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SPLOŠNA METODA ZA DOLOČANJE DOZE PRI RADIKALNI RADIOTERAPIJI HODGKINOVE BOLEZNI NA TELEKOBALTU

M. Habič, A. Kmet

Izvleček: Razvili smo dozimetrično metodo, s pomočjo katere moremo določiti dozo v vsaki točki bolnika, ki se obseva na telekobaltu z nepravilno oblikovanimi obsevalnimi polji. Prispevka primarne in sekundarne dozne komponente smo obravnavali ločeno. Uporabili smo model efektivne aktivnosti in določili parameter, ki ocenjuje vrednost primarne dozne komponente za Theratron 80 in Gammatron I. Sekundarna dozna komponenta je določena s pomočjo funkcije »scatter — air ratio«.

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Deskriptorji: Radioterapija, telekobalt, dozimetrija, nepravilno oblikovana polja, Hodgkinova bolezen.

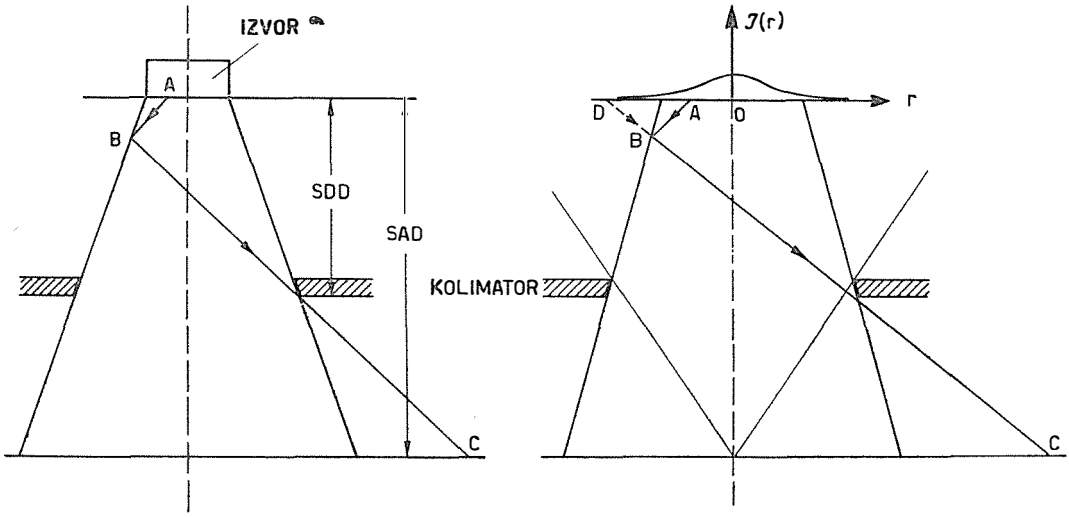
Radiol. Iugosl., 4: 285—291

Uvod. — Določanje doze v pacientih, ki se obsevajo z velikimi, nepravilno oblikovanimi obsevalnimi polji, kot sta npr. »mantle field« ter »inverted Y« pri radioterapiji Hodgkinove bolezni (15), je kompleksen proces. Dozimetrične metode običajno slonijo na aproksimacijah in meritvah na fantomih (4). Vrednost takšnih metod je omejena, saj so vezane na vrsto obsevalnega aparata, na izbiro točk, kjer želimo določiti dozo, ter zavisijo tudi od drugih parametrov, kot npr. od oblike obsevalnega polja (14, 8).

V tem delu nameravamo opisati splošno veljavno dozimetrično metodo, s pomočjo katere bo možno določiti dozo v poljubno izbrani točki vsakega posameznega pacienta, v obsevanem ali zaščitenem področju, z natančnostjo, ki jo zahteva sodobna klinična dozimetrija (8, 2). Metoda je uporabna v vsakodnevni klinični praksi, obenem pa predstavlja nekakšen primerjalni standard za verifikacijo uporabnosti aproksimativnih metod, ki ga ni treba več preverjati z eksperimenti.

Osnovna zamisel v tej metodi je ločitev doze na primarno in sekundarno ali sipano komponento, tako kot je to opisal Clarckson (1). V prvem primeru imamo opraviti v glavnem z visokoenergijskimi žarki gama, ki imajo določeno smer širjenja. Sekundarno dozno komponento pa povzročajo žarki zelo različnih energij in smeri. Zato je smiselno, da ločeno določimo primarni in sekundarni prispevek k dozi ter vrednosti na koncu seštejemo.

Določanje primarne dozne komponente. — Problem določanja primarne dozne komponente smo rešili z modelom efektivne aktivnosti (17, 11, 13, 8). Predstavljajmo si foton, ki izhaja iz točke A v izvoru (sl. 1) in se siplje v točki B v ohišju



Sl. 1: Določanje primarne dozne komponente z modelom efektivne aktivnosti

izvora ali kolimatorju tako, da prispeva k dozi v točki C, ki leži izven območja geometrijske polsence. Sklepamo lahko, da izhaja ta foton iz točke D na neskončni plošči aktivnosti, katere center O je v centru pravega izvora. Porazdelitev aktivnosti po tej plošči seveda ni enakomerna. Največ aktivnosti je v območju pravega izvora, medtem ko aktivnost izven njega naglo pada ter predstavlja izvor sipanih fotonov iz okolice izvora.

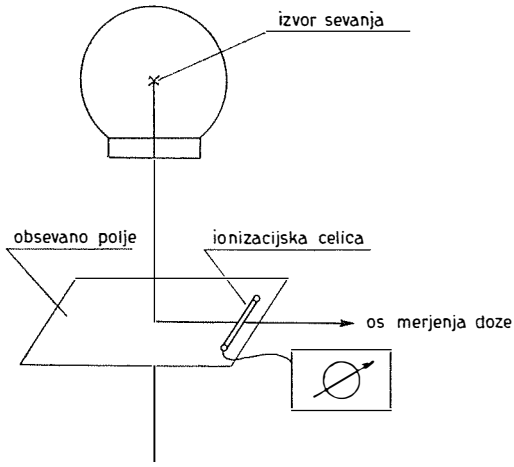
Osnovni problem je, kako najti ustrezen izraz, ki bo opisal efektivno porazdelitev aktivnosti. Zaradi enostavnosti smo za funkcijo efektivne porazdelitve aktivnosti zahtevali rotacijsko simetričnost. Obenem smo predpostavili, da »vidijo« točke na centralni osi ves izvor, kar je razvidno iz sl. 1. Točke izven centralne osi prejmejo dozo, ki je sorazmerna z množino aktivnosti, ki je vidna iz teh točk. Dozo v poljubno izbrani točki računamo z integracijo funkcije efektivne porazdelitve aktivnosti po področju, ki je vidno iz točke, kjer določamo dozo (17).

Za funkcijo efektivne porazdelitve aktivnosti I(r) smo izbrali izraz:

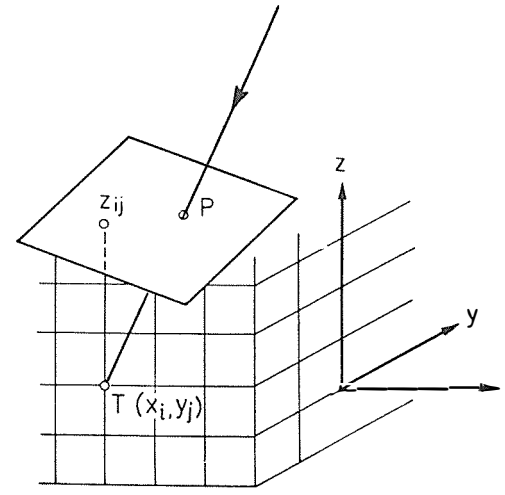
$$I(r) = \frac{\beta}{\pi} e^{-\beta r^2}$$

pri čemer je β parameter, r pa spremenljivka funkcije, kot je razvidno iz sl. 1.

Naslednji problem je določitev parametra β. Ker je ta parameter odvisen od geometrijskih obsevalnih pogojev in od konstrukcijskih lastnosti glave obsevalnega aparata, smo ga določili posredno, z meritvijo primarne dozne komponente v osi merjenja (sl. 2) na Theratronu 80 in Gammatronu I, pri različnih obsevalnih pogojih. Za merilni instrument smo uporabili Carry Vibrating Read Electrometer skupaj z ionizacijsko celico domače izdelave, notranjih dimenzij ∅ 2,7 mm × 12 mm (8, 9). V istih točkah, v katerih smo dozo merili, smo jo tudi računali z modelom efektivne aktivnosti. Pri tem smo za parameter β jemali poljubne vrednosti. Primerjali smo merjene in izračunane podatke o primarni porazdelitvi doze ter z metodo najmanjših kadra-



Sl. 2: Skica meritve pri določanju parametra β



Sl. 3: Določanje točke, kjer žarek vstopa v bolnika, s pomočjo pritisnjenih ravnin

tov določili najustreznejše vrednosti za parameter β.

Z modelom efektivne aktivnosti določimo primarno dozno komponento relativno glede na primarno dozo na centralni osi. Če hočemo določiti absolutno vrednost primarne doze, moramo upoštevati še razdaljo med izvorom in točko kjer dozo določamo, dalje aktivnost izvora, vpliv absorpcije v pacientu na primarno dozno komponento ter faktor, ki določa odvisnost primarne dozne komponente od velikosti zaslonke telekobaltnega aparata (4).

Med drugim moramo poznati tudi vstopne točke žarkov v pacienta. Ravno kompliciranа oblika pacienta pa vnaša v izračun nove probleme. V naši metodi smo pacientovo površino aproksimirali s sistemom pritisnjenih ravnin (8). Vstopno točko žarka v pacienta torej ponazorimo s prebodom žarka s pritisnjeno ravnino, ki je določena za točko Z_{ij} (sl. 3). Ker je pritisnjena ravnina določena tako, da upošteva poleg točke Z_{ij} tudi sosednih osem točk in ker je kot med centralnim žarkom in žarkom skozi točko računanja T (x_i, y_j) majhen, je napaka, ki nastane s takšno aproksimacijo majhna.
hna.

Določanje sekundarne dozne komponente. — Sekundarno dozno komponento računamo s pomočjo funkcije »Scatter-air ratio« (6) ali kot jo krajše označujemo — SAR. SAR je empirična funkcija, ki so jo za telekobalt leta 1966 uvedli Gupta in sodelavci (7), kot:

$$SAR\ (r_d, d) = TAR(r_d, d) - e^{-\mu\,(d-d_o)}$$

pri čemer pomeni:

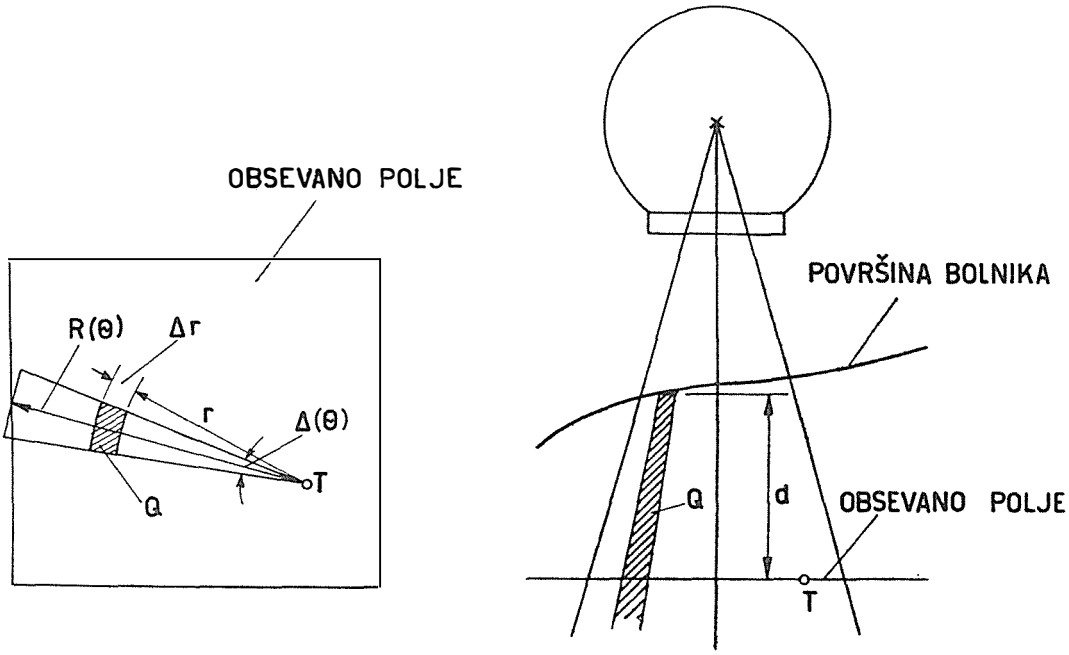
r_d = radij okroglega obsevanega polja v globini d

TAR (r_d, d) = »tissue-air ratio« za radij r_d in globino d (3)

d_o = 0,5 cm

μ = linearni absorbcijski koeficient za ozka polja. Meritve so pokazale, da je $\mu = 0{,}0657\ cm^{-1}$ (7).

Funkcija SAR je empirična in namenjena izključno za računanje sipane dozne komponente. Je neodvisna od razdalje med izvorom in kožo (SSD), kot tudi od konstrukcijskih lastnosti glave obseval-



Sl. 4: Določanje poprečne vrednosti funkcije SAR

nega aparata. Pri določanju sekundarne dozne komponente smo uporabili tabele za funkcijo SAR, ki so jih objavili Gupta et al. (7) ter Habič et al. (12).

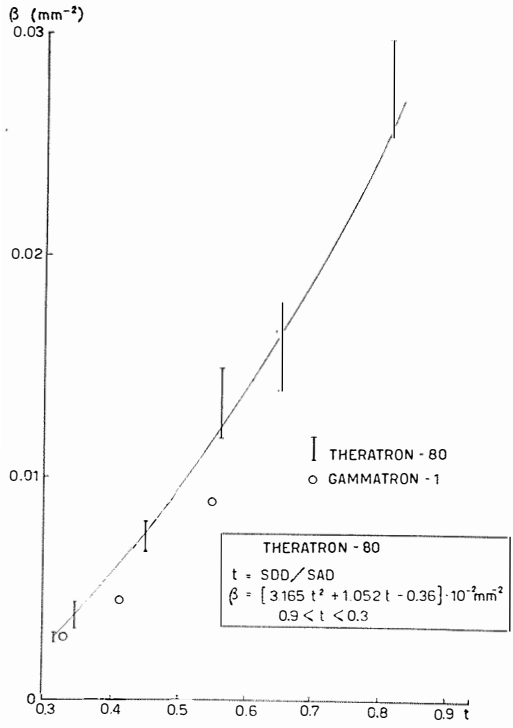
Podrobna analiza (5, 6) pokaže, da potrebujemo pri določanju sekundarne dozne komponente v poljubno izbrani točki poprečno vrednost funkcije SAR, do katere pridemo po postopku, ki je nakazan na sl. 4. Če želimo določiti sekundarno dozno komponento v točki T, moramo najprej ugotoviti, koliko doprinese k sipani dozi v točki T volumski element Q, ki je na sliki šrafiran. Seštejemo prispevke vzdolž radija R in nato z integracijo po sektorjih seštejemo še prispevke posameznih sektorjev. Pri tem pa, podobno kot pri določanju primarne dozne komponente, določimo globino d v posameznem volumskem elementu Q s pomočjo pritisnjenih ravnin, ki ponazarjajo bolnikovo površino.

Rezultati. — 1. Na Theratronu 80 smo za funkcijo I (r) poiskali tiste vrednosti parametra β, pri katerih je razlika med izračunano vrednostjo primarne dozne komponente z modelom efektivne aktivnosti in merjenimi podatki vedno manjša od 5 %. Tako določene vrednosti za parameter β smo narisali na sl. 5 ter z metodo najmanjših kvadratov določili najustreznejšo kvadratno funkcijo, ki podaja funkcijsko zvezo med vrednostmi β ter kvocientom t = SDD/SAD. Ta kvadratna funkcija ima enačbo:

$$\beta = (3{,}165\ t^2 + 1{,}052\ t - 0{,}36)\ .\ 10^{-2}\ mm^{-2},$$

pri čemer je SDD razdalja med izvorom in kolimatorjem obsevalnega aparata, SAD pa je projekcija razdalje med izvorom in točko, kjer dozo določamo, na centralno os.

2. Meritve primarne dozne komponente na Gammatronu I so pokazale, da funk-



Sl. 5: Prikaz odvisnosti parametra β od parametra t. Krivulja ponazarja analitični zapis odvisnosti β od t za Thratron 80

cijska zveza med β ter SDD/SAD, izračunana za Theratron 80, ne da ustreznih rezultatov za Gammatron I, kar kaže na vpliv konstrukcijskih razlik med kolimatorji na primarno dozno komponento.

Zaključki. — Z opisano metodo moremo, kot smo že poudarili, določiti dozo v poljubno izbrani točki v pacientu, ki se obseva na telekobaltu s poljubno oblikovanim poljem. Zanima nas, kolikšna bo napaka.

Pri določanju primarne komponente smo uporabili model efektivne aktivnosti. Navedli smo že, da je maksimalna napaka ± 5 %. Ta napaka pa se pojavlja le na robu polja. Izven roba napaka hitro pada proti 0. V splošnem so torej podatki o dozi na robu za 5 % manj točni od podatkov zunaj tega področja.

Pri določanju sekundarne komponente pa smo uporabili več aproksimacij, katerih vsaka zase je vir napak, in sicer:

1. napaka, ki nastane zaradi tega, ker funkcija SAR ni določena v idelanih okoliščinah;

2. napaka, ki nastane zato, ker je funkcija SAR definirana pri konstantni SSD. Pri bolniku smo upoštevali atenuacijo primarnega žarka zaradi komplicirane geometrije le ob primarni dozni komponenti, ob sekundarni pa ne;

3. pri določanju sekundarne dozne komponente je funkcija SAR določena v vodnem fatomu takšnih dimenzij, da so rezultati enaki tistim, ki bi jih dobili v neskončno velikem fantomu. Ob uporabi »mantle field« tehnike pa moramo upoštevati efekt končnih dimenzij sipalnega medija vsaj v takšnih regijah, kot sta vrat in pazduha.

ad 1. Meritve funkcije SAR so izvedene v divergentnem snopu s končno polsenco. Funkcija je torej določena le aproksimativno. Pri določanju sipane dozne komponete z integracijo po sektorjih bi vsled tega utegnilo priti do napake. Analizirali smo dozne porazdelitve v kvadratnih poljih in jih primerjali z izodoznimi krivuljami, ki jih je objavila I. A. E. A. (16). Potrdimo lahko Cunnighamovo trditev (5), da so podatki za funkcijo SAR dobri, saj so bile razlike med našimi doznimi porazdelitvami in tistimi, ki jih navaja I. A. E. A., vedno manjše od 1 %.

ad 2. Napako smo ocenili numerično in njena vrednost je tudi v najbolj neugodni situaciji manjša od 1 %. Enake rezultate so dobili tudi drugi avtorji (4).

ad 3. Napaka zaradi končnih dimenzij sipalnega medija se po mnenju Združenja ameriških fizikov v medicini giblje od 0 do —2 % (5), kar se ujema z našimi ocenami.

Pri določanju sekundarne dozne komponente je torej skupna napaka v najneugodnejši situaciji ± 3 %.

Pri določanju bolnikove geometrije z metodo pritisnjenih ravnin je napaka

lahko poljubno majhna. Važno je, da smiselno izberemo podatke o obliki pacienta (8), to je, da določimo čim več koordinat na pacientovi površini tam, kjer se ta močno spreminja (npr.: prehod iz vratu v torax).

Nismo se dotaknili problema, ki se pojavi, če v obsevano polje zajamemo del pljuč. Doza je na področju pljuč večja zaradi zmanjšane absorpcije. Naša metoda bi sicer lahko upoštevala, da imajo nekatera področja obsevanega medija različno gostoto. S tem pa bi metoda izgubila svojo klinično veljavo (8), saj bi bilo tehnično povsem nemogoče določiti za vsako presečno ravnino področje pljuč in njihovo gostoto. Postopek bi bil prezamuden in dobljeni rezultati ne bi opravičili truda. Naša metoda bo na področju pljuč dajala prenizke vrednosti. Domnevamo, vendar nismo preverili, da bi bilo rezultate možno korigirati na podoben način kot pri določanju doze v kvadratnih poljih.

Iz tega izhaja, da je v večini primerov doza po opisani metodi določena do 3 % natančno. Na robu polja doseže napaka v najbolj neugodni situaciji 8 %. V področju pljuč, če so v obsevanem polju, je doza izračunana prenizko.

Poleg tega, da je opisana metoda uporabna pri radikalni radioterapiji Hodgkinove bolezni, jo moremo uporabiti tudi pri drugih obsevalnih tehnikah, kjer imamo opraviti z nepravilno oblikovanimi obsevalnimi polji (npr. ca colli uteri — »diamantno polje«). Služi lahko kot rutinska klinično dozimetrična metoda ali pa kot primerjalni standard, in sicer pri uvajanju aproksimativnih dozimetričnih metod, ki ga ni treba več verificirati z meritvami.

Za reševanje zamudnih računskih operacij je bil izdelan računalniški program (10), ki se ga poslužujemo na Onkološkem inštitutu v Ljubljani. Obširnejše informacije v zvezi s tem programom daje prvi avtor tega članka.

Summary

A method for dose determination at any poitn of a patient treated by telecobalt with irregularly shaped fields is developed. The contribution of the primary and secondary dose components are discussed separately. The model of the effective activity was used. We determined the parameter establishing the contribution of the primary dose compoment for Theratron 80 and Gamamtron I. Scatter-air ratio was used for the secondary dose component determination.

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KLINIČNI CENTER LJUBLJANA, INŠTITUT ZA RENTGENOLOGIJO

ODRAZ PATOLOGIJE PANKREASA NA LIENALNI VENI

Stropnik, J.

Izvleček: Avtor analizira prikaz linealne vene na arterijskem splenoportogramu pri skupini 40 bolnikov z operativno (22 primerov) in klinično (18 primerov) dokazanim obolenjem pankreasa. Rezultat analize je naveden v zaključku.

UDK 6166.149.4-073.75:61637(497.1)

Deskriptori: Rentgenska diagnostika, pankreas vena lienalna, splenoportogram (arterijski).

Radiol. Iugosl. 4; 293—298, 1974

Uvod. — Vena lienalis poteka tesno ob repu in korpusu pankreasa. Bolezni pankreasa povzročajo zato večkrat dislokacijo, impresijo in okluzijo vene. Pionirji perkutane splenoportografije (Abeatici in Campi, 1952, Gvozdanović, 1955, Anacker, 1957 in drugi) so to problematiko predstavili že pred leti.

Proučevanje lienalne vene pa je postalo dostopnejše po uvedbi celiakalne arteriografije in arterijske portografije (Ödman, 1958, Boijsen in sod., 1963, Polard in sod., 1964, in drugi). Varnejša arterijska kateterizacijska tehnika in povezanost razpoznavanja pankreatičnih obolenj v arterijski in venozni fazi postavlja danes arterijsko splenoportografijo na prvo mesto, kot najprimernejšo metodo za prikazovanje lienalne vene.

Arterijska splenoportografija nam omogoča prikazovanje in študij sprememb na lienalni veni tudi pri tistih primerih, ko zadene izvajanje perkutane splenoportografije na tehnične težave, npr. majhna, za punkcijo neugodno ležeča vranica, lienalne ciste, lienalna trauma in posttraumatske spremembe, inflamatorna obolenja vranice in podobno.

Material. — Stanje lienalne vene smo analizirali na celiakalnih angiogramih v flebografski fazi pri 40 bolnikih z izrazito pankreatično patologijo, zbranih v dveh skupinah.

Prvo skupino predstavlja 22 bolnikov, pri katerih je bilo obolenje pankreasa verificirano in lokalizirano pri operaciji po naslednjih diagnozah:

1. Pancreatitis (6 primerov)

a) razširjen po vsem pankreasu	3 primeri
b) lokaliziran v repu in korpusu	1 primer
c) lokaliziran v glavi	1 primer
d) lokaliziran v korpusu	1 primer

2. Pseudocystis pancreatis (8 primerov)

a) lokalizirana v glavi in v korpusu	2 primera
b) lokalizirana v korpusu in v repu	2 primera
c) lokalizirana v glavi	1 primer
d) lokalizirana v korpusu	1 primer
e) lokalizirana v repu	2 primer

3. Pancreatitis necroticans (3 primeri)

a) razširjen po vsem pankreasu	2 primera
b) lokaliziran v glavi in v repu	1 primer

4. Malignoma pancreatis (4 primeri)

a) razširjen po vsem pankreasu	1 primer
b) lokaliziran v glavi in v korpusu	1 primer
c) lokaliziran v glavi	2 primera

5. Klinično in angiografsko sum na tumor pancreatis — operativno negativni izvid 1 primer

Skupaj 22 primerov

Druga skupina — 18 bolnikov — so klinično ugotovljeni primeri bolezni pankreasa z naslednjimi diagnozami:

Pancreatitis	11 primerov
Tu ad portam hepatitis	4 primeri
Diabetes — pancreatitis	2 primera
Tu corporis et caudae	1 primer
Skupaj	18 primerov

Rezultati. — Analiza oblike lienalne vene in liena je dala naslednje podatke:

I. skupina: operativno verificirana obolenja pankreasa

Vena lienalis	Lien norm. velik	Lien povečan
normalna	8	
kavdalno dislocirana	2	
okludirana	1	
nehomogeno opacificirana	1	
neprikazana	5	5

Skupaj 17 + 5 = 22 prim.

II. skupina: klinično verificirana obolenja pankreasa

Vena lienalis	Lien norm. velik	Lien povečan
normalna	3	2
kavdalno dislocirana		3
okludirana		2
nehomogeno opacificirana	2	2
neprikazana	1	3

Skupaj 6 + 12 = 18 prim.

Vrednotenje rezultatov. — Diagnostično vrednotenje lienalne vene na arterijskem splenoportogramu pri obolenjih pankreasa se opira na naslednje podatke:

1. Prikaz normalne lienalne vene.

Pri pravilni tehnični izvedbi arterijske splenoportografije se v času 6 do 10 sekund po vbrizganju kontrastnega sredstva dobro prikaže lienalna vena, kadar je normalna.

K normalni sliki splenograma spada tudi zmerna kontrastna opacifikacija gastroepiploične vene in koronarne želodčne vene. Močnejša kontrastna opacifikacija omenjenih ven lahko že predstavlja zgodnji znak patološkega procesa.

Normalna lienalna vena je bila pri prvi skupini bolnikov prikazana v 8 primerih. Pri vseh 8 primerih je bil patološki proces pri operaciji ugotovljen predvsem v glavi pankreasa. Operacija je tako potrdila že dolgo znano rentgensko diagnostično pravilo, da bolezenski procesi, lokalizirani v glavi pankreasa, ne prizadenejo lienalne vene.

2. Neprikazana lienalna vena.

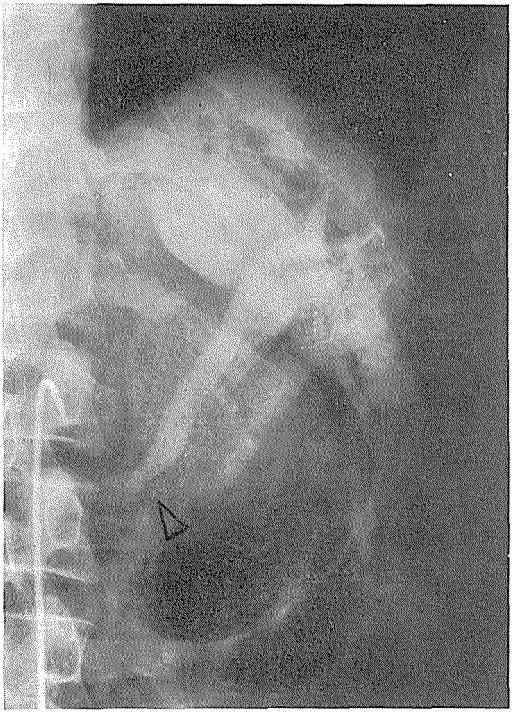
V prvi skupini bolnikov je bilo 10 primerov brez prikaza lienalne vene, lien pa je bil intenzivno kontrastno opacificiran.

Operativne diagnoze so bile naslednje:

Pancreatitis capitis et corporis	1 prim.
Pancreatitis corporis et caudae	4 prim.
Pseudocystis corporis et caudae	2 prim.
Pseudocystis caudae	1 prim.
Ca pancreatis	2 prim.
Skupaj	10 prim.

Pri operaciji je bila ugotovljena tromboza ali kompresija lienalne vene zaradi patološkega procesa v pankreasu. Pogoj za pravilno vrednotenje izostanka opacifikacije lienalne vene kot podatka za dokaz patologije je seveda pravilna tehnična izvedba arterijske splenoportografije, to je

a) uporaba dovoljne količine kontrastnega sredstva in



Sl. 1. Celiakalna arteriografija — venozna faza: Okluzija linealne vene pri pankreatitisu

b) slikovna serija, ki mora zajeti obdobje vsaj 25 sekund po končanem vbrizganju kontrastnega sredstva.

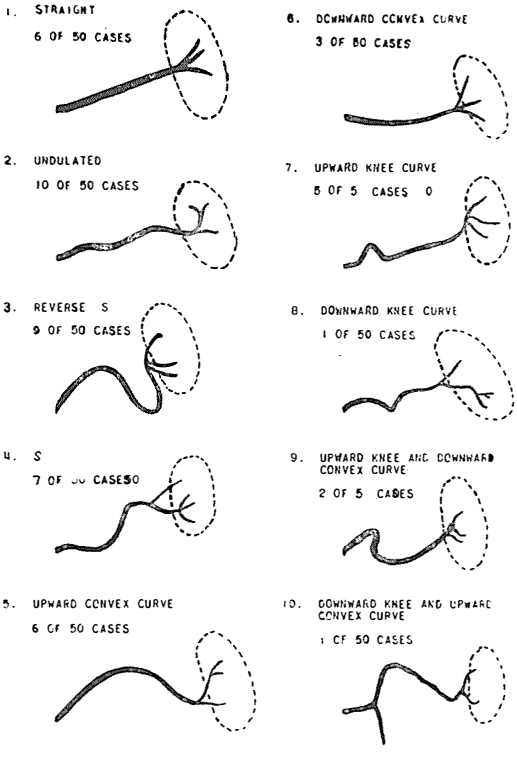
3. Direktni prikaz okluzije lienalne vene.

Intenzivnost kontrastne opacifikacije linealne vene je pri arterijski splenoportografiji običajno dovolj velika, da se prikaže tudi direktno mesto okluzije, kar je dragocen podatek za lokalizacijo patološkega procesa (slika 1).

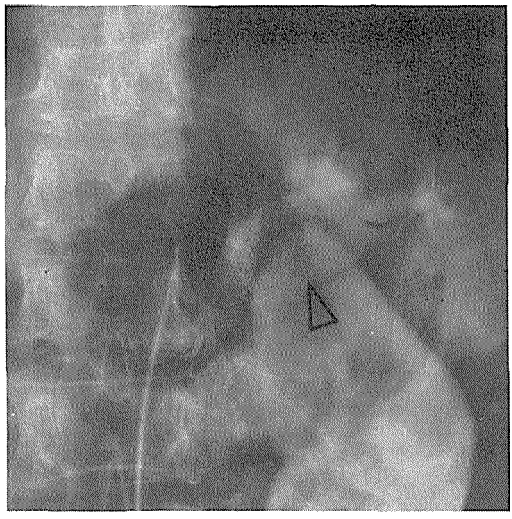
Lokalizacija okluzije je otežkočena pri patoloških spremembah na veni že v lienalnem hilusu in pri močno razvitem kolateralnem obtoku.

4. Dislokacija lienalne vene.

Potek lienalne vene močno variira. Največkrat je dokaj ravna ali le lahno vijugava, včasih pa tudi močno vijugasta. Oblike poteka sta raziskovala Doehner in Ružička s sod. (1955) ter prikazala naslednje oblike kot normo (slika 2). Pri našem materialu v kranialno konveksnem loku ali oglu potekajoča lienalna vena ni v nobenem primeru bila povezana z ekspanzivnim procesom v abdomnu. Kranialno konveksni lok lienalne vene opazujemo često pri poteku lienalne vene tesno ob kranialnem polu leve ledvice, kar se dobro vidi na normalnem abdominalnem aortogramu v venozni fazi (slika 3).

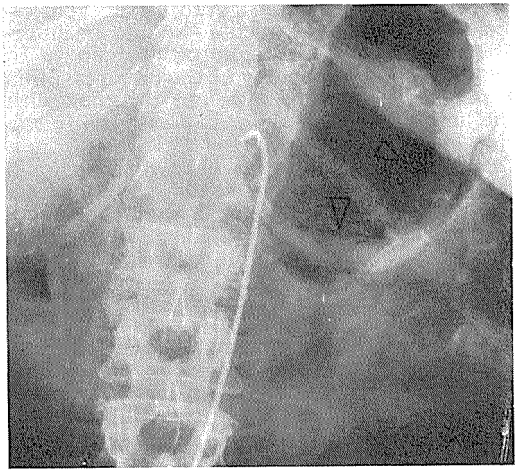


Sl. 2. Variante poteka linealne vene po Doehner-ju (1955)

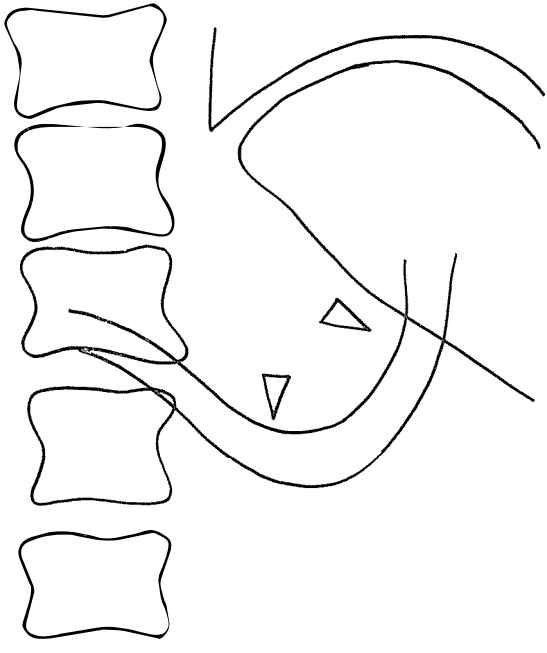


Sl. 3. Abdominalna aortografija — venozna faza: Kranialno konveksni lok v poteku lienalne vene ob normalnem zgornjem polu leve ledvice

Ingemar Bergstrand (1971) trdi, da so normalne variacije poteka lienalne vene tako številne, da po obliki njenega poteka ni mogoče sklepati na ekspanzivni proces v okolici. Na osnovi 2 primerov kavdalne dislokacije v I. operativno verificirani skupini naših bolnikov pa smatram, da je izrazito kavdalno usločenje lienalne vene le možno vrednotiti kot patološko dislokacijo in sicer kot znak ekspanzije v repu pankreasa (slika 4 a, 4 b). Operacija je odkrila obakrat pseudocisto pankreasa, omejeno v prvem primeru



Sl. 4 A. Selektivna lienalna arteriografija — venozna faza: V loku kavdalno dislocirana vena pri op. diagnozi pseudocystis caudae pancreatis



Slika 4 B. Skica flebograma

predvsem na rep, pri drugem pa na rep in korpus pankreasa.

5. Prikaz kolateral.

Kolaterale pri okluziji lienalne vene je možno prikazati tudi z arterijsko splenoportografijo. Običajno so kolaterale bolj slabo naznačene, kadar se kontrastno sredstvo preveč razredči pri močno razvitem kolateralnem obtoku. Pri dovoljni količini kontrastnega sredstva pa se prikaže kolateralni obtok prav nazorno.

Kadar z arterijskim splenoportogramom ne uspe dovolj točno prikazati lienalne vene, daje prikaz arterijske in parenhimske lienalne faze dobro osnovo za kasnejšo perkutano splenoportografijo, ki je na ta način tehnično bistveno olajšana.

6. Tumor lienis in izbira vrst angiografske preiskave za prikaz lienalne vene.

Pri povečanem lienu, ki predstavlja sicer tehnično ugodno situacijo za prikaz lienalne vene s perkutano splenoportografijo, je po današnji koncepciji glede na vrstni red preiskav tudi potrebno izvršiti najprej arterijsko splenoportografijo, ker daje številnejše podatke o vzrokih povečanja liena kakor pa sama perkutana splenoportografija.

Zaključek. — 1. Angiografski prikaz lienalne vene daje pri obolenjih pankreasa pomemben podatek o naravi in lokalizaciji ter obsežnosti procesa.

2. Diagnostična vrednost angiografskega prikaza lienalne vene se bistveno poveča s prikazom lienalnega arteriograma in lienalne parenhimske faze, to je z arterijsko splenoportografijo.

3. Pri dokazani patologiji pankreasa nakazuje normalna lienalna vena lokacijo procesa predvsem v glavi pankreasa.

4. Kaudalno dislokacijo je kljub izredni variabilnosti poteka lienalne vene v določenih primerih možno diagnostično ovrednotiti kot patološki znak za lokalizacijo ekspanzivnega procesa v repu pankreasa.

5. Izostanek opacifikacije lienalne vene pri pravilni tehnični izvedbi preiskave je že zanesljiv bolezenski znak. V odnosu na patologijo pankreasa je to sicer indirektni znak, ki pa lahko v povezavi z analizo lienalnega arteriograma bistveno pripomore k eksaktni diagnozi.

6. Izpopolnjena selektivna lienalna arterijska kateterizacijska in angiografska tehnika lahko v večini primerov nadomesti perkutano splenoportografijo. Perkutana splenoportografija ostaja tako rezervirana le za posebne primere.

Angiografski prikaz lienalne vene dobiva v taki povezavi preiskave vse večji pomen pri diagnostiki obolenj pankreasa.

Summary

An analysis of arterial splenoportograms in a group of 40 patients with diseases of the pancreas is presented. Pathology was proved either operatively (22 cases) or clinically (18 cases). The following concluscions were made:

1. Angiographic analysis of the splenic vein represents an important source of information in the pathology of the pancreas, concerning the nature and the localization of the disease.
2. Its diagnostic value may be enhanced with the visualisation of the splenic artery and of the splenic parenchyma as is achieved by arterial splenoportography.
3. In cases of proved pathology, normal angiographic appearence of the lienal vein indicates the localization of the process predominantly in the head and body of the pancreas.
4. In spite of variability in the course of the splenic vein, its caudal dislocation could be interpreted as a pathological sign, indicating an expansive lesion in the tail of pancreas.
5. Nonopacification of the lieral vein — technical errors excluded — should be interpreted as a reliable sign of pathology. In relation to the pathology of the pancreas, this is per se an indirect sign, but together with the lieral arteriography it can essentially elucidate the diagnosis.
6. Improved techniques of selective splenic arterial catheterisation with simultaneous pharmacoangiography can replace the percutaneous splenoportography in the majority of cases.

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ONKOLOŠKI INSTITUT LJUBLJANA

RENDGENOLOŠKI PRIKAZ DUKTUSA TORACIKUSA

Lukič, F., G. Klanjšček, J. Lavrič

Sažetak: 1. Prikaz duktusa toracikusa pomoću retrogradnog injiciranja kontrasta u sam duktus nalazi se još u eksperimentalnoj fazi i još nije uveden rutinski u kliniku.
2. Indirektan prikaz duktusa toraciklusa ima preoperativno kao i postoperativno vrednost za dokaz da li je operativno lečenje pomoću duktovenozne anastomoze uopšte moguće i posle operativnog zahvata kao dokaz da novo stvorena duktovenozna anastomoza funkcioniše.

UDK 616.424-073.75(497.1)

Deskriptori: Rentgen diagnostika, duktus toracikus, duktografija (direktna.

Radiol. Iugosl., 4; 299—301, 1974

Uvod. — Limfatični sistem igra sve važniju ulogu u klinici i eksperimentu. Proučavaju se njegova dinamika, biologija i morfologija.

Ductus toracikus možemo prikazati pomoću direktne[1] ili indirektne[2] duktografije. Na indirektan ga način prikazujemo izvodjenjem limfografije donjeg ekstremiteta, na direktan način medjutim možemo duktus toracikus prikazati putem kanulacije i retrogradnog injiciranja kontrasta u sam duktus.

Za kliniku je indirektan prikaz duktusa toracikusa važan pre izvodjenja duktovenozne anastomoze na vratu.[3] Pomoću indirektnog prikaza duktusa odredimo i vidimo naime promer duktusa i time saznamo da li je operativno lečenje pomoću dukto-venozne anastomoze uopšte moguće. Kao što je poznato, indikacije za ovu anastomozu jesu refraktorni ascites kod dekompenzirane ciroze jetre sa portalnom hipertenzijom.

Prikaz duktusa toracikusa pomoću kanulacije i retrogradnog injiciranja kontrasta u sam duktus danas nalazi se još u eksperimentalnoj fazi i još nije rutinski uveden u kliniku.

Materijal i metode. — Kod 10 bolesnika izvršili smo rendgenološki prikaz duktusa toracikusa pomoću kanulacije i retrogradnog injiciranja u sam duktus. Uštrcali smo do 5 ml lipiodola UF pomoću Rüttimannove aparature. Indikacija za kanulaciju duktusa bila nam je studija toka limfe i pojava malignih ćelija u duktusu. Svi kanulirani bolesnici imali su maligno karcinomsko obolenje u probavnom traktu. Komplikacija nakon kanulacije duktusa i posle rendgenološkog prikaza istog nismo imali. Direktna duktografija izvedena je po prvi puta u Japanu.[4] Kod nas smo je izveli prvi put u godini 1967. Svi bolesnici su nakon pretrage bili bez ikakvih tegoba. Po završenoj duktografiji osta-

vili smo da se kontrast delomično isprazni kroz kanilu, koja je zatim ligirana za 24 časa a posle toga izvućena je iz duktusa toracikusa.

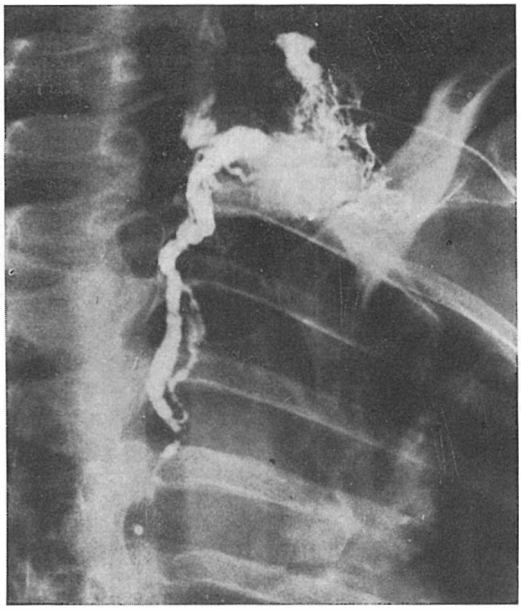
Prikazivanje duktusa toracikusa na indirektan način većinom je uzgredni nalaz kod limfografije donjih ekstremiteta. Za kliniku je indirektan prikaz važan za prikaz duktusa pre izvodjenja dukto-venozne anastomoze na vratu zbog ocene njegovog promera. Izvršili smo šest takvih pretraga. Tehnika limfografije donjih ekstremiteta poznata je, samo da je bilo upotrebljeno nešto više kontrasta Lipiodola UF, čak i do 8 ml na jednu nogu.

Kod obe pretrage posmatrali smo napredovanje kontrasta na TV monitoru i na taj način pratili smo dinamiku kretanja kontrasta i našli pravi trenutak za rendgensko slikanje i radiografsku dokumentaciju.

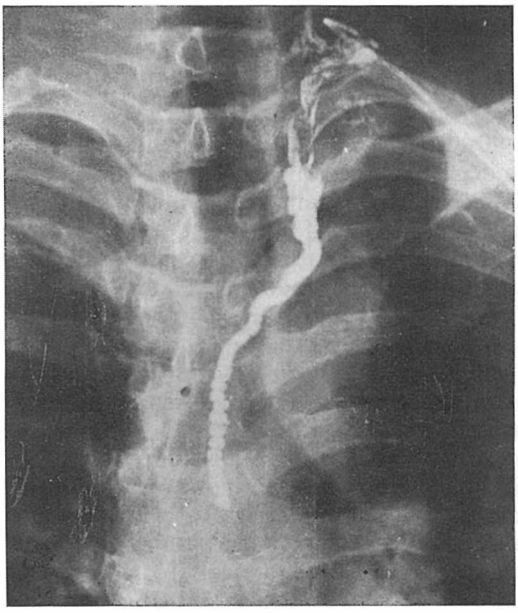
Rezultati. — Metodom direktne duktografije pomoću kanulacije duktusa toracikusa i retrogradnim injiciranjem kontrasta uvek smo dobili jasne slike, pomoću kojih je prikazan duktus do visine 8. torakalnog kralješka. Punjenje do 4,5 ml kontrasta bolesnici su podnosili bez tegoba. Kod daljeg injiciranja i kod veće količine kontrasta medjutim nastupaju retrosternalni bolovi. Promer duktusa iznosi normalno 5 do 8 mm, većinom se dobro vide i zalisci i pojava t. zv. »otočiča«. Većinom takodjer nastupa »back-flow« u limfne žile vrata. Pojava »back-flowa« u limfne žile pluća nije primečena.

Ovom pretragom ustanovljeno je da duktus može svoj kalibar povećati najviše 4 puta, a nikako više. Rupture nisu zapažene ni u jednom slučaju. Opisane promene prikazane su na rendgenskim snimcima. (Slika br. 1 i 2).

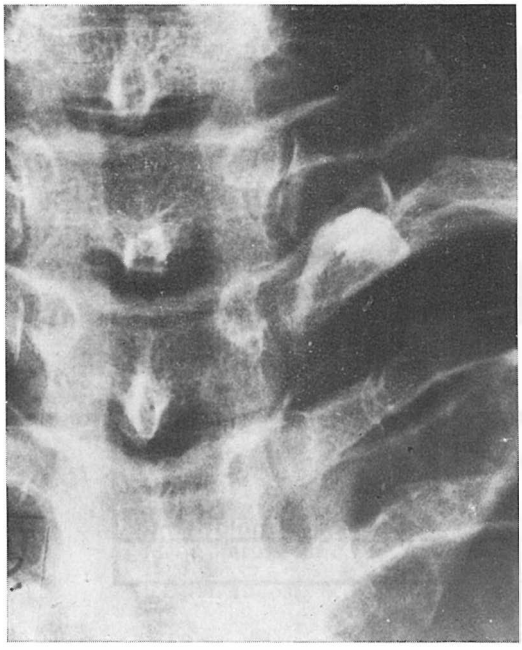
Vrlo su zanimiva dinamička osmatranja punjenja duktusa ispred njegovog ulaza u venozni sistem, kod prikazivanja na indirektan način. Pojedinačne kapi kontrasta sakupljaju se u sve veće otoke kon-



Sl. 1.: retrogradna duktografija i »back-flow« u vratne limfne žile (4 ml Lipiodola UF)



Sl. 2.: retrogradna duktografija (4,5 ml Lipiodola UF)



Sl. 3.: prikaz duktusa toracikusa putem indirektne nožne limfografije kod bolesnika sa dekompenziranom cirozom jetre i ascitesom

trasta sve do promera 8 mm, a zatim se čitava ova količina kontrasta brzo isprazni u venu. (Slika br. 3).

Kao već pomenuto u uvodu ove pretrage izvršili smo kod bolesnika sa dekompenziranom jetrenom cirozom s ascitesom kao preoperativnu pretragu. Izgleda da postoji ispred ulaza duktusa, a naročito kod cirotičara ampularno proširenje samog duktusa, što dosada nismo pronašli u literaturi. Na slici 3 vidimo punjenje duktusa kontrastom u njegovom prevenoznom, ampularnom delu.

Diskusija. — Obadve pretrage jednostavne su i nije ih teško izvesti. Topografske promene položaja i toka duktusa ustanovljene prilikom direktne duktografije, mogu biti od pomoći kod ocene tumora gornjeg medijastinuma. Indikacija za kanulaciju uvek nam je bila studija limfe, a duktografiju izvršili smo kao dodatnu pretragu. I ako se pretraga danas još nalazi u eksperimentalnoj fazi, verovatno će u buduće biti uvedena u klinički rad.

Kod prikazivanja duktusa na indirektan način (limfografije noge) bili su prigovori zbog mogućnosti mikroembolizma pluća od uljanog kontrasta. Ova embolija medjutim prema našem iskustvu na Onkološkom institutu u Ljubljani kod više od 1500 limfografija ne nastupa u ozbiljnom ili opasnom obliku, dakako pod uslovom da su pluća zdrava i da nema kontraindikacija.

Pretraga ima preoperativnu kao i postoperativnu vrednost kao dokaz da novo operativno stvorena dukto-venozna anastomoza funkcioniše.

Summary

1. Retrograde ductography with Lipiodol UF is still an experimental examination.

2. Indirect presentation in the cases of ductovenous anastomosis of the thoracic duct has a preoperative and postoperative value. In the preoperative period the examination demonstrates to the surgeon the diameter of the thoracic duct in the postoperative period however the examination confirms the funotional effectivnes of the new performed ducto-venous anastomosis in the neck region.

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KLINIČNI CENTER LJUBLJANA, INŠTITUT ZA RENTGENOLOGIJO

REDKA ANOMALIJA CEREBRALNEGA OŽILJA

Čerk, M.

Povzetek: Opisan je primer angiografsko diagnosticirane aplazije, oz. agenezije desne arterije karotis interne pri 61 letih starem bolniku.

UDK 616.133.33-007.1(497.1)

Deskriptori: Rentgenska diagnostika, ožilje cerebralno, angiografija, arterija karotis interna, anomalija, primer.

Radiol. Iugosl., 4; 303—305, 1974

Uvod. — Možgani so organ, ki potrebuje za svoje nemoteno delovanje veliko kisika. Preskrbo s kisikom zagotavlja razporeditev možganskega arterialnega ožilja, ki je za primer motenj v tem ožilju med seboj bogato povezano tudi z anastomozami. Med tem, ko so možnosti nadomeščanja možganskih arterij, če le-te izpadajo v kasnejšem življenju, precej pogoste in dobro znane, se v praksi le redkeje srečamo z izpadom možganskih arterij v njihovem zgodnjem razvojnem obdobju. Tako je med drugim lahko moten razvoj arterije karotis interne. Ta žila zavzema pri človeku pomembno mesto pri preskrbovanju možganov z arterijsko krvjo in je možnost kolateralne cirkulacije pri trombozah te arterije tolikšna, da lahko povsem nadomesti ta izpad in bolnik nima nikakih motenj. Isto velja tudi za dokaj redke prirojene izpade arterije karotis interne. Prirojene anomalije arterije karotis interne so:

1. Aplasia oz. agenesia, ki ju v medicinski literaturi opisujejo skupaj. Pri agenezi se arterija embriološko ne razvije in je povsem odsotna, pri aplazijah pa najdemo del te arterije. To stanje se lahko kaže v popolni odsotnosti ene ali obeh arterij karotis intern, ali odsotnost arterije karotis interne in eksterne, lahko pa je arterija karotis interna fibrozen trak z ozko svetlino ali pa brez nje. Opisane so tudi aplazije, ki zavzemajo samo posamezne dele arterije karotis interne, npr. samo njen distalni, oz. samo njen proksimalni del. O tem, ali gre za agenezijo ali pa za aplazijo, nas pouči predvsem operacija ali avtopsija, oz. aortografija, ki nam pri aplaziji pokaže krn iztopišča.

2. Hipoplazije arterije karotis interne so pogostnejše. Navadno je ozka arterija v celotnem poteku in konča z arterijo oftalmiko, oz. arterijo cerebri anterior.

Vse te razvojne anomalije arterije karotis interne so opisane pri odraslih, ki so

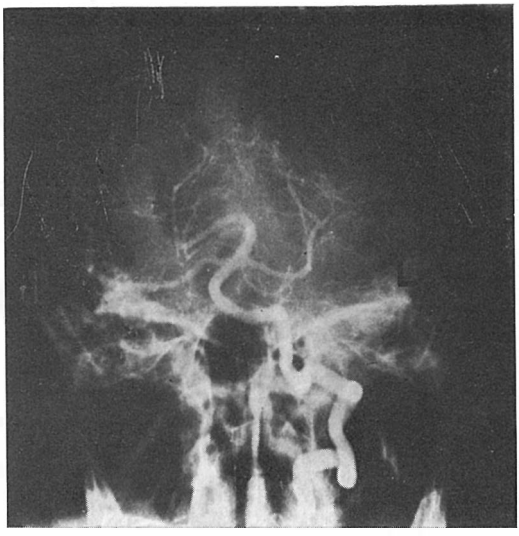
živeli brez vsakih znakov insuficience cirkulacije v ožilju, ki ga oskrbuje arterija karotis interna. To je dokaz, da so tudi v razvojni dobi cerebralnega ožilja možnosti za uspešno nadomeščanje arterij, ki se razvijejo nepopolno, ali pa se sploh ne razvijejo. Pri izpadu arterije karotis interne ločimo po Lie-ju dve vrsti kolateralne cirkulacije skozi Willisijev obroč:

1. Arterija cerebri anterior na prizadeti strani se polni skozi arterijo communicans anterior iz normalno razvite arterije karotis interne z nasprotne strani, arterija cerebri medija pa se polni iz arterije bazilaris skozi arterijo communicans posterior. Taka kolateralna cirkulacija se razvije v zgodnji embrionalni dobi, to je tako imenovani »foetalni tip« kolateralne cirkulacije.

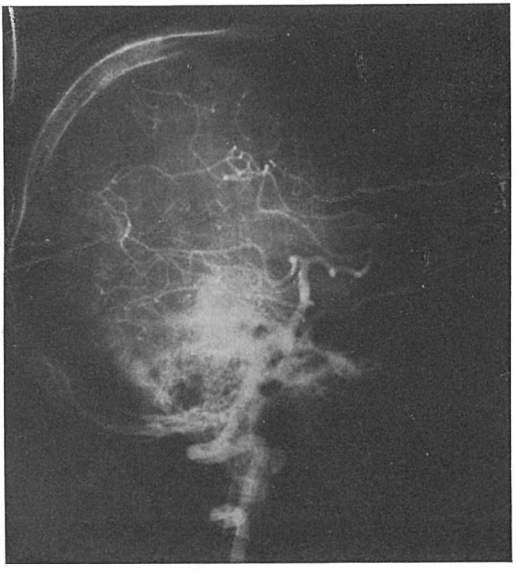
2. Druga oblika kolateralne cirkulacije pa je taka, kot jo običajno srečamo pri trambozah arterije karotis interne. Arterija cerebri anterior in medija na prizadeti strani se polnita iz zdrave strani skozi arterijo communicans anterior. To je tako imenovana »zrela oblika« kolateralne cirkulacije, ki se je morala razviti potem, ko je bil cirkulus Willisii že formiran, to je ko je embrio dolg 24 mm.

Prvi je opisal aplazijo arterije karotis interne Tode leta 1787. Peugnet je leta 1876 opisal primer, pri katerem je bila odsotna desna arterija karotis interna, obe arteriji cerebri anterior je oskrbovala leva arterija karotis interna, desna arterija cerebri medija pa je dobivala kri iz bazilarne arterije skozi arterijo communicans posterior. Verbiest pa je leta 1954 prvi prikazal to anomalijo z angiografijo. Do leta 1966 pa je bilo opisanih vsega šest angiografsko obdelanih primerov te vrste. Pri nekaterih opisanih primerih je odsotnost arterije karotis interne združena še z drugimi žilnimi anomalijami, kot so npr. sakularne aneurizme.

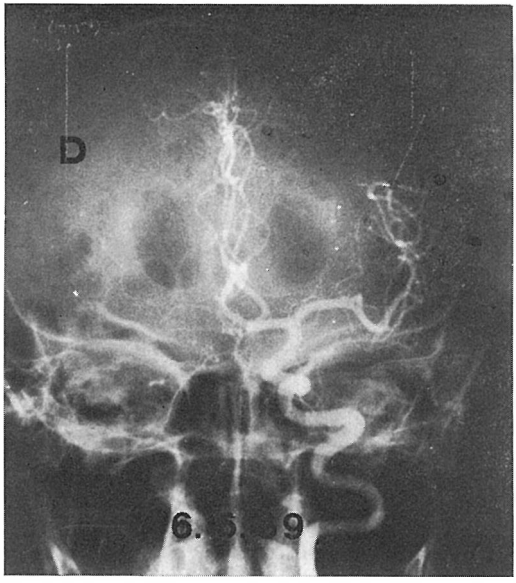
Opis primera. — K. A., 61 let star, ki razen 10 let trajajočih astmatičnih težav ni bil nikoli bolan, je bil sprejet na kli-



Sl. 1.: Levostranska vertebralis angiografija v AP projekciji. Leva arterija cerebri posterior se odcepi od arterije bazilaris znatno nižje kot normalno, distalni del arterije bazilaris pa se cepi v desno arterijo cerebri posterior in v močno navspred potekajočo arterijo, katere proksimalni del najbrže ustreza arteriji communicans posterior in se nadaljuje v desno arterijo cerebri medijo.



Sl. 2.: Levostranska vertebralis angiografija v stranski projekciji



Sl. 3.: Levostranska karotis angiografija v AP projekciji. Pri angiografiji leve arterije karotis sta se polnili normalna arterija cerebri medija in arterija cerebri anterior na levi strani, razen tega pa še skozi arterijo communicans anterior desna arterija perikaloza.

niko zaradi glavobolov, ki jih je imel občasno zadnje dve leti. Štirinajst dni pred sprejemom je postal omotičen, glavoboli so se stopnjevali, bruhal je, pri hoji ga je zanašalo na levo, postal je zmeden. Pri nevrološki preiskavi je bil ugotovljen psihoorganski sindrom, disdiadohokineza desnice, širokotirna hoja in padanje navzad pri Rombergu. Po dvanajstih dnevih hospitalizacije se je stanje močno poslabšalo in je bil na zahtevo svojcev odpuščen, predno so bile izvršene vse potrebne preiskave. Ker pri PEG nismo uspeli prikazati IV. ventrikla in je bila stisnjena cisterna pontis, pri sicer normalni PEG, smo napravili levostransko vertebralis angiografijo.

Na vratu nismo tipali niti pulza desne arterije karotis, niti kakšne rezistence podobne trombozirani arteriji, zato smo napravili levostransko karotis angiografijo.

Zaključek. — Razvoj tako imenovane »foetalne oblike« kolateralne cirkulacije nam daje misliti, da gre pri našem bolniku za aplazijo, odnosno za agenezijo desne arterije karotis interne, čeprav nismo te uspeli direktno dokazati z aortografijo, ali z operativnim posegom, oz. z avtopsijo, odnosno s prikazom kostnega kanala arterije karotis, je »foetalni tip« kolateralne cirkulacije po našem mnenju zadosten dokaz.

Summary

A case of angiographic verified aplasia respectively agensia of the right carotid artery in a 61 year old patient is descriebed.

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Naslov avtorja: Dr. Martin Čerk, Klinični center Ljubljana, Inštitut za rentgenologijo.

INŠTITUT ZA RENTGENOLOGIJU KLINIČKE BOLNICE GRADA BEOGRADA

ANGIOGRAFSKA ISPITIVANJA I KATETERIZACIJE SRCA SA STANOVIŠTA PROFESIONALNE RADIOLOŠKE ZAŠTITE I RIZIKA. — NEPOGODNOST SISTEMA ANGIOGRAFSKOG UREDJAJA SA ZRAČNIKOM IZNAD BOLESNIKA

Ojdanić, Z.

Sadržaj: U ovom se radu poredjuju vrednosti doza na kritičnim tačkama otkrivenih delova tela personala prilikom angiografskih pregleda vršenih pri istim uslovima merenja i rada na angiografskim uredjajima sa zračnikom iznad i sa zračnikom ispod bolesnika. Rezultati pokazuju da postoje velike razlike izmerenih vrednosti. Ove razlike se zasnivaju na fizičkogeometrijskim svojstvima i suprotnostima zračnih sfera u kojima se obavljaju pregledi. Primljene doze kod uredjaja sa zračnikom ispod bolesnika su na otkrivenim delovima tela osobja vrlo nizke, konstantne za vrstu pregleda i srazmerne sa dužinom vremena TV-radioskopije. Kod sistema gde je zračnik angiografskog uredjaja postavljen iznad bolesnika, primljene doze na istim tačkama merenja su na granicama MDD ili ih prelaze. Zbog toga avtori preporučuju poduzimanje mera koje bi sprečile moguća profesijonalna oštećenja pri angiografskim pregledima sa nepogodnim uredjajima u 10 ustanova SR Srbije.

UDK 616.12-089.819.1:614.876(497.1)

Deskriptori: Rentgen diagnostika, angiografija, kateterizacija srca, zaštita od zračenja, profesionalna izloženost.

Radiol. Iugosl., 4; 307—313, 1974

Uvod. — Danas je razvoj radiobiologije dostigao takav stupanj, da je suština oštećenja izazvanih dejstvom jonizujućeg zračenja, uspešno protumačena promenama na makromolekulama jedra ćelije (4, 3), čime je zaštita dobila egzaktan teorijski osnov. U početku, povezanost radiobioloških saznanja sa praktičnim merama zaštite karakteriše empirija, a kasnije saznanja koja se temelje na istraživanjima u okviru morfoloških i kvantitativnih promena u korelaciji sa količinom i vrstom absorbovane zračne energije (15). Sama suština morfoloških oštećenja i poremećaji funkcija ćelije i organizma u celini, ostaju dugo nerasvetljeni i njih obradjuju mnogobrojne hipoteze sa relativno zadovoljavajućim uspehom (8, 11, 15). Sa sadašnjih stanovišta, radiobiološka oštećenja u širem smislu reči, svode se na oštećenje makromolekula nukleinskih kiselina sa daljim posledicama na složene i povezane fizičko-hemijske sisteme i krajnjim odrazom na život, deljenje, nasledje, metabolizam i funkcije ćelije (3, 4). U prelomnom periodu, oko 1960. godine, empiriju, radiobiološku morfologiju i hipoteze, nadgradjuju i dopunjuju egzaktno proučene i potvrdjene činjenice o suštini mehanizma oštećenja (4, 3). Oštećen makromolekul nukleinske kiseline predstavlja početnu tačku odakle se zakonitim i složenim mehanizmima oštećenje prenosi na dalje hemijsko-fizičke strukture ćelije (3, 4).

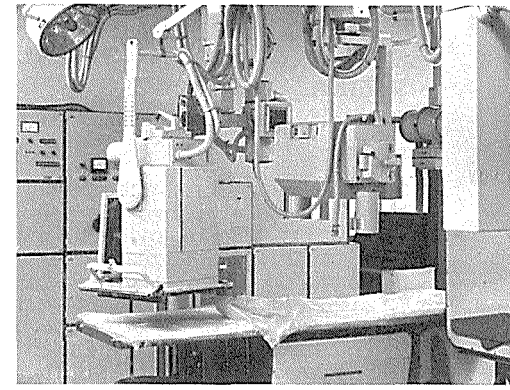
Po završetku II. svetskog rata, nove tehnološke tekovine otvorile su perspektive širokih razmera i na polju rendgenoloških ispitivanja i obogatile dijagnostiku mnogobrojnim novim metodama. Kateterizacije srca, angiografska ispitivanja i mogućnost intervencije u toku kateterizacije, postale su rutinska praksa u mnogim centrima. U metodologiju i tehniku

rendgenoloških ispitivanja uneti su mnogi novi elementi vezani za neizbežno veću izloženost osoblja i bolesnika dejstvu x-zračenja (6), koje je i danas, u strukturi ukupnog dodatnog zračenja na čoveka — širokom primenom konvencionalnih i uvodjenjem novih metoda — zastupljeno sa preko 80 % (1, 2, 11). I dok su dostignuća radiobiologije i srodnih disciplina razsvetlile suštinu mehanizama radiobioloških oštećenja, a zaštita u mnogim zemljama ostvarila vidne rezultate i ozračivanje ljudi smanjila ispod dopuštenog, u nas se, u nekim oblastima odražava nesklad teorijskog znanja i prakse. Susretanje sa novim problemima radiološke zaštite osoblja koje radi sa modernim angiografskim uredjajima ukazuje, da zaštita u ovoj oblasti nije dosledno sprovedena. U poslednjih nekoliko godina na području SR Srbije, u 10 ustanova osnovni elementi modernih angiografskih uredjaja povezani su u sisteme, koji su sa stanovišta profesionalne zaštite krajnje nepogodni.

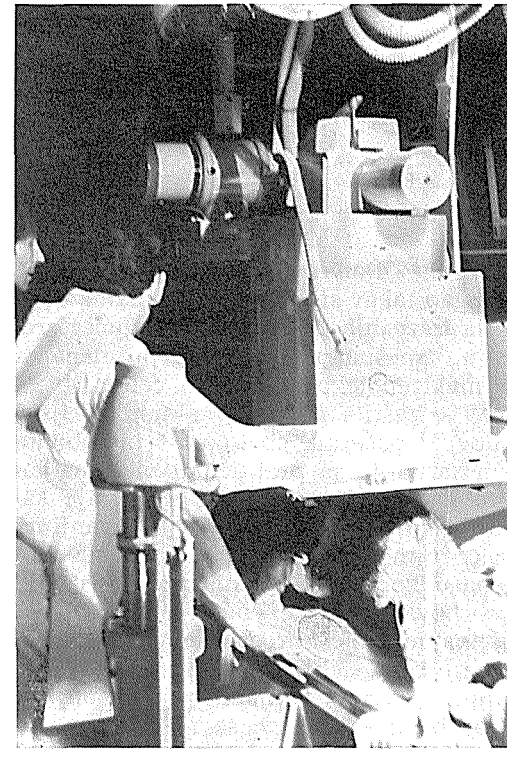
Merenjem i uporedjivanjem primljenih doza na kritičnim tačkama otkrivenih delova tela rendgenologa i asistenta pri izvodjenju različitih selektivnih angiografija i kateterizacija srca, tražen je kriterijum sa stanovišta zaštite, za ocenu pogodnosti angiografskih uredjaja koji mogu da se postave u sisteme sa zračnikom ispod, ili sa zračnikom iznad bolesnika. Cilj rada je da prema opšte usvojenim normama ukaže na nepogonost sistema sa zračnikom iznad bolesnika, kao i na potrebu preuzimanja mera za otklanjanje nedostataka.

Metod i materijal. — Merenja su vršena u dve serije, tj. na sistemu kada je uredjaj postavljen tako da se zračnik nalazi ispod bolesnika, i obratno, kada je zračnik postavljen iznad bolesnika.

Merenja se odnose na doze koje primaju rendgenolog-operator i asistent, kao i na dužinu vremena TV — radioskopije potrebnog za uvodjenje vodiča i katetera



Slika 1: Moderni Simensov angiografski uredjaj sa zračnikom postavljenim ispod stola. Elema-Schönander AOT-sistem u dve ravni



Slika 2: Isti uredjaj pri jednoj eksperimentalnoj kateterizaciji srca psa. Slike iz Rendgenološkog odeljenja Instituta za kliničku i eksperimentalnu hirurgiju Akademije nauka ČSSR — Prag, Krč

Seldinger-ovom tehnikom, sondiranje odredjenog ušća krvnog suda ili srčane šupljine, provere položaja vrha katetera, zamene katetera, centriranja itd.

Primljene doze merene su integralnim penkalo-dozimetrima Ei-Niš, koji su istovremeno stavljeni horizontalno na čelo i na gornju ivicu grudne kosti rendgenologa i asistenta.

Prva serija merenja vršena je na Rtg — odeljenju Centralne armijske bolnice u Pragu 1969. i 1970. godine na uredjaju sa zračnikom ispod bolesnika (Sl. 1 i sl. 2) i obuhvata ukupno 62 angiografska pregleda i katerizacionih postupaka sa 103 merenja doza. U ovoj seriji bilo je moguće merenje primljenih doza penkalo-dozimetrom i na volarnoj strani desnog ručnog zgloba zbog male brzine doze u sferi iznad bolesnika.

U drugoj seriji primljene doze izmerene su u 23 angiografska pregleda. Ukupno je izvršeno 79 merenja doza. Ova merenja su vršena 1971. i 1972. godine na angiografskom Rtg-uredjaju sa zračnikom iznad bolesnika u Institutu za rendgenologiju K. B. G. Beograda. Zbog velike brzine doze u sferi iznad bolesnika, u ovoj seriji nisu bila moguća merenja doza na volarnoj strani ručnog zgloba.

U obe serije, angiografske preglede i kateterizaciona ispitivanja, kao i merenja doza vršio je autor istim postupkom i u tab. I. dao prikaz izmerenih vrednosti. Vreme TV-radioskopije prikazano je uporedo sa vrednostima izmerenih doza i dato je u granicama najčešće izmerenih vrednosti. Pregledi sa ekstremno dugim i kratkim vremenima TV-radioskopije, i pri tom izmerene doze, nisu uzeti u obzir i nisu uneti u tabelu. Njihov broj je mali i izmerene vrednosti nemaju značaj za globalno razmatranje problema.

Fizički uslovi prosvetljavanja u oba sistema regulišu se automatski i kreću se u granicama od 80—110 KV i od 2—3,5 mA. Za vreme serijskog snimanja osoblje je van sfera zračenja.

Rezultati i diskusija. — Mada merenjem nije obuhvaćena šira topografska izloženost otkrivenih delova tela, vrednosti primljenih doza na najkritičnijim tačkama (čelo i gornja ivica grudne kosti) ipak pokazuju karakteristično ponašanje u obe serije merenja, što omogućuje da se prosudi pogodnost ili nedostatak jednog, odn. drugog sistema postavljanja angiografskih uredjaja sa stanovišta profesionalne radiološke zaštite i rizika.

Kod sistema u kome je zračnik postavljen ispod bolesnika, izmerene doze su veoma niskih vrednosti i upravo su srazmerne sa dužinom vremena TV-radioskopije. Dužina vremena TV-radioskopije kod ovakvog sistema ima ulogu presudnog činioca koji uslovljava veličinu primljene doze. Upravo srazmerni odnosi vreme — doza uslovljeni su fizičkim i geometrijskim svojstvima u sferi rasutnog i sekundarnog zračenja iznad bolesnika, gde slab intenzitet ima izvesnu homogenost i pravilno opada sa daljinom. Na tačkama merenja doze su minimalnih vrednosti i prema vrsti pregleda kreću se na čelu od 0 do 8 mr., na gornjoj ivici grudne kosti od 0 do 10 mr. i na ručnom zglobu do 30 mr. U sferi zračenja iznad bolesnika, položaj i odnos pojedinih delova tela rendgenologa nemaju značajni uticaj na veličine primljenih doza. To posebno ilustruje mala vrednost izmerene doze na ručnom zglobu rendgenologa, koji se nalazi najbliže središtu zračne sfere, i koja, i prilikom najdužih ispitivanja — kao što je to kateriziranje desnog srca — ne prelazi vrednosti od 30 mr.

Velike razlike pokazuju rezultati dobijeni merenjem doza na sistemu angiografskog uredjaja sa zračnikom iznad bolesnika. One se ogledaju u sledećem:

1. Vrednosti su višestruko veće od onih koje su izmerene u prvoj seriji na istim tačkama za iste vrste pregleda. Na čelu rendgenologa za selektivnu angiografiju bubrega iznose 25 do 60 mr. i veće su 8 do 20 puta, na gornjoj ivici grudne kosti

TABELA I

PREGLED MERENJA DUŽINE TV-RADIOSKOPIJE (u min) I IZMERENIH DOZA (u mr) NA OTKRIVENIM DELOVIMA TELA RENDGENOLOGA I ASISTENTA KOD RAZLIČITIH ANGIOGRAFSKIH PREGLEDA I KATETERIZACIJA DESNOG SRCA

VRSTA - NAZIV PREGLEDA	VREME TV RADIOSKOPIJE (u min)	RTG - UREDJAJ SA ZRAČNIKOM ISPOD BOLESNIKA				RTG - UREDJAJ SA ZRAČNIKOM IZNAD BOLESNIKA				
		BROJ PREGLEDA	RENDGENOLOG			BROJ PREGLEDA	RENDGENOLOG		ASISTENT	
			ČELO	GORNJA IVICA STERNUMA	RUČNI ZGLOB		ČELO	GORNJA IVICA STERNUMA	ČELO	GORNJA IVICA STERNUMA
SELEKTIVNA ANGIOGRAFIJA BUBREGA	3,5 - 5	6	< 3	< 3	5	5	25 - 60	70 - 140	5 - 35	10 - 40
SELEKTIVNA FLEBOGRAFIJA BUBREGA	4 - 6	3	< 3	< 3	5	2	30 i 55	75 i 160	10 i 20	15 i 45
CELIJAKOGRAFIJA	5 - 7	15	< 5	< 5	5 - 8	3	30 - 70	90 -> 200	15 - 45	30 - 80
SELEKTIVNA ANGIOGRAFIJA A. MESENT. SUP.	5 - 7	15	< 5	< 5	5 - 8	3	30 - 75	85 -> 200	15 - 35	40 - 75
SELEKTIVNE ARTERIOGRAFIJE LUMBALNIH ARTER. (DVA STABLA)	8 - 10	2	< 5	< 5	7 i 9	2	30 i 70	120 i > 200	15 i 45	45 i 110
CAVOGRAFIJA (V. CAVA I NF.)	2,5-3	2	0	0	< 5	3	15 - 50	50 - 90	10 - 15	15 - 25
AORTOGRAFIJA (LUK AORTE)	3 - 4	8	< 3	< 3	3 - 5	1	30	75	15	30
AORTOGRAFIJA (TRBUSNA AORTA)	2 - 2,5	6	0	0	3 - 5	4	10 - 45	50 - 75	> 10	20 - 30
KATETERIZACIJA DESNOG SRCA (OKSIMETRIJA I PRITISCI)	16 - 23	5	5 - 8	5 - 10	20 - 30	–	–	–	–	–
SVEGA PREGLEDA I MERENJA		62	103			23	41		38	

iznose od 70 do 140 mr. i veće su 23 do 46 puta. Pri izvodjenju abdominalne aortografije Seldinger-ovom tehnikom, rendgenolog primi na ovom uredjaju u visini oka od 10 do 45 mr., dok je doza na ovoj tački nemerljiva na angiografskom uredjaju sa zračnikom ispod bolesnika. Isto važi i za gornju ivicu grudne kosti, gde primljena doza dostiže vrednost i do 75 mr. izmerene doze na čelu i gornjoj ivici grudne kosti asistenta sa prosečno za 70 % niže kod istih vrsta pregleda.

2. U ovoj seriji postoje varijacije vrednosti u širokim granicama za iste vrste pregleda, premda vreme TV-radioskopije ne pokazuje razlike koje bi odgovarale vrednostima izmerenih doza. Očigledno je da ne postoji upravo srazmeran odnos izmedju dužine vremena i vrednosti doza, već da vlada potpuna nepravilnost tih odnosa. Visoke vrednosti i nejednakost izmerenih doza nastaju čestim promenama položaja delova tela rendgenologa i asistenta u toku rada prema primarno zračnom snopu, jačim intenzitetom sekundarnog i rasutnog zračenja, i većim obimom zračne sfere. U njenom središtu dejstvuje konus primarnog zračnog snopa, oštro ograničenih od ostalog dela zračne sfere. Skup svih pokreta u toku pregleda i fizičko-geomertrijska svojstva zračne sfere kod uredjaja sa zračnikom iznad bolesnika predstavljaju presudne činioce koji formiraju visoke vrednosti doza. Prvi od njih je sasvim subjektivne prirode i u uslovima raznovrsnih i složenih angiografskih pregleda njegova kontrola i regulisanje na optimalni nivo nije izvodljiva. I pri obazrivom radu dogadjaju se nekontrolisani »upadi« i približavanja delova tela primarnom snopu, što dovodi do ekstremnih skokova primljenih doza. Ovo sa pravom nameće pitanje da li je takav profesionalni rizik dopušten. Za procenu rizika u obzir treba uzeti i broj pregleda koje pojedinac izvrši u jednoj godini, kao i računicu ekonomske eksploatacije ovih skupin uredjaja (13). Ako se rešenje traži u smanjenju broja pregleda zbog visokih vrednosti primljenih godišnjih doza, i ako se računa sa vrednostima koje je autor izmerio, onda su dovoljne samo dve selektivne angiografije nedeljno, pa da rendgenolog za godinu dana prosečno primi na čelo 5 r. i gornju ivicu sternuma 10 r. Iz tih razloga angiografski Rtg-uredjaj sa zračnikom postavljenim iznad bolesnika pokazuje se nepogodnim.

Primedbi da integralni penkalo-dozimeter nije precizan instrument i da rezultati merenja nisu pouzdani, može se uputiti prigovor da se ovim radom u prvom redu ukazuje na motorne činjenice i ekscese koji dovode do znatnog ozračivanja osoblja, kada se uporede rezultati merenja pod istim uslovima na dva različita sistema angiografskih uredjaja. Za iste vrste pregleda razlike su očigledne i kada se računa sa 50 % odstupanja od izmerenih vrednosti doza; u drugoj seriji merenja (zračnik iznad bolesnika) njihove vrednosti su visoke — na granici dopuštenih ili je prelaze. Suprotno, u prvoj seriji doze su vrlo niskih i konstantnih vrednosti. U ovoj razlici odražavaju se fizička i geometrijska svojstva zračnih sfera dva različita sistema postavljanja angiografskih uredjaja, od kojih je jedan pogodan, a drugi krajnje nepogodan sa stanovišta profesionalne radiološke zaštite.

Zaključak. — Poredjenje vrednosti doza na kritičnim tačkama otkrivenih delova tela rendenogloga i asistenta prilikom različitih angiografskih pregleda koji su vršeni pri istim uslovima merenja i rada na sistemima angiografskih uredjaja sa zračnikom iznad i sa zračnikom ispod bolesnika, ukazuju na velike razlike izmerenih vrednosti.

Ove razlike se zasnivaju na fizičko-geometrijskim svojstvima i suprotnostima zračnih sfera u kojima se obavljaju pregledi.

Zračnu sferu angiografskog rtg-uredjaja sa zračnikom ispod bolesnika karakteriše slab intenzitet i relativna homogenost sekundarnog i rasutnog x-zračenja. Primljene doze na otkrivenim delovima tela osoblja su niskih vrednosti (daleko ispod granica MDD), gotovo su konstantne za vrstu pregleda, i upravo su srazmerne sa dužinom vremena TV-radioskopije. Najizloženiji delovi tela (ručni zglob) i pri najdužim pregledima, kao što je kateterizacija desnog srca, ne prime više od 30 mr. Sa stanovišta profesionalne radiološke zaštite, postavljanje zračnika ispod bolesnika je sasvim pogodan i bezbedan sistem za rad.

Kod sistema gde je zračnik angiografskog uredjaja postavljen iznad bolesnika, zračna sfera ima veći intenzitet, nehomogenost i širinu, i u njenom središtu deluje konus primarnog snopa. Primljene doze na istim tačkama merenja su na granicama MDD ili ih prelaze (2, 12, 14). Kod istih vrsta pregleda postoje velike razlike. Dužina vremena TV-radioskopije ne predstavlja bitan i jedini činilac srazmeran primljenoj dozi; veći značaj imaju nekontrolisani, subjektivni činioci u toku rada, koji se ne mogu izbeći i ispraviti. Kod ovog sistema merenja doza na šakama penkalo dozimetrom nisu moguća zbog velike brzine doze, a izmerene vrednosti na čelu su i do 25 puta veće, a na gornjoj ivici grudne kosti do 50 puta veće od vrednosti izmerenih na uredjaju sa zračnikom ispod bolesnika. Iz ovih razloga rad sa angiografskim rtg-uredjajem, u kome je zračnik postavljen iznad bolesnika je krajnje nepogodan i rizičan.

Ne postoje tehnički i ekonomski razlozi koji bi opravdali postavljanje zračnika iznad bolesnika (13).

Intervencijom svih institucija radiološke zaštite treba preduzeti mere koje bi sprečile moguća profesionalna oštećenja pri angiografskim pregledima i kateterizacijama srca sa nepogodnim uredjajima u 10 ustanova SR Srbije. Zbog ozbiljnosti problema ukazuje se potreba svestranijeg razmatranja sa posebnom dozimetrijskom metodologijom, koju treba da razrade službe radiološke zaštite. Postojeće angiografske rtg-uredjaje sa zračnikom iznad bolesnika treba rekonstruisati i ne dozvoliti postavljanje novonabavljenih u nepogodan sistem.

Summary

The doses of radiation were determined in professional personel during catheterisation and angiographic procedures. The results were compared in two types of angiographic equipments: A. with the tube under the catheretisation table, B, with an overhead tube.

Significant differences were found: in systems with a tube under the catheterisation table, the doses were relatively low, constant in specific procedures and proportional to the duration of fluoroscopy.

In the systems with an overhead tube, on the other hand, the radiation measured at the same points, was at limits of permissible doses or above.

The adequate measures are proposed to prevent radiation injuries in professional personel, since there are 10 angiographic equipments with an overhead tube installed in SR Serbia.

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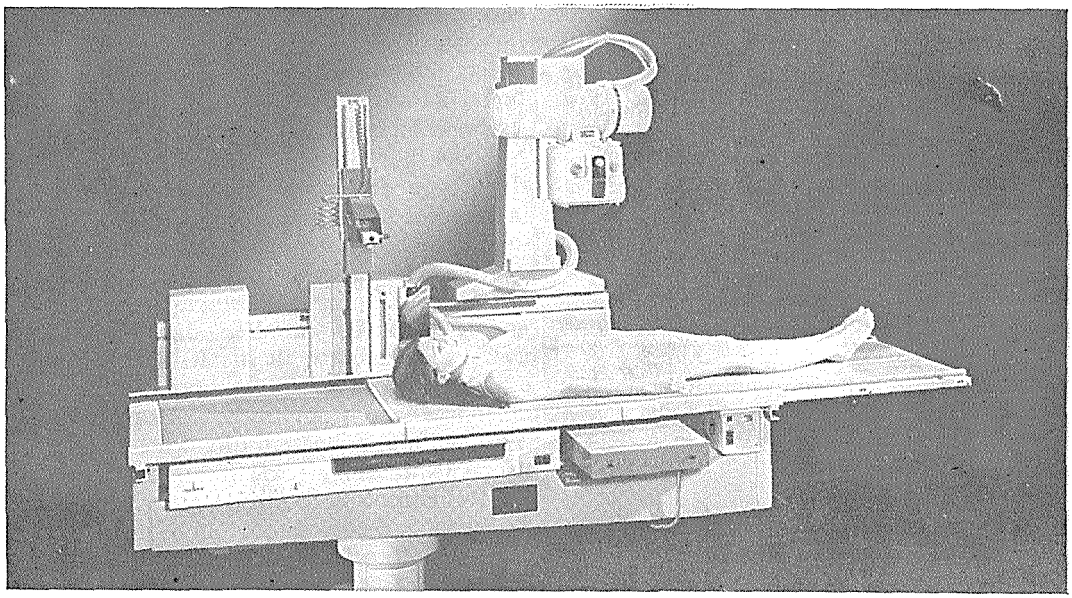

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RADIOLOGICAL SIGNIFICANCE OF THE THYROID GLAND CALCIFICATIONS

Us J., M. Auersperg, R. Golouh

Abstract: In order to differentiate benign from malignant lesions of the thyroid gland, neck soft tissue roentgenography was performed in 45 patients. In 25 patients calcifications in neck soft tissues were found. Out of 25 cases, 16 were correctly interpreted as benign and 5 as malignant whereas two false positive and two false negative interpretations were made. In the group of 20 patients without roentgenologically demonstrable calcifications, 16 had histologically benign lesions, 2 had papillary and 2 follicular carcinoma of the thyroid gland. Since in 21 out of 25 cases the calcifications were correctly interpreted the use of the described method seems to be justified. In view of the 8 incorrectly interpreted cases the method, however, should be employed only in combination with other diagnostic procedures.

UDK 616.44-003.84-073.75(497.1)

Deskriptori: Rentgenska diagnostika, ščitnica, kalcinacije, diagnostični pomen.

Radiol. Iugosl., 4; 315—318, 1974

Introduction. — Cancer of the thyroid gland is relatively rare accounting for no more than 0.1 to 0.7 percent of all malignomas. It is more frequent in women than in men. Its highest incidence is between age 40 and 70 but it can be observed also in childhood 1,7).

The relatively favorable prognosis and the successful treatment of early cases call for an accurate diagnostic evaluation of each single case.

X-ray method. — Among the various roentgenological diagnostic procedures for the assessment of thyroid pathology there is besides the technically more demanding methods (angiography, pneumothyreography, etc.), also the simpler neck soft tissue roentgenography, the diagnostic value of which is comparable to that of the former ones (2). The advantage of the neck soft tissue roentgenography is in that no special equipment is required. The method is simple and similar to soft tissue roentgenography used for joints, the larynx, the breast, etc. (3).

In goiter calcifications are frequently encountered. From the shape of these calcifications the nature of thyroid gland changes can be determined (3, 4, 5).

In benign lesions calcifications develop at a slow rate. Their contours are sharply delineated, their shape is regular or irregular (conchiform, oblong, spherical, poligonal) their diameter is from a few millimeters to several centimeters. On roentgenograms their shadow is dense and sharply outlined (Fig. 1).

In malignomas the calcifications develop at a fast rate, are small, amorphous, their contours are blurred, their shape is irregular, their density is weak and they are poorly visible on roentgenograms (Fig. 2).

The malignant and benign type of calcifications occur often concomitantly.

Fig. 1. Benign calcifications in the neck soft tissue

In neck soft tissue roentgenography different techniques are utilized. Some workers use cassettes (4) others again fine grained films without intensifying screens, i. e. films as used in mammography (5).

Methods and materials. — From September 1972 to November 1973 a modified neck soft tissue roentgenography was used for patients with various thyroid gland diseases with aim to differentiate malignant from benign lesions.

The postero-anterior and lateral views were taken. The cassettes with fine grained intensifying screens and commercial films were used. A group of 62 patients, 44 females and 18 males were examined. Calcifications were detected in 32 patients whereas in the remaining 30 patients none could be demonstrated. In the following only those 45 patients will be discussed who had been operated and whose roentgenological findings were correlated with definite histology.

Results. — In 25 of these patients calcifications were revealed by neck soft tissue roetngenography. The calcifications were classified as benign or malignant and correlated with the histological findings (Table 1).

In 20 patients in whom our method failed to reveal calcifications, histological examination showed benign lesions in 16 and carcinoma in 4 casse.

In 45 patients who had undergone surgery, histological examination revealed malignomas in 11, roentgenological examination only in 5 cases. In 6 patients with malignoma the diagnosis was false negative whereas in 4 cases of malignoma no calcifications were revealed.

Calcifications were most frequently detected in benign lesions of the thyroid gland. Sixteen of them were correctly interpreted. In two cases only, the roentgenological diagnosis of the lesions was false positive.

Fig. 2. Malignat calcifications in the neck soft tissue

Table 1

No of cases	Age	Sex	Roentgenological findings	Histological findings
1	59	M	Benign	Anaplastic carcinoma
1	68	M	Malignant	Follicular carcinoma
1	69	M	Malignant	Follicular carcinoma
1	67	F	Malignant	Follicular carcinoma
1	60	F	Malignant	Follicular carcinoma
1	69	F	Malignant	Follicular carcinoma
1	65	M	Benign	Follicular carcinoma
1	34	F	Malignant	Nodular goiter
1	65	M	Malignant	Nodular goiter
16	22—71	13 F 3 M	Benign	Various benign lesions
Total 25 cases				

Our cases of thyroid gland carcinoma were histologically classified as follows:

Follicular carcinoma	8 cases
Papillary carcinoma	2 cases
Anaplastic carcinoma	1 case

It is interesting to note, that in our two cases of papillary carcinomat no psammoma bodies, which according to Segal (5) are typical for this kind of carcinoma were found neither roentgenologically nor histologically.

Povzetek. — Avtorji prikazujejo 45 primerov, kjer so s pomočjo nativnega rentgenskega posnetka mehkih delov vratu skušali ločiti maligne od benignih sprememb v ščitnici. Ugotovitve so preverjali operativno in histološko.

Pri 25 bolnikih so ugotovili kalcinacije v mehkih delih vratu ter pravilno ovrednotili naravo obolenja pri 16 benignih spremembah in pri 5 malignomih.

Pri dveh malignomih je bila rentgenološka ugotovitev napačno negativna, pri dveh benignih spremembah pa napačno pozitivna.

Pri 20 bolnikih z opisano rentgensko preiskovalno tehniko ni bilo mogoče ugotoviti kalcinacij v mehkih delih vratu. Pri 16 bolnikih te skupine so histološko ugotovili nemaligno naravo obolenja, pri štirih pa malignom.

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MAGNETIC RESONANCE IN THE DIAGNOSIS OF CANCER*

Šentjurc M., M. Schara
Auersperg M., R. Golouh, J. Lamovec

Sadržaj: Da su autori mogli ustanoviti značaj magnetskih resonancija u dijagnostici rakastih tvorevina, merili su spektre elektronske paramagnetske resonancije (EPR), i relaksaciono vreme spin-mreža T_1 za protone vode. Merenja su vršili na seriji pacijenata sa različitim patološkim promenama štitnjače, limfnih žlezda, i sa malignim melanomima.. Prema zapažanjima, autori mogli su zaključiti da su tkiva, u kojima je T_1 veći od 700 msec, sumljiva na rakastu tvorevinu. Istovremeno i tkiva u kojima su nadjene nekroze, pokazuju vrednost T_1 iznad 700 msec, a sa druge strane opet se vrednosti T_1 papilarnih karcinoma štitajače ne razlikuju od vrednosti za nemaligna tkiva.
Pošto se nekroze mogu lako izdvojiti na osnovu histoloških ispitivanja, njihove visoke vrednosti za T_1 ne smanjuju korisnosti metode merenja protonskog spin-mrežnog relaksacionog vremena za karakterizaciju rakastih tvorevina. Ova metoda mogla bi se verovatno upotrebiti za intraoperativnu dijagnostiku, jer su merenja brža od metoda intraoperativne histološke dijagnostike, i ne zavisne od ličnog iskustva.

UDK 616-006.6-07:539.143.43(497.1)

Deskriptori: diagnostika raka, elektronska paramagnetska resonanca (spektri) štitasta žlezda, limfna žlezda, maligni melanom.

Radiol. Iugosl., 4; 319—327, 1974

Introduction. — Recently, there have been several attempts to characterize and specify tissue samples according to their malignancy with magnetic resonances.

By electron paramagnetic resonance methods (EPR) it is possible to follow the changes in the type and concentration of the native paramagnetic centres and the free radicals in tissues (1, 2, 3). These centres are intermediates of the metabolic processes or are bound to the tissue structures. Their nature is only partially known and can change during the neoplastic growth. The changes in the concentration of these centres as well as the appearance of some new centres have already been reported for some malignant tissues (3).

Pulsed NMR technique is used to determine the proton relaxation times that depend on the paramagnetic centres concentration, water content and structural distribution of water molecules in tissues. They reveal the structure of the water molecules environment and the dynamics of the molecular motions. Spin lattice relaxation time T_1 and spin-spin relaxation time T_2 have been found to be longer for malignant than for normal tissues (4, 5). It was also found that T_1 is prolonged not only in the cancerous tissue but in all other tissues of the animals with tumourous growth (6).

Considering all these findings, we have tried to estimate if the increased T_1 is specific for malignant growth or can also be observed in some other pathologically changed tissues, benign tumours, inflammations etc. At the same time we have tried to examine the applicability of the magnetic resonance methods for the diagnosis of cancer. In our previous work (7) measurements have been per-

* This work was supported by the »B. Kidrič« Foundation.

formed on a series of patients with different thyroid gland diseases. Increased T_1 values, above 700 msec, were found for malignant thyroid gland tissue in comparison with the other pathologically changed thyroid tissues, where the T_1 values were bellow 700 msec.

In this work we have tried to extend our observations to some other malignant tumours and increase the series of measurements on the thyroid gland tissue in order to obtain better statistics.

Experimental. — The EPR spectra and proton spin-lattice relaxation time T_1 were performed on the thyroid gland tissue in the series of 47 patients with different thyroid gland diseases, on lymph nodes in the series of 10 patients with different primary tumours and on malignant melanoma — 6 cases. In addition, measurements on one malignant schwannoma, one fibrosarcoma and one breast cancer were performed.

Samples were taken from different parts of pathologic and macroscopically normal tissue and cut in two for magnetic resonances and histologic characterization.

About half an hour after the removal of the tissue, the samples for EPR were frozen in liquid nitrogen. The EPR spectra were taken at —160° C on an E-9 Varian spectrometer. The microwave power 100 mW and 1 mW was used in order to resolve free radicals from the other paramagnetic centres. Modulation frequency 100 kHz and the modulation amplitudes up to 10 gauss have been used. In this study we are only looking for the appearance of some new EPR lines or some distinct changes in the paramagnetic centres concentration, since only pronounced differences can be used for cancer diagnosis.

The intensity of EPR lines was compared to the ruby standard in a double microwave cavity. An equal quantity of tissue was used in all sample tubes.

About one hour after the removal of the tissue, the proton spin-lattice relaxation time was measured at room temperature on a pulsed 32 MHz NMR spectrometer IJS—2—72 with pulse sequence $\pi/2$—$\pi/2$. A retrospective comparison of the magnetic resonance data and definitive histologic diagnosis for the same samples were made.

Results. — A typical change between the EPR spectra of the malignant and nonmalignant thyroid gland tissue is presented in Fig. 1. The strong increase in the $g = 1{,}94$ centre concentration was observed in the cancerous thyroid gland tissue as well as in the lymph node metastases. This observation can well be explained by the histological diagnosis of isostructural malignant tissue in the lymph node and thyroid gland. The paramagnetic centre with $g = 1{,}94$ belongs to the reduced state of non-haeme iron protein (8), and coincides with the one previously found in the malignant thyroid gland tissue (9). Increased concentration of this complex is probably due to the anaerobic conditions sometimes observed in malignant tissues. It was shown, namely, that in tissues stored in an anaerobic atmosphere concentration of the $g = 1{,}94$ centre increases as the enzyme concentration in its reduced state increases (10).

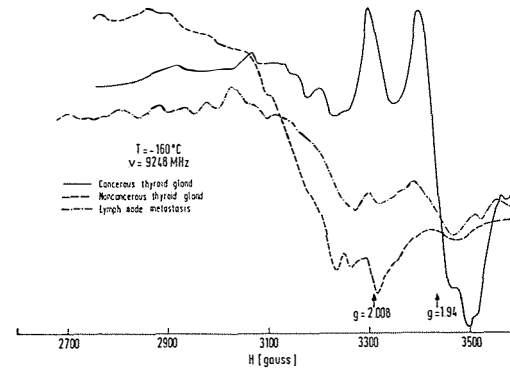

Fig. 1. EPR spectra of the thyroid gland tissue measured at — 160° C

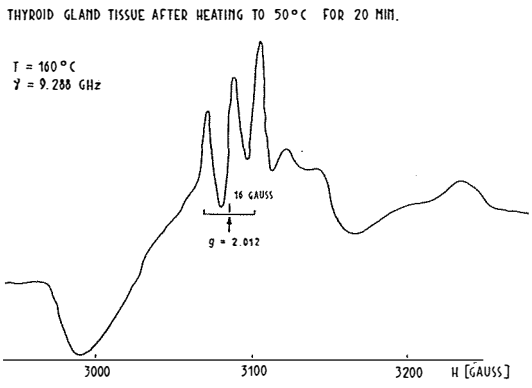

Fig. 2. EPR spectra of the triplet signal which appears during the warming of some tissues up to 50° C for 20 min.

It was also found that the formation of the triplet signal with g = 2,012 and hyperfine splitting constant of 16 gauss (Fig. 2), which appeared during the warming of the samples up to 50° C for 20 min, was more frequent in malignant than in non-malignant tissue. This signal is supposed to belong to NO-haeme iron protein complex (11).

From the experimental point, these two paramagnetic centres might be suitable for a rapid characterization of malignant tissue but were found to be poorly correlated with the histological findings as shown in Fig. 3. Here the intensity ratio between the centre with g = 1,94 and free radical, for different tissue samples are

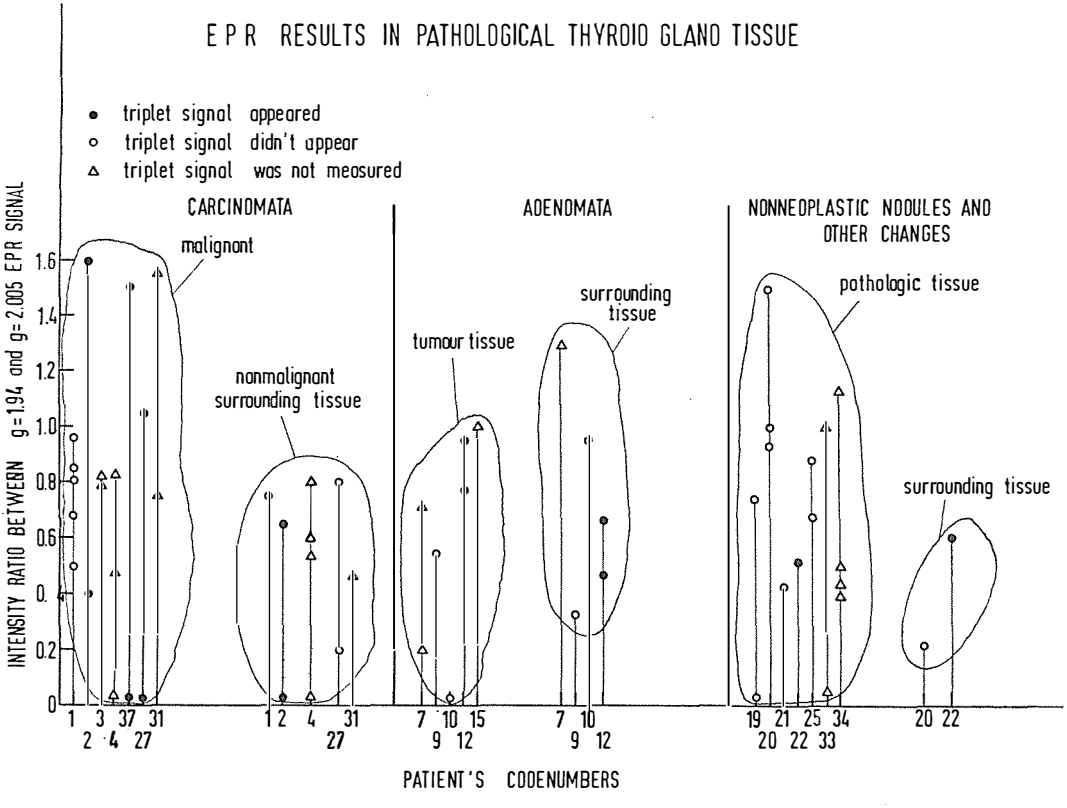

Fig. 3. Intensity ratio between the g = 1.94 paramagnetic centre and free radicals for the series of patients with different thyroid gland diseases

grouped according to their histologic diagnoses. The values corresponding to the samples with the same histologic diagnosis in the same patient are presented in one column. Since the samples were taken from different sites of the surgical specimen with different pathologic changes, the same patient's code number appears in more than one column. Samples with triplet signal are marked with full circles. No additional paramagnetic centres in the whole range from 0 to 4000 gauss have appeared in the malignant tissue as compared to the normal one.

Proton spin-lattice relaxation time of the thyroid gland tissue, malignant melanomas and lymph nodes are presented in Fig. 4 and 5, in the same way as in Fig. 2. The lymph nodes metastases, fibrosarcoma, breast cancer and some cases of malignant melanomas show T_1 values above 700 msec. These values are in accordance with our findings on malignant thyroid glands. In spite of the fact that T_1 values for the malignant samples from th e same patient are scattered, there were always at least some of them exceeding this value.

On the other hand, however, in almost all other cases with different pathological changes of thyroid gland: adenoma, reactive nodules, thyroiditis and hormonal hyperactivity, T_1 values never exceed 700 msec, with the exception of a few samples (no. 14, 16 and 45) which are characterised by other preoperative examinations as suspicious for malignancy. Therefore, tissue samples with T_1 values

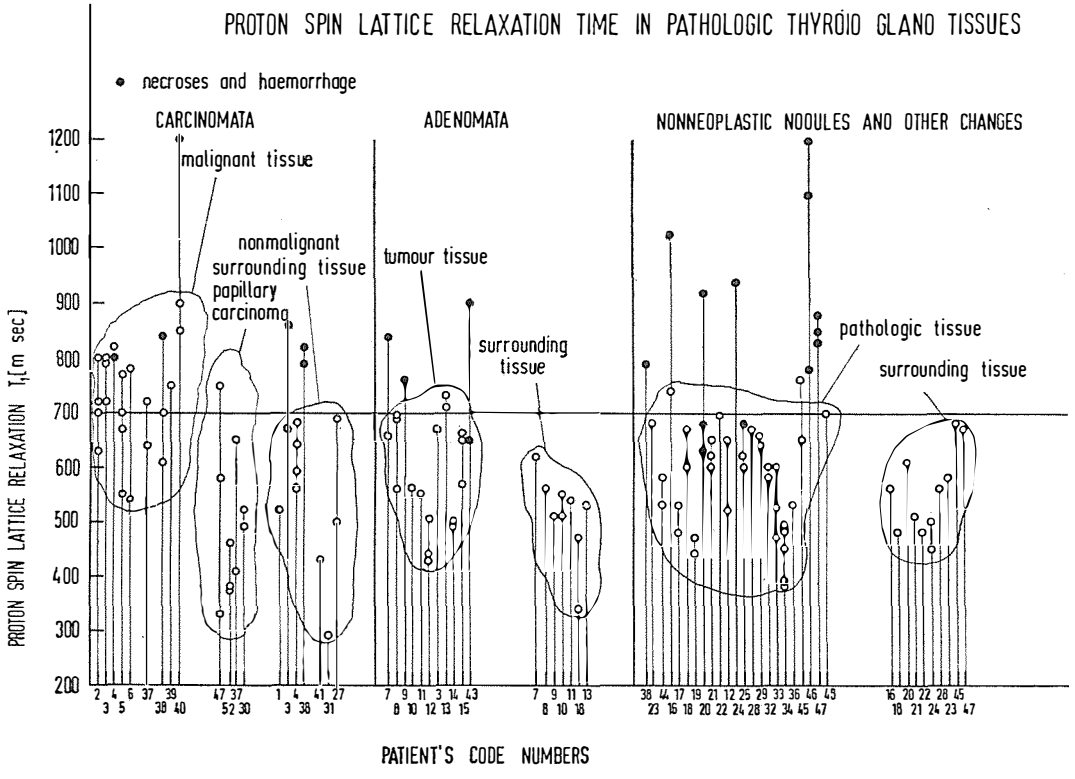

Fig. 4. Proton spin-lattice relaxation time of the thyroid gland tissue for the series of the patients with different thyroid gland diseases

above 700 msec should be considered suspicious for malignant growth.

Necroses and haemorrhages are exceptions which also show T_1 above 700 msec. These values are usually even higher than in malignant samples and even exceed 1000 msec. It has to be stressed at this point, that the critical value 700 msec is valid for T_1 measurements performed at resonant frequency 32 MHz. Recently, similar results were reported by Damadian (12, 13). Their measurements were done at resonant frequency 100 MHz. Since T_1 in the tissues increases with increased frequency (14), the values reported by Damadian are higher than ours.

However, there are some well differentiated carcinomas, like papillary thyroid gland carcinoma, where T_1 values are in the same region as in nonmalignant tissues. In Fig. 4 they are plotted in their own group since they behave specifically.

Another type of malignant tissue with T_{1x} below 700 msec are some cases of malignant melanoma. Low T_1 values for malignant melanoma were also reported in the already mentioned work (13). In our series of malignant melanoma, however, T_1 values are ranged from 350 to 1100 msec. In order to explain this scattering of results, specimens were carefully examined for the presence of necrotic areas. In Fig. 5 necrotic samples are marked with full circles. From Fig. 5 it can be seen that T_1 values in some malignant melanomas with no necrotic areas are high. Therefore, we have tried to determine the histologic grade of malignancy

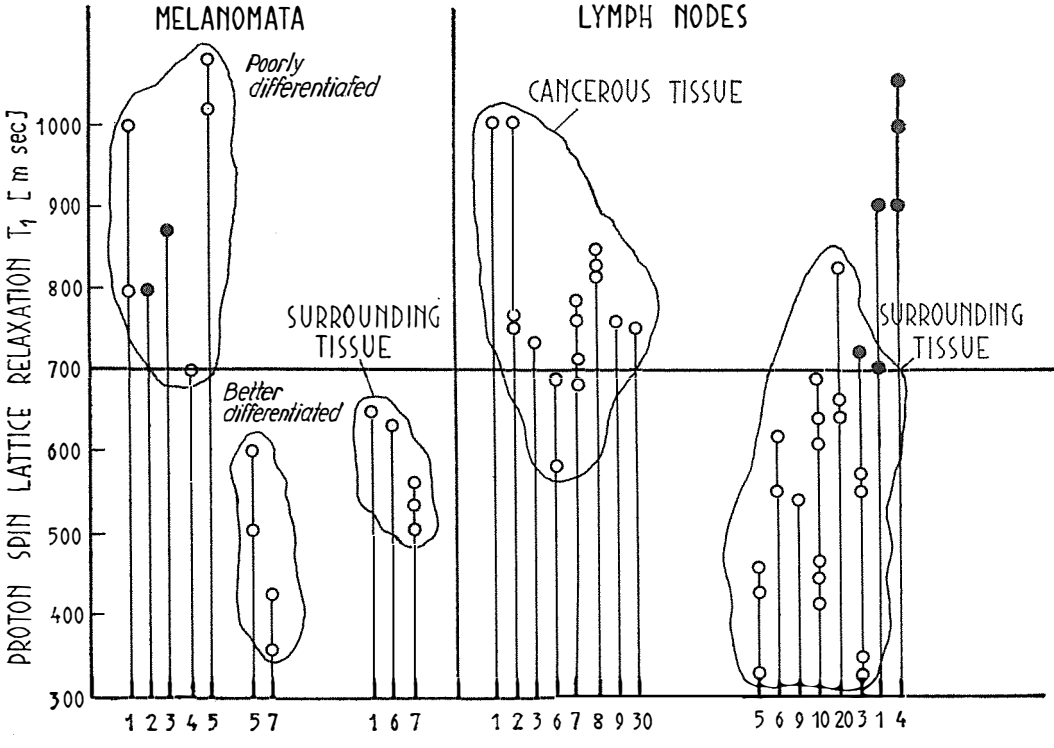

Fig. 5. Proton spin-lattice relaxation time of the lymph nodes and malignant melanoma. Necrotic samples are noted with full circles

and the amount of melanin in melanomas. It seems that well differentiated melanomas have lower T_1 values as undifferentiated types (Fig. 5). At the same time the amount of melanin was higher in the cases with low T_1 values. Both before mentioned characteristics of melanoma could be the reason for decreased T_1 values. The series of 6 cases studied in this work is too small to allow any definite conslusion. Therefore, further studies are in progress.

Discussion. — There are two important questions to be answered: what is the reason for T_1 prolongation in some pathologic tissues and why this prolongation is most pronounced for malignant tissues and necroses.

For the time being, prolongation of the proton spin-lattice relaxation time is still a matter of discussion concerning the relaxation mechanisms in tissues, and only by explaining this part, reliable conclusions could be made about the changes of the intra and extracellular water in malignant tissues. Now the model is being used according to which separation of water protons in two fractions is supposed — those which relax fast, the so called modified water protons which are influenced by protein surfaces and ions dissolved in intra and extracellular water, and protons of free water which are not influenced that way. Therefore, their relaxation time is longer. Assuming the exchange of molecules between the two fractions of water is fast; the relaxation rate $1/T_1$ is:

$$1/T_1 = x/T_1 \text{ (mod)} + (1—x)/T_1 \text{ (free)},$$

where x is a fraction of modified water. Using this model, some possibilities arise for T_1 prolongation in malignant and necrotic cells.

1. The ratio of free to modified water molecules alters at the constant amount of total water. Damadian suggested that the prolongation of T_1 could be due to the increased potassium content in malignant tissues. He found that increased K^+ ion concentration can imply increase in the amount of free water in the tissue (15).

2. The total amount of water content increases in malignant cells in favour to the free fraction. It was shown that the prolongation of spin-lattice relaxation time is correlated to an increased water content in tissue (16). The longest T_1 was found in nondifferentiated tissues.

3. The lowering of the paramagnetic centre concentration in malignant cells can result in an increase in T_1 value. This question arose several times (17) but has never been sistematically examined. There are many paramagnetic centres which are not observable by EPR method, and their role on the proton relaxation is not easy to estimate.

4. Nonspecific changes, diminishing of the O_2 and glucose concentration in malignant cells, lowering of pH value down to 6 and other changes could also influence spin-lattice relaxation (18).

None of these factors was completely proved or omitted until now, but the assumption 1. together with 2. seems to be the most probable.

In order to discover, how different factors influence spin lattice relaxation times and EPR data, we have made several experiments on the rat liver tissue homogenate. In these experiments we studied the influence of the animal diet (19), the oxygen content in the atmosphere, where the tissue was stored after removal, and the age of the animal. At the same time we also measured how the time between the removal of the tissue and measurements influences T_1 values and EPR spetra of the rat liver tissue. Significant changes in free radical concentration and T_1 values were found about two hours after the removal of the tissue (10, 19). Therefore, they could not appreciably influence the results of our measurements.

In an experiment with animal diet the rats were fed on avitaminous diet whereas in another one the carcinogen dimethylamino-azobenzene was added to the avitaminous diet. Both diets did not influence T_1 values of the rat liver tissue appreciably. The changes were about 50 msec. On the EPR spectra of the rat liver, however, the increase of the centre at $g = 2{,}03$ was observed. This paramagnetic centre was ascribed to the nitroxy-iron protein complex (20). In a similar experiment with the rats, which were on the diet with different carcinogens, the same centre was found at $g = 2{,}03$ (21). It was supposed to have been a potential tool for an early diagnosis of cancer. In our experiment this signal appears in the liver tissue of the rat fed on the diet containing dimenthylamino-azobenzene and in the liver of the rats fed only on avitaminous diet. Therefore the signal at $g = 2{,}03$ was considered as nonspecific for malignant growth.

In the experiments concerning the influence of the oxygen concentration in the storage atmosphere, an increased concentration of the $g = 1.94$ centre was found in the rat liver tissue when the tissue was in the nitrogen atmosphere (10). In the same samples no changes in the spin-lattice relaxation time were detected.

In figures 6 and 7 the paramagnetic centre concentration and the proton spin-lattice relaxation time in the rat liver and muscle tissue are presented as a function of the animal age. The paramagnetic centre concentration was found to increase up to the third month of the rat's life. This is the time in which the animal developes and the enzymatic activity reaches the optimal value. After this period, the paramagnetic centre concentration remaines unchanged.

T_1 decreases in the first month after the birth, which is in accordance with the intracellular water content decrease in the same period (22). After this time T_1 remains independent of the animal age.

These experiments have proved that T_1 values are influenced mostly by the water content variations in tissue while other influences are not so important. On the other hand, it was shown that the same effects do influence the paramagnetic centre concentration. Taking this into account, the scattered results in Fig. 3 can be better understood.

In addition, from the comparison of our EPR and NMR results obtained on the same tissues (see for example Fig. 6 and 7 and ref. 19) we can concluded that the changes of the paramagnetic

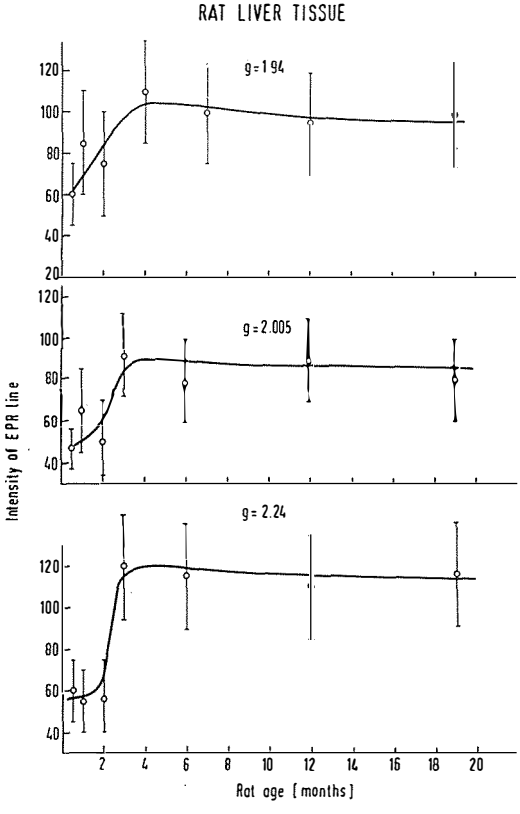

Fig. 6. Paramagnetic centre concentration of the rat liver tissue as a function of the animal age

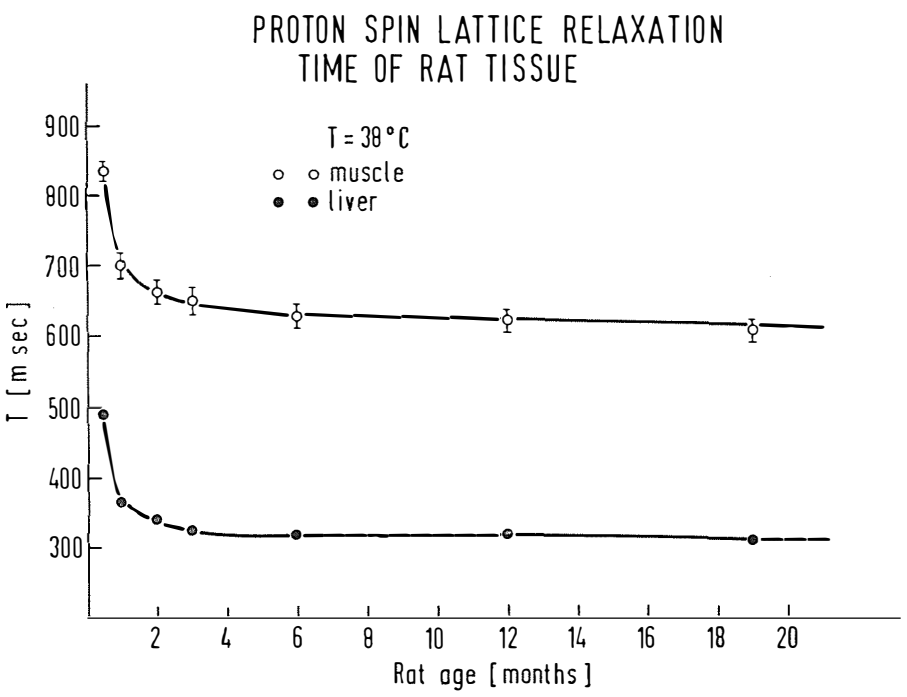

Fig. 7. Proton spin-lattice relaxation time of rat liver and muscle tissue as a function of animal age

centres concentration which were observed by EPR are not influencing proton relaxation.

Conclusion. — It was found that proton spin-lattice relaxation time in almost all malignant tissue we had examined, exceeded the value of 700 msec if measurements were performed at the resonance frequency of 32 MHz. All the other pathologic changes as well as normal tissue provided T_1 below this value. We believe that the proton spin-lattice relaxation measurements can be helpful not only in thyroid gland intraoperative diagnosis, where frozen section technique is often inconclusive, but also in the diagnosis of other malignancies, since it is much faster (about 2 min) and requires considerably smaller samples as frozen section technique. Their interpretation is not dependent on personal experience as the histological findings are.

T_1 measurements are inconclusive in a few cases of well differentiated carcinomas which provide T_1 values in the same region as nonmalignant samples. On the other hand, T_1 values in the necrotic tissues exceed 700 msec.

Since necroses and haemorrhages can be easily characterized by histologic examinations, the usefulness of T_1 measurements for the characterization of malignant growth has been not diminished.

In further work it would be worthwhile to find out if the same critical value, i. e. 700 msec, for spin-lattice relaxation time is valid for other malignant growth also, and the usefulness of EPR measurements has to be considered for other malignant tissues. A correct inter-

pretation of T_1 prolongation in malignant tissues has still to be found in order to contribute to the understanding of the basic molecular mechanisms of malignant growth.

Abstract. — Electron paramagnetic resonance spectra and the proton spin-lattice relaxation time T_1 have been measured on a series of pathologically changed human thyroid glands, lymph nodes and malignant melanomas. The T_1 values above 700 msec seem to be reliable indicators of malignancy. Necrotic tissues, however, can likewise yield T_1 values exceeding 700 msec. On the other side the T_1 value of the highly differentiated papilary carcinoma of the thyroid gland closely resembles that of the nonmalignant thyroid gland tissue.

The obtained EPR data were found to be inconclusive for characterization of thyroid malignancy.

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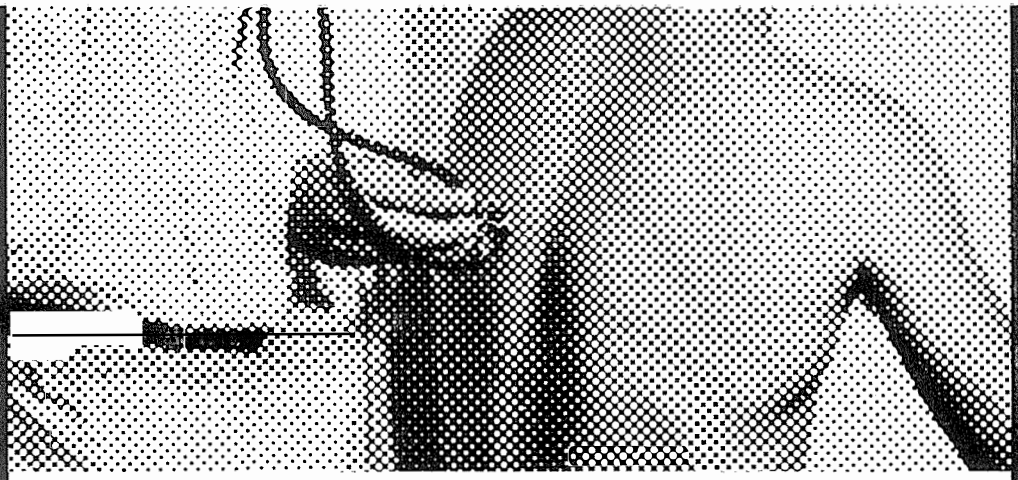

Kadar je na vrsti izbira antibiotika, upoštevajte tudi urfamycin®

(tiamfenikol)

DELOVANJE

Tiamfenikol je antibiotik širokega spektra; deluje na po Gramu pozitivne in po Gramu negativne bakterije, spirohete in rikecije. Velikokrat deluje tudi na stafilokoke, ki so odporni proti drugim antibiotikom. Obstaja navzkrižna rezistenca s kloramfenikolom. Tiamfenikol se dobro absorbira iz prebavil; praktično se ne veže na serumske proteine, zato dobro predira v tkiva in telesne tekočine. Zlasti velike koncentracije so v ledvicah, jetrih in žolčnih potih. V organizmu se ne metabolizira in se izloča pretežno v aktivni obliki.

INDIKACIJE

Infekcije urogenitalnega trakta, žolčnih potov, prebavil, dihalnih potov, sinusitis, otitis, mastoiditis, gonoreja, meningitis, peritonitis in številne druge infekcije, ki jih povzročajo mikroorganizmi, občutljivi za tiamfenikol.

KONTRAINDIKACIJE

Motnje hematopoeze in anurija so kontraindikacije za uporabo tiamfenikola. Načelno ne priporočamo uporabe zdravila v prvih treh mesecih nosečnosti in pri nedonošenčkih in novorojenčkih.

PREVIDNOSTNI UKREPI

Zdravljenje je treba praviloma omejiti na največ 10 dni. Pri daljši uporabi ali če dajemo doze, večje od priporočenih, so potrebne redne kontrole krvne slike in metabolizma železa. Če se pokažejo prvi znaki okvarjene hematopoeze, je treba zdravljenje pretrgati. Bolnikom z renalno insulienco je treba zmanjšati doze v skladu s stopnjo ledvične okvare. Če dajemo astmatikom Urfamycin v obliki aerosola, priporočamo sočasno uporabo bronhodilatatorjev. Zaradi antagonističnega učinka ne priporočamo kombinacij s penicilinskimi preparati.

STRANSKI UČINKI

Oralno uporabo lahko spremljajo zgaga, slabost, bruhanje in driska, zelo redko pa pomanjkanje teka, vrtoglavica ali glavobol. Zelo redke so preobčutljivostne reakcije na koži in sluznicah. Redko se zmanjša nastajanje hemoglobina in eritrocitov, pa tudi levkocitov in trombocitov. Te spremembe so reverzibilne in izginejo, ko prenehamo dajati zdravilo. Pri uporabi tiamfenikola niso opazili ireverzibilnih hematotoksičnih učinkov.

OPREMA

Škatlice z 12 kapsulami po 250 mg.
Stekleničke s 60 ml sirupa.
Škatlice z eno stekleničko po 500 mg in 5 ml topila.
Škatlice s 50 stekleničkami po 500 mg.

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TOZD FARMACIJA

v sodelovanju z Zambon, S. p. A., Milan.

INSTITUTE OF ONCOLOGY, LJUBLJANA, YUGOSLAVIA

67-Ga CITRATE AND 75-Se METHIONINE IN THE DIFFERENTIAL DIAGNOSIS OF THYROID NODULES

Erjavec, M., M. Auersperg, R. Golouh, M. Porenta, J. Šnajder

Povzetek: Avtorji so scintigrafirali 71 bolnikov z obolenjem ščitnice s pomočjo 75-Se metionina in 67-Ga citrata, da bi ugotovili vrednost teh radiofarmakov v preoperativni diagnostiki malignih tumorjev. Ugotovili so, da je tolmačenje konvencionalnih scintigrafskih slik težko in nezanesljivo. Izdelali so računalniško metodo, ki je omogočila izražanje radioaktivnosti tkiv vratu v odnosu na »telesno ozadje« in omogočila iztiskavanje »kvantitativne slike«. S to metodo so prikazali, da se oba radiofarmaka kopičita v različih normalnih in patoloških strukturah vratu, pri čemer se razmerje do »telesnega ozadja« giblje med 1,5—2,5. Izjemo predstavljajo anaplastični karcinom, maligni limfomi in thyreoiditis Hashimoto, kjer so našli vrednosti do 5,2. Med uspešno terapijo in po njej je bilo ugotovljeno zniževanje vrednosti za 67-Ga, s čimer je podana možnost zasledovanja uspešnosti zdravljenja.

UDK 61644-006-07:621.039.8(497.1)

Deskriptori: Nuklearna medicina, ščitnica diagnostika diferencialna, 67-Ga citrat, 75-Se metionin.

Radiol. Iugosl., 4; 329—334, 1974

Solitary thyroid nodules which fail to concentrate radioiodine or radiopertechnetate (cool and cold nodules) occur frequently and represent, histologically, a variety of conditions including malignancy. Early and adequate surgery is likely to »cure« patients with well differentiated adenocarcinomas, whereas for anaplastic tumors radiation seems to be the preferable treatment (1). Benign adenomas and regressive changes may not need immediate treatment.

In this study, scintillation scanning with 67-Ga citrate and 75-Se methionine has been tried in order to examine its ability to improve the preoperative differentiation of thyroid nodules.

Material and methods. — To the first group of 35 patients with thyroid nodules 2 mC of 67-Ga citrate and/or 0.25 mC of 75-Se methionine were administered i. v. If both radiopharmaceuticals were tried on the same patient, the latter was given after a two-weeks delay in order to decrease the background radioactivity within the neck. The images of the neck were made two days later by means of a rectilinear color-dot scintiscanner or an Anger camera.

In the first group of 35 patients, the relative concentration of the radiopharmaceuticals within the nodules was visually scored as higher (+), same (+/—) or lower (—), than that within the normal thyroid tissue.

Since the overall target/non-target ratios were low in most cases, the scoring of images was soon found to be uncertain. Further, the precise topographic correlation of conventional thyroid images with the 67-Ga and/or 75-Se was difficult and errors due to subjective interpretation could not be avoided. In order to improve the reproducibility of

this interpretation, a computer assisted technique was devised for a better assessment of the quantity and topography of the radionuclide concentration within the normal and pathological neck tissue.

A second group of 36 patients was given orally about 1 mC of 99 m-Tc pertechnetate as the second tracer, about 30 minutes before the scintigraphy with either of the two radiopharmaceuticals. A dual-analyser digitalised scintiscanner was used for this study. The spectrometers were set at appropriate photopeaks for either radionuclide. Parallel to the colour-dot imaging, counts from the two analysers were collected by a CAMAC type data acquisition system and punched into the paper tape.

The tapes were processed off-line by a 6000 series CDC digital computer. After the formation of the two matrices within the computer core memory, the background counts for each matrix were assessed by averaging the activity of two adjacent scanning lines with the lowest mean values. Then the »background« counts were subtracted and the remaining data smoothed. The images of the two radionuclide distributions were produced on a fast lineprinter using alphanumerical symbols corresponding to 10 isocount levels. Blanks and overprints were employed to increase the legibility of the image.

The apparent target/bcg ratios of 75-Se and that of 67-Ga within the neck structures were visualised by an additional »quantitative« image of the count/background ratio, the printing levels being arbitrarily preset at a »maximum« of 3 times the background value. The highest count/background ratio and its coordinates were printed out also numerically.

In order to facilitate the topographic correlation, the contours of the functioning thyroid, represented by a half-maximum isocount line of the 99 m-Tc matrix established separately, were brought into the processed 75-Se or 67-Ga matrix by using a particular symbol.

In two cases of autonomous or toxic adenomas the diagnosis was supported only by clinical, laboratory and scintigraphyc finding. The rest of the patients were operated. Surgical specimens were topographically oriented and histologically examined. The findings were topographically correlated with scintigrams.

Results. — Results of altogether 148 observations in 71 patient are summarised in Tables 1 and 2. They show on the whole that in various neck structures the concentration of both radiopharmaceuticals employed is roughly comparable.

Apparent differences between the uptake of 67-Ga and 75-Se methionine for papillary and follicular carcinomas shown in tab. 1. are probably due to unavoidably subjective interpretation of conventional images and were not confirmed by computer processed records.

Both agents were taken up by normal thyroid gland about twice as much as by the surrounding normal tissue. The mean values of the gland uptake seemed to depend slightly on the hormonal activity but the ranges in normal, suppressed and hyperactive thyroid tissue obtained by quantitative scanning largely overlap. Regressive changes within nodular goiter concentrated neither of the two agents.

Acute purulent inflammation showed a moderate content of both radionuclides.

Chronic thyroiditis showed a large variety of uptake values of either agents, the highest ones were obtained in Hashimoto disease while in the fibroplastic inflammation the values found were approaching the body background.

Both agents were markedly concentrated in anaplastic carcinomas and in malignant lymphomas, but the values obtained in papillary, follicular and medullary carcinoma were virtually undistinguishable from the normal thyroid tissue.

Discussion and conclusions. — Difficulties in the correct preoperative differen-

Table 1
Conventional imaging of 75-Se methionine and/or 67-Ga citrate uptake; 61 observations in 35 patients

	No. of observ.	75-Se methione			No. of observ.	67-Ga citrate		
		—	+/—	+		—	+/—	+
Adenomas	5	—	—	5	6	4	2	—
Toxic adenomas	2	—	—	2	2	2	—	—
Nodular goiter with regression changes	14	4	10	—	15	14	1	—
Papillary and follicular carcinoma	6	—	3	3	4	3	1	—
Anaplastic carcinoma and malignant lymphoma	2	—	—	2	3	—	—	3
Purulent inflammation	1	—	—	1	1	—	—	1
Total No. of observations	30				31			

The uptake of radionuclides within lesion was visually scored as higher (+), same (+/—), or lower (—) than that within thyroid tissue.

Table 2
Computer-assisted imaging of 67-Ga citrate aand/or 75-Se methionine uptake; 87 observations in 36 patients

	No. of observ.	Uptake of 67-Ga citrate		No. of observ.	Uptake of 75-Se methionine	
		mean	range		mean	range
Normal thyroid	7	2.2	1.5—2.5	9	1.9	1.2—2.3
Supressed thyroid	2	1.7	1.7	2	1.45	1.3—1.6
Toxic adenomas	2	1.75	1.7—1.8	3	2.0	1.6—2.3
Manubrium sterni	15	1.7	1.5—2.1			
Nodular goiter with regression changes	12	1.5	1.0—1.8	8	1.6	1.2—2.2
Papillary and follicular carcinoma	5	1.8	1.2—2.3	6	1.95	1.2—2.2
Medullary carcinoma	1	2.0	2.0			
Anaplastic carcinoma and malignant lymphoma	6	3.2	1.2+—4.9			
Thyroiditis Hasimoto and focal thyroiditis with lymphocitic infiltration	5	2.8	1.3+—5.2	2	4.5	2.1—6.9
Lymphadenitis tbc	1	2.0	2.0			
Purulent inflammation	1	2.2	2.2	1	2.3	2.3
Total No. of observations	56			31		

+ after treatment
Results are given in values of structure/body background ratio as red out of the quantitative images. Three patients were reexamined with 67-Ga citrate after treatment.

tiation of cold thyroid nodules led several authors to investigate possibilities offered by positive scintillation scanning using various »tumor-seeking« radiopharmaceuticals. It has been shown that 131-Cs citrate concentration reflects to some extent the »cell density« and can tell thyroid cysts from solid nodules (2). 75-Se methionine, widely used to indicate sites with increased protein synthesis,

has been investigated for this purpose but results were not unanimous. While some authors (3) were able to identify all malignant thyroid tumors unless they had a diameter smaller than 2 cm, the others (4) failed to demonstrate neoplasy in two out of five cases.

Radiogallium has been introduced recently (5) and its usefullness in shown in cases of fast growing malignant tumors.

The present study has been initated in order to assess the relative value of both 75-Se methionine and 67-Ga citrate in identifying malignant tumors of the thyroid before the operation and thus to improve the possibility of a correct planning of the extent of surgery before the operation, particularly since the histological differentiation of highly differentiated carcinomas and adenomas in frosen sections in often impossible (6).

First difficulties met with in this study were the technical ones. In most cases scanning images were of a poor quality because of the inherently low target/non target concentration ratio and large statistical fluctuation of the counts. Also the topographic correlation of scanning image and physicial findings was uncertain. Therefore the 99 m-Tc pertechnetate was introduced as the simultaneous label of the functioning gland and a computer-assisted method was worked out in order to quantitate the uptake of either radiopharmaceutical within a given structure.

Results of the quantitative scanning demonstrated that both radiopharmaceuticals show a similar concentration pattern in a variety of thyroid conditions. Both are concentrated slightly in normal thyroid tissue. Similarly to earlier observations of other authors (7) the uptake of selenomethionine by the gland seemed to paralel slightly its hormonal activity. We believe, however, that the suppression of the gland is not likely to increase the diagnostic ability of the examination.

Slightly increased concentration has been found also in acute inflammation, but a marked uptake was demonstrated in chronic thyroiditis. The focal thyroidits with lymphocytic infiltration showed a locally increased uptake of radiogallium but the highest values (above 5.0) for both agents were found in two developped cases of diffuse chronic inflammation with lymphocytic infiltration (Hashimoto). When the inflammation subsided after treatment, the uptake values of radiogallium were found to be lower (2.0—4.0). In a case in which histology showed that Hashimoto disease seemed to evolute into chronic fibroplastic thyroiditis, the fibrotic areas showed greatly decreased values (1.3).

In neoplastic conditions of the thyroid, the uptake values depended seemingly on the degree of the cell differentiation.

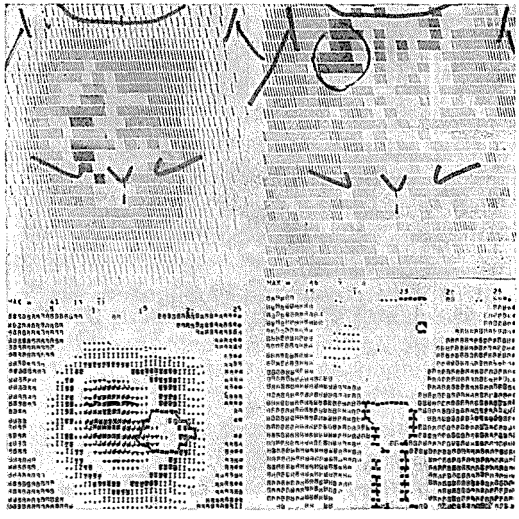

Fig. 1. Conventional (top) and computer-processed quantitative (bottom) images with 67-Ga citrate of a case of reticulosarcoma of the thyroid before (left) and after (right) irradiation. Maximum tumor/body background ratios were 3.7 before and 1.5 after treatment.
Thyroid contours obtained from 99 m-Tc matrix are enhanced for better visualisation.

The highest values for radiogallium (4.9) were obtained in anaplastic carcinomas but conventional scanning performed earlier showed also a remarkable concentration of selenomethionine in these tumors. In a case of reticulosarcoma the radiogallium showed the value of 3.7 but after a successful irradiation this concentration declined to 1.5.

Papillary and follicular carcinomas concentrated roughly the same amount of either agent as the normal gland. We were able to identify such malignant growth scintigraphically in a few cases when the primary or metastatic tumor was well outside of the gland but in a case of mestastatic papillary carcinoma there were no detectable amounts of radiogallium in a large lateral neck lump. Two cases with marked histological dedifferentation showed the highest values in this sub-group.

In conclusion, we believe that the diagnostic power of both radiopharmaceuticals is moderate. Highly differentiated carcinomas can not be distinguished from adenomas. Nodules representing regressive changes can be identified by this method, but the same can be achieved easily by thermography (8). The scintillation scanning with 67-Ga or 75-Se methionine, however, invariably demonstrated fast growing anaplastic carcinomas and malignant lymphomas, which is a great help in planning of the treatment. Chronic thyroiditis of Hashimoto type could perhaps give rise to some diagnostic doubt but the patient's history and other clinical findings can help to establish a correct diagnosis.

From practical point of view 67-Ga citrate has a definite advantage over 75-Se methionine. Its markedly shorter physical half-life (78 hours vs. 121 days) enables the use of larger amounts of radioactivity which improves the statistic quality of the image and also enables subsequent diagnostic procedures with other radionuclides which eventually might be needed for the patient.

For this reason we have abandoned the use of 75-Se methionine for this purpose but have retained 67-Ga citrate in the clinical practice for cases in which this examination could facilitate the differentiation of cold thyroid nodules.

Altogether 71 patients with thyroid nodules were investigated with 75-Se methionine and/or 67-Ga citrate in conjuction with scintillation scanning in order to assess the value of these agents for the preoperative diagnosis of malignancy. It was found that conventional images are equivocal and difficult to interpret. Therefore a computer method was devised by means of which the uptake of various neck structures was expressed in terms of »body background« count rate producing an image of apparent target/non-target ratios. By means of this method it was demonstrated that both agents concentrate in a variety of normal and pathological neck structures, the range of ratios being roughly 1,5—2,5 excepting anaplastic carcinomas, malignant lymphoma and Hashimoto tyroiditis, where the values up to 5,2 were reached. During and after successful therapy the high values for 67-Ga were found decreased which enables assessment of the response to the treatment.

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DIAGNOSTIC ULTRASOUND IN OBSTETRICS: RECENT ADVANCES AND PRESENT STATUS

Campbell S., A. Kurjak

Sadržaj: Autori u svome referatu iznose upotrebu ultrazvuka u porodiljstvu kao dijagnostičku metodu kod oštećenja fetusa i kao pomočno metodu u cilju merenja karlice. Iznose prednost upotrebe ultrazvuka pred rentgenskim slikanjem iako još postoje područja gde je rentgensko slikanje uspešnije (pelvimetrija, skeletne malformacije fetusa). Upotrebnost ultrazvuka objašnjavaju sa primerima rane gestacije, zrelosti fetusa, multiple gestacije, cefalometrije i dr. Navode se i problemi oko proučavanja podataka dobivenih sa ultrazvukom kod fetalne zrelosti, teže, placentografije, dijagnosticiranja mole hidantidoze, tumora, hidramniona, fetalne abnormalnosti, (anencefalija, hidrocefalija, renalne abnormnosti).

UDK 618.2-07:534-8(497.1)

Deskriptori: Rentgen diagnostika, ultrazvuk, ginekologija, akušerstvo.

Radiol. Iugosl., 4; 335—347, 1974

KEY TO FIGURES: B — bladder, CP — cephalic pole, Cx — cervix, E — embryonic echo, Ec — ectopic pregnancy, F — fibrioid, FH — fetal head, FT — fetal trunk, H — pelvic haematocoele, Hy — hydramnios, IM — invasive mole, L — limb, ML — middle echo, MT — molar tissue, O — ovarian cyst, P — placenta, Pa — parietal bone deflection, PE — placental edge, PF — placental fragment, S — gestation sac, Sp — spone, SP — symphysis pubis, S Pr — sacral promontory, U — umbilicus, V — vagina.

Introduction. — Diagnostic ultrasound was first applied to obstetrics 15 years ago by Professor Ian Donald in Glasgow (Donald at al., 1958). More recently, the development of the ultrasonic doppler device (Callagan et al., 1964) has made possible the antenatal detection and monitoring of the fetal heart.

Several good review articles on the subject of ultrasonic diagnosis in obstetrics have been published (Sunden, 1964; Donald, 1968; Thompson, 1969; Kurjak, 1971; Kurjak, 1972).

Early pregnancy. — For examination of the pregnant uterus during the first 12 weeks of pregnancy, it is important that the maternal bladder should be moderately distended with urine. The normal development of the fetus during the first 12 weeks of pregnancy, is well illustrated by Donald, 1969; Abdulla, 1970 and Kobayashi et al., 1972. The fetus can first be identified as a small discrete circle (gestation sac) in the upper pole of the uterus, usually at five weeks and certainly at six weeks menstrual age. By seven weeks, a small embryonic echo can be seen within the sac which now occupies about half of the uterine cavity. At 10 weeks the gestation sac completely fills the uterus and by 11 weeks the embryonic echoes are sufficiently developed for the fetal head to be visualized. At this time also, the placenta can be clearly identified as a discrete »spleckled« disc. (Fig 1.)

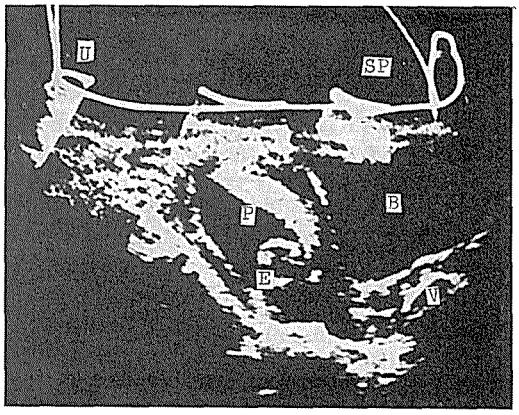
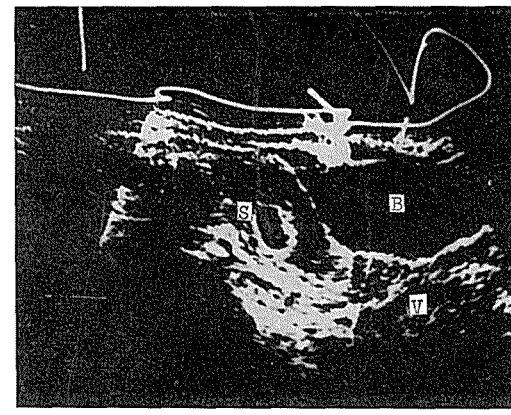


Fig. 1. Normal pregnancy of 11 weeks menstrual age showing embryonic echo and anterior placenta

Maturity. — Predicting the maturity of the fetus is usually made by visually assessing the size of the gestation sac and embryonic echo on a compound B ultrasonogram. (Fig 2.) It is likely that maturity predictions are accurate to within two weeks. However, no clinical appraisal of the accuracy of maturity predictions during this period has been published. Hellman et al. (1969) measured the gestation sac in two dimensions and there by attempted to introduce objectivity not published any clinical assessment of the accuracy of this technique.

Abortion. — Ultrasound is particularly valuable in the diagnosis of missed abortion (the diagnosis frequently being made before the pregnancy test is negative) and the ultrasonic features are well described by Donald et al., 1972. In most cases, the gestation sac is small, misshapen and poorly defined (Fig. 3). In these circumstances, the diagnosis can often be made on one examination, although a further examination one week later is advised to confirm that no growth of the gestation sac has taken place. The importance of this is shown by the fact that in the study of Donald et al. (1972), 6 out of 44 patients with normal pregnancies had



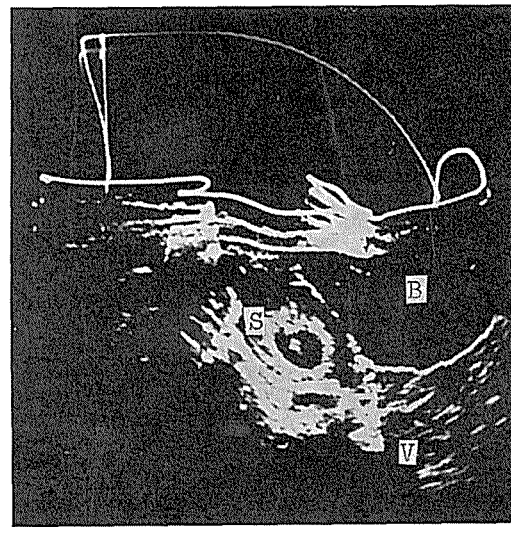
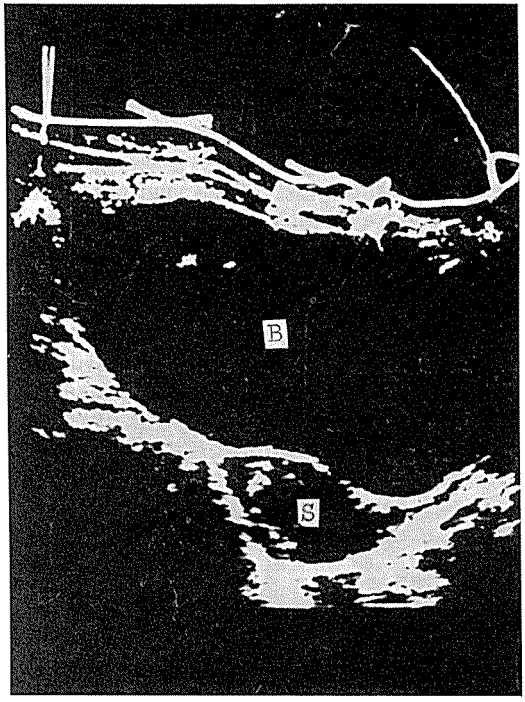


Fig. 2. Case of threatened abortion at 11 weeks menstrual age — a) small gestation sac (7 weeks size) and b) both gestacion sac and embryonic echo show normal growth

a »poor« gestation sac at the first examination. Sometimes the sac is well defined but is smaller than normal for its gestational age. In this case, a further examination in a weeks time is manditory to establish whether or not growth is continuing. This is well illustrated in Fig. 2 where a patient was referred with bleeding per vaginum at 11 weeks menstrual age. The gestation sac was small (a) and a missed abortion was suspected.



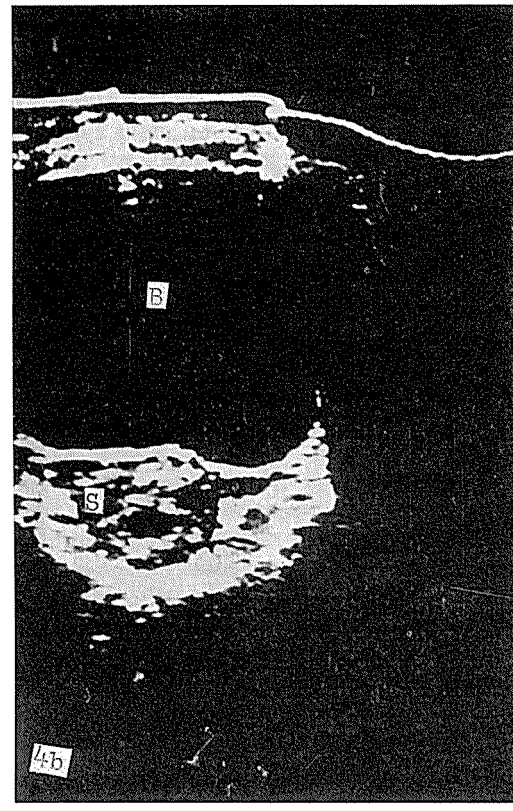


Fig .3. Case of missed abortion at 12 weeks menstrual age — a) longitudinal scan showing poorly defined sac and b) transverse scan showing misshapen sac

A further scan one week later however, showed a normal increase in size of both sac and embryonic echo (b) and it was clelar that the fetal maturity was four weeks less than the menstrual age. This pregnancy progressed normally. Rarely, missed abortion will be manifest by a normal sized (or slightly enlarged) gestation sac and an absent or vestigial embryonic echo. This is true »blighted ovum« and the diagnosis can usually be made on one examination.

It is sometimes claimed that inevitable abortion can be predicted by the finding of a low implantation gestation sac and indeed in the paper of Donald et al., 1972, five out of six pregnancies with a low implantation sac subsequently aborted.

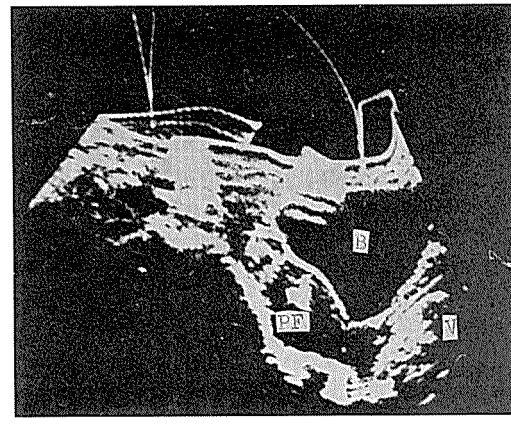


Fig. 4. Case of incomplete abortion — placental tissue can be seen at the uterine fundus

The evidence however at the moment is not sufficiently substantial for this sign to be used in itself as a reliable indicator of impending abortion.

Ultrasonic examination can also be useful in the diagnosis of incomplete abortion (Robinson, 1972). Retained placental tissue is always seen in the line of endometrial cavity (Fig. 4) although it is possible to obtain echoes suggestive of retained products from a thick decidual lining or organised blood clot.

Multiple pregnancy. — Although multiple pregnancy is usually diagnosed in the second trimester by counting fetal heads, it can also be recognised between weeks six and 11 by counting the gestation sacs. Donald and Abdulla (1967) first reported the diagnosis of twin fetuses at eight weeks maturity while Campbell and Dewhurst (1970) diagnosed quintuplet pregnancy at nine weeks menstrual age in a patient who had been treated with gonadotrophins. In Queen Charlotte's Hospital, we have diagnosed multiple pregnancy before 12 weeks maturity in six cases without any failure. A recent twin pregnancy at eight weeks maturity is shown in Fig. 5. The accurate enumerative of the number of gestation sacs in early pregnancy is of obvious advantage in patients who have had gonadotrophin therapy.

Ectopic pregnancy. — The pregnancy sac is not easy to identify outside the uterus as inside and the diagnosis of ectopic pregnancy is one of the less successful applications of ultrasound. Kobayashi et al. (1969) in 21 surgically proven cases of ectopic pregnancy, found that the incidence of false positive and false negative diagnoses by ultrasonic examination was 24 per cent. They described the typical extrauterine findings as an' »irregular poorly defined mass containing some echoes.« This description unifortunately can also apply to other pelvic conditions such as tubo-ovarian abscess or endometriosis. A case of tubal abortion and pelvic hameatocele is illustrated in

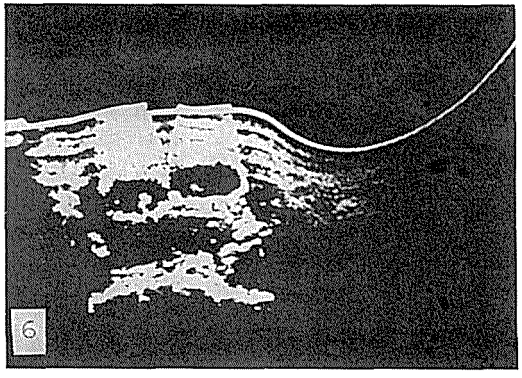


Fig. 5. Normal twin gestacion sacs at 8 weeks menstrual age — transwerse scan showing embryonic echo in each sac

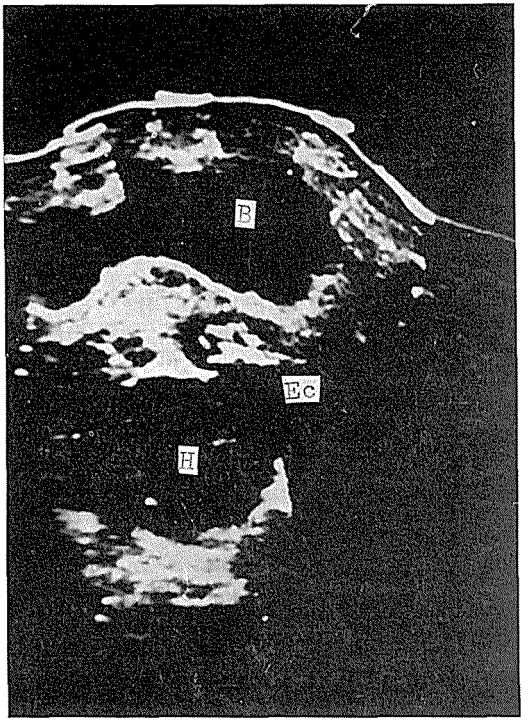


Fig. 6. Case of ectopic pregnancy and pelvic haematocele (transverse scan)

Fig. 6; this was mistakenely diagnosed as endometriotic cyst. In patients with suspected ectopic pregnancy, an initial ultrasonic scan however, can be useful for the demonstration of a gestation sac inside the uterus, rules out the diagnosis of ectopic pregnancy (coincident ectopic and intrauterine pregnancy being an extreme rarity).

Cephalometry. — Cephalometry is technically the most difficult antenatal ultrasonic investigation, but when performed accurately, is undoubtedly one of the most rewarding. A measure of its importance as a diagnostic aid can be gained from the fact that in 85 per cent of patients refered to Queen Charlotte's Hospital Ultrasonic Department, the principal request is for ultrasonic cephalometry.

Technique. — The original technique of ultrasonic cephalometry was described by Donald and Brown (1961) and involved the use of A scan alone. Willocks et al. (1964) determined the figure ob 1600 metres per second for the velocity of sound through the mature fetal head (taking into account distal skull and scalp thickness), and found that when ultrasonic measurements based on this figure were made on newborn babies' heads, a high degree of correlation between ultrasonic and caliper measurement was obtained. For antenatal measurements, the fetal head was identified by abdominal palpation and the transducer angled in various directions over the head until two maximal and equal echoes were obtained on the A scan display. It was believed that echoes of equal height could only be obtained from the biparietal and occipital frontal diameters (being the only pair of parallel surfaces in the skull) and that these diameters could easily be distinguished from each other by their dissimilar size. When accuracy of antenatal measurements was assessed, however, the relationship between the antenatal ultrasonic and post natal caliper measurement was less satisfactory. Both Willocks (1963) and Durkan and Russo (1966) had an error incidence of 5 mm or more in over 35 per cent of cases. It was clear that »dobule spike« echograms could be obtained from diameters other than that between the perietal eminences. Kohorn (1967) found more consistent results, when a vertical deflection was obtained midway between the skull echoes (triple spike echogram), but and error of over 4 mm in 15.5 per cent of his readings indicates that even the appearance of a midline echo on the A scan display does not ensure that a biparietal measurement has been obtained.

In 1968, Campbell described the combined A and B scan technique, which was designed to overcome errors inherent in the A scan method, due to misdirection of the ultrasonic beam. The fetal head is scanned by compound B scan, first longitudinally, in order to determine the exact position of head, and then transversely at the appropriate angle, to obtain a transverse section of the fetal head at the level of the parietal aminences. When this had been successfully accomplished, a midline echo is seen, exactly bisecting the fetal head (Fig. 7 a). The ultrasonic beam is then directed across the parietal eminences and an A scan measurement taken (Fig. 7 b). If the midline echo is not observed, or if it is asymmetrically placed in the fetal head, then no measurement should be taken as the beam is not correctly positioned across the biparietal diameter. Difficulties can be encountered when the fetal head is deeply engaged and in the occipito posterior position but we have found that these problems can nearly always be overcome by tilling the examination couch »head down« through 30^0, thus disengaging the fetal head.

There are two important advantages to the combined A and B scan technique. Firstly, measurements of the fetal biparietal diameter are more accurate than

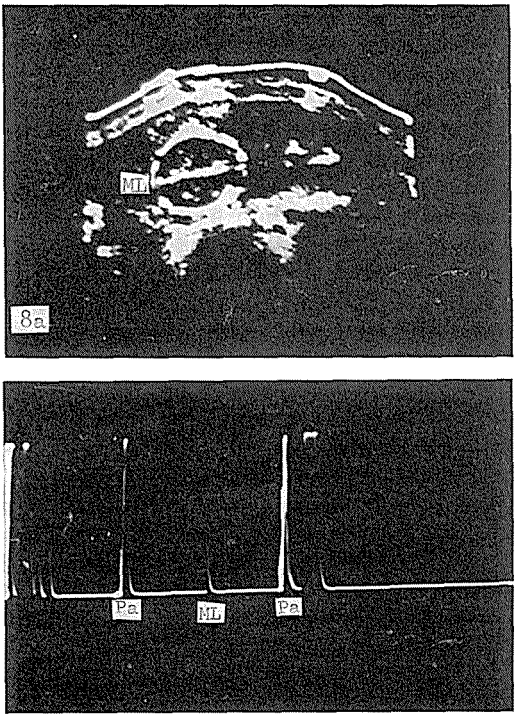


Fig. 7. Cephalometry at 16 weeks menstrual age — a) transverse section on B-scan display showing midline echo, and b) a scan tracing of same fetal head (measurements are more accurately made on this display; biparietal diameter = 3.84 cm)

those previously obtained with the A scan technique. Assessment of the accuracy on 35 babies delivered by elective Caesarean section (Campbell, 1968) and 50 fetuses delivered by hysterotomy (Campbell, 1970) showed that in 90 per cent of cases, the discrepancy between the antenatal ultrasonic and post natal caliper measurement, was less than 2 mm, and the mean error in both groups was less than 1 mm. The second advantage is that measurements can be obtained before the fetal head is palpable, and accurate cephalometry in now possible from 13 weeks onwards.

Normal values. — Several workers have now produced graphs of biparietal diameter values taken during normal pregnancy and plotted against the menstrual age of the fetus. Most of these graphs resemble each other in the shape of the graph (an symtotic curve) but unfortunately there is a wide divergence in the absolute size of the biparietal diameter for a particular week of gestation.

Campbell and Newman constructed two distinct types of graph from their normal values; the first is used to assess size and maturity, while the second is used to assess growth. In the first graph, a total of 1029 individual measurements were plotted against the menstrual age of the fetus. The mean weekly increase in the biparietal diameter is rapid and almost linear from 13 until 30 weeks gestation (3.5 m/week), slows slightly between 30 and 34 weeks (2.2 mm/week) and thereafter falls rapidly until 40 weeks, at which time the rate of increase is less than 1 mm per week. The range of head size for a particular week of maturity is confined within narrow limits during the middle trimester and widens gradually after 30 weeks maturity. To construct the second type of graph they took 646 serial measurements (longitudinal data) and assessed the mean growth rate with upper and lower percentile limits for each week of pregnancy and for increasing head sizes. The graph growth rate in relation the head size was found to be the most useful for assessing intrauterine fetal growth, as it is then not necessary to know the maturity of the fetus when assessing the fetal growth rate.

Fetal weight. — Many workers have attempted to make predictions of the birth weight from a single biparietal roading near term. Willocks et al. (1964) found that in 67 per cent of cases the fetal weight could be estimated to within $\pm$ 454 gms, Thompson et al. (1965) found that in 68 per cent of cases it could be estimated to within $\pm$ 480 gms and Kohorn (1967), that in 68 per cent of cases

it could be estimated to within 490 gms. From these results, it was generally concluded that a single biparietal diameter reading was of value in fetal weight prediction. The figures however, seem less impressive, if we consider the statement by Lind that if an observer did not examine the patient at all, but simply guessed each fetal weight as 3.41 kg, he would be within 454 gms of the true weight in 70 per cent of 500 normal cases at term. It is clear from this that to assess the value of any technique of fetal weight prediction, it is important to investigate a significant number of babies at the upper and (especially) the lower limit of normal. In none of these ultrasonic studies was a significant number of babies below 2.5 kg investigated. In one of the most quoted papers on this subject, Thompson et al claimed that when the fetal biparietal diameter was 8.5 cms or greater, the fetal weight was in excess of 2.5 kg in 91 per cent of cases. However, from Fig. 5 in their paper, it can be seen that only 11 of their cases were below 2.5 kg in weight and of these, nine (82 %) had biparietal measurements above 5.8 cms. In summary, the prediction of fetal weight from a single biparietal diameter measurement has not been properly evaluated, but it is likely that in view of the wide variation in head size for each week of pregnancy near term (Campbell and Newman, 1971) ultrasonic predictions would be no better than the estimination of fetal weight by clinical methods.

Fetal maturity. — The prediction of fetal maturity is a much more successful application of ultrasonic cephalometry. The most accurate predictions are made when measurements are taken before 30 weeks menstrual age (or equivalent head size). This is because the rate of growth of the biparietal diameter is rapid and remarkable uniform. Campbell (1969), made maturity predictions during this period on 170 antenatal patients in whom the fetal maturity was in dobut; delivery occured within nine days of the date predicted from the ultrasonic measurement in 84 per cent of patients in whom labour began spontaneously and who were delivered of mature babies. Unterahill et al (1971) compared the accuracy of predicting fetal maturtity by ultrasonic cephalometry, radiology and liquor studies in patients with unknown confinement dates. The highest incidence of correct predictions was given by ultrasonic cephalometry.

Because the growth of the fetal head is still fairly rapid between 30 and 34 weeks gestation, predictions during this period are also useful. After 34 weeks there is a progressive decrease in the accuracy of maturity preductions, due to the slower growth and greater variation in head size for each week gestation. Nevertheless, maturity prediction at all stages of pregnancy (Levi, 1971) were found to be useful. He found that the average duration of pregnancy as calculated from a reliable last menstrual period was found to be 282 days (S. D. 13.5 days) while from the ultrasonic prediction, it was 282 days (S. D. 15.4 days).

All these studies were based on predictions from a single ultrasonic measurement. There is little doubt that maturity predictions are more reliable if serial measurements are taken. Maturity predictions are unreliable if growth is already retarded when the measurements are taken. Even in the second trimester it is now the author's practice to perform follow-up measurements on all predictions which disagree with the menstrual dates. Furthermore, in the third trimemester, serial measurements can be very successful in determining in either or not the fetal maturity is in error. This is further elucideated in the next section.

Fetal growth. — Willocks (1963) pioneered the use of serial measurements in the assessment of fetal growth and the paper by Willocks et al (1967) is notable

in that it was the first one to assess the accuracy of this technique in the diagnosis of the small-for-dates baby. This study introduces the simple and attractive concept of 1.7 mm per week as the lower limit of normal growth of the fetal biparietal diameter. The concept of a fixed lower limit of growth is erroneous as the growth rate of the fetal biparietal diameter in the third trimester varies considerably. Furthermore, the figure of 1.7 mm per week was set too high when we consider that Willocks et al (1964) found the mean normal growth rate in the last 10 weeks to be 1.6 mm per week. The net result was that though the pick-up rate of the small-for-dates fetus was good (70 per cent small-for-dates babies had a growth rate less than 1.7 mm per week) there was a high incidence of false positive diagnoses (57 per cent of babies with a low ultrasonic growth rate were of normal birthweight).

It is clear from this that the lower limit of growth must be allowed to vary with fetal maturity of head size. Campbell and Kurjak (1972) and Campbell and Dewhurst (1972) using the graphs of Campbell and Newman (1971) evolved the following method of estimating fetal growth. When the first measurement is taken it is compared with the first graph to see if it is within the normal range for a particular week of gestation; subsequent growth is then assessed on the second graph (weekly growth rate versus head size). This technique can probably best be explained with an example. A fetus whose maturity is supposed to be 34 weeks is found to have measurement of 80 mm, ie. equivalent to 30 weeks size. There are two possible reasons for the small head size (excluding microcephaly and dolichocephaly); either the maturity is in error of fetal growth is impaired. A further measurement is taken one week later. If the hiparietal diameter is 83 mm this indicates that fetal growth is normal and that the maturity is in error providing subsequent growth is normal. If however it is only 81 mm then this indicates retarded fetal growth. Campbell and Kurjak (1972 a) and Campbell and Dewhurst studied (1972) 406 cases who were referred because they were clinically small-for-dates or had pregnancy complication; 149 were found to be normal; 117 had a maturity problem and 140 had a retarded growth rate. In this later group, 68 per cent of babies were below the firth percentile also had a significant increase of low apgar scores, perinatal deaths and fetal abnormalities when compared with the other groups. Campbell and Kurjak (1972 b), compared serial cephalometry with urinary oestrogen excretion in the asessment of fetal growth retardation. They found that cephalometry was significantly better at diagnosing the small-for-dates fetus thought there was no significant difference between the two methods in predicting perinatal aspyxia.

Placentography. — The ultrasonic appearances of the placenta have been described and illustrated by Donald and Abdulla (1968) and Campbell and Kohorn (1968). Placental tissue appears as an area of fine speckling. When the position is anterior, the fetal surface is clearly demarcated as a line; this line is not usually observed with the posterior placenta

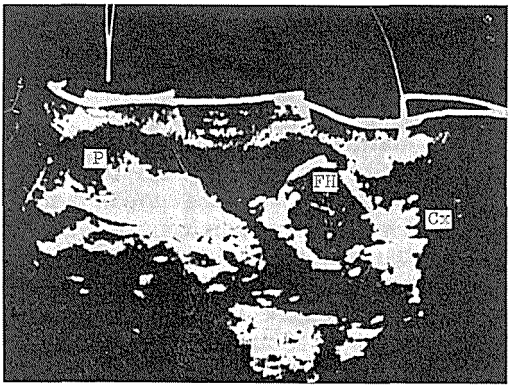


Fig. 8. Normal pregnancy at 18 weeks showing upper posterior placenta

through the fetal surface is equally clearly seen when there is an interface between liquor and placental tissue (Fig. 8).

Placentography by ultrasound is highly successful and in many ways comes nearest to the ideal method of placental localisation. An advantage is that the placenta can be visualized from 11 weks menstrual age onward. This makes useful in reducing the potential hazards of amniocentesis. The edge of the placenta can be visulazed and this can be related to the presenting part and to the cervix. Thus not only can the degree of placenta praevia be ascertained, but in case of marginal praevia the chances if a vaginal delivery can be assessed. Despite these favourable features, mistakes can be made however as the published work on this subject shows. Donald and Abdulla (1968) had a 94 per cent success rate in 613 cases and failed to demonstrate 4 out of 30 placenta praevias; Kobayashi et al (1970) had a success rate of 95 per cent in 100 cases and had one error in 19 placenta praeviae, while Morrison et al (1969) had one error in 23 cases of placenta praevia. Taking these three studies together, in 72 cases of placenta praevia, there were six failures (8.3 per cent), and of these, only one was on the anterio-uterine wall. The difficulties that can be encountered in localisation of the posterior placenta usually arise in the third trimester and can be attributed to two factors — a relative diminution in the amount of liquor amnii and an increase in the size of the fetal trunk. The body of the fetus attenuates the sound so that when a longitudinal midline scan is made, the placental tissue does not «speckle« and the fetal surface cannot be identified. In Queen Charlotte's Hospital, we have developed a technique to deal with this situation and have found it highly successful. Firstly, longitudinal scans are made lateral to the fetal trunk where if the placenta is indeed posterior, speckling can always be seen. The operator next ascertains if the presenting part is closely applied to the sacral promontory and if it is then placenta praevia is impossible. If there is a space between the presenting part and the sacral promotory, the patient is given a 30° »head down« tilt and the fetal head gently raised (this is easy when placenta is praevia). If placenta praevia exists, then the lower edge can be easily identified. An example of this technique is shown in Fig. 9.

Other conditions of mid and late pregnancy. — This section will cover the other conditions that can be diagnosed by ultrasound in the second and third triemeters of pregnancy.

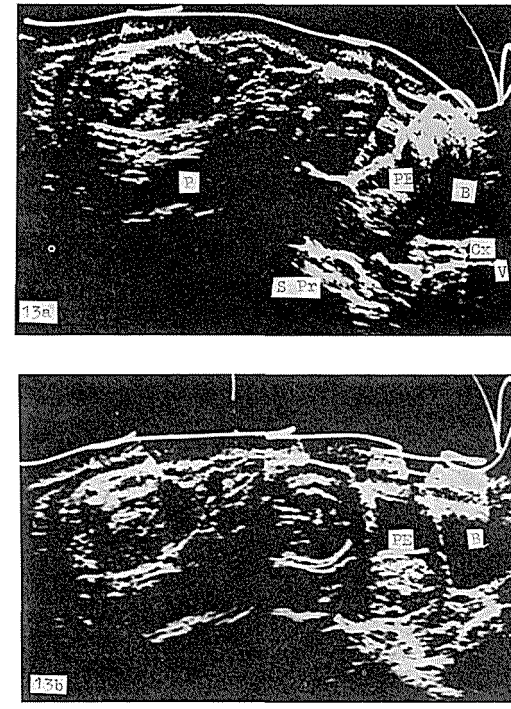


Fig. 9. Case of Type III posterior placenta praevia at 36 weeks — a) longitudinal scan showing suspicion of posterior placenta praevia and b) placenta now shown more clearly with head-down tilt and upward displacement of the fetal head

Hydatidiform mole. — The diagnosis of hydatoiform mole was first reported by Donald and Brown (1961) and subsequent workers (Kohorn and Blackwell, 1968; Morrison et al, 1970) have confirmed that ultrasound is probably the most reliable and certainly the most rapid method of diagnosing this condition.

The characteristic appearance of a hydatidiform mole is that of diffuse speckling due to multiple reflections from the vesicles which are present throughout the uterus when the ultrasonic intensity is hngh (Fig. 10); these echoes quickly disappear when the intensity of the ultrasound is slightly reduced (giving the appearance of an empty uterus) but the rate of disappearance of echoes in variable and the diagnosis is usually made on the speckling alone. There are no fetal echoes (unless rarely when there is a coexisting fetus) and no evidence of liquor amnii. Occasionally blood clot which is transonic is present in the lower pole of the uterus. Even when there is a coexisting fetus the diagnosis can usually be made and in our department we have recently successfully diagnosed two such cases.

Another important aspect is that after evacuation of the mole, ultrasound can be used to examine the uterus should the gonadotrophin levels rise again. Ultrasound can quickly distinguish between recurrent molar tissue or choriocarcinoma and a normal pregnancy (Fig. 11).

Multiple pregnancy. — In mid pregnancy this diagnosis can easily be made by counting the fetal heads. As even the most primitive of B scanners will outline the fetal head this as a diagnosis that should not be missed. Although the fetal head can be seen as early as 12 weeks menstrual age, the diagnosis can only be reliably made from 14 weeks onwards. Eexamples of multiple pregnancy are shown in Fig. 12.

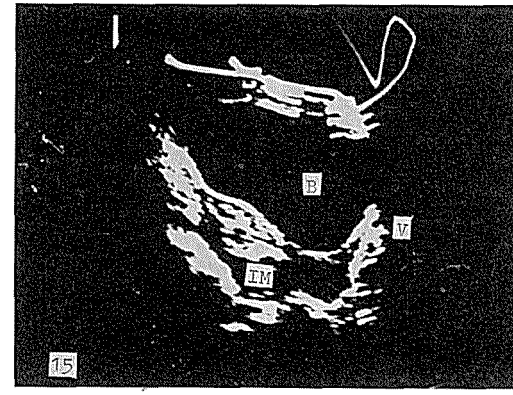


Fig. 11. Recurrence of molar tissue (invasive mole) 3 months after evacuation of hydatidiform mole

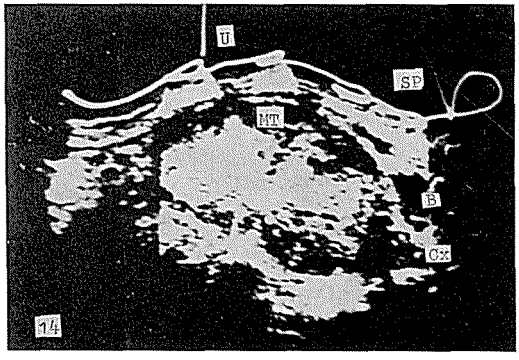


Fig. 10. Hydatidiform mole at 16 weeks menstrual age

Fig. 12. Multiple pregnancis in the middle trimester — a triplets at 22 weeks

Associated tumours. — Pelvic tumours associated with pregnancy can usually be clearly defined. For the majority of such swellings, the differential diagnosis is between uterine fibroid and ovarian cyst. Echoes from fibroids typhically merge with those of the uterus (Fig. 13). Furthermore, fibroids usually attenuate the sound waves to a greater degree (requiring a higher intensity or lower frequency sound wave to penetrate them) are frequently irregular and give diffuse course echoes from their substance. Ultrasound may fail to diagnose small subserous fibroids but will usually reveal large ones and (importantly) will always show a cervical fibroid (Fig. 13). Ovarian tumours on the other hand are usually transonic (unless solid and malignant) have smooth walls and frequently displace the uterus to one side (Fig. 14).

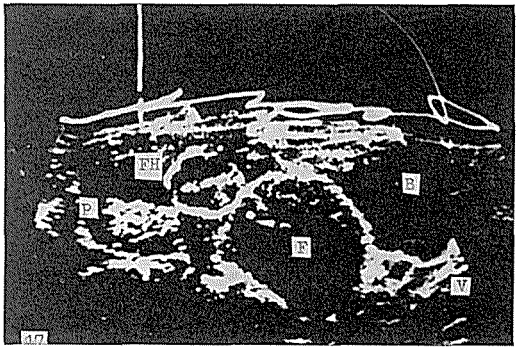


Fig. 13. Case of cervical fibroid at 17 weeks gestation — the vagina is seen to merge with the fibroid

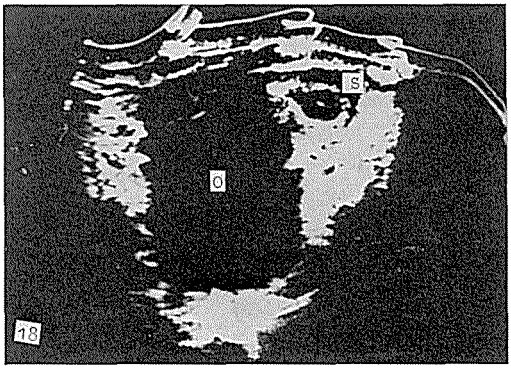


Fig. 14. Case of a large ovarian cyst displacing at 8 weeks menstrual age to the left side of the abdomen

Hydramnios. — The appearances were first described by Sunden (1964) and characteristically, there are large echo-free areas in which the fetal limbs appear as »blobs« (Fig. 15). There is unfortunately no way of assessing this quantitively and the diagnosis is made by visual impression only. In a similar way, oligohydramnios can be recognised by an absence of echo-free area and »blobbing« of the limbs.

Fetal abnormality. — At present only cephalic abnormalities can be reliably diagnosed by ultrasound. Anencephaly is characterized by the abcsence of the typical strong smooth outline of the fetal head (Fig. 15). Hydramnios is usually asociated after 24 weeks gestation. In theory, the diagnosis should be possible if the fetal head is not visualized by 14 weeks gestation but if termination of pregnancy is contemplated it is best to confirm the diagnosis by at least two further weekly scans. In Queen Charlotte's Hospital, we have successfully diagnosed three cases of anencephaly before 20 weeks gestation and in one case, termination was carried out (Campbell et al, 1972). It is notable that in none of these early cases was hydramnios present..

Hydrocephaly should be considered if the fetal biparietal diameter is above 11 cm though usually it is far in exces of this figure. The fetal head is typically more spherical than ovoid and there is often an asymetrically placed midline echo. Microcephaly is diagnosed by the appearance of an abnormally small fetal head, especially when compared with a transverse section of the fetal chest. It should be stressed that in both hydrocephaly and microcephaly, borderline cases can give rise to difficulty in diagno-

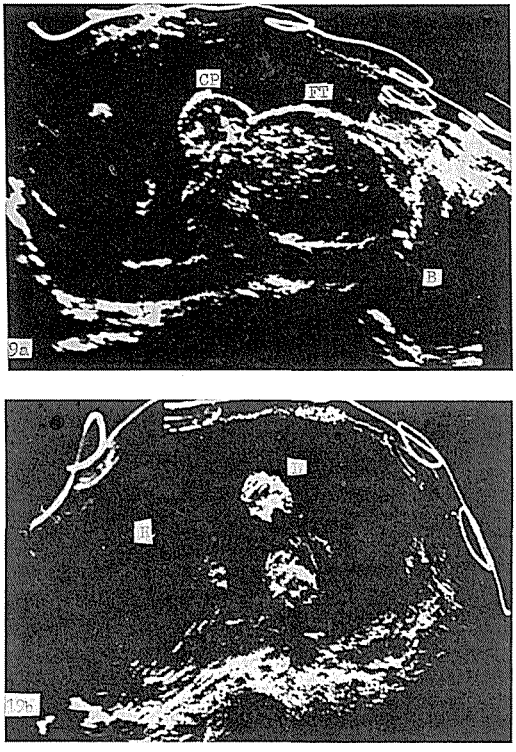


Fig. 15. Case of anencephaly at 28 weeks gestation — a) longitudinal scan showing absence of normal head echo and b) transverse scan showing hydramnios and blobbing of the limbs

sis. Unfortunately, the fetal spinal column cannot be visualized by ultrasound with the precision of an X-ray and at present the diagnosis of spinal abnormalities is not in practical proportion.

Using their water coupling scanner, Garrett et al (1970) diagnosed polycystic fetal kidneys at 31 weeks gestation. It is unlikely however, that this diagnosis would have been made with a contact scanner. However, a renal abnormality of the fetus that should be detectable with the contact scanner is renal agenesis. As described above, the fetal bladder can always be seen on the B scan display. The absence of fetal bladder echoes over a six-hour period together with oligohydramnios would be strong presumptive evidence of renal agenesis. So far, this condition has not been diagnosed.

Abnormal babies are usually small-for-dates (because of low growth potential) and so indirectly fetal abnormality can frequently be indicated from serial biparietal measurements. Campbell and Kurjak (1972 a) described how in contrast to the baby suffering from intrauterine starvation, who shows only a terminal flattening of the growth rate, the abnormal baby frequently demonstrated impaired growth from early in the second trimester.

Summary

In a decade, ultrasound has progressed from being a research tool to an invaluable aid in obstetric diagnosis. In many conditions such as placenta praevia, hydatidiform mole and fetal death in utero, it has become the diagnostic method of choice while it use in cephalometry has provided obstetricians with an important means of assessing fetal maturity and growth. In our practice, the introduction of ultrasound has necessitated some changes in obstetrics practice. For example, the obstetrician is encouraged to refer possible maturity problems for diagnosis early in pregnancy rather than defer investigation until late in the third trimester. It has also caused a dramatic reduction in the use of x-rays for antenatal diagnosis. However, in certain fields such as pelvimetry and the detection of skeletal abnormalities of the fetus, radiology remains supreme. If progress over the next 10 years is as rapid as in the last, then ultrasound will play an increasingly important role in the elucidation of obstetric diagnostic problems.

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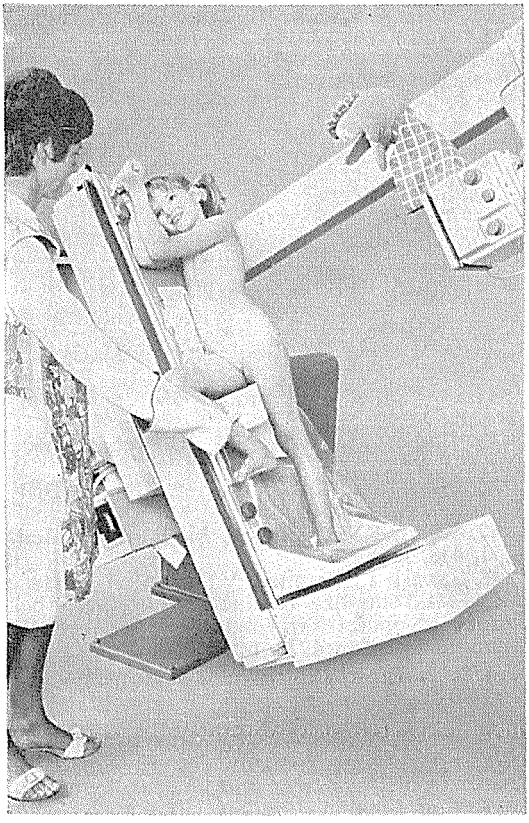

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MEDICINSKI CENTAR KARLOVAC — SLUŽBA ZA RADIOLOGIJU

NOVOTVOREVINE SLEZENE

Mates I.

Sadržaj: Autor opisuje dva slučaja novotvorevina slezene. Kod jednog bolesnika radilo se o pseudocisti, a kod drugoga o retikulosarkomu. Oba slučaja verificirana su patohistološkom pretragom operativnog materijala.

UDK 616.411-006(497.1)

Deskriptori: Rentgen diagnostika, slezena, novotvorevine, pseudocista, retikulosarkom.

Radiol. Iugosl., 4; 349—352, 1974

Novotvorevine u slezeni su veoma rijetke i dolaze u svega 0,6 % svih novotvorevina (3). Kao i u drugim organima one mogu biti dobročudne i zločudne, a ove opet primarne i sekundarne ili metastatske.

Dobročudne novotvorevine su fibromi, hondromi, osteomi, limfangiomi, hemangiomi i to najčešće kavernoznog oblika. Ovamo nadalje spadaju ciste slezene, koje se prema većini autora dijele na:

1. kongenitalne, primarne ili prave ciste,
2. posttraumatske, hemoragične, sekundarne ili pseudociste, i
3. parazitarne ciste.

Sigurna diferencijalna diagnoza dobročudnih novotvorevina slezene moguća je jedino histološkom pretragom operativnog ili punkcionog materijala. Veličina cista može varirati od sasvim malenih pa do onih koje narastu do veličine nogometne lopte. Mogu biti pojedinačne ili u većem broju. Terapija je jedino kirurška.

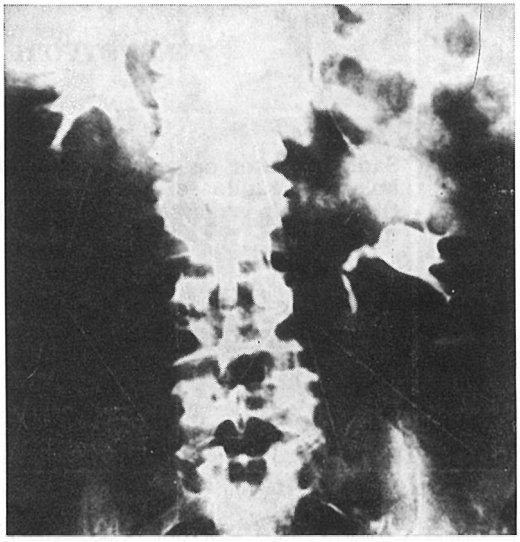
Primarne zločudne novotvorevine u slezeni su veoma rijetke i dolaze u svega 0,1 %. Njihova diagnoza je teška, a prognoza izrazito loša. Najčešće su to sarkomi celularnih stanica, potpornog tkiva ili sarkom krvnih žila. Nešto češće su metastaze karcinoma drugih organa kao pluća, nadbubrežne žljezde, maternice, jajnika i dojke (0,6 % Saegesser, 1—4 % Schurer, 10 % Aschoff)[3].

Diferencijalno diagnostički moraju se isključiti novotvorevine okolnih organa slezene, lijevoga bubrega, nadbubrežne žljezde, repa gušterače, lijevoga režnja jetara, omentuma, želuca, debelog crijeva, lijevoga ošita, kao i retroperitonealni procesi te uvečanje limfnih žljezda.

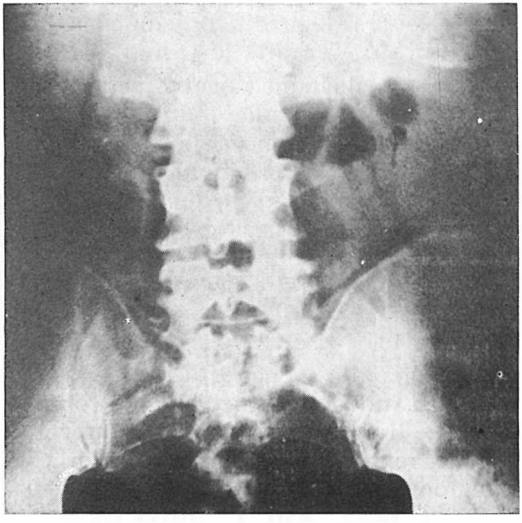
Radiološki prikaz može biti direktan, kada se nastoji prikazati sama slezena i patološke promijene na njoj, ili indirek-

tan, kada se prikazom okolnih organa nastoji prikazati promijene na slezeni.

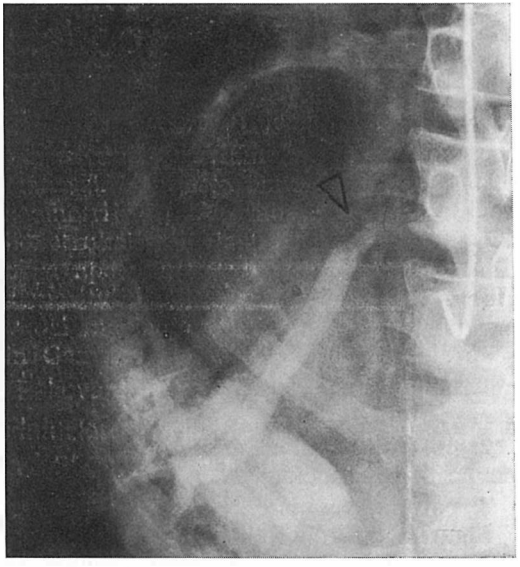
Prikaz slučajeva. — Bolesnik R. M., 53 godine, muškog spola. Iz anamneze se doznaje da se dječjih bolesti ne sjeća, a kasnije navodno uvijek zdrav. U anamnezi ne spominje bilo kakovu traumu. Prije dvije godine liječio se na istom odjelu zbog upale vena lijeve noge. Tada učinjeni klinički i laboratorijski nalazi bili su u granicama normale. Sada je na odjel primljen zbog istih smetnji. Ponovljeni laboratorijski nalazi su u granicama normale. Kod kliničkog pregleda trbuha pipa se u lijevom gornjem dijelu tumefakcija veličine dječje glave, palpatorno potpuno bezbolna, glatke površine, slabo pomična. Bolesnik istu nije primjetio niti je imao bilo kakovih poteškoća. Diaskopija pluća i srca pokazala je uredan nalaz. Rentgenogram trbuha dopunjen sa profilom pokazuje u lijevom gornjem kvadrantu cističnu tvorbu veličine dječje glave sa jasno vidljivim istaloženim vapnom u stijenci. Tvorba leži



Sl. 2. I. v. urografija: lijevi bubreg je potisnut prema dolje uz impresiju gornjeg pola. Čašice gornje skupine lagano deformirane. Lijevi ureter izvijugan

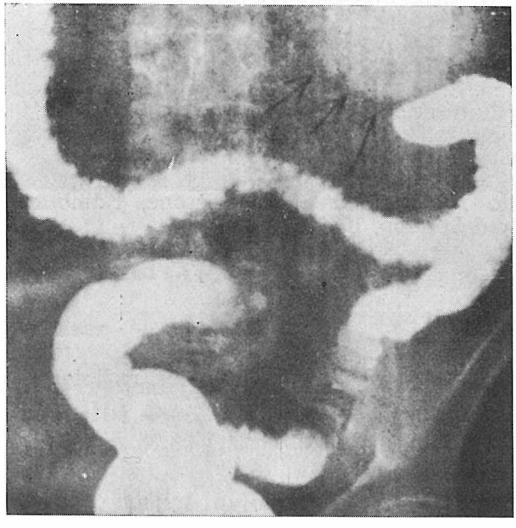


Sl. 1. Rentgenogram trbuha: u lijevom gornjem kvadrantu vidi se cistična tvorba veličine dječje glave sa jasno vidljivim vapnenim rubom. Sjena lijevoga bubrega potisnuta je prema dolje

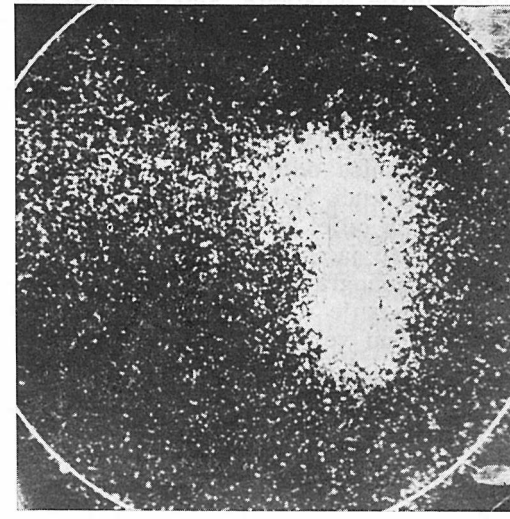


Sl. 3. Frontalni planigram trbuha: jasno vidljiva cistična tvorba u lijevom gornjem kvadrantu trbuha sa istaloženim vapnom u stijenci

više straga. Sjena lijevoga bubrega potisnuta je prema dolje, tako da donjim polom prelazi preko linije kriste. Kontura lijevoga m. psoasa je glatka i pravilna. (Sl. 1.) Diaskopija želuca prikazala je njegov pomak prema naprijed i u desno bez znakova eventualne impresije stijenke u području velike krivine. Irigoskopija sa irigografijom pokazuje fleksuru lienalis kolona potisnutu prema dolje i naprijed uz sasvim blagu impresiju, dok se infiltracije stijenke nije utvrdilo. Infuziona urografija dala je uredan nalaz funkcije i morfologije desnoga bubrega. Lijevi bubreg pokazuje sada još jasnije prije spomenuti pomak prema dolje i desno uz impresiju gornjeg pola. Funkcija lečenja, koncentracije i evakuacije je uredna. Kanalni sistem ne pokazuje promijena. Lijevi ureter je lagano izvijugan, što je uvjetovano potisnućem bubrega (Sl. 2.). Učinjeni su frontalni planigrami lijevoga gornjeg kvadranta trbuha, koji jasno pokazuju cističnu tvorbu veličine dječje glave sa vapnenim rubom. Opisana cistična tvorba odijeljena je od lijevoga ošita



Sl. 4. Rentgenogram irigoskopije kod punjenja: fleksura lienalis kolona potisnuta je sjenom veličine muške šake prema dolje i medijalno, bez znakova infiltracije stijenke



Sl. 5. Scintigram slezene: velika hladna zona uvečane slezene

sa dva prsta širokom homogenom sjenom koja pripada gornjem polu slezene (Sl. 3.). Scintigrafija slezene pokazala je veliku hladnu zonu koja zauzima njene centralne partije i čitav donji pol.

Predloženi pneumoperitoneum bolesnik odbija. Splenoportografija kao i aortografija nisu radjene zbog neopremljenosti rentgen odjela za takove pretrage.

Nakon konzultacije sa kirurgom bolesniku je predložen operativni zahvat na kojega pristaje. Operativan nalaz: uvečana slezena napete čahure, veličine dječje glave, glatke površine, tamno crvene boje. Na donjem polu vide se fibrinske naslage. Učinjena je splenektomija, a patohistološki nalaz je — pseudocista. Postoperativni tok je uredan i bolesnik se odpušta iz bolnice kao izlečen.

Bolesnica J. J., 64 godine. Dječjih bolesti se ne sjeća. Kasnije nekoliko puta lijećena radi upale bubrega. Ležala na internom odjelu od 5. 3.—2. 3. 1974. g. zbog povremenih bolova ispod lijevoga rebranog luka, laganih povremenih mučnina, slabljenja i proljevastih stolica. Laboratorijski nalazi pokazali su lagani pad broja eritrocita uz

porast broja leukocita, kao i porast brzine sedimentacije krvi. Kliničkom inspekcijom trbuha palpira se u lijevom gornjem kvadrantu tvorba veličine muške šake, neravne površine, bezbolna, veoma slabo pomična. Predložene daljne pretrage bolesnica odbija i na vlastiti zahtjev odlazi kući. Nakon 14 dana vraća se ponovno na odjel zbog pogoršanja općeg stanja i sve jačih bolova u trbuhu. Nativni rentgenogram trbuha u ležećem položaju pokazuje u lijevom gornjem kvadrantu sjenu veličine muške šake, oštro ograničenu od okoline. Diaskopija pluća pokazuje položen i respiratorno uredno pomičan lijevi ošit. U frenikokostalnom sinusu vidi se sasvim maleni izljev. Diaskopija želuca i duodenouma sa pasažom crijeva je u granicama normale. Irigoskopija sa irigografijom pokazuje fleksuru lienalis potisnutu prema dolje i medijalno, bez znakova infiltracije stijenke (Sl. 4.). Urografski nalaz oba bubrega je funkcionalno i morfološki potpuno uredan. Scintigrafija slezene pokazuje veliku hladnu zonu uvečane slezene (Sl. 5.). Kako bolesnica oseća sve jače bolove, opada na težini, gubi apetit, predlaže joj se operativni zahvat na kojega pristaje, te se prebacuje na kirurški odjel. Kod operacije vidi se uvečana slezena, izrazito čvoraste površine, čvrsto srasla sa okolinom i bez mogućnosti mobiliziranja radi splenektomije. Učini se samo punkcija slezene a patohistološki nalaz punktata je — retikulosarkom. U postoperativnom toku, nakon 14 dana nastupa smrt uslijed insuficijencije bubrega.

Zaključak. — Prikazana su i opisana dva bolesnika sa novotvorevinom u slezeni. To su rijetka oboljenja sa veoma oskudnim kliničkim nalazima, te se često puta odkriju kao slučajan nalaz kod pretraga radi drugih oboljenja. Novotvorevine slezene mogu biti dobročudne i zločudne, a ove potonje najčešće metastatske. Radiološki prikaz može biti direktan, kada se nastoji prikazati sama slezena i promijene na njoj, ili indirektan, kada se radiološkim prikazom okolnih organa nastoji utvrditi promijene na slezeni. Terapija je operativna, uz ozračivanje, ukoliko se radilo o zločudnoj novotvorevini.

Summary

Two cases of tumor of the spleen are described. In the first case a pseudocyst was found, in the second the tumor proved to be reticulosarcoma. Both cases were verified by histology.

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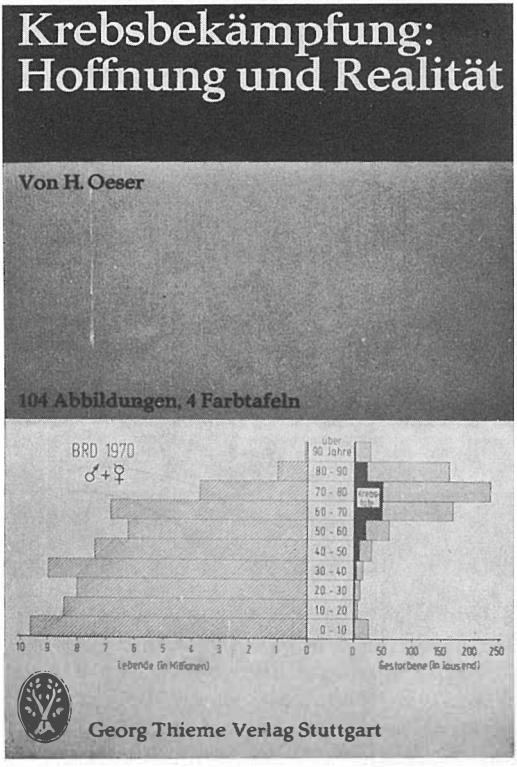
Adresa autora: Dr. Ivo Mates, radiolog, Pivovarska 10, 47000 Karlovac.

RECENZIJE KNJIGA



KREBSBEKÄMPFUNG: HOFFNUNG UND REALITÄT

H. Oeser

Georg Thieme Verlag, Stuttgart 1974, 184 strani, 104 slike, 9 tabel in 4 barvne priloge. Cena 39,80 DM.

V tej knjigi avtorji obravnavajo že sicer znano tezo o determinirani kvoti ozdravitev rakastih bolnikov. Novost pa je v tem, da skušajo tezo sedaj osvetliti z novejšimi dognanji v kinetiki celice in tkiv ter v odnosu med tumorjem in njegovim rednikom. V prvem poglavju avtorji vpeljejo nov terminus, govore o tumorski valenci, ki jo sestavljajo tri komponente in sicer: (1) lokalizacija in velikost tumorja pri ugotovitvi, (2) hitrost rasti tumorja in (3) nagnjenost tumorja k tvorbi metastaz. Vsako od teh poglavij avtorji kritično prikažejo. V zvezi z lokalizacijo in razširjenostjo govore o pomenu TNM klasifikacije, ki ji očitajo predvsem statičnost pogleda ter opozarjajo, da nas lahko pripelje do »birokratskega« načina zdravljenja. Glede parametra hitrosti rasti so avtorji mnenja, da je le-ta pomemben, ker prikaže dinamiko rasti ter tako ni v nobeni zvezi z velikostjo tumorja. Avtorji menijo, da je pojem časa podvojitve močno uporaben podatek, ki pa ga je zaenkrat težko zajeti, saj tumor v najboljšem primeru vizualiziramo, ko je njegova velikost 5 do 8 mm. V zvezi z metastazami avtorji opozarjajo, da so te rezultat medigre med tumorjem in rednikom/organom. Pravijo, da so minili časi izključno hemodinamskega gledanja na ta proces, ki je po njihovem mnenju močno imunsko obarvan.

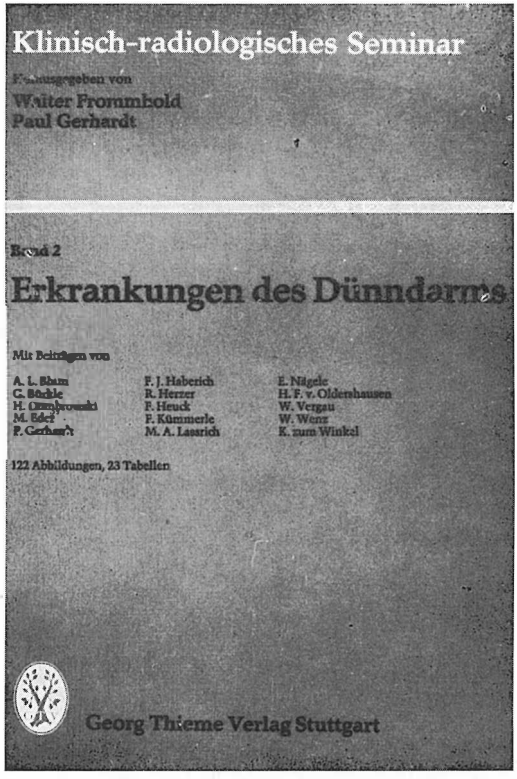
V zvezi s problemom analize rezultatov zdravljenja, tj. podatkov, na katere se vedno opiramo in pri katerih je zaslediti veliko neresnice, menijo, da je treba vpeljati ločeno **kvantitativno** vrednotenje rezultatov, kar pomeni ozdravljenje ali interval prost simptomov, in **kvalitativno,** ki naj pove, ali daje naš način zdravljenja v primerjavi z netretiranimi serijami dejansko boljše preživetje. Temu sledi poglavje o poizkusih zvišanja učinkovitosti zdravljenja. Tu je govora večinoma o znanih stremljenjih kot so npr. superradikalne operacije, zvi-

ševanje doze pri obsevanju in uvajanje novih izvorov sevanja; pri tem se omenjajo tudi pi-mezoni. Prav tako daje avtor tega poglavja velik poudarek kombinaciji naštetih terapevtskih možnosti.

Zadnje poglavje obravnava organizacijo borbe proti raku. Pričeti je treba že na začetku, kar pomeni vzgajati zdravnika, točneje, uvesti bolj podroben, praktičen študij onkologije v medicinske šole. Težišče problema je pač danes v zgodnjem odkrivanju rakastih bolezni, in s tem v zvezi prihaja vsekakor bolj in bolj v poštev definiranje rizičnih skupin. Potrebo po tem nam nenazadnje diktira tudi gospodarnost pri trošenju sredstev, potrebnih za zgodnje odkrivanje rakastih bolezni.

Knjiga je pisana zelo dinamično in zato zanimivo. Opremljena je s serijo domiselnih slik in diagramov, ki močno olajšajo razumevanje. Smatramo, da knjiga vsebuje koristen tekst za ljudi, ki se bavijo oz. jim je pri srcu reševanje problema rakastih bolezni.

S. Plesničar



KLINISCH-RADIOLOGISCHES SEMINAR

ERKRANKUNGEN DES DÜNNDARMS

Herausgegeben von W. Frommhold, P. Gerhardt

G. Thieme Verlag, Stuttgart, 1973. 204 strani, 122 slik, 23 tabel, cena 48 DM.

Interdisciplinarni pogovori predstavljajo za moderno radiologijo neprecenljivo vrednoto. Ob njih si bogati strokovno znanje radiolog, klinik, patolog in (pato)fiziolog. Omogočajo iskanje skupnih poti za zdravnikovo ravnanje.

Ni torej čudno, da je pred dvema letoma publiciran tekst klinično-radiološkega seminarja Tübinške univerze požel tolikšno zanimanje (glej recenzijo: Klinisch-radiologisches Seminar; Erkrankungen der Niere, Radiologia Iugoslavica 1-2/1973).

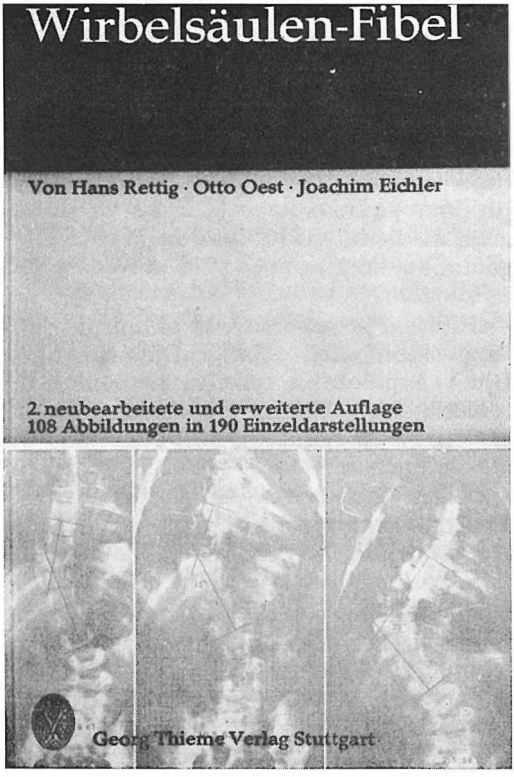
Zdaj je pred nami druga knjiga v tej seriji. Obravnava bolezni tankega črevesa. Sodeluje 15 priznanih avtorjev. V svojih sestavkih prikazujejo pregled patologije tankega črevesa, fiziologijo, možnosti in meje rentgenske diagnostike, specialne rentgenske metode (angiografije, hipotonična duodenografija) in izotopske preiskavne možnosti. Precej prostora je odmerjeno diagnostiki Crohnove bolezni. Zanimivi so tudi članki o kirurških možnostih pri obolenjih tankega črevesa, reaktivnih spremembah med in po terapevtskem obsevanju, o preiskavnih metodah pri otrocih, ter o malabsorbcijskih sindromih.

Knjižica daje vrsto vzpodbud za vsakodnevno rentgenologovo delo, daje pregled

danes možnega, svetuje izpopolnitve v metodiki in sistematiki radiologovega pregleda. Klinik bo v njej našel pregleden oris meja možnosti radiološke diagnostike.

Knjižica ne želi zamenjati učbenike, njena velika vrednost je v aktualnosti in celovitosti obravnavane teme.

P. Soklič



WIRBELSÄULEN-FIBEL

H. Rettig, O. Oest, J. Eichler

2. predelana izdaja
127 strani, 108 slik, 190 tabel
cena 29,80 DM

Število pacientov, ki zaradi bolečin v križu, motenj ravnotežja, izžarevanja bolečin v zatilje, ischialgije in podobnega iščejo zdravniške pomoči predvsem v splošni praksi ni majhno. Pričujoče delo, sicer ne posebno obsežno, na strnjen način, vendar v okviru najpomembnejših informacij prikazuje celotno patologijo hrbtenice tako etiološko, klinično, diferencijalno diagnostično in tudi na kratko nakaže možnosti zdravljenja.

Zavoljo lažjega razumevanja je v prvem poglavju predstavljena anatomija hrbtenice predvsem v klinično-aplikativnem smislu. Celotno delo je nato razdeljeno v poglavja, ki smiselno slede drug drugemu.

Vrstijo se: preiskovalna tehnika tako klinična kot radiološka, motnje v statiki hrbtenice, degenerativna obolenja, vnetja, metabolna obolenja, novotvorbe, poškodbe, radikularni in pseudoradikularni sindromi, anomalije oziroma variante aksialnega skeleta.

Značilnost vsega povedanega je, da delo ni namenjeno samo specialistu s tega področja. Poudarek je v prikazu patologije aksialnega organa v taki obliki, da je razumljiva predvsem tistim, ki se z njo srečujejo v ambulanti splošne prakse. Seveda je dobrodošel repetitorij vsem ostalim, ki se interdisciplinarno udejstvujejo pri obolenjih hrbtenice.

Tako je v poglavju statičnih motenj na hrbtenici pregledno prikazana razdelitev skolioz, njihova klinika, diferencialna diagnoza, prognoza in terapija.

Pri razlagi degenerativnih obolenj je razločno podana razlika med deformantno spondilozo, hondrozo in intervertebralno osteohodrozo. Razločno je tudi povedano kaj je Mb. Scheuermann.

Razumljivo, čeprav s skopimi besedami je razložena vključitev skeleta v endokrini sistem, ter etiopatogeneza povečane razgradnje kosti. V to razpravo so pridružene: razdelitev in prikaz osteoporoz, njihova diferencialna diagnoza ter terapija. Razloženo je tudi razlikovanje med

starostno atrofijo in involutivno osteoporozo. Dobro so pojasnjena tudi dogajanja pri inaktivitetni osteoporozi.

Veliko pozornost so avtorji posvetili travmi hrbtenice, kar je spričo vse številnejših poškodb hrbtenice bodisi poklicnih, bodisi v prometu še posebno pomembno. Pri klasifikaciji teh poškodb so upoštevani tako funkcionalno-dinamični kot patoanatomski parametri. V skladu s temi dejstvi je tudi obravnavana terapija teh lezij.

V posebno poglavje so uvrščena in razložena tako imenovana vertebragena obolenja oziroma iritacije živčnih korenin. Patologija, ki je vsebolj aktualna. Marsikdo, posebno pa praktikus bo našel koristne napotke in razlago cervikalnega sindroma, ki zajema dokaj obsežno patologijo: vertebrageni glavobol, okcipitalno neuralgijo, brahialgijo parestetiko nokturno, migreno cervikalis in podobno.

Pregledna je tudi obravnava anomalij razvoja oziroma variant skeleta hrbtenice. Ob navedeni klinični sliki so naštete vse možnosti, ki se običajno pojavljajo.

Kot zaključek je prav gotovo umestna trditev, da si podobnih publikacij lahko samo želimo. V strnjenem tekstu z bogato ilustracijo je s širokim pogledom, čeprav v gotovih poglavjih po načinu enciklopedije, prikazana celotna patologija, mestoma tudi patofiziologija hrbtenice obenem s terapijo.

Ludvik Tabor

NUCLEAR HEPATOLOGY

M. Lio, H. Yamada, K. Kitani, Y. Sasaki: Clinical and Physiological Aspects of Liver Disease by Radiosotopes.

George Thieme Publishers Stuttgart, Igaku Shoin ltd. Tokyo, 1974. 164 strani, 15 bravnih slik in 332 ilustracij.

Vsebina knjige je sumaričen prikaz izkušenj in spoznanj avtorjev v zadnjih 10 letih v hepatologiji s pomočjo nuklearno medicinskih preiskav. Položaj nuklearne medicine v hepatologiji je opisan v duhu kliničnega hepatologa, diagnostika in raziskovalca. Avtorji opišejo jedrnato patološko-fiziološko osnovo v poglavju obravnavanega kliničnega problema, bistvo (ne pa tehnologijo) nuklearno medicinskega postopka, rezultate pa prikažejo na poučnem kliničnem primeru ter v statistični obdelavi rezultatov preiskav skupine kontrolnih oseb in bolnikov hepatopatov.

Knjiga je razdeljena v 13 kratkih poglavij, ki so napisana v lahko razumljivi angleščini, jasno in jedrnato. Osnovno znanje o nuklearno medicinskih in vivo in v in vitro preiskavah in poznavanje terminologije v nuklearni medicini je pogoj za razumevanje vsebine. Avtorji uporabljajo aparate in radiofarmacevtike kot jih ima na razpolago Klinika za nuklearno medicino v Ljubljani in je zato knjiga toliko bolj zanimiva za slovenske hepatologe.

Odkrivanju procesov, ki okupirajo jetrni prostor, služi scintigrafija. Scintigrafija v 3 položajih odkriva hepatalne defetkte v 80—90 % z ^{198}Au, dodatna scintigrafija z ^{67}Ga citratom, z ^{131}J-RISA ali ^{99}Tc-albuminom, z ^{131}J-BSP in celiakalna ter portalna perfuzijska scintigrafija z ^{131}J-MAA pa omogočajo njihovo diferenciacijo v malignome, hemangiome, dilatacije intrahepatičnih žolčevodov in ciste.

Za kliničnega hepatologa so predvsem zanimivi diagnostični postopki in nova spoznanja dosežena s pomočjo študija metabolizma ^{131}J-BSP. Rentencijski test z 0,5 mg ^{131}J-BSP loči z veliko zanesljivostjo hepatopate od kontrolnih oseb, sekvenčna scintigrafija in študij intrahepatalnega in ekstrahepatalnega transporta ^{131}J-BSP omogoča diferenciacijo ikterusa: parenhimskega od obstrukcijskega, ločevanje Dubin-Jonsonovega sindroma od Rotorjevega tipa bilirubinemije. Avtorji postavljajo nove modele v kinetiki ^{131}J-BSP pri konstitucionalnih zlatenicah.

Novosti prinaša študij hemodinamičnih prilik pri cirozi jeter in idiopatski portalni hipertenziji: spremembe v portalnem in arterialnem minutnem volumnu jeter ter v minutnem volumnu vranice. Študija prinaša test odkrivanja in semikvantitativnega določanja intra- in ekstrahepatalnega shunta s pomočjo perkutanega vbrizga ^{131}J-MAA in ^{85}Kr ali ^{133}Xe v vranico.

V domeno in vivo preiskav z radioaktivnimi izotopi sodi še poglavje obširnejše klinično nuklearne medicinske študije o shistosomiazi na Japonskem, krajše poglavje o Wilsonovi bolezni z gledišča metabolizma bakra (^{64}Cu) in sprememb v vranici ter poglavje o scintigrafski detekciji kongenitalnih anomalij jeter.

In vitro preiskave v hepatologiji imajo skromnejši obseg, vendar so odličen prispevek k klinični hepatologiji: radioimunsko določanje X-fetoproteina in Australia antigena ter določanje latentne vezalne kapacitete za železo (LIBC). Mikroelemente v jetrih pa je mogoče določati z aktivacijsko analizo bioptičnega materiala jeter (baker, mangan, brom in jod).

Najnovejši primer poznavanja in fiziologije soli žolčnih kislin je detekcija bakterijske dekonjugacije soli žolčnih kislin pri sindromu slabe absorpcije s tehniko meritve radioaktivnosti izdihanega zraka po oralni aplikaciji glicin — 1-^{14}C-holata. Ta tehnika odkriva bolnike s povečano bakterijsko dekonjugacijo žolčnih soli (bacterial overgrowth syndrome).

Zadnje kratko poglavje informira bralca o testiranju funkcije RES-a jeter in odkrivanju amiloidoze z ^{131}J-Congo-rdečilom.

Moje poročilo o »Nuclear Hepatology« je namenoma obširnejše, ker bi rad opozoril na napredek zadnjega desetletja v nuklearni hepatologiji, za katerega so pogoji tudi v našem Kliničnem centru. Knjigo, kateri sta napisala uvodni besedi pionirja nuklearne medicine prof. G. V. Taplin in prof. H. N. Wagner priporočam zlasti kliničnim hepatologom in internistom, seveda pa tudi vsem uporabnikom nuklearne medicine.

B. Varl

HIP DISEASE OF INFANCY AND CHILDHOOD,

R. H. Freiberger, J .J. Kaye, B. Ghelman, J. W. Spragge.

Current problems in Radiology, Vol. III Number 5, Sept.—Oct. 1973,
Year book medical publishers, Chicago
51 strani, 32 slik, letna subskripcija 20 $

Revija »Current problems in Radiology« je dvomesečnik in s svojimi publikacijami bralca ne razočara. Tudi s septembrsko-oktobrsko številko je tako.

Obolenje kolčnega sklepa novorojenčka oz. otroške dobe je prikazano na način, kot si ga lahko samo želimo. Pisano živahno, obenem brez leposlovne navlake, nove ugotovitve, pisano tako kot moramo v radiologiji gledati na vsak problem. Klinično-diagnostično široka zasnova, vprašanja podprta z dokazi, ki ne dopuščajo dvoma.

Publikacija prikazuje štiri najbolj pogostna obolenja kolčnega sklepa dojenčka oz. rane otroške dobe: kongenitalna displazija, bakterielni infekti, aseptična nekroza, epifizioliza glavice femorja.

Izraz kongenitalno displazijo je zamenjala kongenitalna dislokacija kolčnega sklepa, posledica novejših ugotovitev in gledanj na nastanek motenega razvoja kolčnega sklepa.

Zanimivo je, da avtorji ne prikazujejo v svojih razpravah le diagnostičnega problema. Obravnavana je tudi terapija oz. kako se kažejo na rentgenski sliki posledice različnih terapevtskih posegov.

Tak pristop predstavitve nekega diagnostičnega problema odpira možnosti najširšega informiranja. Na ta način obrav-

navana katerakoli tematika daje vse možnosti, da lahko govorimo v pravem klinično diagnostičnem jeziku, metoda, ki je v radiologiji edino pravilna.

V poglavju vnetja kolčnega sklepa pri novorojenčku in kasneje, je prikazano razlikovanje med septičnim artritisom, supurativnim artritisom in specifičnim koksitisom.

Avtor opozarja na odločilno vlogo radiologa v timu neonatalec, pediater-ortoped. Vendar radiolog brez dobrega znanja klinike ne more uspešno konkurirati v tem triu.

V poglavju aseptične nekroze glavice femorja in epifiziolize glavice femorja se avtorja držita ustaljenega načina obravnavaja tematike — klinična slika, patologija, etiologija, radiologija, zdravljenje. Zanimivo je, da terapiji, kar sicer pri radioloških razpravah ni navada, posvečajo avtorji enak pomen kot diagnostiki. Ta način daje tisto potrebno širino, ki jo v radiologiji vse prevečkrat pogrešamo. Vsa prikazana dela oz. razprave spremlja bogata fotodokumentacija.

L. Tabor

Od 11. do 15. novembra 1974 je potekal v Brescia-i (Italija) letošnji (tradicionalni) tečaj oz. kolokvij iz radioterapije in njej sorodnih področij. V organizaciji Radiološkega inštituta »O. Alberti«, pod vodstvom prim. dr. M. Piemonteja, so se vrstila predavanja priznanih strokovnjakov iz uglednih svetovnih zdravstvenih centrov.

V programu navedena področja: tehnologija in avtomatizacija v radioterapiji, dozimetrija in mikrodozimetrija v odnosu z LET in RBE, frakcionirane doze, novosti v curie-terapiji, so privlačna za vse, ki jih zanimajo novosti v radioterapiji.

T. Benulič

IN MEMORIAM

Profesor dr. Branislav Gadjanski
(1891—1974)

Dana 7. avgusta 1974. godine ugasio se život doktora Branislava Gadjanskog, jednog od prvih radiologa Srbije.

Rodio se 1891. godine u Jaši Tomiću u staroj srpskoj porodici koja ga je vaspitavala u patriotskom duhu i spremala ga da služi svom narodu.

Gimnaziju je učio i završio u Pančevu. Medicinu je počeo da studira u Pešti, koju je morao da napusti zbog aktivnosti u nacionalnoj organizaciji »Kolo mladih Srba«, koja nije bila u volji Peštanskim vlastima. Studije je nastavio u Beču gde ga zatiče objava rata Srbiji. Iz Beča prebegne u Srbiju i prijavi se u dobrovoljački odred srpske vojske sa kojom se povlači sve do Krfa. Posle oslobodjenja odlazi u Prag i tamo diplomira na medicinskom fakultetu.

Po završenim studijama bude postavljen za sreskog lekara u Zaječaru i na toj dužnosti je proveo tri godine.

Iz Zaječara odlazi ponovo u Beč na specijalizaciju iz radiologije. Posle završene specijalizacije dobija službu u Valjevu na novo osnovanom rendgenskom odeljenju Valjevske bolnice i na tom odeljenju je proveo čitavu deceniju. Stiče zvanje primarijusa i novo postavljenje u Opštoj državnoj bolnici u Beogradu. Na rendgenskom odeljenju Beogradske državne bolnice ostaje sve do završetka drugog svetskog rata. Uskoro posle oslobodjenja dolazi do fuzije Medicinskog fakulteta i Opšte državne bolnice i dr. Gadjanski postaje jedan od prvih profesora Medicinskog fakulteta na novo stvorenom Institutu za radiologiju.

Odličan stručnjak, čovek široke kulture, elokventan i dobar didaktik prof. Gadjanski usmerava celokupnu svoju aktivnost na pedagoški rad. Veliki je njegov doprinos na uzdizanju mladih stručnih kadrova zahvaljujući stalnom i bliskom kontaktu sa svim svojim saradnicima. Kao dugogodišnji šef katedre bio je inicijator za održavanje mnogih stručnih sastanaka i organizator mnogih seminara za stručno uzdizanje lekara i srednjeg medicinskog osoblja.

Veoma aktivan i cenjeni član Srpskog lekarskog društva, dugogodišnji član redakcije časopisa »Srpski arhiv«, profesor Gadjanski je bio inicijator za osnivanje Radiološke sekcije Srpskog lekarskog društva.

Čitavu deceniju je bio u penziji a bio je prisutan na svim sastancima i kongresima radiologa Jugoslavije.

Ličnost profesora Gadjanskog je bila puna izuzetnih ljudskih vrednosti. Kao učitelj: strpljiv pedagog i dobar didaktik. Kao lekar: savestan, saosećajan i požrtvovan sa velikim iskustvom i znanjem. Kao čovek: prijatan, vedar, duhovit ali odmeren i dostojanstven. Uživao je ugled i poštovanje svih koji su ga poznavali.

Ostao je dosledan sebi do zadnjih dana svoga života i samrtničke patnje je podnosio sa mirom i dostojanstvom. Veliko i hrabro srce je imao taj čovek.

Neka živi sećanje na profesora, doktora Branislava Gadjanskog koji je bio odličan lekar, dobar učitelj i plemenit čovek.

Neka je slava i hvala profesoru, doktoru Branislavu Gadjanskom!

R. Nikolić-Ljubisavljević

POROČILO S SEMINARJA »PERSPEKTIVE V BIOFIZIKI IN MOLEKULARNI BIOLOGIJI«

OTOČEC, od 2. do 6. septembra 1974

Seminar sta organizirala Mednarodno združenje za čisto in aplikativno biofiziko, ter Jugoslovansko društvo za biofiziko. Tehnično izpeljavo srečanja in tudi izbor tem ter predavateljev pa sta prevzela prof. J. Wyman z Instituta Regina Elena v Rimu in doc. dr. S. Svetina.

Seminar naj bi potekal kot letna šola v okviru postdiplomskega študija in je bil namenjen predvsem študentom biofizike, vendar je zaradi široke zasnove in visokega nivoja predavateljev pritegnil širšo, heterogeno grupo slušateljev.

Uvodno predavanje prof. Eigena, nobelovca iz Göttingena, pod skupnim naslovom: Evolucije, je bilo pregledno razdeljeno na štiri dele, ki so se dopolnjevali, razlagali in potrjevali njegovo teorijo nastanka bioloških sistemov in njihovo matematično dokazljivost. Sploh je bil matematičen aspekt seminarja vedno bolj očiten in prav predavanje eksperimentalnega matematika O. Gurela, IBM, New York, ki je našel svoje, izredno enostavne in zanimive rešitve za razlago molekularnih, celularnih in kancerskih problemov, s katerimi nam je nakazal široko uporabnost matematičnih metod v biologiji.

Wyman je študij kooperativnosti in vezave prikazal na molekuli hemoglobina in nakazal možnost uporabnosti tudi za druge sisteme.

Rojasa zanima evolucijski problem hitrosti propagacije impulza po živčnem vlaknu, proučuje selektivnost celične membrane, ter skuša dokazati obstoj kanalov za posamezne ione.

Predavanji Walkerja in Brennerja sta se dopolnjevali. Oba proučujeta organizacijo genetičnega materiala, vendar ne na prokariontih, temveč na insektih in nematodah. Walker proučuje mutacijsko hitrost, Brenner pa eksperimentalno dokazuje, da Crickov model DNA ne drži popolnoma.

Perry, z Instituta za raziskavo raka v Philadelphiji, je prikazal že znana, pa tudi lastna raziskovalna zapažanja pri delu z messenger RNA.

Oba, Pernis in Hoffman se ukvarjata z imunskimi sistemi. Prvega zanima regulacija imuno sistema in fiziologija limfocitov, drugi pa skuša razložiti funkcijo imuno sistema s teorijo mrežaste povezave, vendar čisto fizikalno in matematično tako, da popolnoma abstrahira biološke lastnosti in odvisnost samega sistema.

Seminar je popolnoma uspel, želimo si, da bi taka in podobna oblika sodelovanja postala utrjena praksa.

E. Kolar

SESTANEK RADIOLOŠKIH TEHNIKOV JUGOSLAVIJE

Ohrid, od 10. do 12. oktobra 1974

Od 10. do 12. oktobra 1974 je bil v Ohridu sestanek radioloških tehnikov Jugoslavije, ki se ga je udeležilo okrog 400 članov združenja.

Teme predavanj so bile iz rentgenske diagnostike, radioterapije, izotopne diagnostike, ostala predavanja pa so bila iz organizacije in normiranja dela rentgenskih tehnikov ter šolanja tehnikov. Iz rentgenske diagnostike smo prvikrat videli abdominalno arteriografijo, tomografijo atlantoxccipitalnega sklepa, teleradiografijo glave in pnevmoencefalografijo. Sami posnetki in projekcije so bili standardni, pač pa smo na diapozitivih videli, da imajo zelo moderne aparature in opremo. Doc. dr. Antevski iz Skopja je predaval o nevarnostih in reanimaciji pri vbrizgavanju intravenoznih kontrastov, kar je izzvenelo kot poziv tehnikom, naj teh preiskav ne delajo brez rentgenologa.

Predavanja dr. Panova o zdravstvenem stanju ljudi, ki delajo pri virih sevanja, je bilo spremljano s prikazom hudih poškodb kože, amputacije prstov in karcinomov, ki so se pojavili po 20-letnem delu s sevanji. Upamo, da so to bile posledice pionirskega dela naših predhodnikov in da se nam pri današnjem delu in ob boljši zaščiti ne obetajo takšne posledice. Opozoril pa nas je, da smatrajo v Beogradu vsak padec števila levkocitov pod 4000 v mm^3 krvi kot profesionalno obolenje, ne glede na izvor tega obolenja.

Iz radioterapije smo poslušali predavanje dr. Budihne z Onkološkega inštituta v Ljubljani, o planiranju radioterapije. Prof. dr. Mark iz Zagreba nam je govoril o svojih izkušnjah z gama kamero.

O normah dela sta nam predavala prof. dr. Novak in doc. dr. Cengić. Skušala sta prikazati kakšne norme storilnosti naj bi veljale za delo retgenskih tehnikov pri slikanju, in kakšne v resnici so. Primerjava med Skopjem in Zagrebom je namreč pokazala, da je treba zagrebškim tehnikom za enako plačilo narediti tretjino manj, ker imajo pač ugodnejšo pogodbo s socialnim zavarovanjem.

Ostre so bile debate o pogojih delavcev (oz. tehnikov) za delo pri virih sevanja. Čedalje bolj se zahteva višja rentgenska šola in odklanja priučen kader, ki je po dosedanji praksi zasedal taka mesta. Izjema naj bi bili le delavci, ki delajo že najmanj dvajset let na delovnem mestu rentgenskega tehnika in imajo vsaj srednjo medicinsko šolo, vendar pa se tudi od njih zahteva polletni radiološki tečaj.

Problem je tudi v tem, da šola v Skopju še ni uradno verificirana, ampak dobijo študentje samo potrdilo, da smejo delati pri virih sevanja.

Zaradi velikih razlik pri dolžini dopusta, delovnem času, beneficijah nasploh in šolanju, ki so zelo očitne — ne samo po republikah, ampak tudi med ustanovami, je zbor sprejel naslednje zaključke:

— prizadevati si moramo za ustanovitev višjih šol za rentgenske in izotopne tehnike;

— za poenotenje predpisov o delu z ionizirajočimi sevanji za vso državo, in

— za beneficiranje delovnega staža po enotnih normah.

Rentgenski tehniki:
Nograšek J., S. Djurišić, J. Škofic, F. Blatnik

OBVESTILI

Od 21. do 24. novembra 1974 se je vršil v Dubrovniku prvi jugoslovanski postdiplomski seminar »Ultrazvok v klinični medicini«. Seminar je obravnaval fizikalne, diagnostične in terapevtske probleme uporabe ultrazvoka v medicini. Organizator: Ginekološka klinika, Petrova 13, Zagreb.

Od 10. do 14. marca 1975 bo na Dunaju (Wien, Austria), IAEA simpozij o novostih v biomedicinski dozimetriji. Informacije: J. W. Kane, Office of inform. Service, USAEC, Washington, D. C. 20545.

STROKOVNI SEMINAR RENTGENSKIH TEHNIKOV

V dneh od 6. do 7. novembra se je vršil v Beogradu strokovni seminar rentgenskih tehnikov pod pokroviteljstvom Radiološkega Instituta Medicinske fakultete v Beogradu. Posvečen je bil deseti obletnici delovanja sekcije radioloških tehnikov SR Srbije. V programu seminarja so bile obravnavane teme, ki se tičejo specialne tehnike slikanja, radioterapije (Uporaba katetrona in teleterapija) in zaščita delavcev v območju jonizirajočega sevanja. V prostem delu so udeleženci obiskali Radiološki institut Medicinske fakultete v Beogradu in Institut »Boris Kidrič« v Vinči.

PRIČETEK GRADNJE TRT OBJEKTA V LJUBLJANI

Dne 27. 11. 1974 je bil na prostoru bivših kliničnih bolnišnic in v neposredni bližini Onkološkega inštituta slovesno vgrajen temeljni kamen ob pričetku gradnje TRT (teleradioterapevtskega) objekta. Po dolgih letih zbiranja sredstev od posameznikov, organizacij in skupnosti je Onkološki inštitut v Ljubljani končno pričel graditi objekt, ki bo pod eno streho združil vso radioterapijo. Direktorica Onkološkega inštituta, prof. Božena Ravnihar, se je ob slovesnosti na gradbišču zahvalila vsem, ki so kakorkoli prispevali k pričetku gradnje in s tem omogočili bolnikom sodobnejše zdravljenje.

Tomaž Benulič

VII. SESTANEK ČLANOV KLUBA RADIOTERAPEVTOV JUGOSLAVIJE

Letošnji drugi sestanek radioterapevtov je potekal skupaj s strokovnim srečanjem hrvatskih ginekologov ob 40-letnici radioterapije karcinoma colli uteri v SR Hrvatski. Dvestopetdeset udeležencev srečanja, prisotnost udeležencev s področja različnih dejavnosti terapije raka, pozornost upravnih in političnih predstavnikov — vse to je ponoven dokaz, da je za sodobno zdravljenje raka potrebno sodelovanje in dogovarjanje vseh, od zdravnikov pa do tistih, ki soodločajo pri načrtovanju zdravstvene politike.

Sestanek kluba je obravnaval običajne probleme radioterapevtov: prihodnji sestanek, skupščino kluba, sodelovanje radioterapevtov na IV. kongresu kancerologov SFRJ v Sarajevu l. 1975, specializacijo, vprašanje članstva, itd.

Sklenjeno je bilo, da bo prihodnji sestanek kluba skupaj s IV. kongresom kancerologov SFRJ, v maju 1975, ko naj bi radioterapija dobila svoje mesto tudi v rednem programu. Kazalo bi odrediti ožje delovno področje že pred kongresom, da bi bile izmenjave izkušenj čim bolj uspene in prepričljive.

Prihodnja skupščina kluba naj bi se vršila jeseni 1975. leta, najverjetneje v Beogradu. Potrebno je še preučiti možnost vključitve v mednarodno združenze radioterapevtov-onkologov ter izvoliti novo vodstvo kluba.

Za SR Slovenijo je tudi SR Hrvatska dobila radioterapijo kot samostojno specializacijo. To je pomemben korak v smislu nadaljnjega uveljavljanja radioterapije ter hkrati obveznost za njen kvalitetni razvoj in izenačitev med posameznimi centri. V drugih republikah oz. centrih se specializacija v glavnem že obravnava samostojno (v času specializacije in izpita), čeprav jo zakon še obravnava skupaj z rentgensko diagnostiko. Glede programa se ravnajo po kasnejši delovni usmeritvi specializanta.

Izenačen še ni status drugih sodelavcev specialnih strok (fizikov, biologov), od katerih imajo nekateri priznan status specialista po treh letih dela v onkologiji, drugi pa morajo še posebej opraviti izpit.

V svetu in pri nas se kaže razvoj v smislu specialista radioterapevta-klinika, z naslovom radioterapevt-onkolog. Zaradi sodelovanja mnogih specialnih strok v onkologiji (patologije, citologije, kirurgije), bo še najbolj ustrezala rešitev naslova v smislu onkologa posamezne ožje specialnosti. Sam program specializacije pa bo treba prilagoditi področju posamezne usmeritve.

Ob koncu sestanka se je obravnaval tečaj radiofizike in radiobiologije v Beogradu in potreba po revidiranju obstoječih skript.

Sestanek radioterapevtov na Reki je uspel, strokovno in organizacijsko ter postal obveznost za nadaljnje delovanje.

T. Benulič