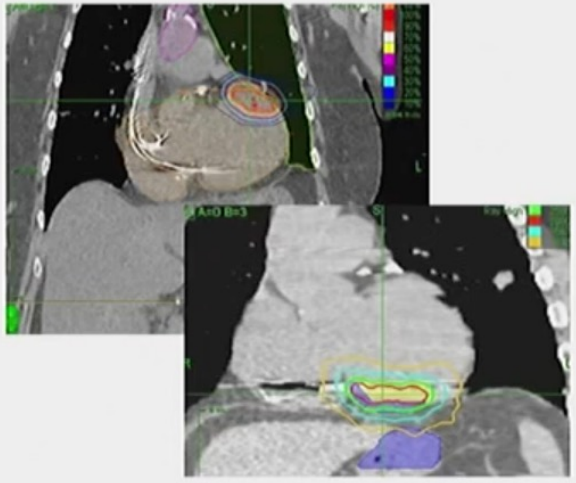
Soltys SG, Technol Cancer Res Treat 2008

Cardiac Radiosurgery for Malignant Ventricular Tachycardia

Jakub Cvek, Radek Neuwirth, Lukas Knybel, Lukas Molenda, Bretislav Otahal, Jakub Pindor, Mária Murárová, Michal Kodaj, Martin Fiala, Marian Branny, David Feltl

Stereotactic Ablative Radiotherapy for the Treatment of Refractory Cardiac Ventricular Arrhythmia

Billy W. Loo, Jr, MD, PhD*; Scott G. Soltys, MD*; Lei Wang, PhD; Anthony Lo, MS; Benjamin P. Fahimian, PhD; Andrei Iagaru, MD; Linda Norton, RN, MSN; Xin Shan, BS, BAH; Edward Gardner, PhD; Thomas Fogarty, MD; Patrick Maguire, MD, PhD; Amin Al-Ahmad, MD; Paul Zei, MD, PhD

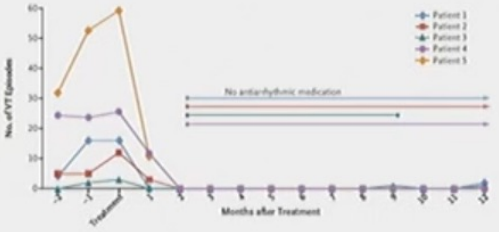


Cvek J, Cureus 2014

Loo BW, Circ AE 2015

Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia

Phillip S. Cuculich, M.D., Matthew R. Schill, M.D., Rojano Kashani, Ph.D., Sasa Mutic, Ph.D., Adam Lang, M.D., Daniel Cooper, M.D., Mitchell Faddis, M.D., Ph.D., Marye Gleva, M.D., Amit Noheria, M.B., B.S., Timothy W. Smith, M.D., D.Phil., Dennis Hallahan, M.D., Yoram Rudy, Ph.D., and Clifford G. Robinson, M.D.

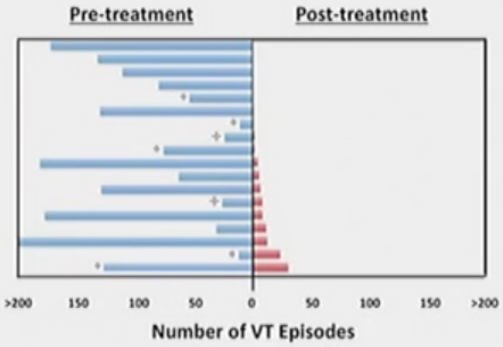


Cuculich PS, NEJM 2017

Circulation

ORIGINAL RESEARCH ARTICLE

Phase I/II Trial of Electrophysiology-Guided Noninvasive Cardiac Radioablation for Ventricular Tachycardia



Robinson CG, Circulation 2019

ENCORE-5

The NEW ENGLAND JOURNAL of MEDICINE

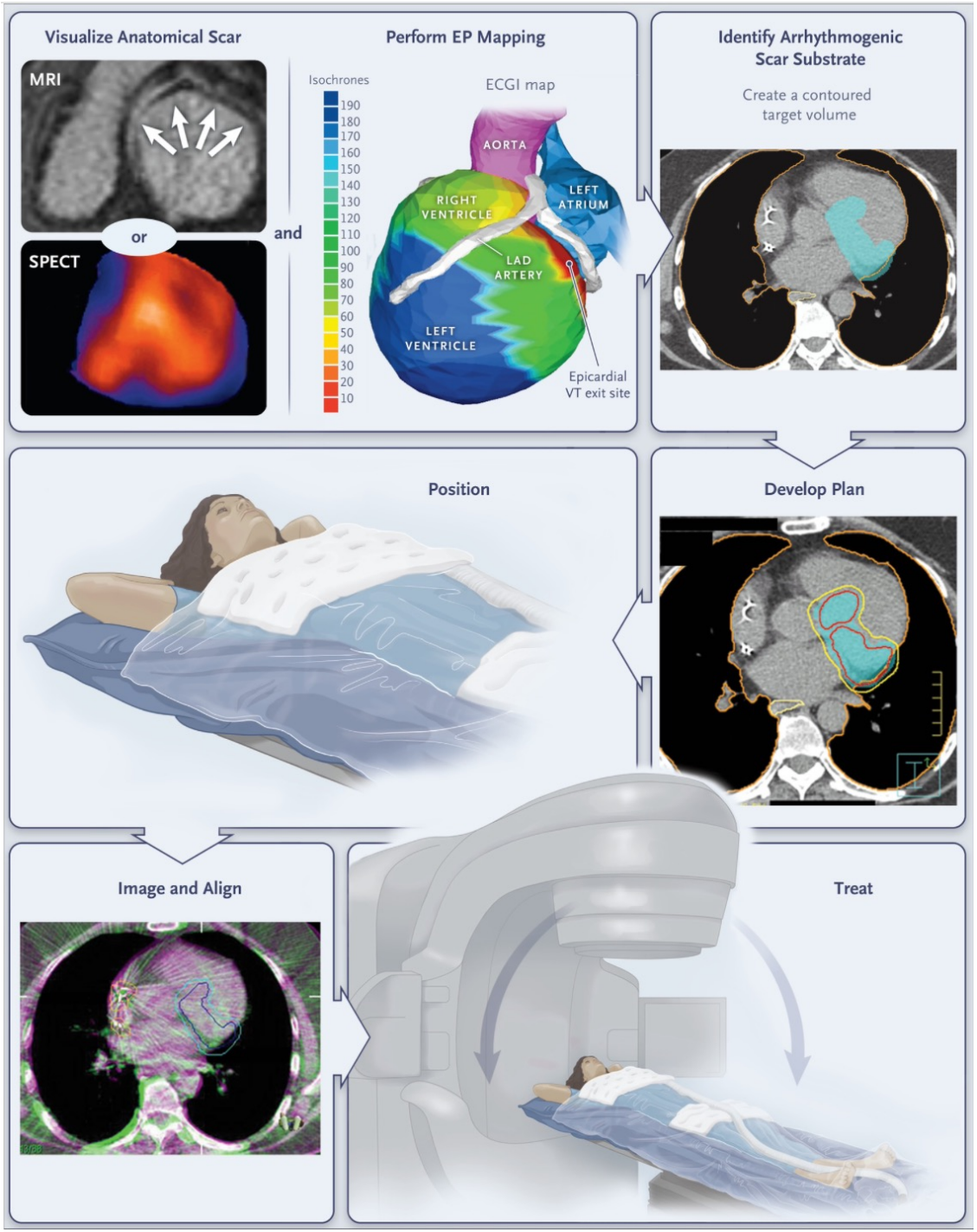
ORIGINAL ARTICLE

Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia

Phillip S. Cuculich, M.D., Matthew R. Schill, M.D., Rojano Kashani, Ph.D., Sasa Mutic, Ph.D., Adam Lang, M.D., Daniel Cooper, M.D., Mitchell Faddis, M.D., Ph.D., Marye Gleva, M.D., Amit Noheria, M.B., B.S., Timothy W. Smith, M.D., D.Phil., Dennis Hallahan, M.D., Yoram Rudy, Ph.D., and Clifford G. Robinson, M.D.

5 bolnikov – SBRT 2015

- Tarča-anatomske slike in EP mapa
- 1 x 25 Gy
- RT 14min (11-18 min)



ENCORE-5

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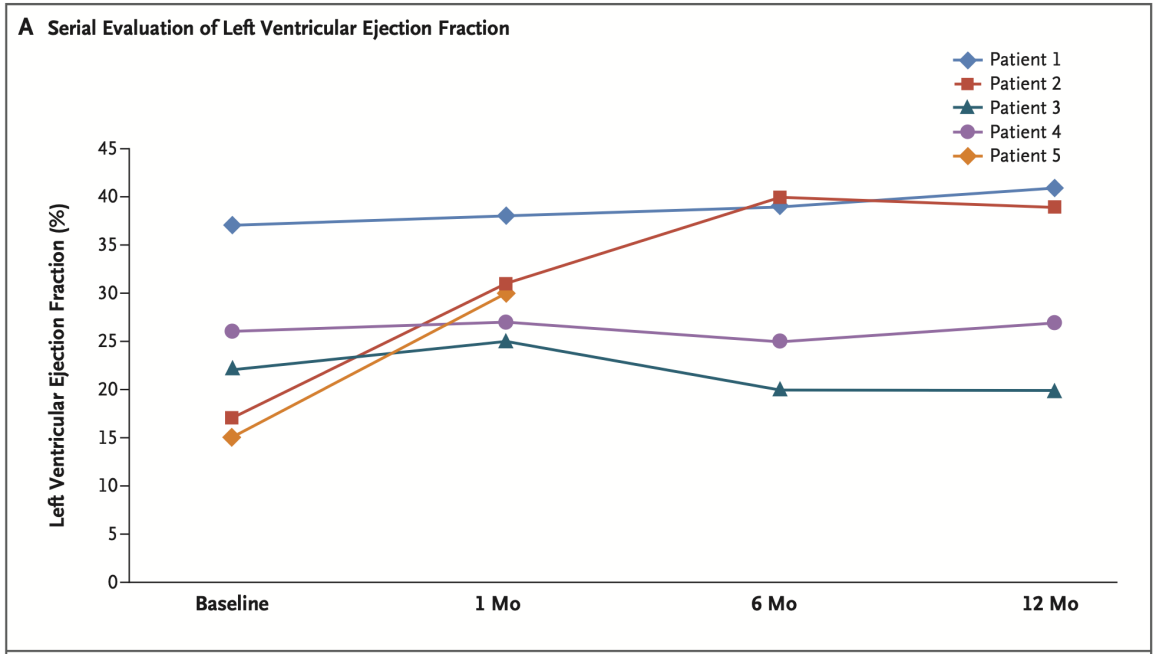
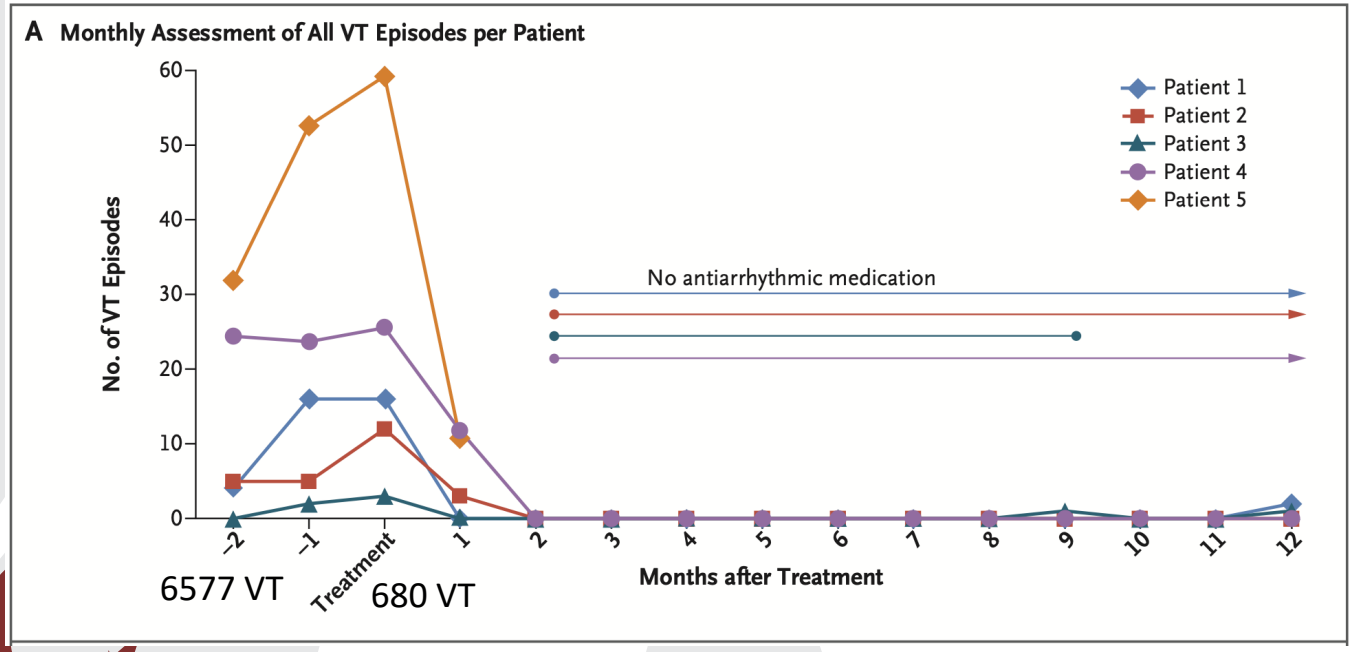




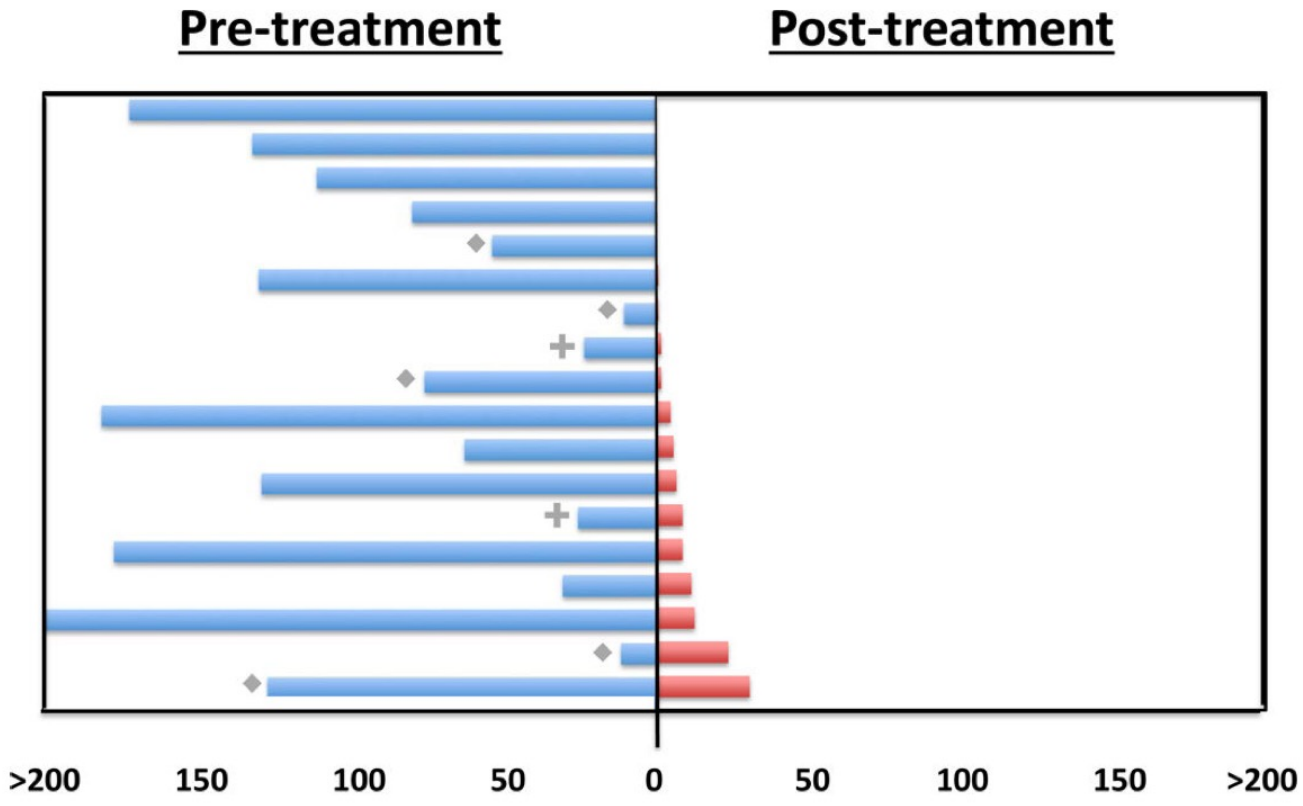
VARNOST:

- Brez akutne tox
- Brez poškodb ICD
- Stabilna EF LV
- 1 pneumonitis po 3m

ENCORE-VT (faza I-II)

19 bolnikov

- Primarni cilj – varnost in učinkovitost



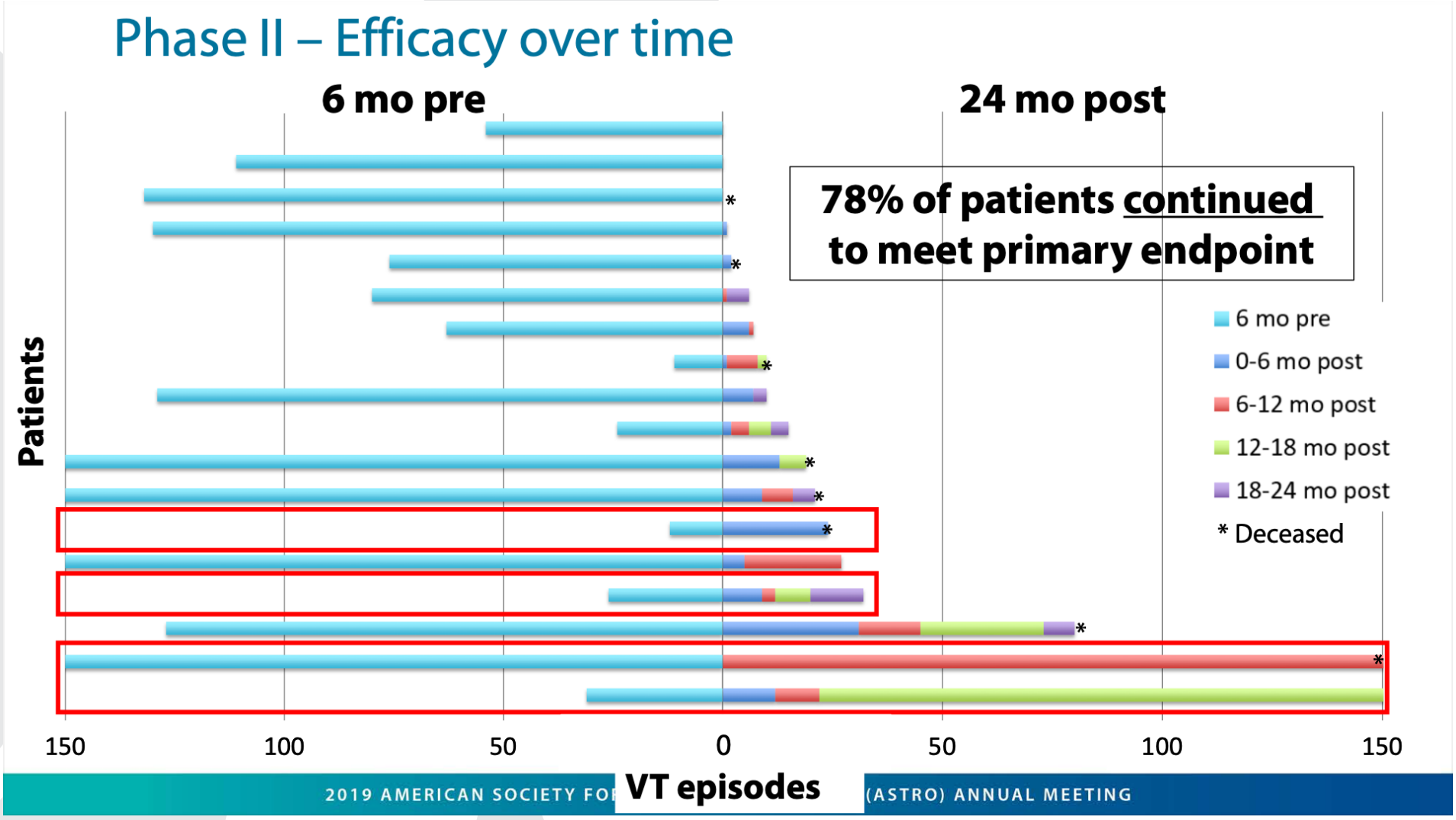
- 94% bolnikov manj aritmij

1778 VT pred RT vs 149 VT po

- Brez zgodnje tox
- Ni okvar ICD
- Utrujenost, slabost
- 6 perikardialnih izlivov (1 drenaža)

Robinson 2019, Circulation

ENCORE-VT (faza I-II)



Wiener 2022 HeartRhytm

Večinoma “single center”, majhno število bolnikov

Study	N	Radiation device	Median Age	Median EF %	ICM	Follow-up time	Outcome
Cuculich 2017	5	Linear accelerator	62	22	2/5	12 months	1 death. Reduced burden of VT
Robinson 2019	19	Linear accelerator	66	25	11/19	12 months	5 death. Reduced burden of VT
Neuwirth 2019*	10	Cyber Knife	66	26.5	8	28 months	3 death. Reduced burden of VT
Gianni 2020	5	Cyber Knife	67	25	4/5	12 months	2 death. Initial reduced burden of VT
Lloyd 2020#	10	Linear accelerator	61	NA	4/10	6 months	3 Tx, 2 hospice. Reduced burden of VT
Ho et al 2021	6	Linear accelerator	72.5	26	2/6	6.0 ± 4.9 months	2 death. Reduced burden of VT
Chin et al 2021	8	Linear accelerator	74	20	4/8	7.8 months	3 death. Reduced burden of VT (not immediate)
Carbucicchio 2021	7	Linear accelerator	72	21	3/7	8 months	3 death. Reduced burden of VT
Lee 2021	7	Linear accelerator	70	25	5/7	6 months	3 death. Reduced burden of VT
Peichl 2021* abstract	33	Cyber Knife	66	30	19/33	29 ± 23 months	17 death. Gradual decrease in VT
Li-Ting Ho 2021	7	Linear accelerator	56	43	0/7	14.5 months	1 death. Reduced VT burden
Yugo 2021	3	Linear accelerator	68	44	0/3	13.5	1 death. Reduced VT burden
Qian 2022	6	Linear accelerator	72	20	6/6	7.7 months	3 death. Reduced burden of VT
Ninni 2022	17	Cyber Knife	68	35	10/17	12.5 months	3 death. Reduced VT burden
Wight 2022#	14	Linear accelerator	59.5	NA	5/14	7.2 months	2 death. Modest decrease in VT
Molon 2022	6	Linear accelerator	79.5	26.5	4/6	12 months	1 death. Reduced VT burden
Aras 2022	8	Linear accelerator	61.5	25	4/8	8 months	4 death. Reduced VT burden
Van der Ree 2023	6	Linear accelerator	73	38	6/6	12 months	2 death. Reduced VT burden

Drsnica Amin Al Ahmada, HRS 2023, New Orleans

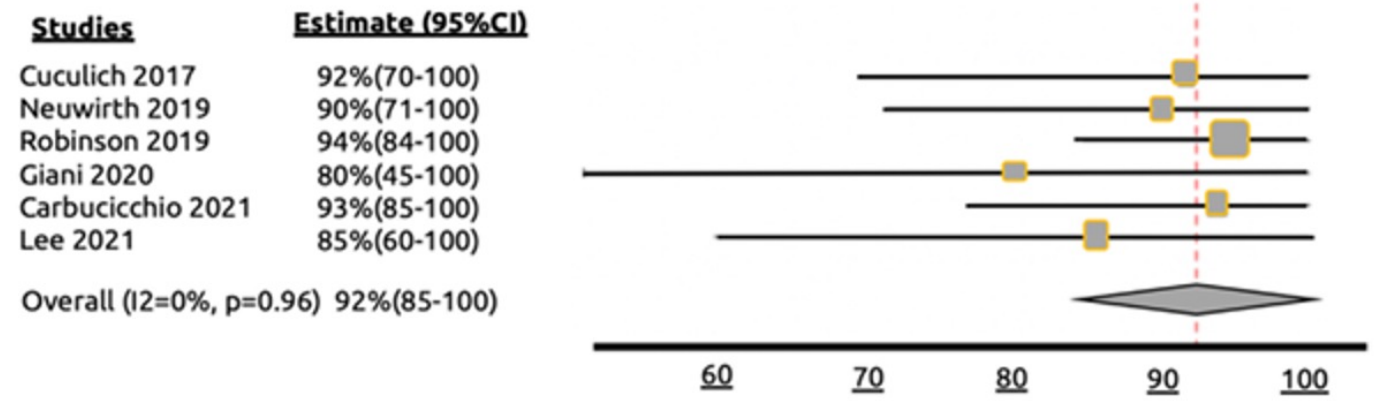
Učinkovitost in varnost STAR

Meta-Analysis > Clin Oncol (R Coll Radiol). 2023 Sep;35(9):611-620.
doi: 10.1016/j.clon.2023.04.004. Epub 2023 Apr 24.

A Meta-analysis of the Efficacy and Safety of Stereotactic Arrhythmia Radioablation (STAR) in Patients with Refractory Ventricular Tachycardia

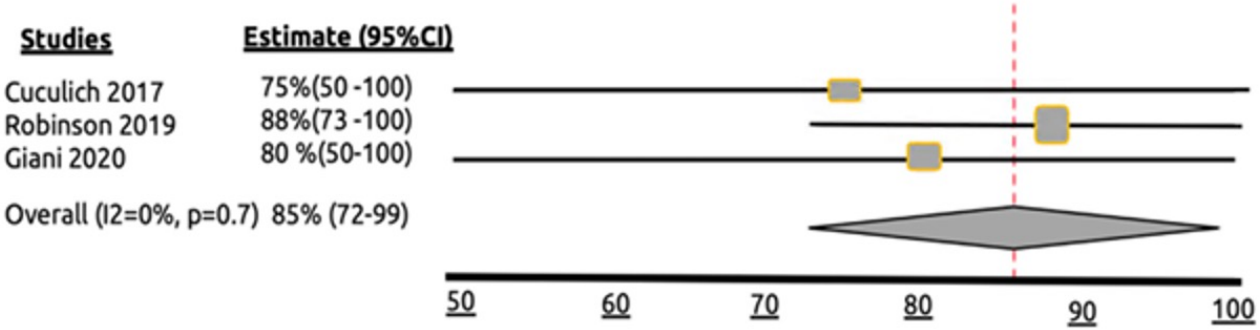
G A Viani [1], A G Gouveia [2], J F Pavoni [3], A V Louie [4], J Detsky [4], D E Spratt [5], F Y Moraes [6]

(a) % of VT burden reduction at 6 months



@6m VT obremenitev ↓ 92%

(b) % patients using < 2 AAD at 6 months

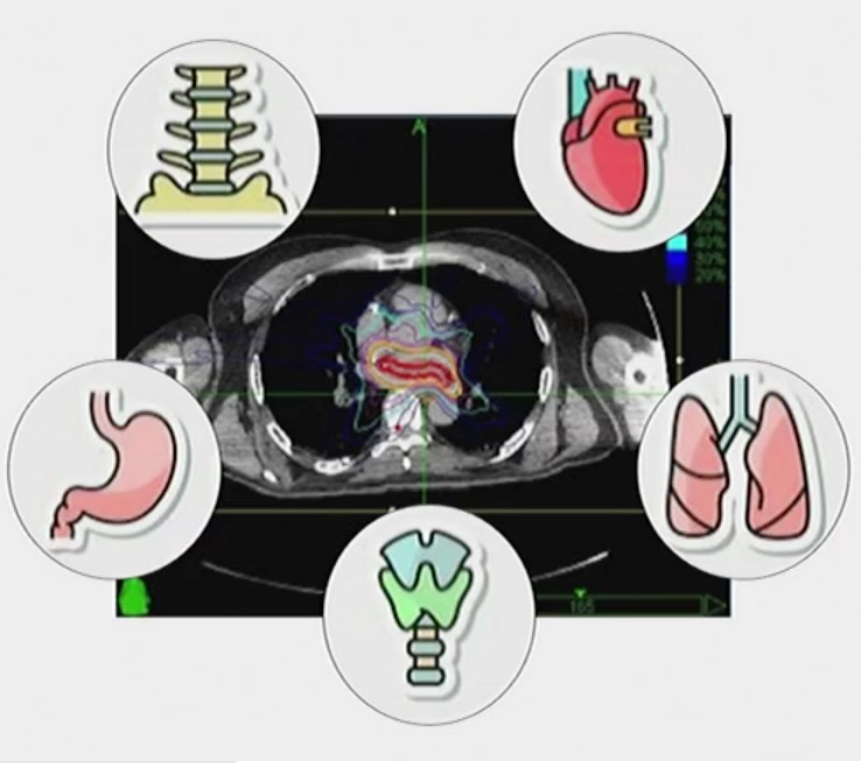


@6m ↓ proženj ICD za 86%

@6m <2 antiaritmika 85%

Viani GA 2023 ClinOncol

Problem STAR



Omejitve na kritične organe

Organs at risk	Dose recommendations/dose limitations
Aorta	Dose limitations: $D_{max} \leq 20.0$ Gy Minor protocol deviation: 20 Gy $< D_{max} \leq 25$ Gy Major protocol violation: $D_{max} > 25$ Gy
Left coronary arteries	Dose limitations: $D_{max} \leq 14.0$ Gy Minor protocol deviation: 14 Gy $< D_{max} \leq 20$ Gy Major protocol violation: $D_{max} > 20$ Gy
Superior vena cava	Dose recommendations: $D_{50\%} \leq 0.6$ Gy
Left atrium	Dose recommendations: $D_{max} \leq 4.4$ Gy
Whole heart minus PTV	Dose recommendations: $D_{50\%} \leq 5$ Gy
Esophagus	Dose limitations: $D_{max} \leq 14.5$ Gy and $V_{9Gy} \leq 1$ ccm Minor protocol deviation: $D_{max} \leq 19$ Gy, $D_{1ccm} \leq 14.5$ Gy and $V_{9\,Gy} \leq 4$ ccm Major protocol violation: $D_{max} > 19$ Gy ‖ $D_{1ccm} > 14.5$ Gy ‖ $V_{9\,Gy} > 4$ ccm
Trachea	Dose limitations: $D_{max} \leq 15$ Gy and $V_{10\,Gy} \leq 1$ ccm Minor protocol deviation: $D_{max} \leq 20$ Gy, $D_{1\,ccm} \leq 15$ Gy and $V_{10\,Gy} \leq 4$ ccm Major protocol violation: $D_{max} > 20$ Gy ‖ $D_{1\,ccm} > 15$ Gy ‖ $V_{9\,Gy} > 4$ ccm
Bronchial tree	Dose limitations: $D_{max} \leq 15$ Gy and $V_{10Gy} \leq 1$ ccm Minor protocol deviation: $D_{max} \leq 20$ Gy, $D_{1\,ccm} \leq 15$ Gy and $V_{10\,Gy} \leq 4$ ccm Major protocol violation: $D_{max} > 20$ Gy ‖ $D_{1\,ccm} > 15$ Gy ‖ $V_{9\,Gy} > 4$ ccm
Spinal canal	Dose limitations: $D_{max} \leq 7$ Gy and $V_{6\,Gy} \leq 0.1$ ccm Minor protocol deviation: $D_{max} \leq 8$ Gy, $V_{6\,Gy} \leq 1$ ccm Major protocol violation: $D_{max} > 8$ Gy ‖ $V_{6\,Gy} > 1$ ccm
Skin	Dose limitations: $D_{max} \leq 14.4$ Gy and $V_{10\,Gy} \leq 10$ ccm Minor protocol deviation: $D_{max} \leq 16$ Gy, $V_{14.4\,Gy} \leq 10$ ccm Major protocol violation: $D_{max} > 16$ Gy ‖ $V_{14.4\,Gy} > 10$ ccm
Whole lungs	Dose limitations: $V_{100\%} - V_{7Gy} \geq 1500$ ccm ($V_{7\,Gy}$ remaining volume > 1500 ccm) and $D_{5\%} \leq 20$ Gy and $D_{50\%} \leq 3.5$ Gy Minor protocol deviation: $V_{100\%} - V_{7Gy} \geq 1000$ ccm ($V_{7\,Gy}$ remaining volume > 1000 ccm), $D_{6.5\%} \leq 20$ Gy and $D_{50\%} \leq 5$ Gy Major protocol violation: $V_{100\%} - V_{7\,Gy} < 1000$ ccm ($V_{7\,Gy}$ remaining volume < 1000 ccm), $D_{6.5\%} > 20$ Gy and $D_{50\%} > 5$ Gy
ICD (major electronics)	Dose limitations: $D_{max} \leq 0.5$ Gy and blocked from primary beam irradiation Minor protocol deviation: 0.5 Gy $< D_{max} \leq 1.0$ Gy Major protocol violation: $D_{max} > 1.0$ Gy

EP CASE REPORT

Oesophagopericardial fistula as a late complication of stereotactic radiotherapy for recurrent ventricular tachycardia

Jana Haskova [1]*, Kristina Jedlickova[2], Jakub Cvek [3], Lukas Knybel [3], Radek Neuwirth [4], and Josef Kautzner[1]

[1]Department of Cardiology, Institute for Clinical and Experimental Medicine (IKEM), Vídeňská 1958/9, Prague 4 140 21, Czech Republic; [2]Department of Pathology, Institute for Clinical and Experimental Medicine (IKEM), Prague, Czech Republic; [3]Department of Oncology, Ostrava University Hospital, Ostrava, Czech Republic; and [4]Masaryk University Medical School, Brno, Czech Republic

* Corresponding author. Tel: 00420739686615. *E-mail address:* hasj@ikem.cz

Stereotactic body radiotherapy (SBRT) has been suggested as a promising therapeutic alternative in cases of failed catheter ablation for recurrent ventricular tachycardias (VTs).[1] Early results triggered a wave of enthusiasm, while severe adverse effects have been reported only in an abstract form (Robinson CG, *et al. Int J Radiat Oncol* 2019;**105**:682).

A 67-year-old patient with a history of inferior myocardial infarction and coronary artery bypass grafting using the gastroepiploic artery was implanted with an Implantable Cardioverter-Defibrilator (ICD) for recurrences of VT 16 years later. He underwent catheter ablation in an expert centre, targeting three different morphologies of VT from the inferior wall. Despite non-inducibility at the end, the patient had recurrences of two faster VTs 2 years later. Stereotactic body radiotherapy was performed (CyberKnife, Accuray), based on electroanatomical maps and positron emission tomography/computed tomography (CT) identification of the scar (25 Gy on 76% isodose, target volume 70 cm^3, CTV covered Target Volume (CTV-PTV) margin was isotropic 3 mm) (*Figure 1*). The maximum dose to oesophagus constraints for oesophagus [D5 mL = 9.23 Gy, Dnear max (0.035 ccm) = 13.9 Gy, Dmax = 14.46 Gy]. V instead of arcs. The patient presented with dysphagia and early oesophagitis was confirmed by endos

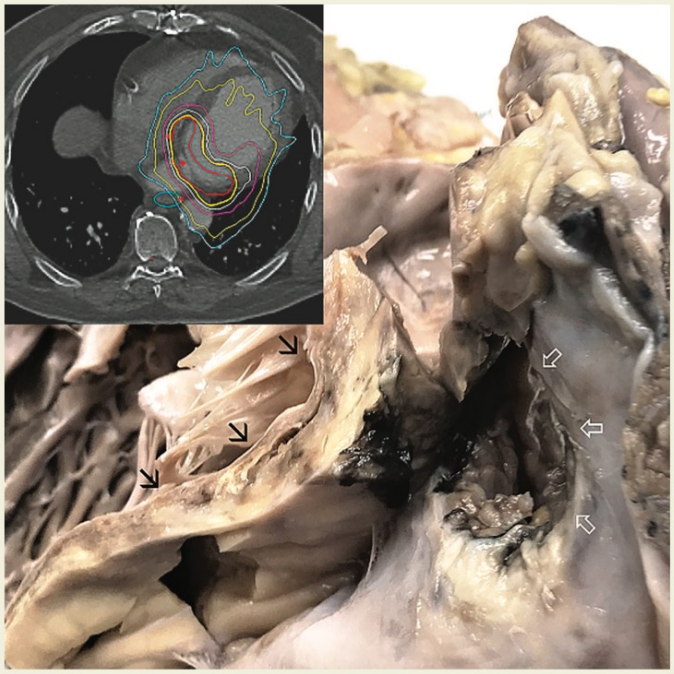


Figure 1 Post-mortem macroscopic picture of the myocardial substrate in the inferior wall (black arrows) and adjacent oesophagopericardial fistula opening through the parietal pericardium (open arrows). *Inset:* CT angiogram depicting radiosurgical treatment plan with isodose lines.

Haskova J, Europace 2022

LBA4

Longer Term Results from a Phase I/II Study of EP-guided Noninvasive Cardiac Radioablation for Treatment of Ventricular Tachycardia (ENCORE-VT)

C.G. Robinson,[1] P. Samson,[1] K.M.S. Moore,[2] G.D. Hugo,[1] N. Knutson,[1] S. Mutic,[1] S.M. Goddu,[1] D.H. Cooper,[2] M. Faddis,[2] A. Noheria,[2] T.W. Smith,[2] P.K. W... and P. Cuculich[2]; [1]W... *of Radiation Oncolo... Medicine, Departme... Louis, MO, [3]Washin... Radiology, St. Louis, ... of Radiation Oncolo... Medicine, Department of Biomedical Engineering, St. Louis, MO*

11% resne pozne toksičnosti

- G3 perikardialni izliv (2,2let)
- G4 gastroperikardialna fistula (2,4 let)

ELSEVIER

Heart Rhythm

Volume 20, Issue 8, August 2023, Pages 1206-1207

Research Letter

Effects of stereotactic arrhythmia radioablation on left ventricular ejection fraction and valve function over time

Martijn H. van der Ree MD [*] [†] [‡], Adrian Luca PhD [*], Claudia Herrera Siklody MD [*],

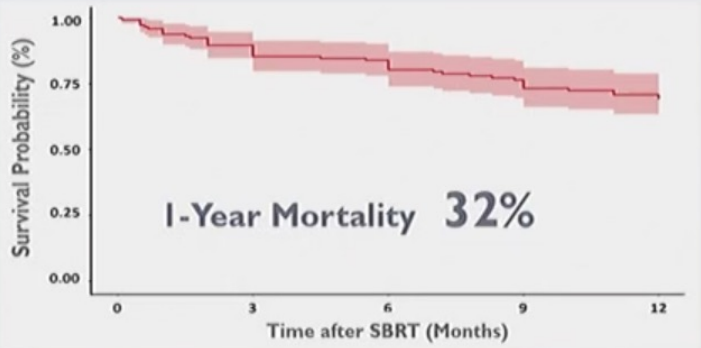
Variable	Worsening Prevalence	Worsening Mean dose (Gy)	No worsening Prevalence	No worsening Mean dose (Gy)	P*
Aortic valve	4 (20)	16.8 (12.7–19.8)	16 (80)	7.2 (1.5–7.2)	.03
Stenosis	2 (50)				
Regurgitation	2 (50)				
Mitral valve	1 (5)	5.6 (n.a.)	19 (95)	7.5 (3.8–10.3)	.84
Stenosis	0 (0)				
Regurgitation	1 (100)				
Tricuspid valve	1 (5)	1.9 (n.a.)	19 (95)	6.7 (2.2–12.6)	.40
Stenosis	0 (0)				
Regurgitation	1 (100)				

Van der Ree M, Heart Rhythm 2023

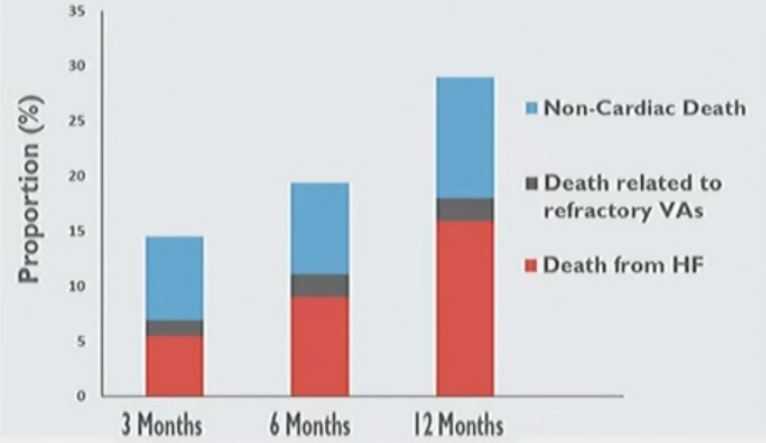
1-year mortality

16 Studies, 157 Patients undergoing Cardiac SBRT for Refractory VAs

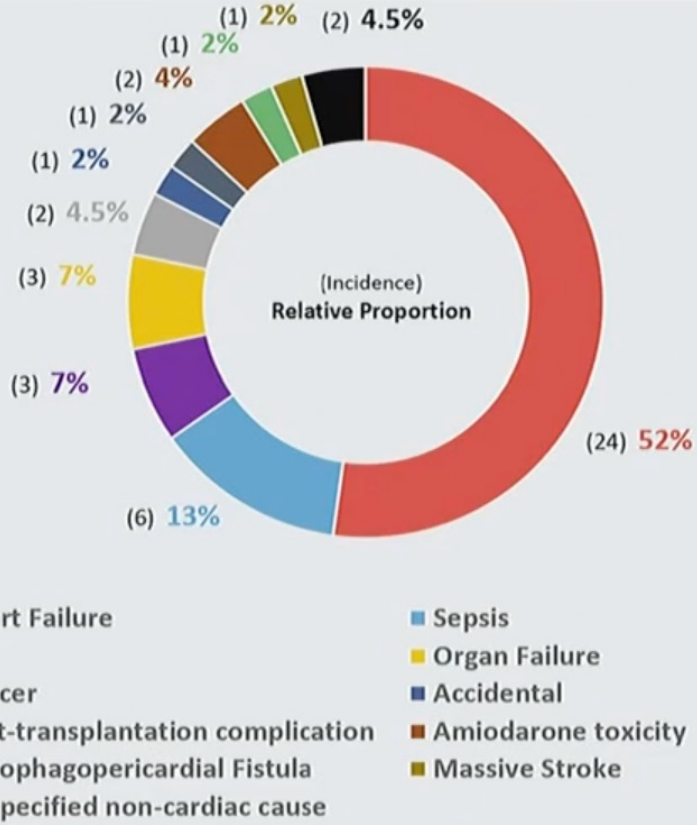
Survival after Cardiac SBRT



HF-related Mortality



Cause of Death



Benali K, ..., Martins R
Under review

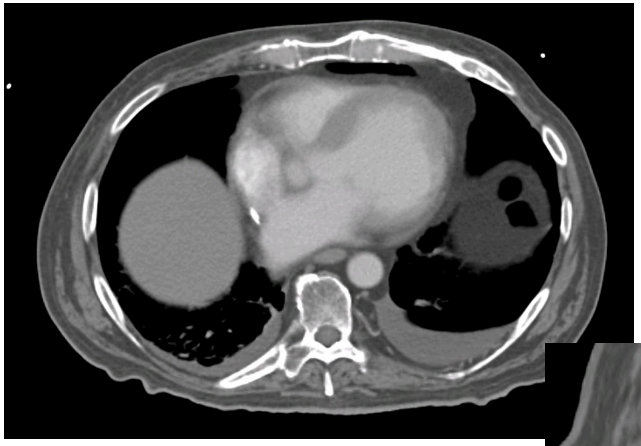
Naše izkušnje

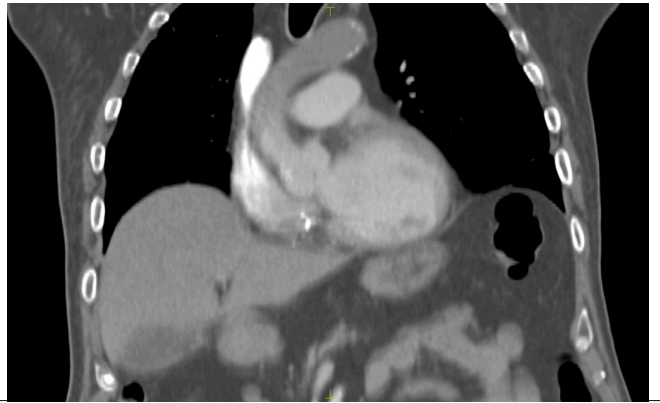
	Starost		PS	STAR
1.	83	Ishemična dilatativna kardiomiopatija, CABG, KAF, recidivni perikarditisi, CRT, 7x ablacija!	4	9/20
2.	79	Neishemična dilatativna kardiomiopatija, 2x ablacija, iatrogeni AV blok	2-3	5/21
3.	90	Infiltrativna kardiomiopatija, samo antiaritmik	3	12/22
4.	67	Ishemična kardiomiopatija, 1x poskus ablacije, obsežen substrat, nedostopen RFA	3 že 4m hopitalen	5/23
5.	78	Ishemična dilatativna kardiomiopatija, po antiaritmiku kardiogeni šok, električni vihar 1x ablacija	4	10/23

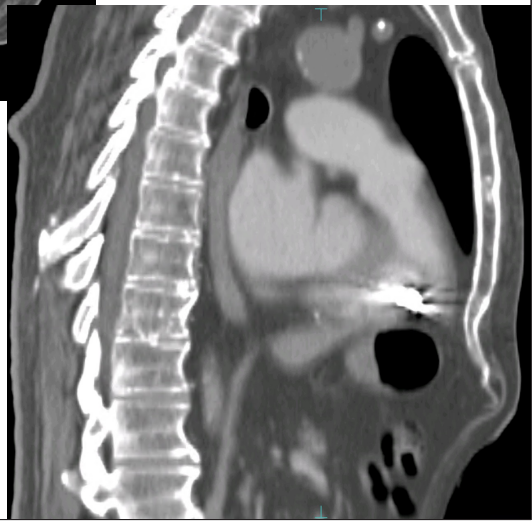
Priprava

CT simulator

- vakuumska blazina
- respiratorni 4D CT
- **iv kontrast!**

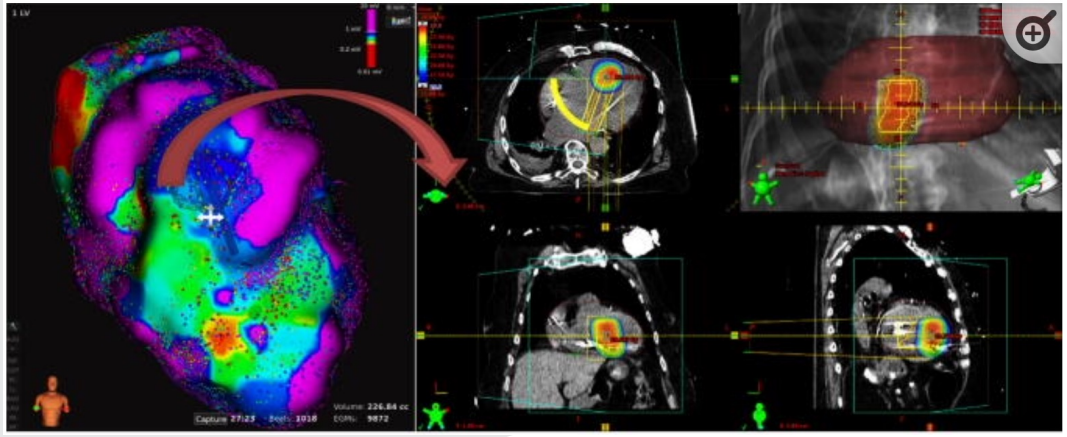


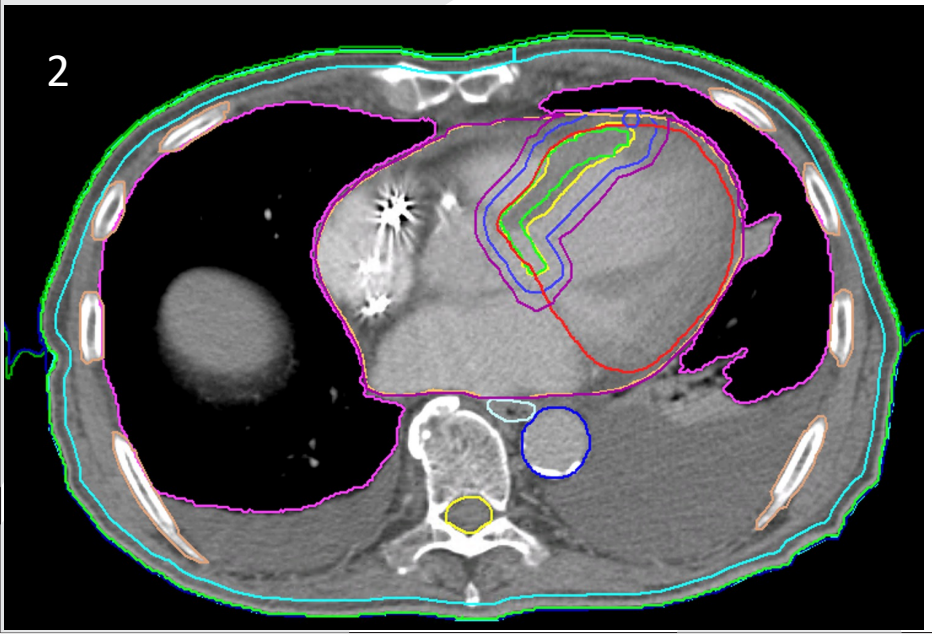




Določanje tarče

	tarča	Določitev tarče
1.	Apikalna anevrizma L prekata	CT, MRI, EKG, EP mapa; Telekonferenca CNCR pred RT
2.	Medprekatni septum	CT, MRI, EKG, EP mapa; Telekonferenca CNCR po RT





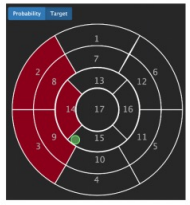
Washington University in St.Louis
SCHOOL OF MEDICINE

Center for Noninvasive Cardiac Radioablation (CNCR)
Departments of Medicine and Radiation Oncology

APRIL 2021 **SLOVENIA 002**

Age: 79
Gender: Male
LVEF: unknown
Cardiomyopathy: NICM
NYHA Class: 3-4
Prior Ablations: 2 (2020, 2021)
Other Features:
On amio + mex
CRT after CHB from prior septal ablation
8 VTs in 2020.
6 VTs in 2021.
1 dominant clinical VT now


Scar Polar Map (red>orange>yellow) + VT Exit Site (green dot)


Proposed Target

ELECTRICAL MAPPING (1 VT)
**ECG VT1 → IBS axis (-V3/-V4) → Segment 15
**Prior ablation of VTs → Segments 2,8 (2020 procedure) & Segments 2,3,8,9,14 (2021 procedure)

SCAR MAPPING
**MRI (gadolinium, pre ICD) → Segments 2,3,8,9,14 (incomplete data, not all the way to apex or base)

FINAL TARGET
****Segments 9, 14 > 3 > 2,8**
****Confidence Score = High**
→Favorable: Only one clinical VT. Beautiful MRI and catheter maps (correlate).
→Unfavorable: Many circuits in this large septal scar.
→Noteworthy: Previous VTs appear to be exiting 1, 7, 10, 14, 15 → all along the scar

Center for Noninvasive Cardiac Radiotherapy
Washington university St. Luis

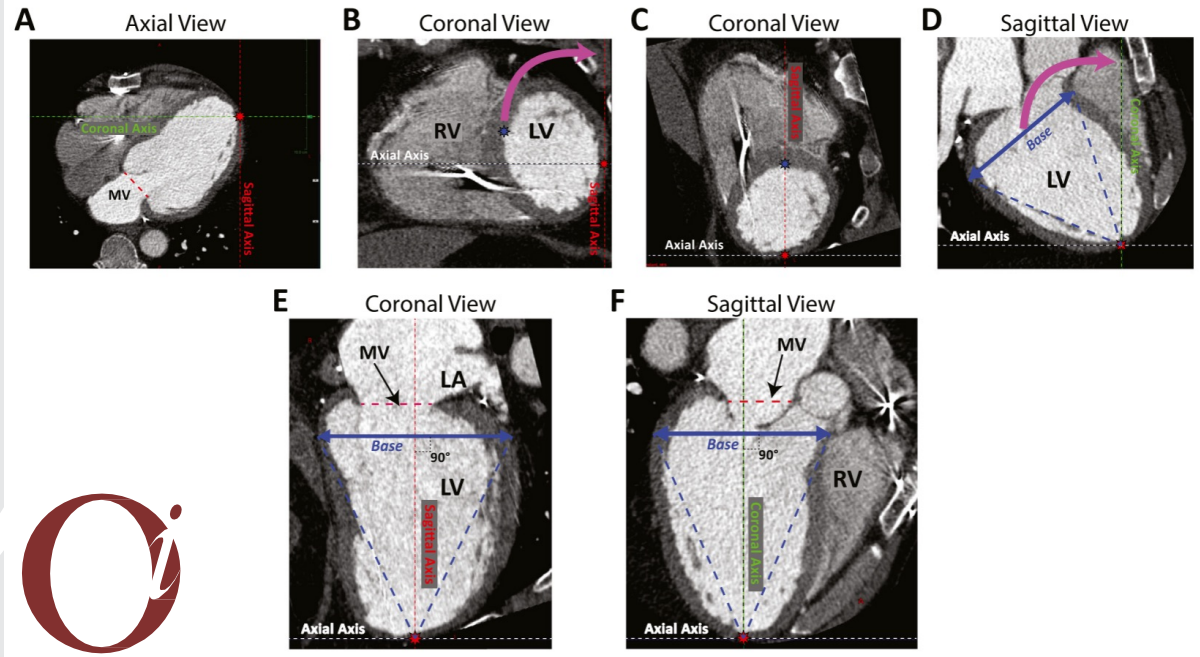
Določanje tarče

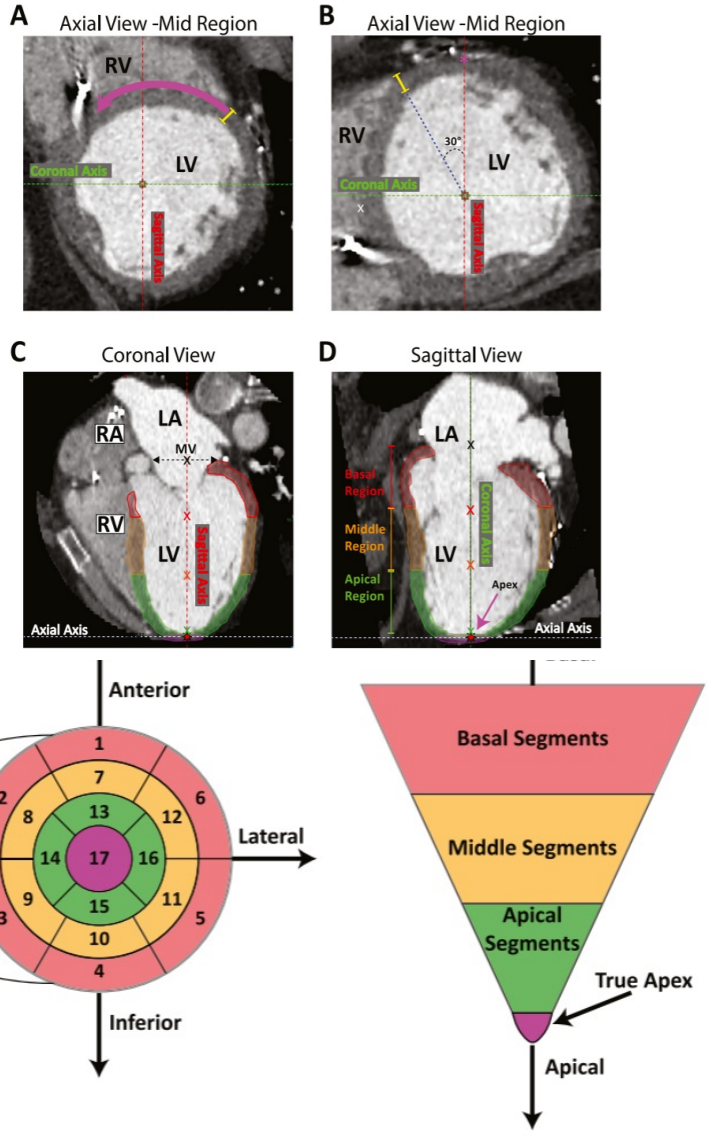
	tarča	Določitev tarče
3.	LV	CT, MRI, EKG, segmentni model

Clinical Investigation

Method and Atlas to Enable Targeting for Cardiac Radioablation Employing the American Heart Association Segmented Model

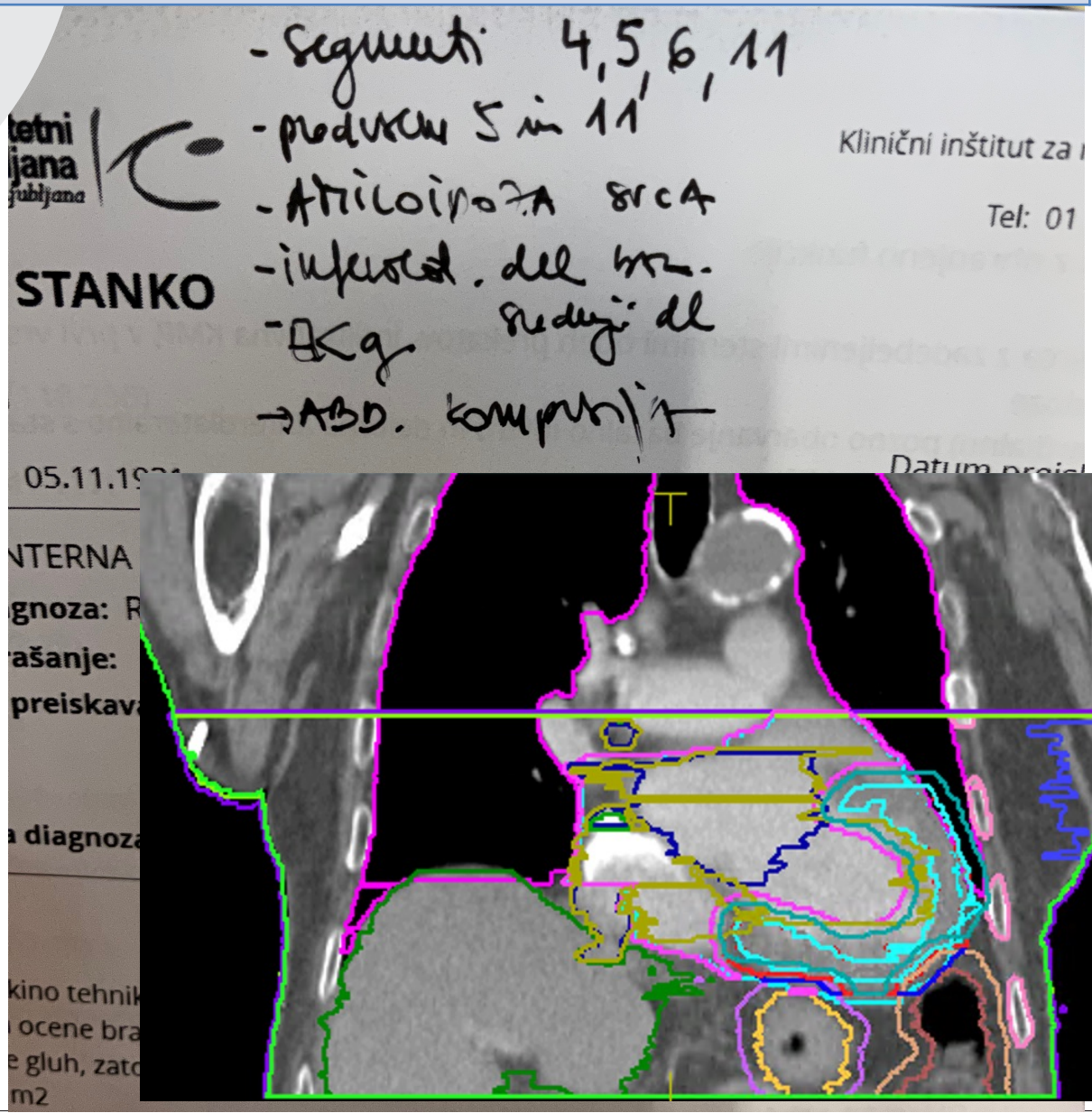
Jeremy Brownstein, MD,* Muhammad Afzal, MD, FACC,† Toshimasa Okabe, MD,† Thura T. Harfi, MD, MPH,† Matthew S. Tong, DO,† Evan Thomas, MD, PhD,‡ Geoffrey Hugo, PhD,§ Phillip Cuculich, MD,§,|| Cliff Robinson, MD,§,|| and Terence M. Williams, MD, PhD*





Določanje tarče

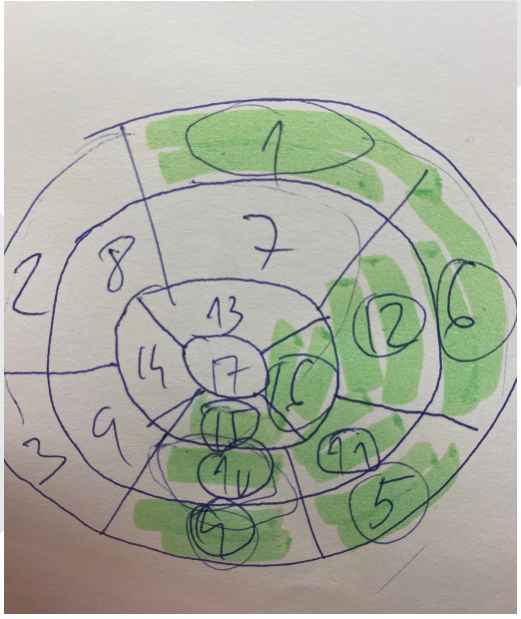
	tarča	Določitev tarče
3.	**LV**	**CT, MRI, EKG, segmentni model**

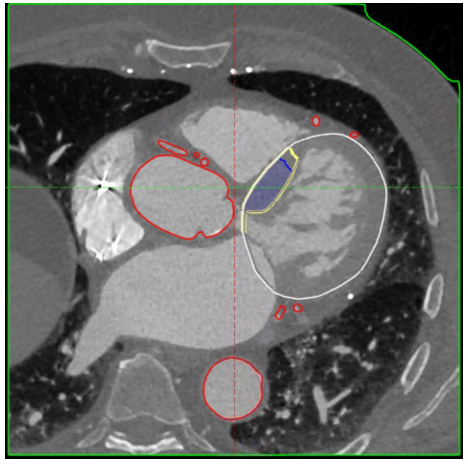


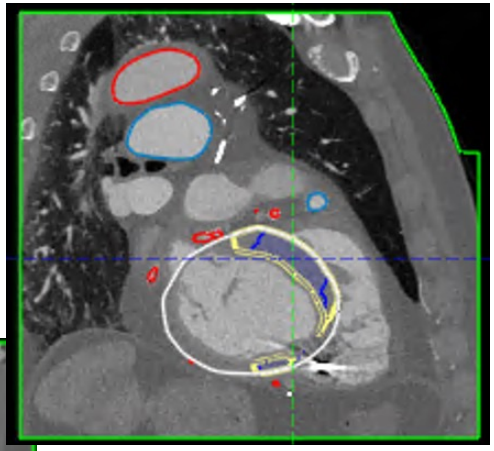
"Evo, sem orientacijsko očrtal tarčni volumen. Je očrtan na t.i. short axis - spodnja leva slika. Na zgornji levi sliki je to del povsem bazalno (ob mitralni zaklopki) inferiorno." dr. Antolič

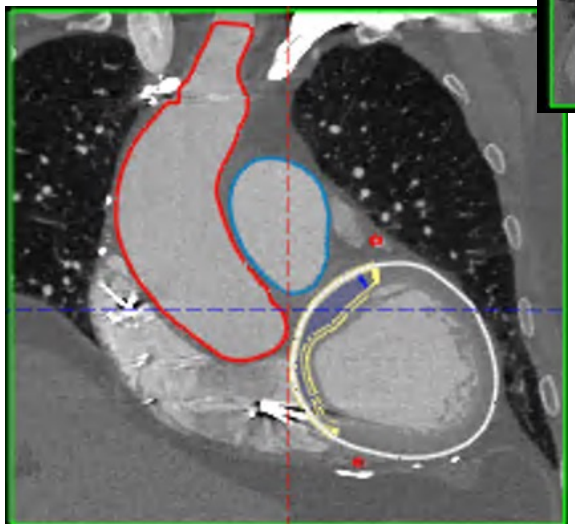
Določanje tarče

	tarča	Določitev tarče
4.	LV + septum	Vse + Segmentni model
5.	septum	Vse +Segmentni model + InHEART tarča

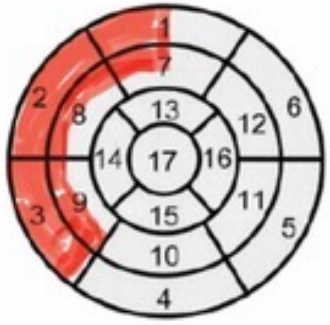






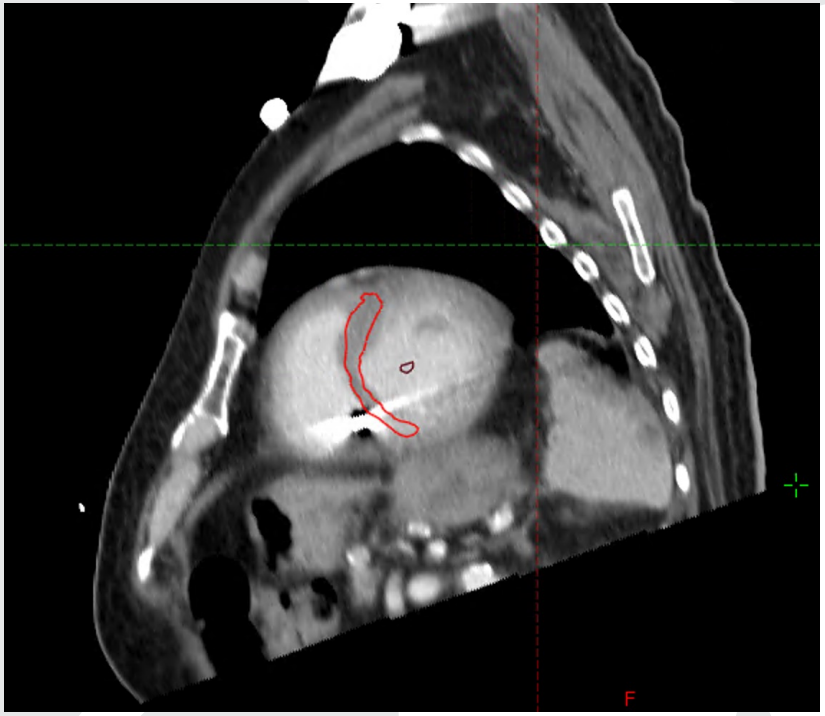


1. Basal anterior
2. Basal anteroseptal
3. Basal inferoseptal
4. Basal inferior
5. Basal inferolateral
6. Basal anterolateral
7. Mid anterior
8. Mid anteroseptal
9. Mid inferoseptal
10. Mid inferior
11. Mid inferolateral
12. Mid anterolateral
13. Apical anterior
14. Apical septal
15. Apical inferior
16. Apical lateral
17. Apex



Določanje tarče

	tarča	Določitev tarče
4.	LV + septum	Vse + Segmentni model
5.	septum	Vse +Segmentni model + InHEART tarča

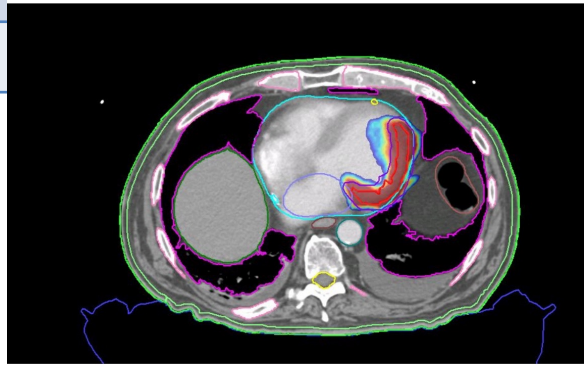


Vrisovanje CTV v Arii

dr. Bor Antolič,
dr. Boštjan Berlot

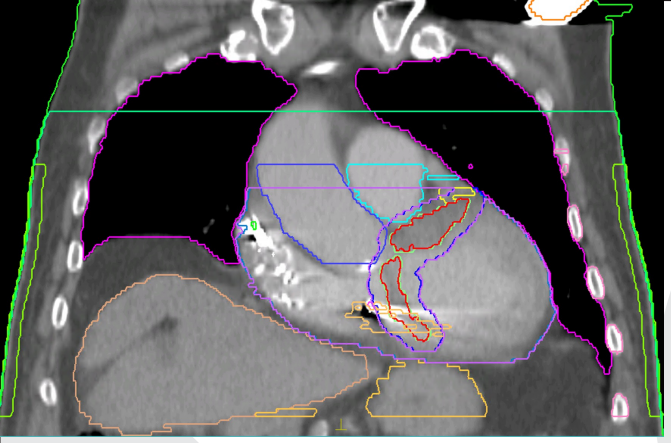
Ivica Ratosa · 1st
MD, PhD, Radiation Oncologist
9mo ·

4th case for us using stereotactic arrhythmia radioablation (#STAR)! Genuine inter-disciplinary cooperation between the teams of UKC Ljubljana and the Institute of Oncology Ljubljana⭐👏. Our first two ❤️❤️ cases would not have been successful without the assistance of Cliff Robinson, Geoff Hugo and Phillip Cuculich (https://lnkd.in/d3CTZuYK)



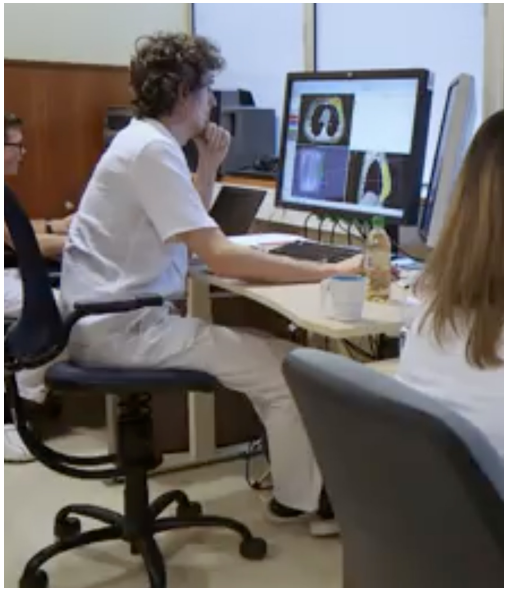
279 19 comments

Pregled kontur v Arii

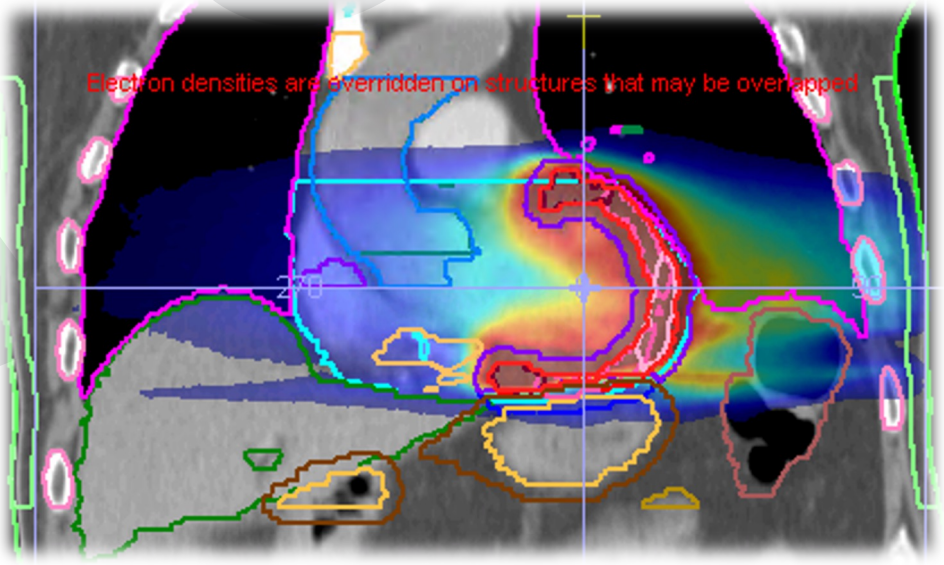


2. Pregled tarče in OAR

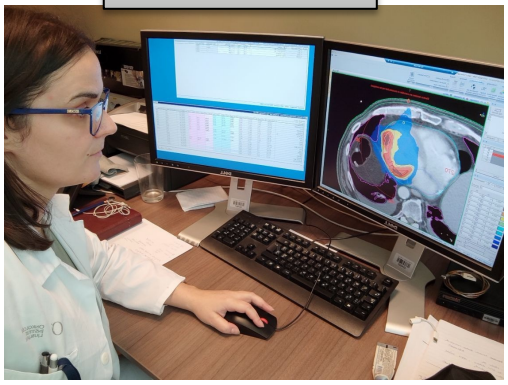
Planiranje



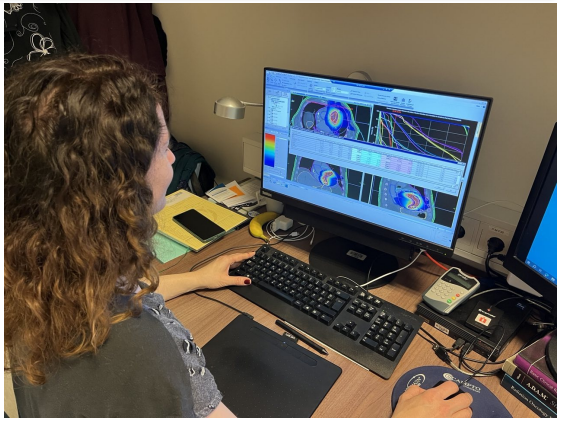
Vrisovanje
ITV in OAR



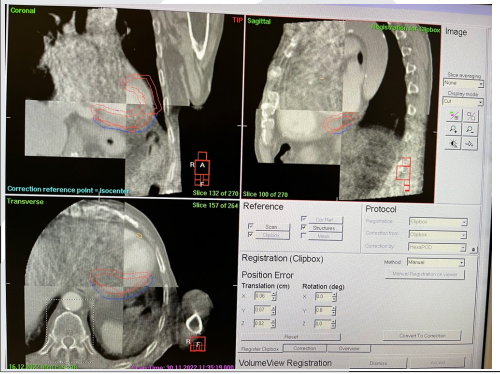
Pregled fizika



Pregled palana + 2. Pregled plana



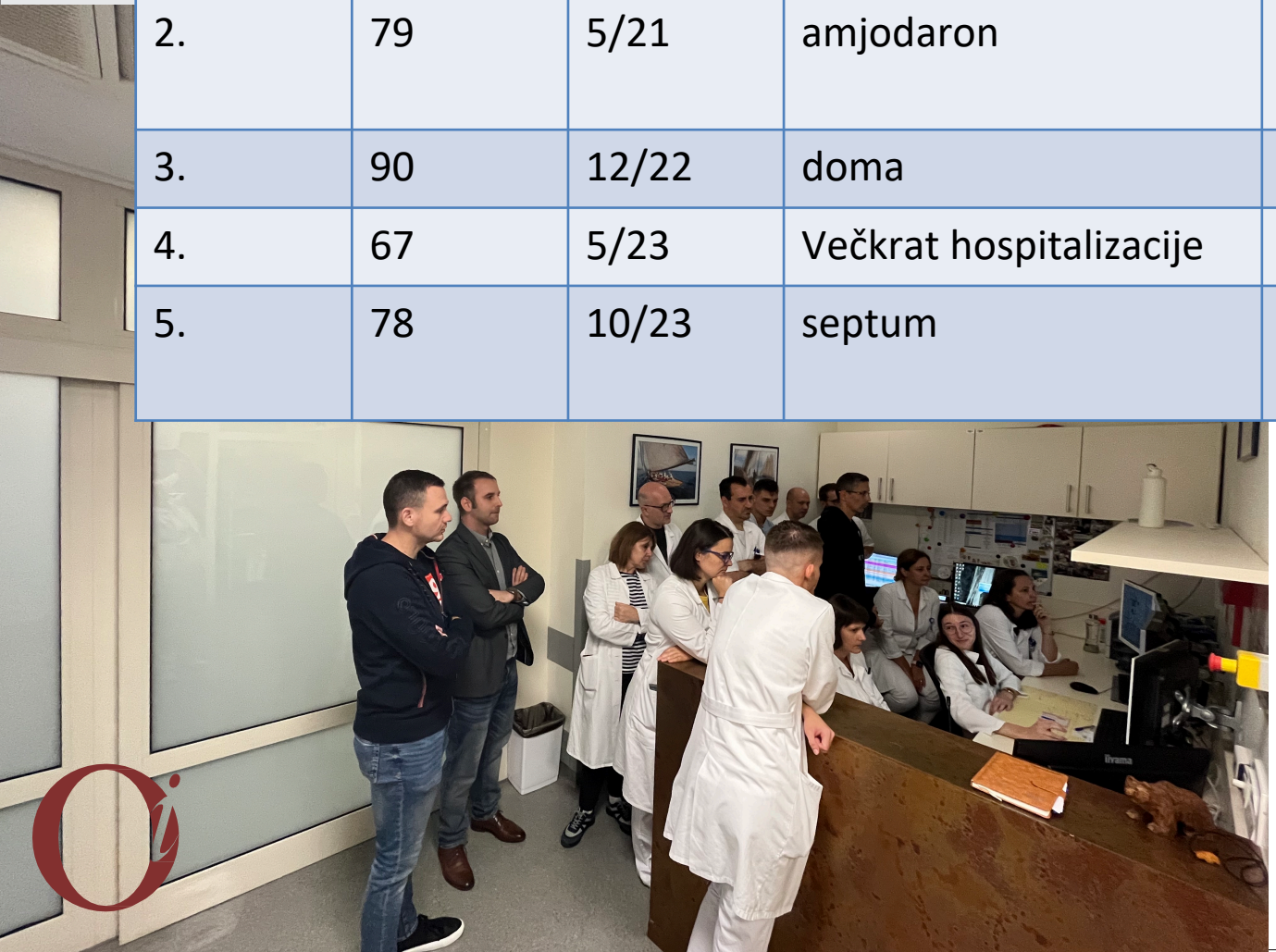
Obsevanje



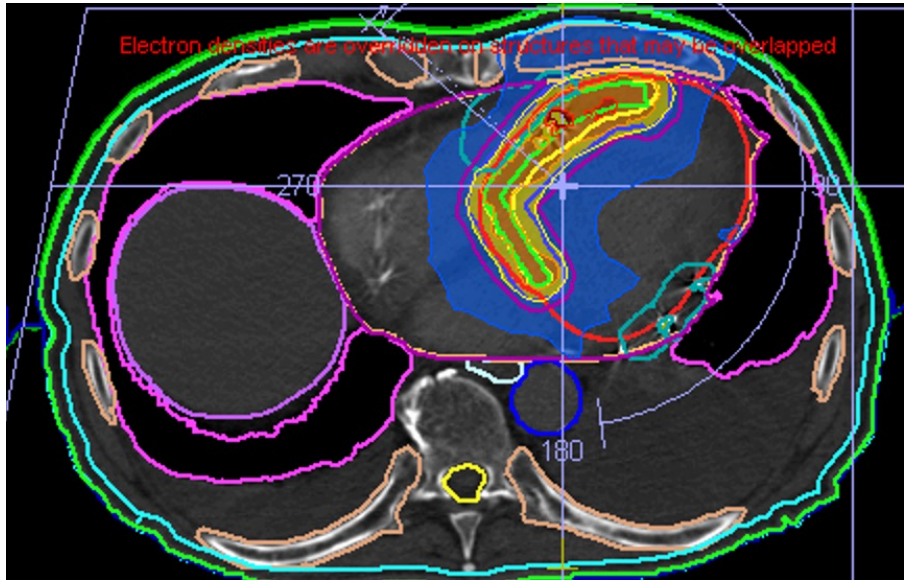
Pošiljanje, QA

Naše izkušnje

	leta	STAR		Učinek
1.	83	9/20	PS 4 → PS 2-3	Brez VT Umrl 12/23
2.	79	5/21	amjodaron	↓ VT umrl 4/22
3.	90	12/22	doma	brez VT, umrl 9/23, srč pop
4.	67	5/23	Večkrat hospitalizacije	Brez VT, hudo srč pop
5.	78	10/23	septum	Izboljšanje, kratke neobstojne VT brez proženja ICD



STAR



Učinkovitost:

- ↓ breme epizod VT
- ↓ proženje ICD
- ↓ potrebo po antiaritmikih

- Varnost:
- Pozna toksičnost G3-5 10%
- 1 letna umrljivost cca 30% - kardialni vzrok

OBSEVANJE IN AMILOIDOZA

Obsevanje benignih bolezni

Ljubljana, 7.3.2024

Janka Čarman

UVOD

KLINIČNI PRIMER

ZAKLJUČEK

AMILOIDOZA

SKUPINA BOLEZNI, ZA KATERO JE ZNAČILNO ZUNAJCELIČNO ODLAGANJE AMILOIDA

AL amiloidoza: povzroča odlaganje delcev protiteles – lahkih verig

PRIMARNA – vzrok ni poznan

SEKUNDARNA - reaktivna, nastane kot posledica kronične okužbe, vnetja (RA, KVBČ), maligne bolezni

LOKALIZIRANA – omejena na en organ

SISTEMSKA – prizadane številne organe

PRIMARNA LOKALIZIRANA AMILOIDOZA SEČNEGA MEHURJA

- Redka bolezen

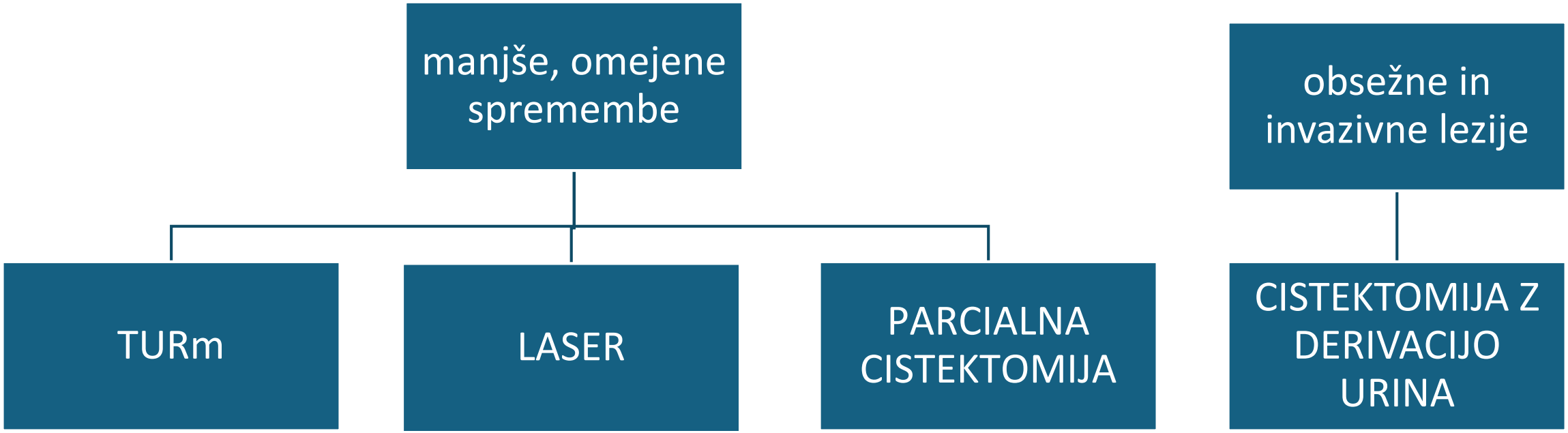
- NI jasnega dogovora o priporočeni obravnavi

- Značilnosti:

- neboleča hematurija
- simptomi spodnjih sečil
- posnemanje raka sečnega mehurja

ZDRAVLJENJE AMILOIDOZE SEČNEGA MEHURJA:

večinoma KIRURŠKO



Boorjan S, Choi BB, Loo MH, et al. A rare case of painless gross hematuria: primary localized AA type amyloidosis of the urinary bladder. *Urology* 2002; 59: 137.

Merrimen JL, Alkhudair WK, Gupta R. Localized amyloidosis of the urinary tract: case series of nine patients. *Urology* 2006; 67: 904–909

Difuzna oziroma lokalno obsežna zajetosti sečnega mehurja:

→

možnost ohranitvenega zdravljenja?

Dimetil sulfid intravezikalno: poskus raztapljanja netopnih amiloidnih skupkov

za zdravljenje in preprečevanje ponovitve

slabi uspehi: 1/3 ni učinka, pri večini ponovitev

Malek RS, Wahner-Roedler DL, Gertz MA, et al. Primary localized amyloidosis of the bladder: experience with dimethylsulfoxide therapy. *J Urol* 2002; 168: 1018–1020.

Nishiyama T, Gejyo F, Katayama Y, et al. Primary localized amyloidosis of the bladder: a case of AL (λ.) amyloid protein and combination therapy using dimethyl sulfoxide and cepharanthin. *Urol Int* 1992; 48: 228–231

Zaman W, Singh V, Kumar B, et al. Localized primary amyloidosis of the genitourinary tract: does conservatism help? *Urol Int* 2004; 73: 280–282

BENIGNA, toda…

Kljub različnim zdravljenjem - ponovitev v 54%

Možni recidivi po dolgih intervalih (npr. 14 let po diagnozi)

Tirzaman O, Wahner-Roedler DL, Malek RS, et al. Primary localized amyloidosis of the urinary bladder: a case series of 31 patients. *Mayo Clin Proc* 2000; 75: 1264–1268.

Ruffion A, Valignat C, Champetier D, et al. Long-term recurrence of primary amyloidosis of the bladder. *Urology* 2002; 59: 444.

Zdravljenje amiloidoze z obsevanjem?

Lokalizirana amiloidoza AL: glava & vrat, grlo, traheobronhialno,
lahko … sečila, orbita, koža …

Zdravljenje z obsevanjem:

- za bolnike, kjer kirurško zdravljenje NI primerno
- recidivne & obsežne spremembe

Hall, Jacob & Rubinstein, Samuel & Lilly, Amy & Blumberg, Jeffrey & Chera, Bhishamjit. (2022). Treatment of Localized Amyloid Light Chain Amyloidosis With External Beam Radiation Therapy. Practical Radiation Oncology. 12. 10.1016/j.prro.2022.03.011.

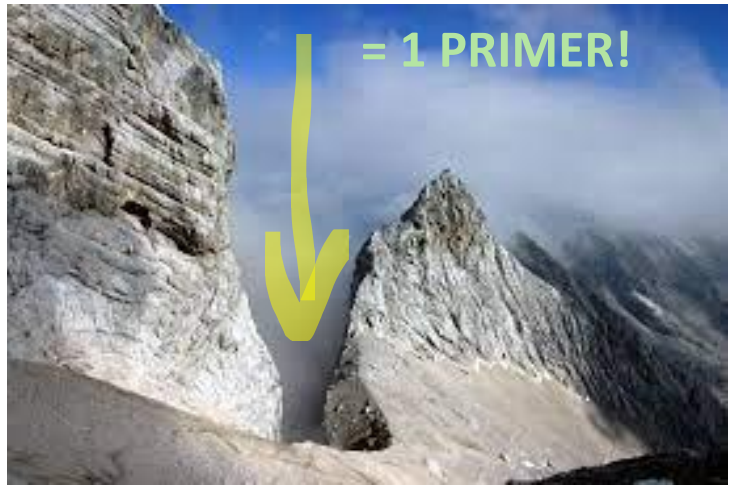
Zdravljenje amiloidoze z obsevanjem?

When to recommend local therapy	Systemic disease has been excluded by a hematologist; bothersome, symptomatic disease
When to recommend surgery	Young patients; obstructive lesions; severely symptomatic
When to recommend radiation	Unacceptable surgical deficit (eg, dysphonia); recurrent disease after surgery; poor surgical/general anesthesia candidacy
Dose & fractionation	20-45 Gy at 1.8-2.0 Gy/fraction; 20 Gy in 10 fractions preferred
Technique	Head & neck (excluding larynx): IMRT; laryngeal: 3D-CRT, lateral fields; tracheobronchial: IMRT or 3D-CRT (IMRT preferred); skin: electrons
GTV	Radiographic and physical examination (including endoscopically) identified disease
CTV	Head and neck: involved site (eg, entire nasopharynx); other sites: GTV + 5-10 mm
PTV	CTV + 3 mm (institution dependent)

Abbreviations: CTV = clinical target volume; GTV = gross tumor volume; IMRT = intensity-modulated radiation therapy; 3D-CRT = three dimensional conformal radiation therapy; PTV = planning target volume.

Različni odmerki, od 20 do 45 Gy.

Hall, Jacob & Rubinstein, Samuel & Lilly, Amy & Blumberg, Jeffrey & Chera, Bhishamjit. (2022). Treatment of Localized Amyloid Light Chain Amyloidosis With External Beam Radiation Therapy. Practical Radiation Oncology. 12. 10.1016/j.prro.2022.03.011.



Kaj pa zdravljenje amiloidoze sečnega mehurja z obsevanjem?

EBRT: 12 x 2 Gy = 24 Gy, (cel sečni mehur, po mikciji)

IZID po 4 m: - cistoskopsko popolna remisija,

- odsotnost hematurije
- zmanjšanje simptomov spodnjih sečil
- brez akutnih / poznih posledic.
- bolnik umrl 7 mesecev po RT

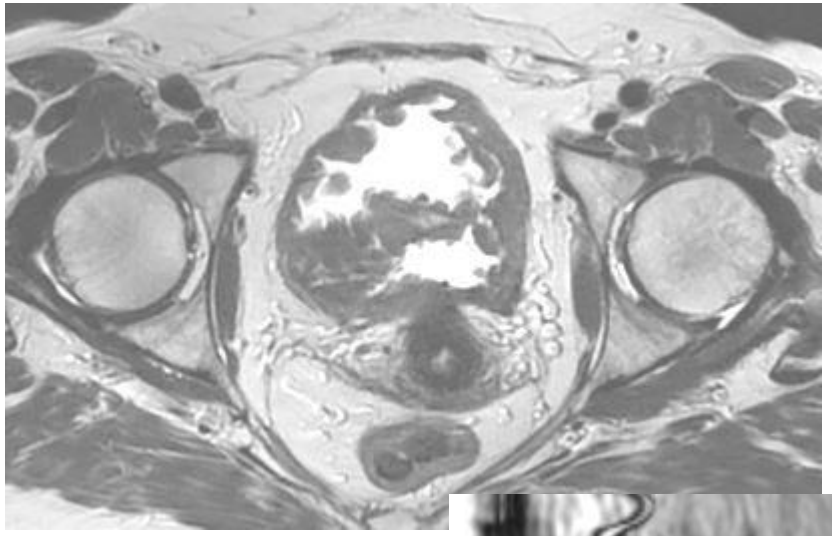
(zaradi pridružene nevrodegenerativne bolezni)

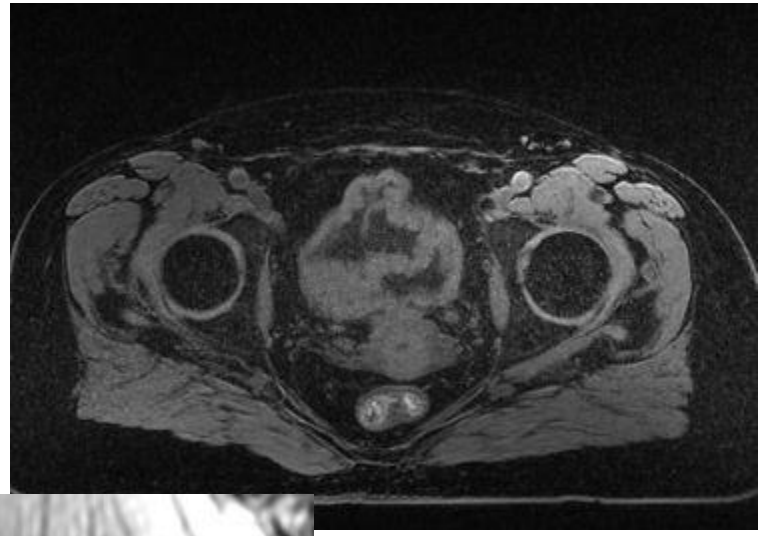
Primarna amiloidoza sečnega mehurja, brez remisije/progres po TURm (spr lateralna stena desno premera cca 5cm): EBRT

EBRT alternativa obstoječemu zdravljenju amiloidoze sečnika?

zlasti kadar ni odgovora na TURm in se odloča o cistektomiji

Cooper CT, Greene BD, Fegan JE, et al. External beam radiation therapy for amyloidosis of the urinary bladder. *Pract Radiat Oncol* 2018; 8: 25–27.

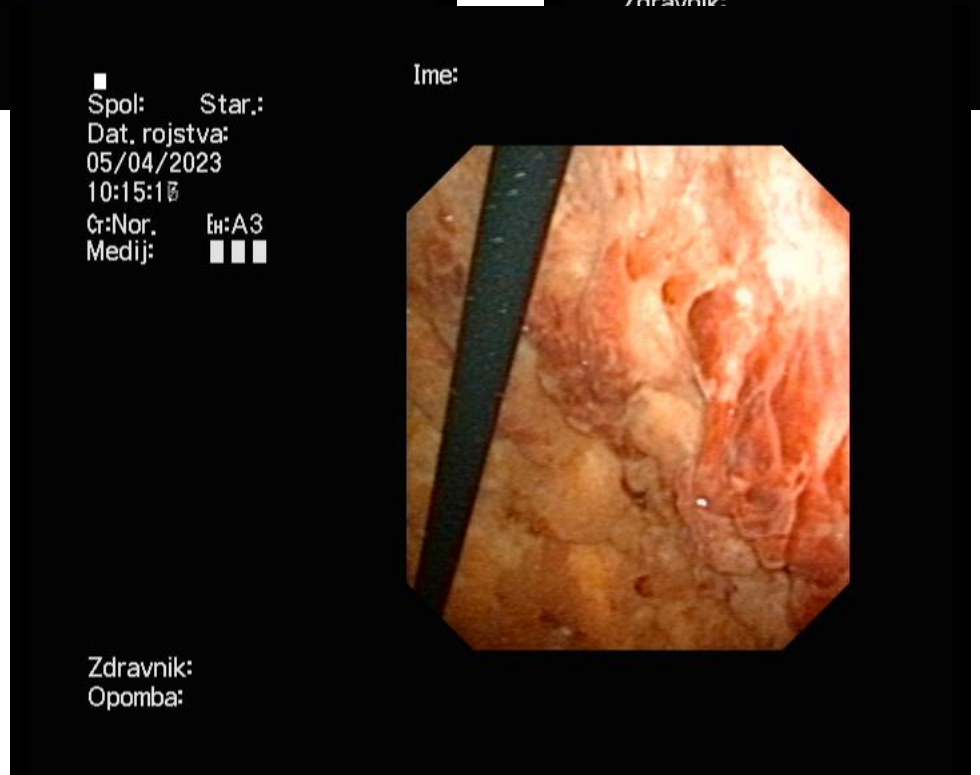


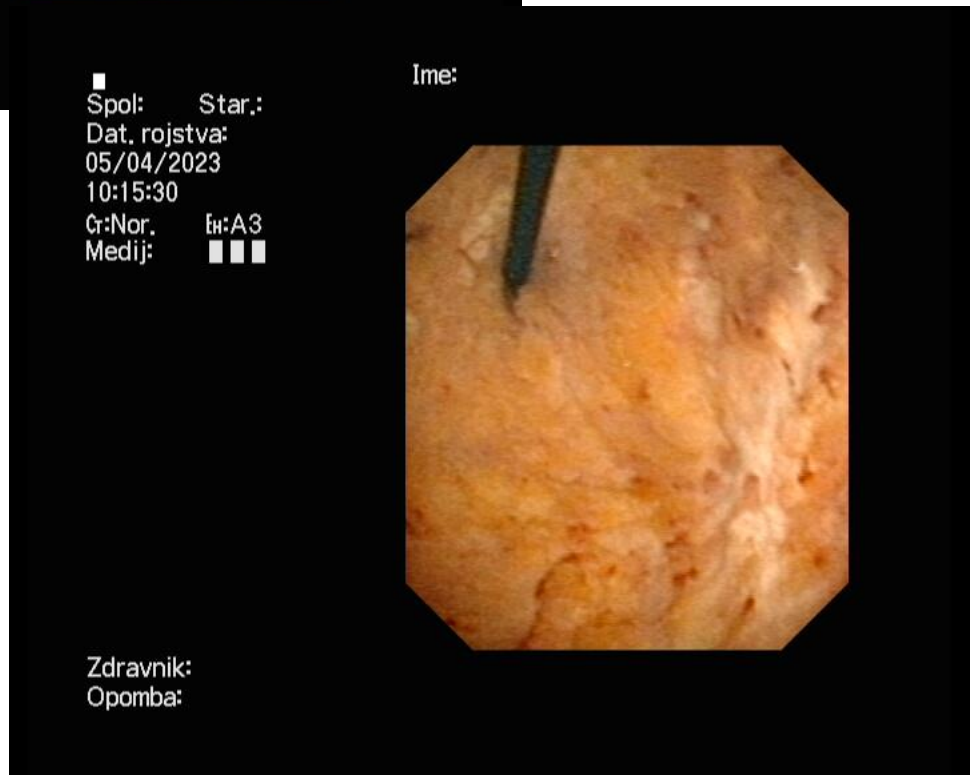


PRED obsevanjem

Vir: arhiv OIL

PRED obsevanjem





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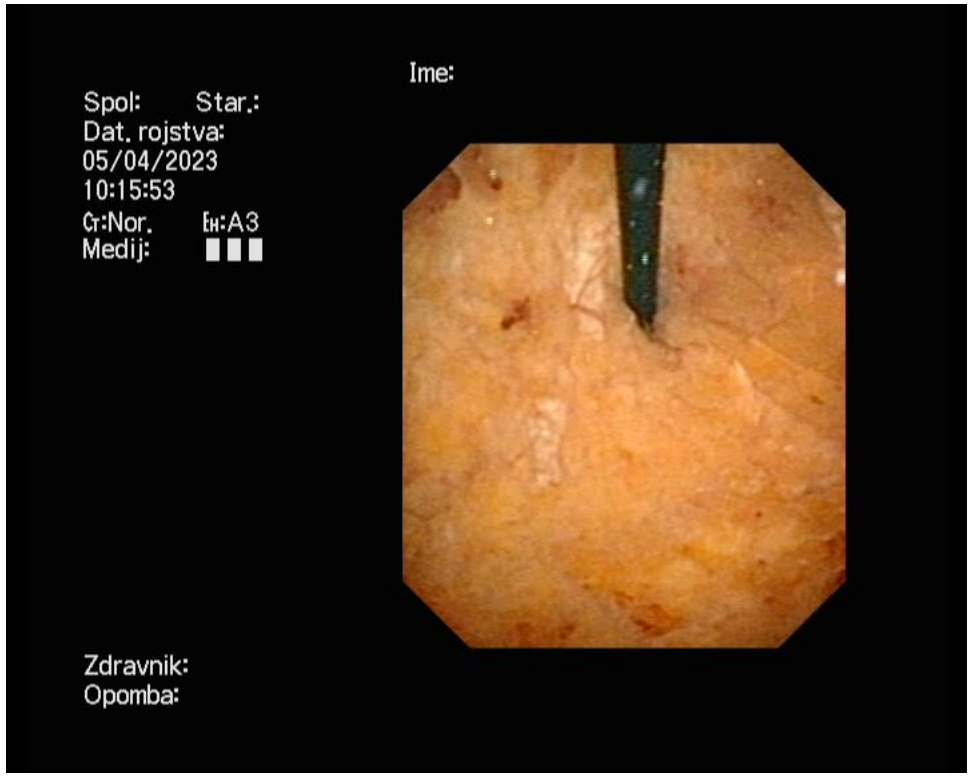

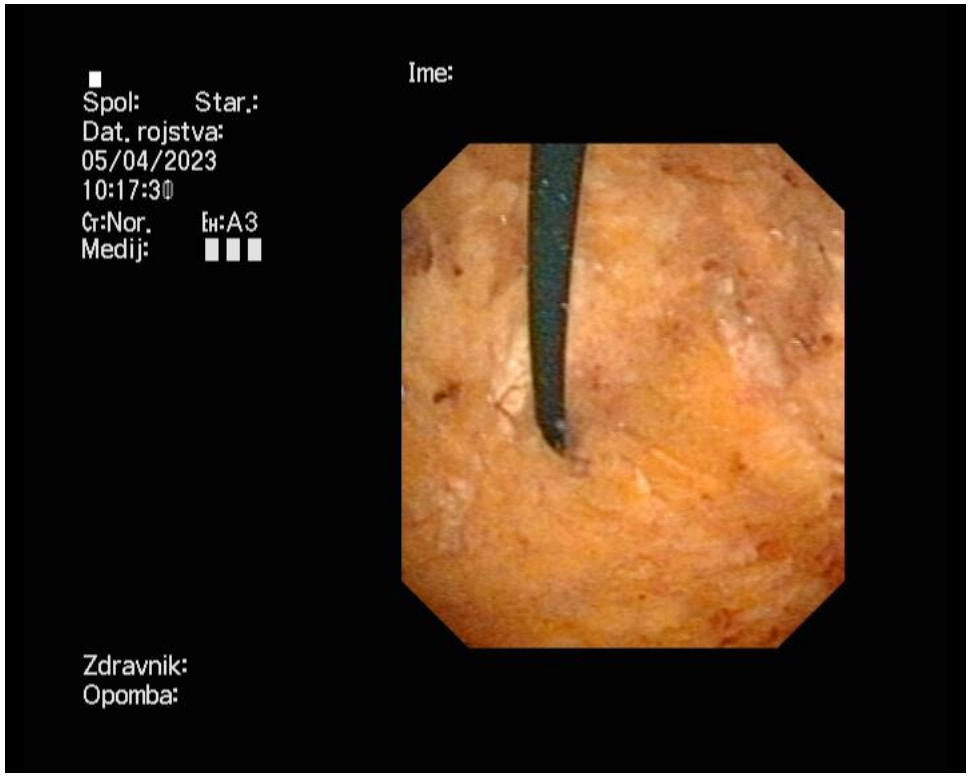

PRED obsevanjem

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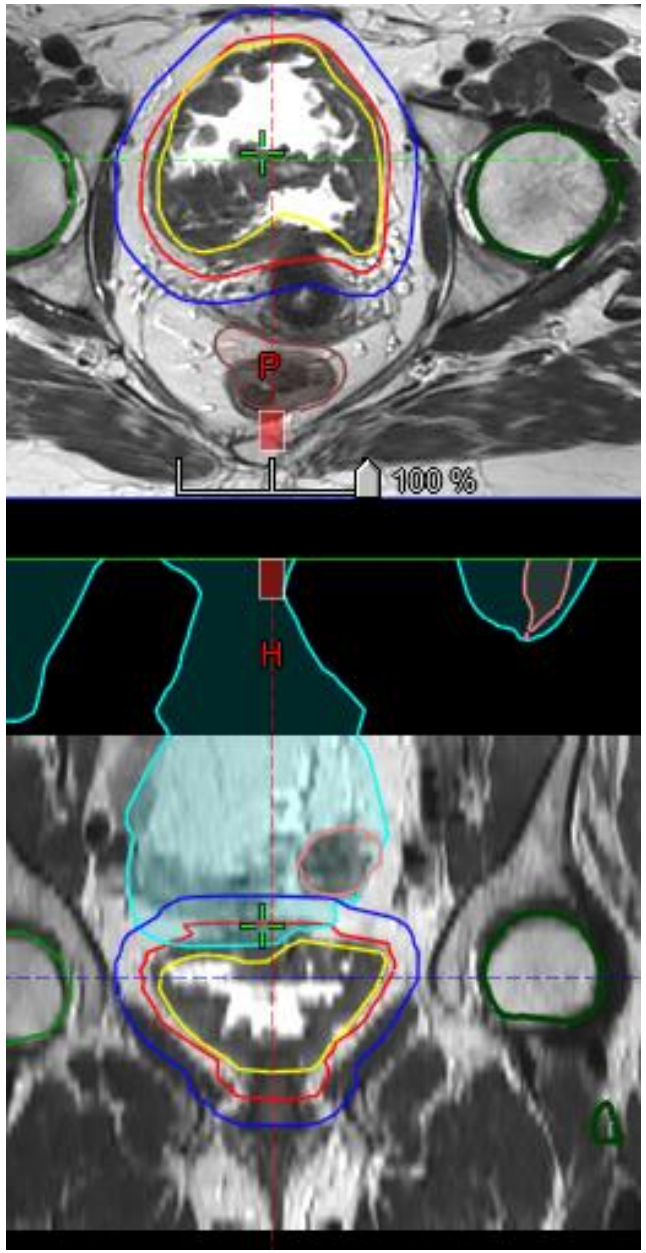

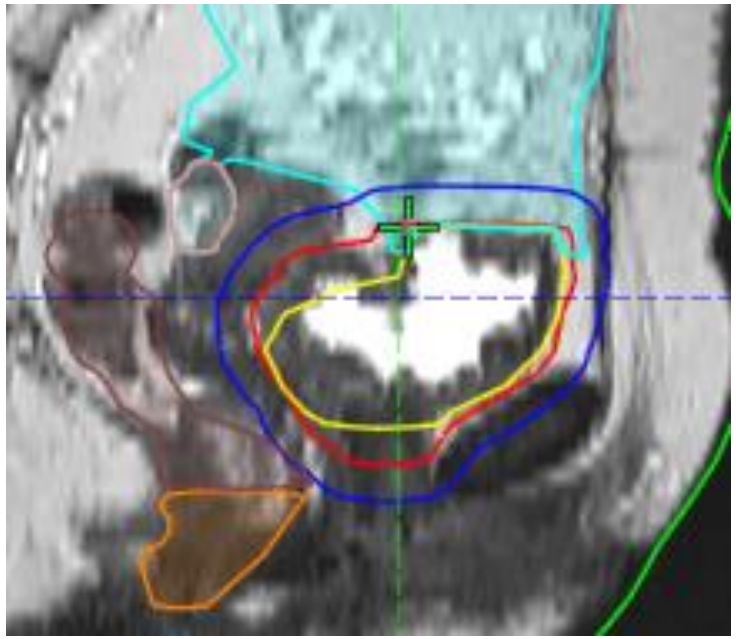

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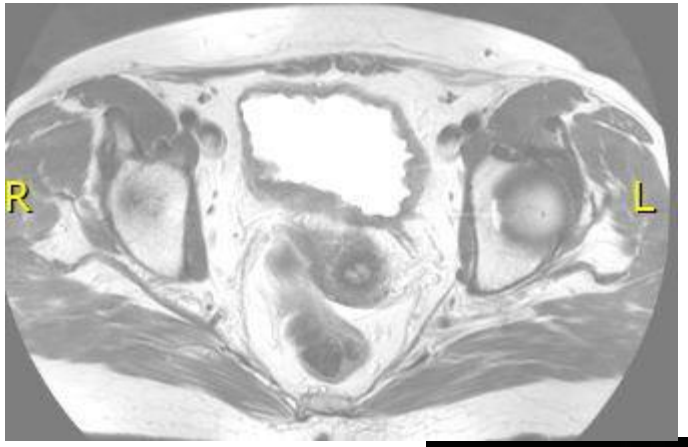
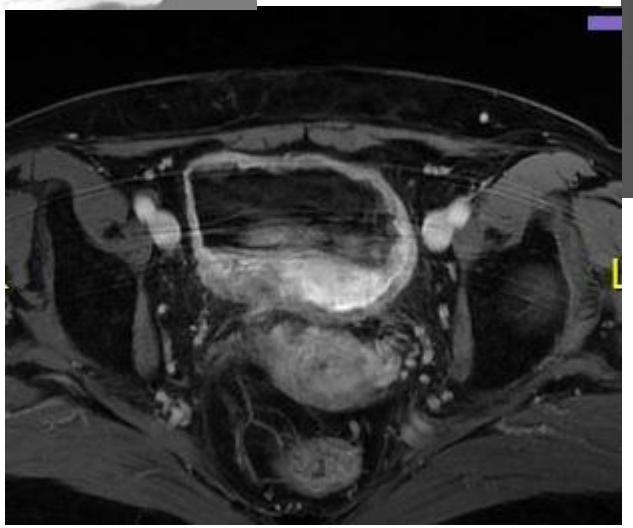




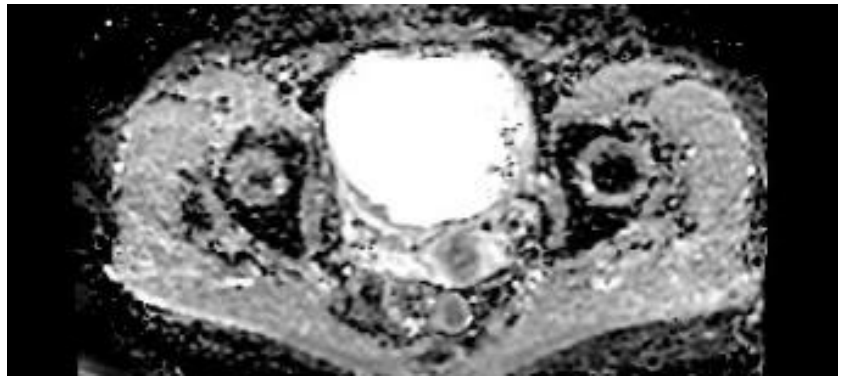
MRI: 4 mesece PO OBSEVANJU:

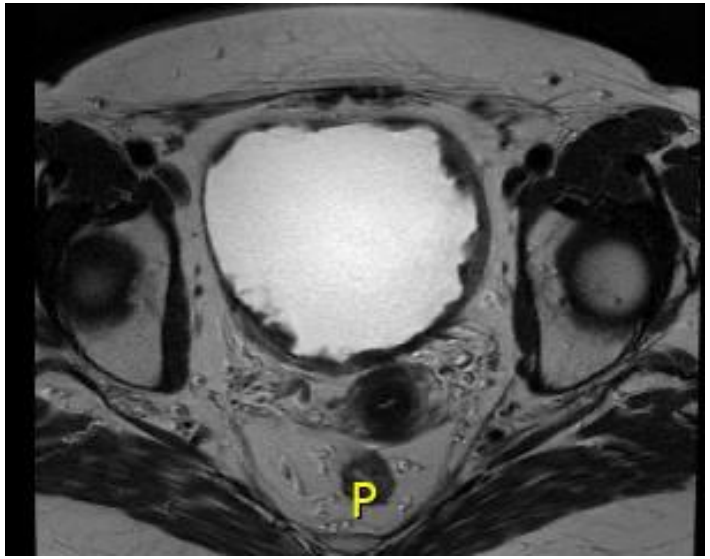
stena sečnega mehurjaje **še vedno difuzno zadebeljena**

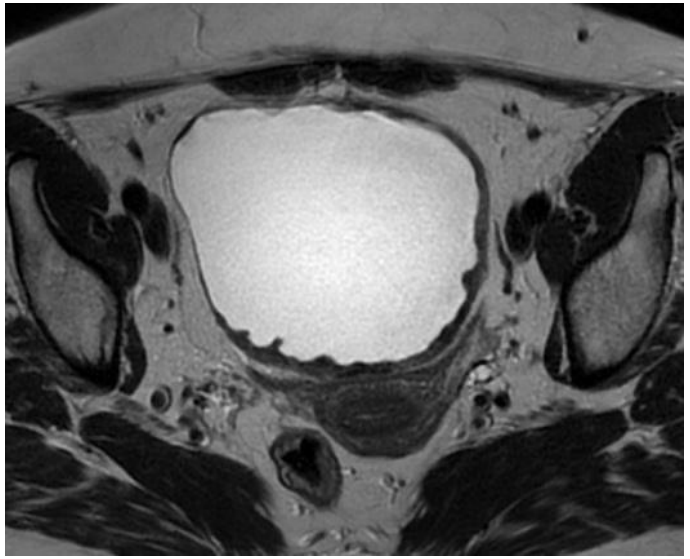
(zadebelitve ni le v kratkem segmentu desno anterosuperiorno),

vendar **manj kot predhodno** (najizraziteje je stena zadebeljena desno lateralno nad ostijem, ki meri v debelino do 18 mm (predhodno v tem delu do 37 mm).

Vir: arhiv OIL







MRI: 7 mesecev po RT
ob različni kapaciteti sečnega mehurja verjetno še **dodaten regres patoloških zadebelitev**

Vir: arhiv OIL

ZAKLJUČEK: amiloidoza & obsevanje

Obsevanje primarne lokalizirane amiloidoze:

- glava&vrat, grlo, traheobronhialno…
- bolniki niso kandidati za kirurško zdr.
- kirurško zdravljenje mutilantno (obsežne spremembe, anatomsko nedostopne)
- recidivne spremembe
- odmerek: 20 – 45 Gy
- malo/nič akutnih & poznih sopojavov

Obsevanje primarne amiloidoze sečnega mehurja: ???

- 1 opisan primer