

## SELF EXPANDING METALLIC STENTS

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**Abstract** – Between September and December 1989 four patients with stenosis of the tracheobronchial tree and obstruction of vena cava superior were treated with self expanding metallic stent. Stents were successfully placed in each patient.

Alle are clasified as cured. For venography before and after stent placement Iohexol 350 was used.

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**Key words:** tracheal stenosis, superior vena cava syndrome, metallic stents

### Case report

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**Introduction** – In 1969, Charles Dotter first published data demonstrating long term patency of intravascular stents in dogs (1, 2). Since Dotter's initial success, others have reported long term patency without significant luminal narrowing in a variety of stents placed in several tubular structures (3, 4, 5, 6, 8, 9, 10, 11, 12). In our patients we used the expandable metallic stent created by one of the pioneers of Interventional Radiology, Cesare Gianturco. His devices have been responsible for opening the door to Interventional Radiology. Among his inventions are the embolic coils, the self-expanding stainless steel stents, the bird's nest vena cava filters, the U-inverted-U balloon assisted stents, patent ductus occluders and septal defect occluders.

**Materials and methods** – In three patients with stenosis of the tracheobronchial tree and in one patients with vena cava superior (VCS) obstruction due to sarcoidosis Gianturco stents were placed. The procedure was performed percutaneously in patients with vena cava superior obstruction and transendoscopically in other patients. In all four cases stenosis was first dilated with a PTA balloon catheter to allow passage of

the guiding sheath. The stents opened the stricture segment in all cases.

The expandable metallic stent is constructed of stainless steel wire bent in a zig-zag pattern and encircled to form a cylinder (5). The stent is compressed and introduced through a Teflon catheter of 10-12 F caliber. The stent is advanced until it reaches the tip of the catheter by using a pusher catheter. It is released from the catheter by withdrawing the catheter while holding the pusher catheter against the stent. Upon release, the stent expands or attempts to expand to its original diameter creating the expansile force to allow the expansion of the vessel against the extrinsic, stenotic force (12).

**Results** – Clinical trials of the Gianturco expandable metallic stent have been conducted also in our institution in Ljubljana. The stent has been evaluated in the tracheobronchial tree and vena cava. To date, the stents opened stenosis in all cases and after at least 3 months, they have remained patent without migration or other complications.

**Case report (1)** – A 41-year old patient developed superior vena cava obstruction secondary to compression by fibrosis due to sarcoidosis. Clinical findings were facial swelling, distention of the veins of the neck and headache. On phlebography, a contrast medium (Iohexol 350) injection into the vena cava superior led to immediate filling of the vena azygos with reversed flow direction. Flebogram showed the superior vena cava obstruction (Fig. 1). The procedure

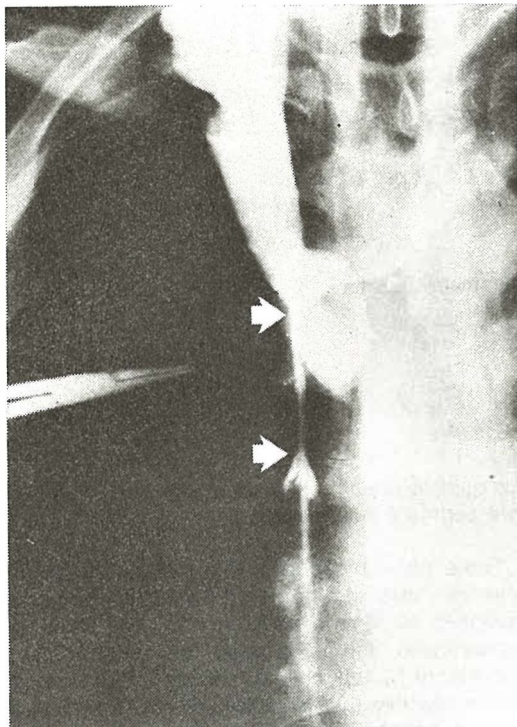


Fig. 1 – Vena cava superior obstruction (arrows)

was performed percutaneously through the right femoral vein. First an introducer sheath was inserted into the femoral vein. For crossing the tight stenosis of vena cava superior we used 0,035 inch. movable core straight guidewire and straight 5 F catheter. Once the diagnostic catheter had crossed the obstruction, the catheter was exchanged for dilatation balloon catheter (6 mm diameter).

Before PTA, 5000 units of Heparin was injected through the sheath side arm. After PTA, the balloon catheter was withdrawn while the guidewire was kept in place. Then a longer 20 mm

balloon was introduced, and after the second inflation the result was satisfactory. A double stent was placed (Fig. 2) and immediate clinical

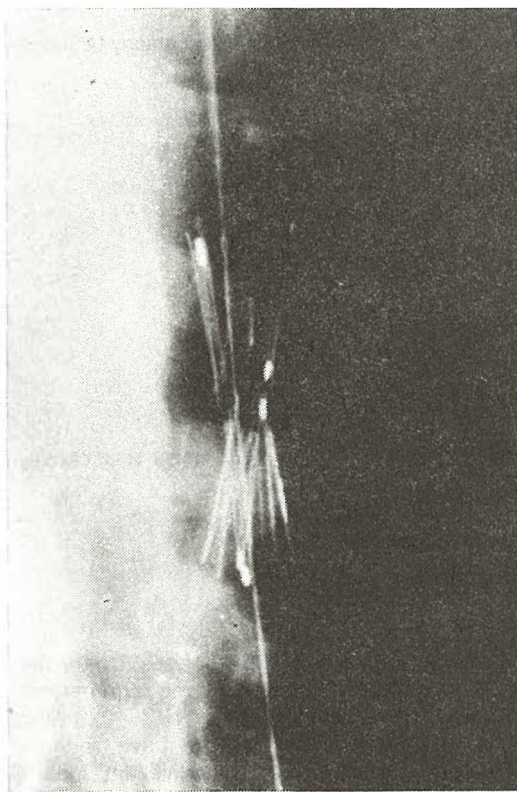


Fig. 2 – Double self expandable stent in vena cava superior

improvement was accomplished. Aspirin and persantine have been given for three months. To date, stent provides good patency of VCS (Fig. 3).

**Case report (2)** – A 58-year old patient developed stenosis of the right bronchus which resulted from fibrosis due to surgery. To overcome this problem we used PTA balloon catheter and two self-expanding stents. This patient has been followed for 4 months. Follow up exams indicate that stents conform to the luminal surface, are stable, and remain patent. The patient is asymptomatic and this indicates that stent can effectively dilate the bronchus.

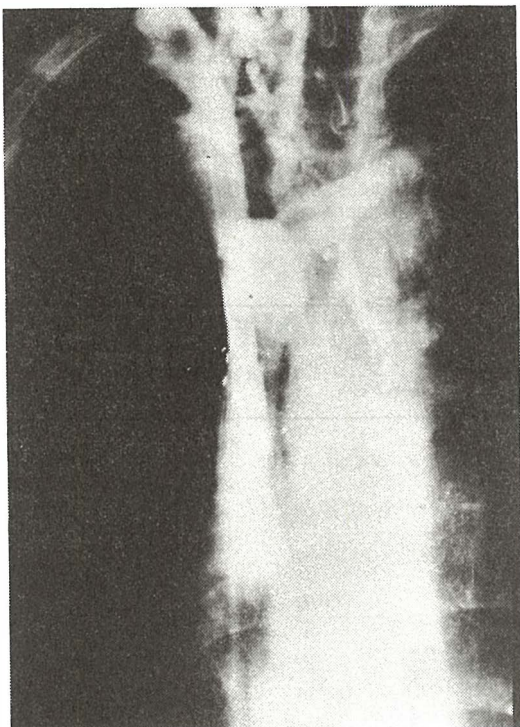


Fig. 3 – Patent stent in vena cava superior

**Discussion** – Gianturco self expandable metallic stent has been evaluated in several tubular structures including the arteries and aorta (12), the veins and vena cava, the tracheobronchial tree (11), the bile ducts (5), and the ureter (4). In the blood vessels, local expansion with neointimal proliferation covering the stents was observed. The stent was incorporated in the wall of the blood vessel. In stenotic veins and vena cava, the stents dilated the vessels and decreased the pressure gradient across the stenoses (3). The stent was also placed in the intrahepatic segment of the vena cava inferior in a patient with Budd-Chiari syndrome (4). When placed in the tracheobronchial tree the stent created focal dilatation and inflammation with mucosal secretion covering the stent. There was no obstruction or perforation of the trachea (11).

Percutaneous biliar drainage is the usual form of biliary decompression in patients with obstructive jaundice secondary to neoplastic involvement of the bile ducts. However, there are many complications associated with currently used decompression techniques. Catheter drainage sy-

stem whether external or internal-external may migrate, be associated with infection, or become blocked. The use of indwelling endoprosthesis has not overcome all the problems, and removal of malfunctioning prostheses may be impossible.

Self expandable stents placed in common bile duct opened the strictured segment and remained patent without migration or other complications up to one year (4, 5).

Placement of the stent in the ureter resulted in mucosal proliferation which caused obstruction of the ureter in some cases.

**Conclusion** – Interventional radiology has provided a promising nonsurgical treatment of vascular and bronchotracheal strictures with Gianturco self expandable metallic stents. The work of many investigators (3, 5, 6, 11, 12) as well as our own results demonstrate that these newly developed self expandable stents will improve the treatment of strictures in several tubular structures.

### Povzetek

#### SAMORAZTEGLJIVE KOVINSKE PROTEZE

V času od septembra do decembra 1989 smo zdravili štiri bolnike, ki so imeli zožitev traheobronhialnega vejevja in obstrukcijo vene cave sup, s samoraztegljivim kovinskim stentom. Pri vseh bolnikih je bila vstavitve uspešna.

Vse bolnike smo opredelili kot ozdravljene, pri venografiji, opravljeni pred in po vstavitvi stenta smo uporabili lohexol 350.

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