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Endobronchial Electrocautery*

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Endobronchial electrocautery is a tool with diagnostic and therapeutic applications in the management of obstructing endobronchial disease. We have performed cautery procedures in 18 patients. Of these 18, five patients had benign diagnoses and 13 had malignancies. All patients with benign lesions had only endobronchial resections and four have done well. Four procedures resulted in the establishment of a diagnosis which had eluded other biopsy techniques.

We have reported the use of endobronchial electrocautery as a tool for use in the management of obstructing endobronchial disease.1 It has both diagnostic and therapeutic applications. The method utilizes two techniques. The first is looping or lassoing of tissue with a wire snare, then resecting the base of the tissue with electrocautery. In the second technique, a cautery probe is directly applied to burn, desiccate, and vaporize obstructing tissue. Since the initial report, our experiences have been primarily with the cautery wire snare. Snare cautery removal of endobronchial tissue has proven to be a safe and useful procedure. It facilitates the diagnoses and management of patients with endobronchial disease. Electrocautery is a worthwhile supplemental technique available to bronchoscopists. This report reviews our experiences to date.

Methods

Procedures were performed in the endoscopy laboratory. Anesthesia was primarily local, but in select cases, general anesthesia was used when an extremely large lesion was present, when the patient's clinical situation dictated careful airway control, or when a long procedure was anticipated.

All procedures performed were done with a fiberoptic bronchoscope. Intubation was carried out only in those patients who received general anesthesia. Patients were prepared with a cautery grounding plate placed on the back to ground the unipolar probes used. Standard endoscopy techniques were employed. After the lesion was localized with the bronchoscope, cautery probes were passed through the aspiration channel of the bronchoscope.

Techniques

To perform snare removal of tissue, a pediatric colonoscope cautery snare (Olympus SD-7DP) was used. The snare was partially opened outside and under direct view of the bronchoscope tip but proximal to the tumor. The open loop was then passed over the tissue to be ensnared by advancing the catheter or bronchoscope depending on positioning and anatomy. As the loop was passed over the tissue, it was further extended out of the catheter so that it was fully opened. Manipulation of the snare catheter (tip just proximal to the open wire loop and in view at the end of the fiberscope) or bronchoscope was often necessary to allow the wire to loop over tissue. The proximal tip of the catheter was advanced to the base of the tissue to be ensnared as the snare was slowly returned to inside the catheter. When it ensnared tissue, a snug feeling was achieved in the hand grip as the snare was withdrawn into the catheter. It was important to perform a firm but not exceptionally strong closure of the snare. If closed too strongly, cutting with the wire alone may occur, resulting in bleeding of the cut tissue.

Once the tissue was lassoed with the snare, a blended current was applied. While current was being applied, the snare was further tightened with the handgrip and slowly advanced through the tissue into the catheter. The current first caused coagulation of the tissue, then cutting of it as the snare was closed. With proper technique, cutting was performed by the electric current, not the mechanical act of advancing the wire through the tissue.24 If the tissue was unusually firm or excessively dried out by the current, the snare may not cut through the tissue. In this instance, further increase in current was applied in a stepwise fashion until the snare was cut through the tissue. Completion of the cut was felt in the handgrip of the snare. The firmness was gone and complete retraction of the snare occurred.

The tissue cut off by the snare may show no change in location (appeared as though it had not been cut) although the base was severed. It may be dislodged, or it may rapidly leave the viewing field only to be found upon inspection in another part of the airway. Alternately, the snare may slip over the tissue and not make a cut. In such a situation, the operator usually could tell by the change in the feel of the handgrip and the endoscopist could usually observe the snare slip off the tissue. Often, a repeat attempt was successful.

Following severing of the tissue, removal of the tissue was accomplished in several fashions. A wire basket snare could be used to entrap the tumor particles for removal with scope and tissue simultaneously. Or, the patient may expectorate the plug of tissue after the scope was removed. This was usually only effective if the patient had good distal airway function to generate the air flow necessary to expel the tissue. With intubated patients, a large lesion may only be removed by extubation if they will not pass through the endotracheal tube. An alternate approach was to further section...
the tissue and remove the smaller pieces. Although tissue can be removed in small segments by grasping it with a standard biopsy forceps, the removal of the unusually large pieces obtained with the snare commonly required other methods.

For application of the cautery directly to destroy tissue, a blunt cautery probe (Olympus CD-5P) was utilized. In a field which was as dry as possible, the probe was advanced to the tissue and a blended cautery current applied. The probe was passed across and through the tissue that was to be destroyed while the current was applied. Frequent debridement was required to clear the airway of tumor debris.

A bipolar probe is now available for direct cauterization of tissues (Microvasive BICAP probe 4050). The application of the bipolar probe is identical to that of the unipolar, but there are two technical differences. No grounding plate is required with the unipolar probe. The current completes its arc through the probe. Secondly, the current should be applied in continuous fashion for tissue destruction. Most bipolar electrocautery units have time limitations controls. In gastrointestinal applications, limited applications of current (ie, 0.5 s) are desirable, however, longer applications are required to achieve tissue destruction.

RESULTS

To date, we have performed 32 cauterity procedures in 18 patients. Four patients and 15 procedures have previously been reported. Our experience is reported in Table 1. A majority of the patients underwent snare resection which was usually accomplished in one procedure. Four patients had two snare procedures.

<table>
<thead>
<tr>
<th>Patients and Procedures</th>
<th>Total Patients</th>
<th>Snare Employed*</th>
<th>Probe Employed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with single procedures</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients with multiple procedures*</td>
<td>5</td>
<td></td>
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<tr>
<td>Two</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>More than two</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Total treated patients</td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Procedure type

| Snare alone | 9 |
| Snare and probe | 2 |
| Snare and laser | 9 |
| Probes alone* | 12 |
| Total procedures performed | 32 |

*Eleven in one patient.

The use of the cautery probe as a technique to destroy tissue was used in four patients, and two of those have been previously reported.

The diagnoses of the patients who underwent electrocautery procedures are listed in Table 2. Five of the 18 patients had benign diagnoses and 13 had malignant diagnoses.

Four procedures resulted in the establishment of a diagnosis. One patient with a malignant airway lesion had not been diagnosed with previous fiberoptic or rigid bronchoscopic examinations. It was diagnosed only after a sizeable biopsy of the tumor was made with the snare. The leiomyoma was not diagnosed until it was removed with a fiberoptic snare procedure. A third patient was referred for management of a mass lesion in the left main stem airway. The patient had metastatic adenocarcinoma of the prostate and was felt to have a metastatic endobronchial lesion by the referring pulmonologist. Biopsy had been performed, but only one specimen was taken because of significant bleeding. No diagnosis was established with that single biopsy. Snare removal demonstrated the lesion to be a massive endobronchial coccidiodomycosis granuloma. A fourth patient presented with a large endobronchial lesion from the left upper lobe. A biopsy was suggestive but not diagnostic of a hamartoma. Snare removal produced a tissue sample large enough to diagnose a carcinosarcoma. Subsequent surgery confirmed this diagnosis.

The patients with benign lesions have done remarkably well. Two tracheal polyps occurred in one individual on two separate occasions. The patient has a diagnosis of obstructive sleep apnea syndrome and was treated with a permanent tracheostomy in 1981. In 1985, a tracheal polyp occurred at the superior aspect of the tracheostomy site. It was removed with a snare. Eighteen months later, a second polyp developed on the inferior aspect of the tracheostomy site and intermittently blocked the tracheostomy tube. This was also removed successfully. The second patient with a tracheal polyp is described below. The patient with a lipoma had a large portion of tumor resected with the snare. Although residual tumor was thought to be present in the lingula, the patient refused surgery and reports at 36 months he is doing well. The patient with the leiomyoma also refused definitive surgical resection. He had laser treatments at the base of the originating site. He is being followed and doing well clinically two years after snare removal. The patient with endobronchial coccidiodomycosis had received chemotherapy for his prostate carcinoma and died after a progressive downhill course.

We have used the bipolar probe in one patient with a tracheal polyp. The patient was difficult to wean from a tracheostomy tube which was required for respiratory failure following open heart surgery. A
polyp was found originating above the tracheostomy tube and obstructing 75 percent of the trachea lumen. After a portion was removed with the snare, the bipolar lead was used to further destroy the polyp. At initial follow-up, the lumen was restored to 95 percent patency. The procedure was carried out at the bedside in the special care unit.

The use of electrocautery in patients with malignant disease was for palliation of airway obstruction with two exceptions. In two patients described above, electrocautery provided a diagnosis of the malignant tissue, and they were successfully treated with surgery. They are free of disease at three years (adenocarcinoma) and two years (carcinosarcoma). The remaining eight patients were treated for palliation. Electrocautery was used as the sole agent in three patients previously reported. More recently, it has been used to assist in debulking endobronchial tumor masses in association with YAG laser therapy.

There have been no complications while utilizing the snare. No bleeding was noted in any of the snare procedures. The patient with an endobronchial coccidioidomycosis granuloma had significant bleeding following a prior biopsy, but a lesion of 10×15 mm was removed in a single snare procedure without hemorrhage. Application of electrocautery probes resulted in two complications. The first was a limited endobronchial bleed which spontaneously ceased with no adverse patient problems. The second, a tracheal fire which occurred while using a cautery probe to destroy tissue, was in our previous report. The fire was associated with the use of a high inspired oxygen concentration with general anesthesia. No other difficulties have been encountered with electrocautery. There has been no difficulty removing tissue through the larynx once it has been firmly grasped. Extubation has been required when tissue samples would not pass through the endotracheal tube. It has been necessary to remove the tissue from the mouth on occasions when the tissue would not pass through the nose with the fiberoptic scope.

**Discussion**

This experience demonstrates the value and relative safety of using cautery wire snare for diagnosis and treat endobronchial lesions. Endoscopic electrosurgical techniques have been used safely for removal of colonic polyps and for controlling gastrointestinal bleeding. The electrocautery snare can be used to obtain large biopsies of airway lesions, to debulk and remove malignant tissue in the airway, and to treat benign lesions. Our experience supports all of these applications.

Application of the endobronchial cautery wire snare requires a configuration of tissue that allows ensnaring a portion of the material for removal. Its most dramatic application is in polypoid abnormalities with small base attachments. With this anatomy, it may be possible to ensnare the complete abnormality and remove it in one piece. Flat lesions or those with large base attachments do not always lend themselves to this type of removal. A snare may only be able to ensnare a small portion of the tissue to be removed and several applications may be necessary for removal of the bulk of the tissue.3 The endoscopic appearance of a lesion can be deceptive. Some lesions may appear appropriate for snare cauterity but cannot be successfully ensnared. Other lesions do not appear appropriate but are easily ensnared.

We have used the cautery probe in a limited number of cases. It does not work as well as the Nd-YAG laser for the removal of tissue. While cautery burns and destroys tissue, little vaporization occurs, and a great deal of debridement is required. A wet surface also spreads out the contact point and interferes with the cautery action. Therefore, any bleeding impairs the cautery probe's effectiveness.4 The cautery probe does have potential for useful application since it is more flexible than a laser bundle. In addition, the bipolar probe (BICAP, Microvasive Corporation) may prove more effective than the unipolar electrodes. In one use of the bipolar probe, it was quite effective at tissue destruction.

Complications related to the use of snare have not occurred, but certainly should be anticipated. Bleeding seems the most likely complication to occur, but it has not been observed in our use of the snare. Complications such as airway perforation or pneumothorax are unlikely if the snares are used with caution. The possibility of snaring an object which cannot be cut (snare entrapment) is a problem we have not encountered but undoubtedly should be anticipated. On two occasions, increases in the usual current used were required in order to fully cut the base of the tissue. In both situations, application of increased current allowed completion of the cutting. In a series of 1,555 colon polyps removed by electrocautery snare, only 19 complications were reported.5 Ten episodes of bleeding and one episode of snare entrapment were included. The remaining eight involved various degrees of damage to the bowel wall which is considerably thinner than the major airways. Their overall complication rate for colon polypectomy of 1.2 percent compares with other series (1.2 to 2.9 percent).6 The potential for perforation and bleeding is probably greater with use of the electrocautery probes when used for tissue destruction than it is with the snare. However, the clinical reports of probe use have been for coagulation of gastrointestinal bleeding sites and not for tissue ablation. When used for coagulation of bleeding sites, serious complications are unusual.7

Electrical shock to the endoscopist is a potential
complication. Fiberoptic bronchoscopes are not electrically grounded as are fiberoptic scopes for the gastrointestinal tract. The cautery current has the potential of travelling through the fiberoptic and the endoscopist instead of the grounding plate when using unipolar electrodes. As a result, the bronchoscope operator may serve as the grounding electrode and be shocked by the current. Care should be taken to keep the wire snare and probe tips out of contact with the bronchoscope. We have not experienced any shock complications.

References

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