Use of self-expanding vascular endoprostheses in superior vena cava syndrome

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Abstract

\textbf{Introduction:} Superior vena cava syndrome (SVCS) is associated to a malignant tumor in more than 90% of cases; being the lung cancer the most frequent (80%). SVCS has a benign cause in less than 5% of cases. Endovascular stenting has been proposed as the primary treatment of choice. We report our experience in SVC recanalization through the use of self-expanding vascular stents as treatment of life-threatening SVCS of benign and malignant etiology. Materials and methods: Between January 1994 and April 2002 44 patients with critical SVCS, were treated at the Hospital Italiano de Buenos Aires. Forty nine self-expanding endovascular metallic stents were percutaneously placed in the SVC. Thirty-one (70%) patients were male and 13 (30%) were female. The mean age was 55.6 years (range: 21–77). The etiology of SVCS was malignant in 40 cases and benign in 4. The malignant causes included lung cancer: 37 (37/44–92.5%), lymphoma: 1 (2.5%), chondrosarcoma 1 (2.5%), melanoma 1 (2.5%). The benign etiology corresponded to central catheters (\(n\): 2) and post-radiation fibrosis (\(n\): 2). Cavography showed complete occlusion of SVC in 12 cases (27%) and significant partial stenosis in 32 cases (73%). Thrombi associated with tumor stenosis were present in 25 (57%) patients.

\textbf{Results:} All procedures were technically successful. No stent migration was observed. Thirty-two patients with malignant tumor ultimately died due to the progression of the disease. Mean survival time was 193 days (range: 25–578). SVCS recurrence was observed on six occasions. In four patients a new stent was placed. Symptomatic improvement was dramatically seen within 24–48 h after stent placement in 40 patients (90.9%) and 83.3% out of the cases (38/44) were symptoms-free during the rest of the disease. Three patients died in the 7 following days.

\textbf{Conclusion:} The use of self-expanding vascular endoprostheses in the recanalization treatment of SVC in SVCS due to a malignant or benign etiology offers excellent results with rapid and prolonged remission of symptoms.

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\textbf{Keywords:} Vascular stenting; Superior vena cava syndrome; Vascular endoprotheses; Mediastinal syndrome

1. Introduction

Superior vena cava syndrome (SVCS) occurs when obstruction of the superior vena cava (SVC) precludes normal blood venous return. Consequently venous stasis develops in the thoraco-brachiocephalic region that leads to cervicobrachial edema, cyanosis and dyspnea. Progressive symptoms can lead to encephalopathy and death. Interruption of venous return may be due to extrinsic compression of the SVC, tumor invasion of the venous wall, and primary or associated thrombosis, either isolated or combined.

SVCS is associated to a malignant tumor in more than 90% of cases; 80–97% correspond to extrinsic compression of the SVC due to malignant mediastinal processes being the lung cancer the most frequent (80%). SVCS has a benign cause in less than 5% of cases [1–6].

Recently, endovascular stenting has been proposed as the treatment of choice instead of classical therapies (chemotherapy, radiation therapy, surgery) in critical patients for SVCS. This therapy allows patency of the SVC through the placement of self-expanding vascular endoprostheses that go across the stenotic region and restore the venous...
return rapidly, thus achieving remission of symptoms [1,3,7–12].

The aim of this paper is to communicate our experience in SVC recanalization through the use of self-expanding vascular stents as treatment of life-threatening SVCS of benign and malignant etiology.

2. Materials and methods

Between January 1994 and April 2002 44 patients with critical SVCS, were treated at the Hospital Italiano de Buenos Aires. Critical SVCS was defined as patients with intense dyspnea and unable to lie flat on their backs. All patients were jointly evaluated by the Services of Clinical Oncology, Thoracic Surgery and Endovascular Therapy. Thirty-one (70%) patients were male and 13 (30%) were female. The mean age was 55.6 years (range: 21–77).

The evaluation process consisted of anamnesis, physical examination, laboratory tests, chest computed tomography scan and upper cavography through bilateral, simultaneous contrast injection in both basilic veins.

The etiology of SVCS was malignant in 40 cases and benign in 4. The malignant causes included: lung cancer: 37 (92.5%), non-Hodgkin’s lymphoma: 1 (2.5%), chondrosarcoma: 1 (2.5%) and melanoma: 1 (2.5%) (Table 1).

The cases corresponding to lung cancer were distributed as follows: 16 adenocarcinomas, 15 epidermoid carcinomas, three small-cell lung carcinomas, one poorly differentiated carcinoma, and two indeterminate carcinomas.

The benign etiology was related to thrombosis caused by long time inserted central catheters (%2); and stenosis because of post-radiation fibrosis due to breast cancer treatment (%2). First two cases were because of several catheters for chronic hemodialysis and another because of parentheral feeding in a politraumatized patient.

Cavography previous to stent placement showed complete occlusion of SVC in 12 cases (27%) and significant partial stenosis in 32 cases (73%). Those stenoses of the SVC that decreased the vascular lumen in more than 50% were considered significant.

There were 27 (62%) patients with isolated SVC involvement and 17 (38%) patients with both SVC and brachiocephalic veins involvement.

Thrombi associated with tumor stenosis were present in 25 (57%) patients, but thrombolytic therapy was not performed in any of the cases.

Of the 44 patients, 33 (75%) had undergone both chemotherapy and radiation therapy. The remaining 11 (25%) patients received vascular endoprosthesis as initial treatment.

Forty nine self-expanding endovascular metallic stents were percutaneously placed in the SVC.

Endoprostheses placement was carried out under conscious sedation in the angiography room. The femoral vein was percutaneously punctured in 43 patients and the basilic vein was punctured in 1.

And hydrophilic guide wire (Terumo, Japan) and a 5 F multipurpose catheter were coaxially introduced through a 10 F vascular sheath to allow access to the SVC. Self-expanding metallic stents (Wallstent, Boston Scientific, USA) were placed across the stenosis by means of a high-supporting guide wire under high-resolution fluoroscopic control. The diameter of the stents ranged between 10 and 16 mm according to the topography of the occlusion and the size of the SVC. During the procedure, all patients received a bolus of 5000 units of sodium heparin intravenously.

Of the 44 patients, three died within 7 days after stenting; one due to serious respiratory failure (late referral), one due to massive hemoptysis at 72 h (anticoagulated patient), and one due to acute pulmonary edema 8 h after stenting due to

| Table 1 |
The etiology of SVCS was malignant in 40 cases and benign in 4

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<th>Patients</th>
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<td>Lung cancer</td>
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<td>Non-Hodgkin</td>
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<td>Chondrosarcoma</td>
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<td>Melanoma</td>
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<td>Benign etiology</td>
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3. Results

All procedures were technically successful. Correct stent placement through the obstruction site was achieved. There were no technical complications and no stent migration was observed.

Of the 44 patients, three died within 7 days after stenting; one due to serious respiratory failure (late referral), one due to massive hemoptysis at 72 h (anticoagulated patient), and one due to acute pulmonary edema 8 h after stenting due to
sudden increasing of 32 patients with malignant tumor ultimately died due to the progression of the disease in the follow up period. Mean survival time was 193 days (range: 25–578) for malignant disease after stent placement.

SVCS recurrence was observed on six occasions. In two cases (4.5%), symptomatic recurrence was secondary to tumor progression at 3 and 9 months, respectively. Both were solved with the placement of a second stent and remained symptom-free (without SVCS) during the course of the disease. In the other four cases (9%) symptomatic recurrence obeyed to intrastent thrombosis. In these patients anticoagulation was previously discontinued because of contraindication or by the patient himself despite medical recommendation. Two patients were not treated due to the end stage of their underlying disease. The other two cases were treated with a second stent. One patient remained symptom-free while the other had recurrent thrombosis and no further therapy was performed.

Symptomatic improvement was dramatically seen within 24–48 h after stent placement. Complete symptomatic relief, defined as disappearance of cyanosis, cervicofacial edema and dyspnea was observed in 40 patients (90.9%) while partial response was observed in four (9.1%) patients. Mean survival time after stenting was 1060 days (range: 966–1116) for patients with a benign pathology.

4. Discussion

SVCS was first described by William Hunter in 1757. It frequently constitutes a medical emergency. Dyspnea is present in more than 60% of the patients. The magnitude of symptoms is related to: rate of progression of SVC obstruction, extent of obstruction and relationship between the obstruction and the arch of the azygous vein.

The combination of dyspnea and encephalopathy announces a short-term ominous course.

Even though radiation therapy reduces the size of malignant tumors in 60–80% of the cases [12,13], the initial edema can aggravate the symptoms. Remission of the clinical condition is not seen until 3–4 weeks and the effect is generally temporary. Recurrent SVC obstruction develops in 60–88% of the patients [3,9,15,16].

Chemotherapy alone or associated with radiotherapy is highly beneficial in lymphomas and anaplastic tumors [5,14]. However, the current use of cisplatin for anaplastic tumors demands patient over hydration to force his diuresis, a fact that can temporarily worsen both SVCS and the encephalopathy due to brain edema increase.

Taking into account the therapeutic limitations previously described, the use of endovascular stents to achieve SVC permeability has currently become an accepted procedure as a palliative treatment of SVCS in critical patients, a fact that has been confirmed by other publications [1,3,4,9–11].

Stenting technique offers two important advantages: immediate remission of the symptoms with prolonged duration of the response and also allows overcoming a clinically critical situation rapidly, making it easier to start chemotherapy and radiation therapy promptly [17].

In our experience, complete remission of the symptoms was achieved within the first 24–48 h in 90.9% of the patients, and 83.3% of the cases (38/44) were symptom-free during the rest of the disease (Figs. 1–3).

According to Nicholson et al. [9] possible recurrence of SVCS treated with stents is 12%, being more frequent in cases of complete thrombosis prior to stent placement, and it can be solved with coaxial stenting [3,4,9]. In our series, recurrence of SVCS was present in six patients (13.6%): due to tumor progression in 2 and due to intrastent thrombosis in 4.

Endovascular SVC stenting is well tolerated by patients. Some authors have described an up to 20% morbidity related to the use of other types of stents not currently in use [4,11]. It is interesting to point out that some authors believe that cardiac failure described after stent placement is due to a brisk increase in blood venous return into the right heart as it actually occurred to one of our patients [18]. To avoid this complication it is very important to carry out negative hydric balance before the endovascular procedure. It is also important to point out that the new type of self expandable stents with greater endovascular adhesion combined with operator’s experience, diminish the risk of stent migration [4,7,11].

5. Conclusion

The use of self-expanding vascular endoprostheses in the recanalization treatment of SVC in SVCS due to a
malignant or benign etiology in the hands of an experienced team offers excellent results with rapid and prolonged remission of symptoms and a few complications.

According to the results obtained, we consider that SVC recanalization with self-expanding vascular stents should be the initial indication for those critical cases of SVCS accompanied by intense dyspnea, encephalopathy, cyanosis and thoraco-cervico-facial edema [19]. Both chemotherapy and radiation therapy can initially worsen the symptoms and can seriously threaten the patient’s life.

References