Possibilities and limits of interventional bronchoscopy in malignant tracheal stenosis -summary-

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The trachea is a vital organ of the respiratory system with particular anatomical and physiological characteristics, with major consequences for diagnostic and therapy of its pathology.

Anatomically, trachea has some particular aspects: it is located partly superficial, a single structure with relative structural rigidity, a short length, the relative lack of longitudinal elasticity, cross elasticity that allows minimal relative torsion, proximity to major cardiovascular structures, segmentally blood supply.

The exact prevalence of central airway obstructive phenomena isn’t known, in the U.S., for example there are treated 80,000 cases each year. Although, there is an increase number in cases of benign due of accessibility to endotracheal intubation methods, most cases turn out to be malignant. Between these, the first place is held by malignant tracheal tumors secondary of lung cancer. This pathology incidence continues to rise despite active measures to combat smoking. In addition to that, about one third of the cancer during evolution would have at least one episode of obstruction of the central airways. Overall, tracheal malignancy is rare in clinical practice with ordinary and nonspecific signs and symptoms.

Bronchial endoscopy procedures at a modern department of bronchology bring a major contribution both for the diagnosis of malignant tracheal stenosis pathology, establishing histopathology, the establish of lesion operability, and in effective treatment of these types of injuries. The aim will be a palliative treatment in most cases less than curative one.

**Bronchoscopy - a method for positive diagnostic of the tracheal malignancies**

The Institute of Pneumology "Marius Nasta" has an exponential increase in the number of bronchoscopies, about 2000/an in 1990 to over 8000/an in
2004, exceeding the 2008 threshold of 10 000 procedures / year, mostly fiber optic bronchoscopies.

Number of rigid bronchoscopies performed for malignant tracheal pathology was dependent on effective therapeutic possibilities, disregarding specific increasing of the annual total number of bronchoscopies. (Figure 1)

Figure 1. Number of rigid bronchoscopies performed annually for tracheal malignant disease.

![Graph showing number of rigid bronchoscopies performed annually for tracheal malignant disease.](image)

Rigid bronchoscopy was used complementary after a preliminary assessment with fiber optic bronchoscopy. The role of rigid diagnostic procedure remained topical for severe obstructive lesions that required combining the two methods.

In 2005 of 6600 flexible bronchoscopic examinations performed were identified 352 cases (5.33 %) with signs of tracheal stenosis secondary to malignant diseases (infiltration, widening of carina, extrinsic compression, endoluminal tumor, stenosis mixed, dyskinesia) (figure 2).
Figure 2 The proportion of cases of malignant tracheal lesions

The majority of the cases identified on the basis of clinical and imaging data was secondary to lung cancer. (Figure 3)

Figure 3 The distribution of pathology identified on the basis of clinical and imagistic data on the trachea

In the lung, regarding the type of the lesions described endoluminal there is a high frequency of mucosal infiltration and carinal widening. The first prevails the third lower trachea, showing the centripetal submucosal spread of lung cancer. Tracheobronchial dyskinesia was stated in this assessment,
although it isn’t shown to be secondary to increased exposure tabacic or secondary of some adenopathies in proximity. ( Figure 4 )

Figure 4 Proportion of the main signs of malignant tracheal stenosis encountered in secondary lung cancer

![Bar graph showing proportion of main signs of malignant tracheal stenosis encounters in secondary lung cancer.]

Regarding the site of lesions, they had a predominance of the 1/3 lower, which is explained by the tendency of the development of lung cancer with centripetal propagation in the submucosal and mucosal layers. (Figure 5)

Figure 5 Distribution of lesions according to floor tracheal

![Diagram showing distribution of lesions according to floor tracheal.]
Speaking about the conventional methods of diagnosis (washing, brushing and biopsies), we find a paradoxal superiority of washing to brushing (Figure 6). Cumulative, both methods provide a significant rate diagnostic but a nonspecific one. The sensitivity of the method depends not only on itself but on other factors (availability of laboratory, accuracy of the technique). The brushing was not used routinely due to the limited availability of the brush, and applying the method only in individuals with injuries "active" type mucosal infiltration. The tracheal mucosa biopsy allowed a good rate of diagnosis of 60%, with the possibility of specifying in most cases, even histopathologic type.

Regarding the histopathology of lung cancer with central involvement there is a predominance of epidermoid lesion known as central favorite growing tumors. Also, the number was significantly increased in the case of microcellular forms, fast-growing aggressive forms known. (Figure 7)
Fig. 7 Distribution according to histopathology of malignant tracheal stenosis secondary lung cancer

The modern methods of diagnosis in malignant tracheal stenosis

EBUS TBNA (Endobronchial ultrasound transbronchial aspiration)

Figure 8. EBUS - TBNA schematical view

( after A.Ernst )

At the our institute, the biopsies were performed with this device in 2013 when a team led by Prof. Dr. Franz Sanzel (hospital Gauting, Munich) achieved a sample demonstration on 8 patients with this technique. The procedure was performed by team with anatomopathologist in the operating room. We used under general anesthesia rigid bronchoscopy associated fiber optic bronchoscopy for EBUS TBNA. Biopsies were performed for peritraheale and peribronchial lymph nodes, each specimen was confirmed microscopically as significant on the basis of obvious pathological elements. The confirmation was obtained for 4 nonsmall lung cancer, 2 cases of small cell lung cancer, a lymphoma and a sarcoidosis. The average working time per patient was
approximately one hour and no complications were recorded. The success rate was 100%, but were carefully selected cases with significant pathology for demonstration purposes. Discharge of patients was performed on the same day or next day depending on the anesthetist recommendations.

These data have, however, assessed in the context of selected batch demonstration. The examinations were performed in the operating theater, having joined pathology which confirmed the production of pathological tissue in direct examination.

**clinical case one:** woman 21 years old, smoker, known with (nodular sclerosis) Hodgkin lymphoma subtype, with previous chemotherapy and bone marrow transplant (January 2013) is presented for the diagnosis of bilateral pulmonary nodular lesions and left hilar adenopathy emerging reassessment CT scan examination.

Figure 9 a) PET CT – hyperfixation in the bilateral pulmonary nodular images (maximum diameter 3 cm and SUV max 16.5) - archive of Prof Dr. E. Crisan

Figure 10 b) PET CT - right and pretracheal lymph nodes without hyperfixation; lower left paratracheal and carinal large lymph nodes with hyperfixation with SUV max of 11.8. - Archive of Prof.Dr. E. Crisan
The fiber optic bronchoscopy revealed bilateral edema and hyperemia of the mucosa, more on the left side, in the left main bronchus and initial portions of lobars bronchi. The bronchial biopsies (3 specimens) performed to junction left main bronchus with left upper lobar bronchus were negative.

The procedure was performed under general anesthesia in rigid bronchoscopy (Prof. Dr. Franz Stanzel) with cytology and histology samples of the nodes with pathological evidence on the PET-CT.

Figure 11 Endoscopic aspects during tracing site for TBNA

a) The origin of the left main bronchus b) Carinal view

c) the moment of EBUS TBNA practice at carinal level d) radio-opaque needle for biopsy in the carinal node – Archive of Prof. Dr. E. Crișan

The histopathological analise revealed the presence of Hodgkin's lymphoma.
Clinical case 2: DM, man, 54 years old, smoker, working in a toxic environment (with petrol and marble vapors) with history of productive cough with mucopurulent sputum for 4 months, left chest pain, low grade fever.

Figure 12. The posteroanterior and lateral chest radiography shows: 1. opacity mediastinal widening to the left; 2. a left hilar opacity with heterogeneous aspect, relatively well defined; 3. A left superior pulmonary opacity, with macronodular aspect, relatively well defined - Prof. archive Emilia Crisan

Figure 13. Image of the bulky mediastinal lymph nodes on CT, upper left pulmonary opacity – archive of Prof. Dr. E. Crișan
The fiber optic bronchoscopy indicated the widening of carina, tracheal mucosa infiltration of the left main bronchus and left upper lobar bronchus, extrinsic compression of the apicodorsal segmental bronchus of the left upper lobe. The conventional methods (biopsy, washing of the main left bronchus revealed the presence of neoplastic cells.

The procedure was performed under general anesthesia by rigid bronchoscopy (Prof. Dr. Franz Stanzel) on the carinal and left interbronchial nodes. (Figure 14)

Figure 14 a) aspects during tracing site for TBNA on the right side for carinal nodes b ) Echographic appearance of carinal lymph nodes; Archive of Prof. Dr. E.Crişan

The histopathological result indicated the presence of a small cell lung cancer.

**Autofluorescence bronchoscopy**

The bronchology department of the National Institute of Pneumology M.Nasta has a limited experience with autofluorescence bronchoscopy. We performed a group of 12 patients which were applied with the standard and autofluorescence bronchoscopy. In addition to assessing with the effective optical exploration, the samples were made in the suspicious areas (as bronchial aspirates for cytology, biopsy and sometimes bronchial brushing). There were included patients with tumoral pathology confirmed and patients with high risk
for neoplastic lesions (heavy smokers, toxic environment). Patients were divided into 4 groups, corresponding to the main indications of autofluorescence bronchoscopy with:

- Group I: patients with lung cancer surgery for postoperative bronchial stump tracking;
- Group II: patients with confirmed lung cancer treated oncological - with minimum 3 series of chemotherapy with or without radiotherapy;
- Group III patients with lung cancer at the first examination, with surgical indication on endoscopic criteria - to follow the exact proximal extension of tumor process;
- Group IV: patients with increased risk for the purpose of early detection of lesions with increased risk of tumor degeneration and tumor lesions.

**Group I - patients with confirmed lung cancer and surgery**

After surgical treatment of lung cancer, in addition to clinical and imaging follow-up, patients are evaluated with fiber optic bronchoscopy to 1 - 3 or 6 months. The procedure seeks early detection of any recurrence at the bronchial stump, place with risk for recurrences. In our service the biopsies are performed where macroscopic changes of mucosal stump are notified, but there are services that perform this exploration periodically with or without direct or indirect signs.

<table>
<thead>
<tr>
<th>Case</th>
<th>Location</th>
<th>Histological type</th>
<th>Fier optic bronchoscopy</th>
<th>Autofluorescence bronchoscopy</th>
<th>Biopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lobe upper left</td>
<td>c. squamous</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Lobe lower right</td>
<td>adenocarcinoma</td>
<td>+/-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1. Results Group I
In the pursuit stump, rate of diagnostic in both endoscopic examination proves to be superior to standard light only. In table 1 there is indicated a correlation between the result of the autofluorescence examination and biopsy results. In conclusion, in the absence of autofluorescence examination, histopathology biopsy can clarify the suspicion of relapse blunt, with the advantage of lower costs.

Figure 15 Tumoral aspects in white light and autofluorescence bronchoscopy (archive of Prof.dr. Emilia Crisan) - right upper lobar bronchia

Figure 16 Aspects of practicing biopsy of suspicious areas in autofluorescence exam. (archive of Prof.dr. Emilia Crisan)

**Group II - patients with confirmed lung cancer treated with at least 3 series of chemotherapy with or without radiotherapy**

The group II included patients with histologically confirmed lung cancer who did not accomplish endoscopical criteria for radical surgery. They were guided to the oncological services with the recommendation to return to control after at least 3 cycles chemotherapy, hoping for operable stage conversion. Conversion requires mucosal lesions regression distal to the carinal level.
Table 2 Results group 2.

The patients with confirmed lung cancer treated oncology, the white light examinations, performed after at least 3 cycles of chemotherapy, have relatively comparable value with autofluorescence bronchoscopy. For tracheal Hodgkin's lymphoma with esophageal fistula it’s proved that standard light bronchoscopy has limited value, with negative biopsies, while examining autofluorescence revealed the evidence of tracheal neoplastic tissue. Since they noticed discrepancies between macroscopic appearance and biopsy results in both examinations (in standard light and autofluorescence) we consider that examinations have a margin of error with false positives or negatives results.

The study does not appear that there is a possible link between histopathological type of lung cancer and rate of diagnostic for standard examination or with autofluorescence. It follows from the table that, regardless of histological type of lung cancer examined (small cells, large cells or squamous), endoscopic examination has its limitations.

We believe that the lack of technical possibilities for autofluorescence examination requires that the macroscopic information obtained at endoscopy is mandatory to be completed with biopsy.
**Group III - patients with lung cancer at the first examination**

There were included the patients who are at first examination which was found at standard examination with lesions suggestive for lung cancer. They were later confirmed by biopsy and they had from beginning the endoscopic criteria for operability. In these cases, the correct description of the bronchial proximal extension is essential in assessing the indication for radical surgery and in choosing the most appropriate type of intervention. Often, bronchial mucosal infiltration are a trap for the endoscopist, being hardly distinguishable macroscopic inflammation edema (secondary of necrotic cancers, overinfected) by neoplastic infiltration.

Table 3 Results group 3.

<table>
<thead>
<tr>
<th>Case</th>
<th>Location</th>
<th>Histological type</th>
<th>Standard endoscopy</th>
<th>Autofluorescence endoscopy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower right lobe</td>
<td>Squamous</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Upper right lobe</td>
<td>Squamos</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Lower right lobe</td>
<td>?</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

In this group patients, the study compared the diagnostic yield in the proximal extension of infiltration gives results almost equal in both types of investigation (with standard light or autofluorescence). Because of the small experimental group the results has no scientyific value, requiring a bigger group with statistically significance.

Although it was hypothesized that the examination under fluorescent lighting will improve the surgical indication for lung cancer yet in our cases there wasn’t claimed superiority of autofluorescence versus white light examination. Anatomical criterion of minimum distance of 2 cm from the resection limit remains valid.
GROUP IV - patients with increased risk factors

The group consisted of three patients, two men and a woman, heavy smokers (more than 20 years), two of them with posttuberculosis sequelae and all with exposure to professional risk factors (2 builders and 1 glass blower). All radiological images have pathological findings: unorganized opacities partially occupying right upper lobe in 2 cases and left upper lobe in 1 case. In literature there are studies that aim the same goal, but are conducted on a larger number of cases. Such are the study of Haussinger (1999) conducted on 60 cases and the study of Sato (1993). They consisted of examining cases, alternatively, the same endoscopic session both white light and blue light. Autofluorescence examination succeeded in detecting a variable number of dysplasia and carcinoma in situ, they go beyond the level of 15% (7% - Haussinger, 14% - Sato).

<table>
<thead>
<tr>
<th>Case</th>
<th>Location</th>
<th>Endoscopies</th>
<th>Autofluorescence</th>
<th>Washing, citology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Left upper lobe</td>
<td>bronchitis</td>
<td>Normal</td>
<td>Negative</td>
</tr>
<tr>
<td>2</td>
<td>Right upper lobe</td>
<td>bronchitis</td>
<td>Normal</td>
<td>Negative</td>
</tr>
<tr>
<td>3</td>
<td>Right upper lobe</td>
<td>Normal</td>
<td>Normal</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Table no. 4 Results Group 4

None of the patients showed tumoral or pretumoral lesions, according the white light and autofluorescence exams.

The literature data shows screening percent around 10% (from 4.5% to 14%), such that the process becomes cost-effective only when considering a large number of patients, which is not the case in our study.

In conclusion, this analysis shows that the standard examination is completed by autofluorescence examination, especially for postsurgical follow
of bronchial stump or for the monitoring of endobronchial bronchial cancer treated oncology.

For group no. 2, there was the most difference between standard examination and autofluorescence. Taking as reference the result of histopathological examination, it was observed that autofluorescence exam is able to detect pathological lesions of the submucosa, where the white light exams indicated like normal area.

The results are informative, this method not being approachable for the time in the bronchology labs from Romania. For statistical value is necessary the experience and the examination of a larger number of patients. Current guidelines use bronchoscopy exams for the early diagnosis of lung tumor pathology, and therefore the equipment for autofluorescence examination must be part of standard endoscopy laboratories. Their price has become affordable and will be quickly amortized by reduced costs of endoscopic treatment for precancerous lesions or carcinoma in situ.

**Bronchoscopy as a method of treatment of obstructive tracheal malignant lesions**

Most cases get to emergency rooms with an obstruction of at least 50 %, with dyspneic symptoms. These cases are exacerbated by superinfection phenomena or local bleeding with clinical decompensation. Considering the average diameter of 12-18 mm for a normal tracheas, a decrease below 8 mm would correspond to a stress-related dyspnea and under 5 mm at rest one. Respiratory failure phenomena will be influenced by chronic obstructive diseases, pleural damage or thromboembolic phenomena. The cases with obstructive phenomena of over 70% are endoscopical urgences due to the risk of immediately decompensation by add of the secretions and bleedings.

Initial stabilization of central airway will allow the optimal conditions for the application of definitive treatment.
General principles of treatment were set based on the three types of lesions encountered. These principles will be applied immediately to the diagnosis of the lesion, then applying definitive treatment.

For intrinsic obstruction type by endoluminal tumor, the obstruction will be permeabilized through debridement of tracheal tumor by one of the specific methods. If there is suspicion of a rapid restoration of the obstruction, it will consider the application of a stent for stabilization.

For extrinsic compression type, it will be permeabilized through dilatation by expansion method - balloon or by rigid bronchoscope and is always followed by stenting, as obstruction will recur in days or weeks. Dilatation procedures are suitable for stenosis with a flexible component, actually detectable by plethysmography method - variable stenosis or by local flexibility appreciated by endoscopic assessment.

For mixed lesions, the simple debridement will not be sufficient and will be required the stenting to counteract both compressive effect and obstruction by tumor growth.

The most optimal time for application of endoscopic techniques remains controversial. In most cases, these endoscopic techniques will be applied to suppress the symptoms secondary of stenosis, giving enough time to prepare the definitive treatment.

Tracheobronchial dilatation procedures, including dilatation balloon or mechanical rigid bronchoscope allows quickly obtaining a patent lumen sufficient to ensure optimal breath for applying final treatment.

Subsequently, additional methods may be applied for tumor ablation. The permeabilization techniques of trachea by tumor ablation will apply depending on the stability of the patient, the equipment, the experience and the preference of the treating physician.
The multiple tumor ablative techniques can be classified into those with rapid effect and those with delayed effect. The first category includes laser therapy, electrocautery and argon plasma coagulation, while the second includes cryotherapy, brachytherapy and phototherapy.

At our department of bronchology, a complex activity was performed on both benign pathology and on the malignancy of the large airways. We analyzed 350 patients with malignant tracheal stenosis over a period of six years (2006-2011) taken into account where reference was made clear to significant obstruction of trahea in the examination protocols.

The proportion of procedures for each pathology indicated an average of 5-6% of all cases of malignant tracheal stenosis.

The most cases were secondary to lung cancer (Fig. 17)

Figure 17. Distribution of malignant tracheal stenosis according to etiology

In the cases of tracheal stenosis secondary of lung cancer, the endoscopic procedures were applied in immediate emergency for a proportion of 2.99%, for one case being made a rigid bronchoscopy with local anesthesia and 5.98% of cases deferred like late emergencies being made in 24-48 hours after presentation.
Figure 18. Distribution of cases according to emergency

Most stented cases received originally a procedure for permeabilisation to increase tracheal lumen by mechanical dilatation with rigide bronchoscope or by "drilling" devitalized tumoral tissue after electrocautery.

The average number of permeabilization sessions through debridement after cautery was 1.6 procedures per patient.

The types of stents for use in the compartment Bronchology are shown in Figure 19.

Figure 19. Distribution of various prosthesis according to etiology
In terms of lung cancer with tracheal invasion which caused a significant degree of tracheal obstruction have held an average of 24% of all lung cancers evaluated in the our compartment of Bronchology, a percentage that hold the international average of 20-40%.

The distribution of cases of significant tracheal obstruction indicates a predominance of cases secondary of lung cancer. It's true that they do not follow a corresponding increase in the number of cases in general and it’s variable from each year. This distribution can be explained by the selection made in patients affected also by other pathologies associated with more or less evidence, depending on the subjectivity of the patient and of the practitioners.

Figure . 21. The distribution of tracheal stenosis secondary of lung cancer on the three tracheal segments

From the point of view of the distribution in the tracheal segments, there is a clear predominance of the cases from the third lower and right-hand side. (Figure 21).

From the point of view of localization in the tracheal wall there is a predominance of the ipsilateral lesions followed by the posterior lesions (explained through depression of the wall membranous secondary to primary
tumors or to mediastinal lymph nodes). Thus, there was a specific distribution of tracheal lesions in cross section with a predominance of lateral forms. For the anterior and posterior forms there was a predominance of compressive lesions, and for lateral forms there were founded mixed lesions and the endoluminal tumors. The circumferential forms predominated in lower third, but they were a minority in each tracheal segment. (Figure 21-22)

Figure 22. The lesions topography of each tracheal third for lung cancer

The tracheal obstruction forms found in lung cancer are in majority of cases forms with extrinsic compresion by direct effect of neighborhood tumor and mediastinal adenopathies associated (Figure 23):

Figure 23 Proportion forms of tracheal stenosis
From the histopathological point of view, the forms identified in these malignant obstruction respect the proportion and the types described in data of literature, with a predominance of epidermoid carcinoma and adenocarcinoma (Figure 24):

Figure 24. Distribution of histopathological forms of tracheal stenosis secondary lung cancer

The proportion of cases with severe stenosis that required endoscopic intervention for emergency, like preparation for surgery or like as a definitive method prior to oncological treatment (chimio-/radioterapy) was 12-13%.

The cases who required emergency for establishing interventional maneuvers constituted a minority.

Figure 25. Distribution of cases according to emergency
The proportion of cases that required interventional maneuvers was 10.12%, more than international reports because they were considered all procedures, although some patients had more than one procedure. (Figure 26)

Figure 26 The proportion of cases that required complex endoscopic maneuvers

The most did not require mechanical expansion maneuvers, there was strictly diagnostic procedure. For 16 cases, there were applied immediate tumoral devitalisation by electrocautery with simple stick, with "loop" or drill through the rigide bronchoscope. One case was performed electroresection of tumoral relapse for a patient received after cryotherapy (1 year ago). For another case was applied for tumor relapse a re-resection with electrocautery, 1 year after first procedure and 3 months thereafter that. (Figure 27)

Figure 27. Number of cases with complex endoscopic procedures for tracheal stenosis secondary of the lung cancer

There was performed a drilling tumor for delay of time of surgery for a right tumor lesion with invasion of carinal area and which tended to obstruct left
bronchus primitive. Then there was performed the right pneumonectomy with carinal resection and trachobronchial anastomosis. In two cases, there made tumoral drilling and bronchial permeabilisation for efficace drainage of retrostenotic supuration and for recovery of distal territory. A resection surgery was applied in a small number due to the strict criteria of operability (lack of mediastinal lymph nodes, metastasis, functional criteria), specific to these types of injuries, with carinal involvement.

The bronchoscopy protocol for 3 cases mentioned the practitioner needed for stenting and the lack of these device. The proportion of cases would be required stenting is obviously bigger.

In our practice, we used the following types of stents:

Figure 28. The types of malignant tracheal stenosis, stents used in the secondary lung cancer.

The choice of each stent was based on the lesion type, the localisation of the lesion, the availability on the Romanian market, preferably practitioner and material constraints.

The data mentioned in the protocols bronchoscopy examination was retained following distribution of diameters, noting that other forms of obstruction level was cited as being significant, but not enough to be said exactly, probably as these diameters over > 12 mm, which not needed a stenting. (Figure 29)
In cases who underwent mechanical clearance, there was achieved a minimum diameter of 6 mm, and secondary the prosthesis achieved a minimum diameter of 13 mm (Freitag 13).

The postprocedural follow-up periods were not consistent due to territorialization patients and loss of evidence. (Figure 30)

All cases of tracheal clearence and/or stenting had a more or less symptomatic clinical improvement, giving of patients time to achieve oncological treatment (objectified by a significant improvement of Karnovski index). The interventional methods do not affect prognosis of oncologic disease, but a little influences exist by avoiding imminent death, providing the conditions necessary for the application chemoradiotherapy treatment.

The application of Freitag stents have resulted in the formation of granulomas, especially to distal ends requiring electrocautery excision, based on a meeting or two. The Montgomery stents required an average of four aspirations until patient succeed to maintain patency and time of patient discharge.
Of the total 350 malignant lesions with stenotic effect of the trachea, there were done 85 endoscopic procedure, whether or not combined. For a procent of 8.75 % was necessary to carried out complex interventional procedures.

Figure 31. Overall proportion of rigid bronchoscopy of malignant tracheal stenosis

Figure 32. Number of complex endoscopic procedures for malignant tracheal stenosis

The most procedures were combined, mechanical dilatation by rigide bronchoscope or by electroresection, followed by stenting.

Figure 33. The distribution of prostheses used in all malignant tracheal stenoses
The choose of stent was not influenced by the hysto-pathology, the decision being determined by the type of stenosis, lesion topography and material options.

All interventional procedures resulted in improvement of respiratory status, in 5 cases excellent results were obtained even with the possibility of making efforts by medium level.

The interventional bronchoscopy procedures were dictated by the type of lesion (endoluminal tumor, extrinsic compression or mixed), by meaning to practice the mechanical dilatation for compression type and devitalization by electrocautery and clearance for those with endoluminal tumor component.

The basic malignancy and his histology did not significantly influence the choice of procedure or type of stent. All instances stented had improvements in quality of life with significant improvement of the degree of dyspnea. The Ultraflex or the Poliflex type proved better tolerated, the Montgomery type claiming repeated sessions of clearance with aspiration in the first 10 days after installation. The Freitag type had a very good tolerance, with reduced sessions of aspiration, but pursued cases we noted a higher incidence of granulomas at the ends, especially distally.

The stents give benefits including for the patients with fistulas esotraheale, because besides achieving a respiratory support there are sealing fistula reducing superinfection phenomena of tracheobronchial tree and there is permitted the oral supplying. It retains the need to prioritize the esophageal stenting before tracheal one to prevent worsening respiratory status.

The complication rate was at zero, although we encountered a case of posterior mucosal damage at mounting a stent with favorable spontaneous evolution and one case of stent migration that required immediate removal. The procedure-related mortality rate was 0 %.
Following these analyzes related on data from the literature I suggest the following algorithm for the management of malignant tracheal stenosis:

- **Malignant tracheal obstruction known/suspected**
  - **Critical obstruction > 50% Symptomatic tracheal stenosis with high risk**
    - Rigide bronchoscopy for diagnostic, stadianisation and interventional purpose
      - intrinsic
      - mixed
      - extrinsic
      - Clearance by tumoral drilling and devitalisation
      - Clearance by tumoral drilling and devitalisation, dilatation and stenting
      - Mechanica dilatation and/or stenting

  - **Uncritical obstruction < 50% asymptomatic tracheal stenosis with low risk**
    - Fiber optic bronchoscopy for diagnostic, stadianisation purpose

  - Definitive treatment
    - Surgery?
    - Chimiotherapy?
    - Radiotherapy?
    - Endoscopic?

- Follow-up - reevaluation
  - Without recurrence
    - Definitive treatment
      - surgery?
      - Chimiotherapy?
      - Radiotherapy?
      - Endoscopic?
  
  - Recurrence
    - Exclusion after 10 years surveillance
    - Exclusion a cause of lack data

* with mention to not being a fixed stenosis
Bibliography


