ORIGINAL ARTICLE

Tracheobronchial Stenting is Safe and Effective in Relieving Upper Airway Obstruction

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Summary

Many studies have shown that tracheobronchial stenting is effective in relieving respiratory distress secondary to major airway obstruction due to lung or oesophageal cancer. A retrospective review on the benefits and complications of self-expandable metallic stent (SEMS) insertion through flexible bronchoscopy for the palliative treatment of upper airway obstruction in University Malaya Medical Centre was performed. Ten patients underwent this procedure. Relief of dyspnoea was immediate following stent insertion in all patients. Stent migration occurred in one patient and three patients had restenosis of the central airway. We conclude that tracheobronchial stenting via flexible bronchoscopy is feasible and safe.

Key Words: Tracheobronchial stenting, Upper airway obstruction, Flexible bronchoscopy, Lung cancer, Oesophageal cancer

Introduction

Obstruction of the trachea and main bronchus due to unresectable malignant disease (lung or oesophageal cancer) is not an uncommon clinical condition. This may arise as a result of exophytic endoluminal growth within the airway or as a consequence of extraluminal compression by the tumour. When major airway obstruction becomes progressively severe, patients develop dyspnoea and stridor. Rapid deterioration may sometimes occur due to superimposed post-obstructive pneumonia or lung collapse secondary to mucus plug formation at the level of stenosis. In advanced disease, extreme respiratory distress occurs and death ensues. Various modalities of treatment including stenting, laser ablation, electrocautery and mechanical core-out have been recommended to offer quick palliation to such patients[1]. Of these, tracheobronchial stenting has emerged as one of the most effective treatment modalities[2,3,4].

A series of patients who underwent tracheobronchial stenting using self-expandable metallic stent (SEMS) in the University Malaya Medical Centre were reviewed to document its efficacy and safety. This is deemed crucial as history in medicine has, not infrequently, revealed that the technical success of certain procedures has not resulted in an improved quality of life and at times contributed to prolonged suffering from the patient's perspective.

Materials and Methods

A 4-year retrospective review of patients undergoing tracheobronchial stenting from March 2000 to April 2004 was performed. All patients were diagnosed to have inoperable and severe major airway obstruction as a result of lung cancer or oesophageal cancer with imminent asphyxiation. The site and length of obstruction was initially assessed using the flexible bronchoscope. In patients with critical stenosis

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whereby the flexible bronchoscope could not be passed beyond the narrowed segment of the airway, spiral computed tomography was performed from which the 3-dimensional virtual bronchoscopy was created. In each case, a single self-expandable metallic tracheal or bronchial covered stent, either Hanarostent or Ultraflex (Microvasive, Boston Scientific Corporation, Watertown, MA02172) was used. Precise placement of the stent was achieved using flexible bronchoscopy (Olympus, model BF type XT40) under the guidance of fluoroscopy. All patients were given nasal oxygen, local anaesthetic spray of 4% lidocaine to the throat. Small boluses of intravenous midazolam 2.5mg to 7.5mg provided conscious sedation during the procedure.

Twelve tracheobronchial stents, one in each patient, were inserted during this period. However, only 10 patient folders were available for review (*Table I gives details). The other two patient folders could not be traced and hence are not included in this review. Of these ten patients, three were females and seven males. Their age ranged from 48 to 78. Five patients had primary lung cancer and five patients had primary oesophageal cancer. Among those with lung cancers, three had squamous cell carcinoma, 1 had adenocarcinoma and in another one, specific histological type was not clearly stated. Of the five patients who had oesophageal cancer, two had oesophageal stent (patient 5 & 7) inserted and one (patient 3) had gastrostomy done as a palliative procedure before the airway stenting.

Seven patients had obvious bronchoscopic evidence of extrinsic compression and these comprised five patients with oesophageal cancer and one each with lung adenocarcinoma and squamous cell carcinoma. Obstruction secondary to endoluminal growth was more frequent in bronchogenic squamous cell carcinoma in this series. One patient (patient 8) underwent laser therapy to reduce the endobronchial mass prior to stenting.

All patients experienced immediate relief of respiratory distress following the procedure. There was no mortality associated with the procedure. One patient (patient 7) developed recurrent shortness of breath about 12 hours after the procedure. This patient had oesophageal cancer with severe stenosis of the tracheal lumen (pinhole size) prior to the procedure. The cause of the deterioration was not clear because revision of the position and state of stent was not done because the patient was discharged by the family against medical advice. There were however a few possibilities postulated: a.) recurrence of airway obstruction due to inability of the stent to sustain high compressing pressure from such severe stenosis, b.) retention of bronchial secretion resulting in obstruction of the distal airways, and c.) migration of stent. The other patients were discharged from hospital with improved symptoms following stent insertion.

The most common complication after the procedure was retention of bronchial secretion which resulted in clinically significant desaturation. This problem seemed to be more common in patients with adenocarcinoma (two patients) and those with severe stenosis secondary to oesophageal carcinoma. Even though one other patient with squamous cell lung carcinoma also had this complication, her stent was noted to have migrated quite soon after the procedure. One patient (patient 10) was readmitted with recurrent bronchopneumonia. This patient already had right sided post obstructive bronchopneumonia prior to stenting. The stent was inserted in the left main bronchus and trachea to prevent the spill-over of infection to the left bronchial tree. His right main bronchus could not be stented because it was completely obstructed. Even though he was treated with prolonged courses of antibiotics before and after the procedure, the infection could not be brought under control. He was readmitted one week after stenting with signs of recurrent upper airway obstruction and respiratory tract infection. He died two days later in hospital.

Recurrent stenosis occurred in one patient (patient 8) with squamous cell lung carcinoma due to growth of tumour at the edge of the stent necessitating multiple sessions of laser ablation therapy. He, however, remained quite well and independent until five months later. There was no trachea/bronchial wall perforation or haemorrhage after the procedure.

Survival for many patients cannot be ascertained accurately either because some of these patients were discharged to the original district hospital or they defaulted follow-up. The longest period of survival documented was 175 days in one patient post stenting.

Table I: Patients' Characteristics, Stents Used, Outcomes and Complications

Patient no	1	2	3	4	5	6	7	8	9	10
Gender	Male	Male	Male	Female	Male	Male	Female	Male	Female	Male
Age (year)	48	73	77	50	56	78	75	66	78	52
Date of insertion	21/3/00	27/6/00	22/8/00	2/4/01	9/6/01	7/1/03	25/9/03	15/1/04	7/2/04	6/4/04
Diagnosis	Carcinoma (?type)	Carcinoma of oesophagus	Carcinoma of oesophagus	Carcinoma of oesophagus	Carcinoma of oesophagus	Squamous cell carcinoma of lung.	Carcinoma of oesophagus	Squamous cell carcinoma of lung.	Squamous cell carcinoma of lung	Adeno-carcinoma of lung
Site of tumour obstruction	Right intermediate bronchus & left main bronchus	Trachea 3cm below vocal cord, 1 cm above carina)	Upper part of trachea (4cm in length)	Upper part of trachea (4cm in length)	Lower part trachea (with Left vocal cord palsy)	Upper part of trachea, (2cm from vocal cord & 2cm in length)	Middle third of trachea. Pinhole opening	Lower third of trachea	Narrowing of both main bronchi	Lower half of trachea & right main bronchus
Intraluminal growth ?	No	No	No	No	No	Yes	No	Yes	No	Yes
External compression?	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No
Site of stent insertion	Right main and intermediate bronchus	Trachea	Trachea	Trachea	Trachea	Trachea	Trachea	Trachea	Left main bronchus and trachea	Trachea
Stent used (covered) D (diameter) L (length)	Ultraflex D: 0.8cm L: 4cm	Ultraflex D: 0.8 cm L: 1.4 cm	Ultraflex D: 1.4cm L: 8cm	Ultraflex D: 1.4cm L: 8cm	Ultraflex D: 1.8cm L: 8cm	Ultraflex D: 1.6cm L: 6cm	Hanaro D: 1.6cm L: 6cm	Hanaro D: 1.6cm L: 6cm	Hanaro D: 1.6cm L: 6cm	Ultraflex D: 1.6cm L: 8cm
Relief of	Immediate	Immediate	Immediate	Immediate	Immediate	Immediate	Immediate	Immediate	Immediate	Immediate
Complications Post-Tracheobronchial Stenting:										
Stent migration	No	No	No	No	No	No	No	No	Yes	No
Retention of secretion	No	No	No	No	Yes	Not much	May be	No	Yes	Yes
Infection	No	No	No	No	Yes (after 1 month)	No	No	No	Yes	Yes (before and after stenting)
Restenosis	No	No	No	No	No	No	?Yes	No	Yes	?Yes
Haemorrhage	No	No	No	No	No	No	No	No	No	No
Survival after tracheo-bronchial stenting (day)	>11	30	>2	14	>44	> 55	>1	175	39	9

Remarks: Symbol > means more than (survival cannot be ascertained accurately because these patients were lost to follow-up subsequently).

Discussion

Airway stenting was pioneered in 1952 by Harkins who used a metal alloy tube to relieve tracheal stenosis. By the early 1960s, Montgomery had designed his T-shaped silicone stent. This stent, as the name suggest, has two arms; one which supports the entire trachea and another one (side-arm) extends through a permanent tracheostomy. Many of the silastic stents in use nowadays have evolved from this stent. Over the past two decades, tremendous progress has been achieved with tracheobronchial stenting. Since the '90s, the Dumon silicone stent[5] has become the "gold standard" with which new stenting methods and materials are being compared. Recent experience using self-expandable metallic stent (SEMS) seems to have matched or even superseded this standard particularly in malignant stenosis. The other advantage of SEMS is that it can be inserted via the flexible bronchoscope with or without fluoroscopic guidance with just light sedation and local anaesthesia compare to the Dumon stent, insertion of which often needs to be done using the rigid bronchoscope under general anaesthesia. Numerous studies have shown that this procedure is safe and effective in relieving upper airway obstruction[2,3,4,7,8,9]. In some centres, it is done without fluoroscopy[9].

In our series, it has been shown that SEMS is very effective in relieving respiratory distress due to upper airway obstruction in most patients. Considerable length of survival with relatively few symptoms post-stenting seemed possible in quite a few patients. Even if tumour recurred at the edge of the stent, other modalities of treatment, e.g. Laser ablation could supplement stenting. Complications seemed relatively few and could be managed conservatively most of the time. Patients with obstruction secondary to squamous cell carcinoma of the lungs appeared to survive longer than those with adenocarcinoma of lung or carcinoma of oesophagus. It is possible that by the time adenocarcinoma causes obstruction, it would have grown to considerable size and more advanced stage squamous cell carcinoma which tends to cause central airway obstruction relatively early as a result of its tendency to be central in location and its endoluminal growth.

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