Stenting or Surgery in Benign Tracheal Stenosis?
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Abstract

Background: Review of stenting in benign tracheal stenosis in the long run in comparison with surgical procedures concerning indications, tolerance of stents, efficacy, complications and follow up after removal, restenting and survival.

Patients and material: In a 18 year period between July 1993 and June 2011 in tracheal stenoses 52 stents, (32 silicone, 12 dynamic bifurcated stents, 2 metallic covered stents, 6 t-tubes) were inserted in 35 symptomatic patients (17 men, 18 women, age 12 till 96, mean 65,7 years, 1.3 stent per patient).

Indications for stenting were: anatomic stenosis, stricture and compression, malacia and combined stenosis. Retrospective analysis was done with follow up till June 2011.

Methods: Bronchoscopic procedure was done under general anaesthesia, intubation with a rigid bronchoscope, dilation by balloon, rigid scope or combination. Stent placement was mostly done under fluoroscopy. Stent removal and/or replacement were also done with a rigid bronchoscope under general anaesthesia. Only the procedures for placement of a Montgomery t-tube were done under local anaesthesia.

Data collection: Data were provided by review of patients’ charts, interview of family doctors, external hospitals and in single cases interview of family members. Patients who came for controlling of the stent were also interviewed.

Results: During the observation period the longest survival time so far was 18 years.

In 19 patients the stent led to a relief of symptoms, mainly dyspnoea and stridor and was tolerated without major complications (Successful stenting). In 12 patients the stent had to be removed because of complications and another four patients died of stenting related complications. In 16 patients therefore stenting was called “not successful”.

Conclusions: In comparison to patients with advanced malignant diseases, where stenting is supposed only palliative, patients with tracheo-bronchial diseases are not limited in their life expectancy from the local tracheal disease, if this can be treated. But often these patients are high risk patients concerning comorbidities, technical and functional operability. In these patients a stent can therefore be an alternative to surgery. Nevertheless because of the high rate of complications, which can be also life threatening, the decision must be done carefully.

Purpose: Review of stenting in benign tracheal stenosis in the long run concerning indications, tolerance of stents, efficacy, complications, follow up after removal, restenting and survival.

Patients and Material

In 18 year period between July 1993 and June 2011 a total of 385 tracheobronchial stents in 291 patients were inserted. 318 stents were used for malignant diseases, 67 in benign diseases [1-3]. In tracheal stenoses 52 stents, (32 silicone radiopaque Dumon stents (3 bifurcated) [4,5], 12 dynamic bifurcated Freitag stents [1], 2 metallic covered Ultraflex® stents [6], 6 Montgomery t-tubes [7] ) were inserted in 35 symptomatic patients (17 men, 18 women, age 12 till 96, mean 65,7 years, 1.3 stent per patient).

Indications for stenting were: anatomic stenosis, stricture and compression, malacia and combined stenosis. Retrospective analysis was done with follow up till June 2011.

Data collection

Data were provided by review of patients’ charts, interview of family doctors, external hospitals and in single cases interview of family members. Anamnestic data were taken from patients directly who came for the control of the stent.

Methods

Bronchoscopic procedure was done under general anaesthesia, intubation with a rigid bronchoscope, dilation by balloon, rigid scope or combination. Stent placement was mostly done under fluoroscopy. Stent removal and/or replacement were also done with a rigid bronchoscope under general anaesthesia. Only the procedures for placement of a Montgomery t-tube were done under local anaesthesia.

Stents:

Under the premise that procedure should be reversible at any time mainly silicone or hybrid stents were used – Dumon stents mainly in the middle trachea and dynamic stents in the distal trachea and if the stenosis reached to the bifurcation. In the case of an already existing tracheostoma a t-tube was placed. Metallic stents were used only in rare cases because of their potential granuloma forming [8-10].

Results

During the observation period the longest observation time so far was 18 years.

The longest stenting time in permanent stenting for one single stent was 1737 days (4.75 years), in sequential stenting altogether 2357 days (6.45 years), in sequential temporary stenting 1838 days (5 years). 13 patients carried a single stent for more than 1 year up to 4.75 years.

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8 Patients are still alive (average 2033 days = 5.57 Years, 5 patients with a stent in place, 1 patient after stenting for stenosis and no recurrence after removal, 1 patient after stent removal and en-to-end resection, 1 patient after stent removal and tracheotomy).

Table 1 Efficacy of stent placement

Successful stenting: In 19 patients 54.3 % stenting was successful. Successful stenting was defined as improvement of respiratory symptoms, no major complications and/or overcome of complications by replacing the primary stent by another stent if necessary and no occurrence of stent related death. One patient had no recurrence of a distal stricture after the removal of the stent after (stenting time 400 days), is still alive for more than 12.8 years. In two other patients stenosis recurred after more than one year of stenting and removal of the stent. Within 3 weeks both patients had to be stented again.

Table 2 Overall complication rate

33 stents (63.5 %) caused complications; some stents had to be exchanged by another. Some had to be extracted. Four patients died of stenting related complication (11.4 %).

Table 3 Unsuccessful stenting (patients n = 16)

The procedures followed after stent removal is shown in table 3.

In 12 patients the stent had to be removed because of complications, four patients died of stenting related complications (11.4%).

Table 4 Analysis of the fatal complications and could have been alternatives to stenting

In one case a tracheotomy or an end-to-end resection would have been probably the better alternative. In the case of tracheomalacia probably the stent was not wide enough. In the case of the aortic aneurysm the patient was not in a condition for an operation. The patient with the extended stenosis was symptomatic and needed immediate therapy. Lung transplantation was a more or less theoretical option.

Discussion

In about 54 % of our patients stenting led to relief of symptoms and surgery because of stenosis was not necessary. Complications occurred, type of complication | stent n (%) | mortality n (%) |
---|---|---|
dislocation total | 10 (19.2) | |
A migration | 8 (15.4) | 1 (2.9) |
B iatrogenic dislocation | 2* (3.8) | |
mucus plugging | 10 (19.2) | 1 (2.9) |
Infection | 3 (5.8) | |
Granuloma forming | 6 (11.6) | |
edema of the glottis | 2 (3.8) | |
Arrosion bleeding | 1 (1.9) | 1 (2.9) |
disruption of posterior tracheal wall | 1 (1.9) | 1 (2.9) |
Sum | 33 (63.5) | 4 (11.4) |

* one stent was dislocated twice

Table 2: Complication rate, mortality (stents placed n = 52, patients stented n= 35).

<table>
<thead>
<tr>
<th>No of patients</th>
<th>Reopened tracheotomy</th>
<th>New tracheotomy</th>
<th>End-to-end resection</th>
<th>death</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of patients</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Percentage of all patients</td>
<td>11.4</td>
<td>17.1</td>
<td>5.7</td>
<td>11.4</td>
</tr>
</tbody>
</table>

Table 3: Unsuccessful stenting (patients stented n = 35).

<table>
<thead>
<tr>
<th>No of patients</th>
<th>Indication for stenting</th>
<th>Cause of death</th>
<th>Maybe alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stricture</td>
<td>Mucus plugging</td>
<td>Tracheotomy or end-to-end resection</td>
</tr>
<tr>
<td>1</td>
<td>Compression due to aortic anerysma compression</td>
<td>Arrosion bleeding</td>
<td>Aortic arch graft</td>
</tr>
<tr>
<td>1</td>
<td>Extended stenosis small central airways</td>
<td>Rupture of posture wall during stenting</td>
<td>Lung transplantation</td>
</tr>
<tr>
<td>1</td>
<td>Tracheomalacia</td>
<td>Stent migration</td>
<td>Customized stent</td>
</tr>
</tbody>
</table>

Table 4: Analysis of stenting related death.

but in some cases could be managed by changing or repositioning the stent. In about 46 % stenting was not successful. The complication rate was quite high and also the rate of fatal complications due to stenting was 11.4 %, In half of these fatal cases an operation might have been a better decision, in the other half the alternative would have been lung transplantation and in the other case an aortic arch graft in an 84 year old woman.

In comparison to patients with malignant trachea-bronchial disease; e.g. advanced local and disseminated cancer, life expectancy is not impaired by a benign trachea-bronchial disease, if the treatment of the local disease is successful [11].

Nevertheless patients with tracheo-bronchial diseases are often high risk patients concerning co-morbidities, technical and functional operability. In these patients a stent can therefore be an alternative to an operation. As this study was only a review and not a randomized study, of course - a precise answer if stenting or surgery is better - cannot be given on this data basis. One main problem is the not precisely done classification of stenoses. The decision for stenting or surgery is often crucial and several factors have to be considered.

Consequences for our own approach to stenting

A A fairly high number of stents which reached the subglottic area- either Dumon silicone or Montgomery t-tubes had to be removed. Because of multiple complications stenting of subglottic area was given up.

B In patients with tracheotomy we avoid additional stenting, because the lack of sufficient humidification can produce dried mucus causing plugging.
In complex stenoses stents can give relief at first. If they are not tolerated well because of complications, the lowest risk in these cases is probably reopening a tracheostomy or new tracheotomy.

**Comparison operation versus stenting in high risk patients**

Surgical measures have also risks as operations can technically demanding e.g. lung transplantation, trachea transplantation, carinal resection, aortic arch graft [9,10,12,13]. The quality of life can be impaired, e.g. in a tracheotomy. Also fairly young patients should be stented if an operation is not possible or has been already done. Patients on a ventilator who cannot be weaned due to tracheomalacia might also profit from a stent and can be weaned. In elderly patients with complex stenosis of course a stent is considered first because of the multimorbidity and the demanding operation procedure which would be necessary.

**Conclusions**

If patients have a good life expectancy concerning the co-morbidities surgery should be considered at first hand especially in short stenosis, when an end-to-end resection is possible. Patients with tracheo-bronchial diseases are often high risk patients concerning co-morbidities, technical and functional operability. In these patients a stent can therefore be an alternative to an operation. Nevertheless because of the high rate of complications, which can be also life threatening, the decision must be done carefully.

**References**