*Monika Miazga, Tomasz Jargiełło, Anna Drelich-Zbroja, Klaudia Karska, Krzysztof Pyra, Michał Sojka, Kowalik Marcin, Małgorzata Szczerbo-Trojanowska

Endovascular treatment for superior vena cava obstruction

Leczenie wewnątrznaczyniowe zwężeń żyły głównej górnej

Department of Interventional Radiology and Neuroradiology, Medical University, Lublin
Head of Department: prof. Małgorzata Szczerbo-Trojanowska, MD, PhD

Key words
superior vena cava syndrome (SVCS), superior vena cava (SVC)

Słowa kluczowe
zespół żyły głównej górnej (ZŻGG), żyła główna górna (ŻGG)

Summary

Introduction. Superior vena cava syndrome (SVCS) is common complication of malignancy, the lung cancer is the most common cause. The clinical indication for superior vena cava (SVC) endovascular treatment is allevation of superior vena cava syndrome (SVCS) caused by malignant obstruction.

Aim. Evaluation of safety and efficacy of SVC stenting in patients with malignant superior vena cava syndrome (SVCS) – our experience.

Material and methods. Between 2011 and 2014, data of 112 patients with SVC syndrome, mostly of malignant aetiology, were retrospectively collected. The study included 68 men and 44 women (mean age – 64; range 43-79 years).

Results. Stent placement was technically successful in 98% cases. Two stents were found to be obstructed after several months and patients needed repeated angioplasty. There was no stent migration to the right atrium. Haemoptysis was observed in one patient and pulmonary embolism in two cases. There were no major remote complications.

Conclusions. Endovascular stenting has become a safe and cost effective treatment for patients with SVCS, providing rapid relief of symptoms and improving their quality of life. Endovascular stenting should be performed in each patient with SVCS.

Streszczenie

Wstęp. Rak płuc jest najczęstszą przyczyną zespołu żyły głównej górnej (ZŻGG). Klinicznym wskazaniem łagodzącym objawy niepożądane ZŻGG spowodowanym przez zmianą złośliwą jest leczenie wewnątrznaczyniowe.

Cel pracy. Przedstawienie doświadczeń własnych i ocena skuteczności zabiegów wewnątrznaczyniowych (angioplastyki balonowej i stenotwania) u chorych z zespołem ŻGG.

Materiał i metody. Poddano retrospektywnej analizie grupę 112 chorych z ZŻGG leczonych wewnątrznaczyniowo w latach 2011-2014. Badaniem objęto grupę chorych w wieku od 43 do 79 lat, składającą się z 68 mężczyzn i 44 kobiety (średni wiek chorych – 64 lata). U większości chorych ZŻGG spowodowany był chorobą nowotworową.

Wyniki. Techniczne powodzenie zabiegu zanotowano w 98% przypadków. Po zabiegu u dwóch chorych doszło do nawrotowego zwężenia w stencie, u jednego chorego po zabiegu odnotowano krwioplucie, u dwóch chorych wystąpiła zatorowość płucna. Natomiast nie obserwowano późnych powikłań w postaci migracji stentu do prawego przedsionka serca.

Wnioski. Metody wewnątrznaczyniowego leczenia zwężeń w obrębie ZGG są stosunkowo bezpiecznymi zabiegami dla chorego, szybko powodują ustąpienie objawów klinicznych i poprawiają jakość życia. Powinny być szerzej rozpowszechnione i stosowane u każdego chorego z ZŻGG.

Address/adres:
*Monika Miazga
Department of Interventional Radiology and Neuroradiology
Medical University
ul. Jaczewskiego 8, 20-954 Lublin
tel. +48 (81) 724-41-54
miazgam@tlen.pl

INTRODUCTION

The superior vena cava (SVC) is a large venous trunk, which receives blood from the supradiaphragmatic body part; it drains blood from the head, neck, upper limbs and thorax. SVC is formed by the union of the left and right brachiocephalic veins and empties into the right atrium (1).

Impaired blood flow through SVC is caused by its stenosis or obstruction and leads to superior vena cava syndrome (SVCS) (1-4).

SVC stenosis or obstruction can develop in patients with bronchial cancer, lung cancer (small cell and non-small cell), lymphoma, Hodgkin's disease, mediastinal tumours (predominantly thymomas), metastases,

pleural cancer/perithelioma. The benign lesions causing SVC stenosis are thrombi within the permanent dialysis catheters or catheters for parenteral nutrition, pacemakers, mediastinal fibrosis (1, 3, 5).

SVCS was first described by William Hunter in 1757 in a patient with syphilitic aortic ulceration, which was the most common cause of SVCS until the mid 50 ties (2, 3).

The typical symptoms of SVCS include swelling of the face, neck and right upper limb, dyspnoea, cough, facial redness, difficult swallowing, hoarseness and thoracic pain. Dilatation of superficial thoracic veins is observed in patients with SVCS developing slowly. The mean survival of patients affected by SVCS is about 6 months (1-3, 6).

AIM

The aim of the study was to evaluate the efficacy of minimally invasive endovascular techniques, i.e. balloon angioplasty and stenting, in the treatment of SVCS.

MATERIAL AND METHODS

In the years 2011-2014, 112 patients with symptomatic SVCS underwent balloon angioplasty and stenting of SVC. We want to share our experiences and observations regarding the treatment of SVCS.

SVCS was treated in (fig. 1):

- 23 patients with small cell lung cancer,
- 54 patients with non-small cell lung cancer,
- 18 patients with metastases to mediastinal lymph nodes,
- 5 patients with lymphoma,
- 9 patients with mediastinal tumours,
- 2 patients due to dialysis catheter-related thrombosis,
- 1 patient due to a pacemaker.

The clinical symptoms of VCS include (fig. 2):

- facial swelling and cyanosis in 88 patients,
- difficulties in breathing in 92 patients,
- hoarseness in 4 patients.

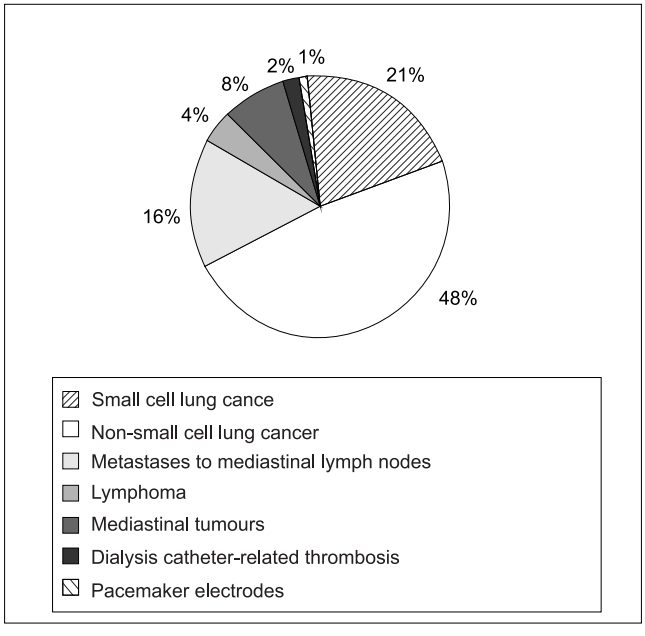

Fig. 1. Causes of SVCS.

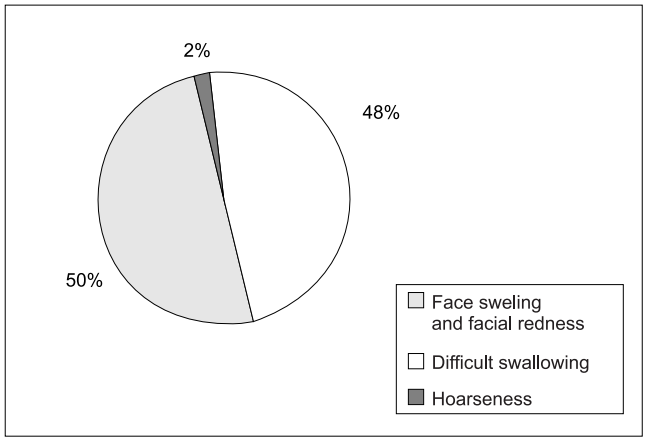

Fig. 2. Clinical symptoms of SVCS.

The mean age of patients was 64 years. The study population included 68 men and 44 women.

DESCRIPTION OF THE PROCEDURE

Priori to the procedure, each patient underwent CT to evaluate the location of tumour in relation to SVC, length of the stenotic SVC segment, presence of collateral vessels. Based on CT findings, the procedure was planned and suitable stents chosen (fig. 3, 4).

Procedures were performed in the laboratory equipped with angiographic devices. Subcutaneous anaesthesia with 2% lignocaine at the puncture site was required. The right femoral vein was most commonly punctured, to which the vascular sheath 5-6 F was inserted. Using the hydrophilic Terumo guide wire and Cobra or Berenstein catheters, the stenotic segment of SVC was crossed. During the next stage, phlebography of central vein outflow was carried out using a Pigtail catheter (fig. 5, 6). The stenotic SVC segment was dilated using a balloon catheter and pressure of 10-16 mmHG (fig. 7), which facilitated free passing of the stent through the stenotic segment.

X-ray-guided stent implantation was performed. The stent covered the place of stenosis and reached about 10 mm above the proximal and distal end of stenosis. The Epic (Boston Scientific) and Smart (Cordis) self-expanding stents were used whose dimensions were bigger by about 15%, compared to SVC diameter. Subsequently, stents were expanded with high-pressure balloons. The procedure was completed with phlebography to assess the degree of SVC dilation and stent position (fig. 8).

RESULTS

Technical success of procedures was noted in 98% of cases. In two cases, procedures were abandoned; in one case – due to extensive SVC thrombosis and in the second one – due to inability to pass through the obstructed segment of SVC.

Two patients had in-stent recurrent stenosis after about 4 months; they developed clinical symptoms and required repeated balloon angioplasty and implantation of another stent. No cases of stent migration to the right atrium were observed.

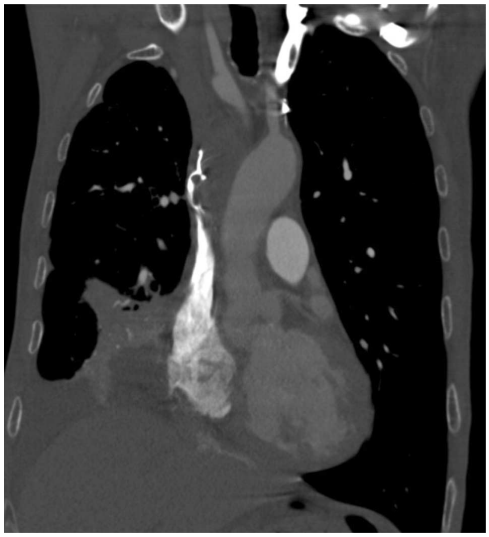

Fig. 3. Computed tomography (CT) reveals SVC obstruction.

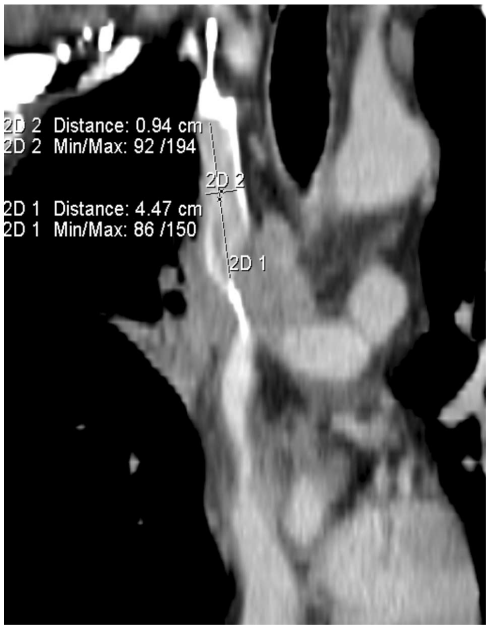

Fig. 4. Pre-procedure CT – evaluation of the stenotic SVC segment enables procedure planning and choice of suitable equipment.

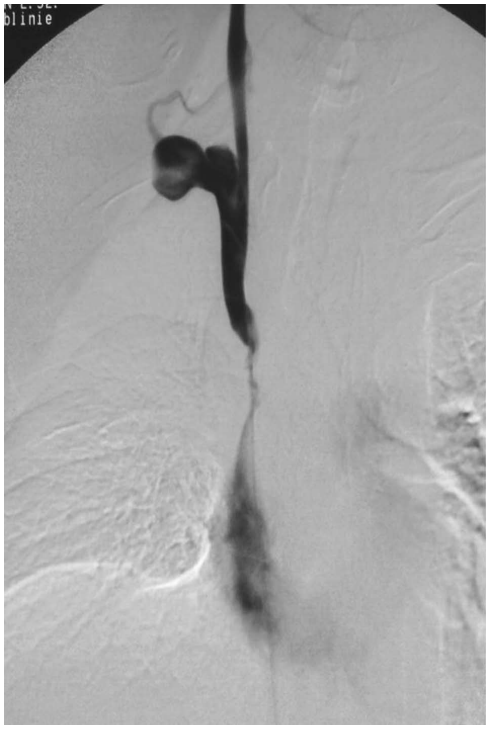

Fig. 5. SVC phlebography demonstrates a classic example of critical stenosis. Collateral circulation is not observed. A patient with clinically acute SVCS.

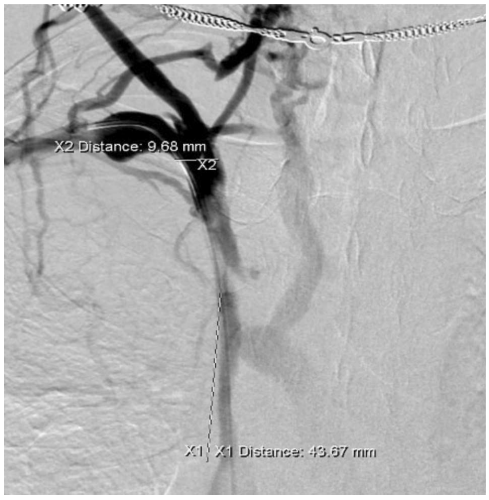

Fig. 6. Phlebography of SVC; measurement of stenosis length and normal diameter of SVC are marked. Additionally, collateral circulation is visible.

An early complication immediately after the procedure was haemoptysis in one patient and pulmonary embolism without clinical symptoms in two other cases.

There were no cases of death associated directly with endovascular procedures.

The majority of patients died within 6-9 months due to the advanced stage of neoplastic disease. In the entire study population, the longest (about 4 years) survival was observed in 7 patients whose clinical state evidenced satisfactory tong-term outcome of SVC stenting.

DISCUSSION

The basic methods of treatment of SVCS caused by neoplasms include radiation and chemotherapy (often combined), tumour surgery and symptomatic treatment.

The quickly developing symptoms of SVCS, in some patients even within several weeks since the underlying disease diagnosis, are emergency cases in oncology as SVC has a low intravascular pressure and flabby walls susceptible to tumour compression, which leads to its complete obstruction. Sudden SVC stenosis or lumen obstruction increases the pressure in jugular veins by 20 to 40 mmHg, which results in cerebral and laryngeal oedema and the remaining symptoms of SVCS. To quickly restore the patency of SVC and ensure proper blood flow through the vein, surgical methods or bypasses are used. The surgical methods described are associated with sternum resection and SVC reconstruction; the intraoperative mortality is about 5% and technical success – about 80-90% (1, 7).

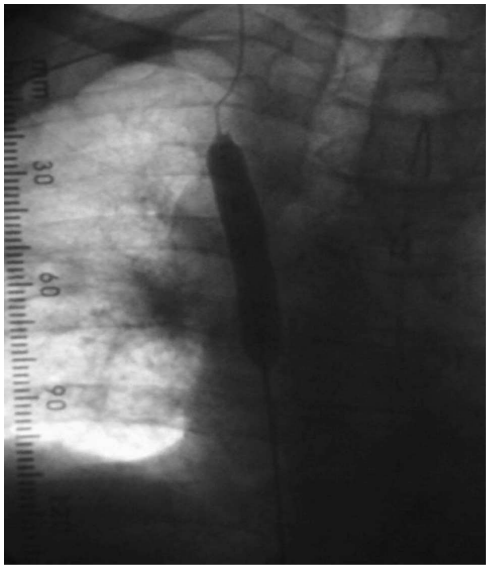

Fig. 7. Balloon angioplasty of the stenotic SVC segment (pressure of 10-16 mmHg). A balloon filled with contrast medium.

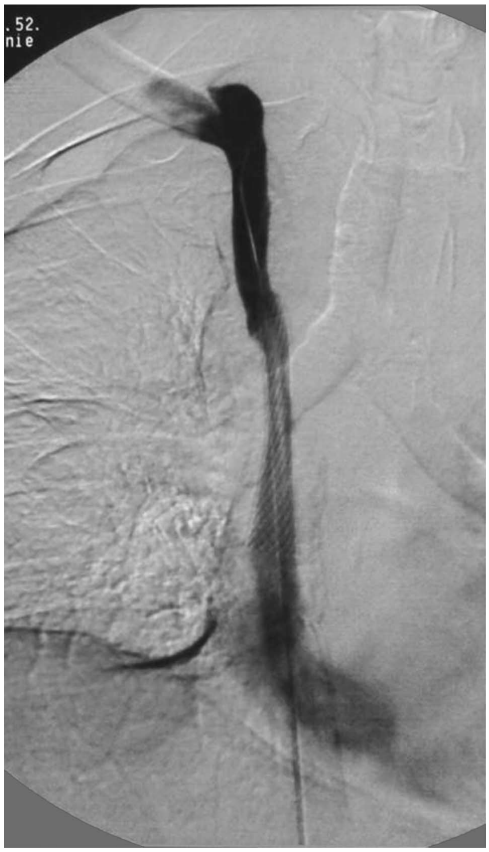

Fig. 8. Follow-up phlebography visualizes satisfactory widening of SVC and proper stent position (epic, 14 mm x 60 mm in diameter).

An alternative procedure in patients with SVCS quickly alleviating clinical symptoms is endovascular treatment with balloon angioplasty and implantation of stents to SVC (8).

The first SVC stenting procedures were carried out in two patients by Charnsangavej in 1986 (6). Since then, due to improved stent materials, low invasiveness of procedures and quickly subsiding clinical symptoms, SVC stenting has become the satisfactory method of treatment of SVCS caused by malignant lesions (1, 2, 4, 6).

The major assets of endovascular SVC treatment include quick clinical improvement, subsidence of dyspnoea, and reduction in facial and upper limb oedema within 48 hours, which improves the quality of life of patients. Moreover, the fact that patients treated with endovascular methods do not require general anaesthesia is essential, which additionally reduces the risk of peri-procedure complications.

A rare, sudden complication described by Rizvi was heart tamponade in two patients undergoing repeated angioplasty due to re-stenosis of SVC. The same complication was described by Ploegmakers et al. (9). It is believed that one of the factors predisposing to this complication is high pressure used during angioplasty of the stenotic segment or during stent final expansion, which can cause iatrogenic injury to the vein and cardiac tamponade.

A remote, adverse effect of SVC stenting is stent migration to the right atrium, which can be avoided by selecting stents of proper dimensions. According to the rule, the stent diameter should be by 10-15% larger than the SVC diameter. The stent requires expansion with a high-pressure balloon (10) (fig. 7). Another remote complication is thrombosis or obstruction of stents, which is most commonly caused by rapid tumour proliferation (7, 11). The majority of patients after SVC stent implantation receive antithrombotic agents. There are reports demonstrating that due to the remote complications mentioned above, SVC stent implantation should be thoroughly considered in young patients with SVCS that is not caused by malignant proliferative lesions (6, 12, 13).

CONCLUSIONS

Endovascular SVC stenting in patients with SVCS quickly alleviates the clinical symptoms and substantially improves the quality of life of patients; therefore, the method should be recognized and widely used. The additional benefit is that the procedure can be repeated.

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