TRACHEOSTOMY COMPLICATIONS AND THEIR MANAGEMENT

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ABSTRACT

The word tracheostomy derived from two greek words meaning 'I cut the trachea' has been known for about 3500 yrs. The process has evolved over the years and has undergone revolutionary changes in the methodology, instrumentation and indications. Although tracheostomy is now commonly used the complication rate remains high. In our series it was 48% which is comparable with other series. The purpose of this paper is to discuss the complications of tracheostomy with special attention to their management and prevention.

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Introduction

Tracheostomy has found wide clinical application during the past decades. It was described as early as BC 100 by Asclepiades, a Greek physician as being practised by the ancients. The results of the tracheostomies were very bad for many centuries. In the 13th century it was described as "semislaughter and the scandal of surgery".

These early tracheostomies were performed mainly for acute airway obstruction. In 1909 Jackson described the technique of tracheostomy which is used today. In 1943, Galloway expanded the indications for the procedure to include access to the tracheobronchial tree for removal of retained tracheobronchial secretions and treatment of respiratory insufficiency. Although tracheostomy is now commonly used, the complication rate remains high. The purpose of this paper is to discuss the complications of tracheostomy with special attention to their management and prevention.

Material and Methods

The last 100 cases of tracheostomy performed by the authors during the period 1986-1998 have been reviewed.

Elective surgery was performed in majority of the cases. However in a few cases where the airway had to be established urgently emergency tracheostomy was done.

The indications were for relief of respiratory obstruction mainly due to tumours of larynx and laryngopharynx, protection of tracheobronchial tree in cases of trauma and neurological diseases and to overcome respiratory insufficiency in neuromuscular disorders and comatose patients. Most of the surgeries were performed under local anaesthesia, standard tracheostomy technique was followed using either horizontal or vertical incision. Metallic or Portex tracheostomy tubes were used depending on the indication for tracheostomy.

Observations

A complication rate of 48% was observed. There were no

deaths due to tracheostomy. The complication rate following emergency tracheostomy was twice that following elective surgery.

The younger the patient the higher was the incidence of complications.

A large variety of complications were encountered as shown in Table 1 with emphysema and stomal infection being the commonest.

TABLE 1
Complication of tracheostomy

Emphysema	14 cases
Infection	12 cases
Obstruction of tube	7 cases
Haemorrhage	3 cases
Displaced tube	2 cases
Aspiration	2 cases
Pneumothorax	1 case
Atelectasis	1 case
Persistent stoma	1 case
TO fistula	1 case
Tracheal stenosis	1 case
Aerophagy	1 case
Difficult decannulation	1 case
Apnoea	1 case

Discussion

Elective vs emergency tracheostomy

The rate of complications with emergency tracheostomy was two times as high as with elective operation (Table 2). This is usually due to haste, inadequate lighting, equipment or assistance and a patient who is struggling for breath.

The key to reducing the number of complications lies in converting an emergency situation of acute airway obstruction to one of an elective nature. In the

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TABLE 2
Type of tracheostomy

Type of tracheostomy	No. of cases	Incidence of complications
Emergency	10	8 (80%)
Elective	90	40 (44.4%)

hospital the insertion of an endotracheal tube or bronchoscope or failing this the performance of cricothyrotomy or minitracheostomy removes the emergency nature of the situation. The patient can then be moved to the operating room and a tracheostomy carefully performed.

Age

The age distribution of patients is depicted in Table 3. It was observed that the younger the patient the higher the incidence of complications. In Oliver's [1] study 85% of the postoperative complications occurred in children under age of five.

TABLE 3
Age incidence of complications

Age of patients	No. of cases	Complication
1-10 Yrs	11 cases	7 cases (63.6%)
11-20 Yrs	09 cases	5 cases (55.5%)
21-30 Yrs	22 cases	10 cases (45.5%)
31-40 Yrs	23 cases	10 cases (43.6%)
41-50 Yrs	17 cases	08 cases (47%)
51-60 Yrs	18 cases	08 cases (44.4%)

In Rebuzzi's [2] series the incidence of pneumothorax (17%) and pneumomediastinum (45%) in children were very high when compared to the adult series.

Because of the relatively high incidence of complications of tracheostomy in children the use of endotracheal intubation for as long as 48 hrs may be indicated.

Haemorrhage

In our series this problem was encountered in only 3 patients one of which was a case of leukaemia and had profuse haemorrhage another had a large goitre which was incised and the third case had skin bleeders.

Haemorrhage may occur during the operation but more frequently is delayed. A medium sized vessel may be transected during the tracheostomy when the patient is hypotensive and go unrecognised. Later when normotensive levels return brisk bleeding with aspiration may result. These skin bleeders are usually controlled by careful cautery or packing petrolatum jelly gauze around the tracheostomy tube on the skin

edges.

The incidence of delayed haemorrhage was reported by Mathog [3] as 2%. It is generally accepted that late haemorrhage is caused by the tip of tracheostomy tube eroding through the walls of the trachea and a major vessel. The innominate artery is almost always involved occasionally the right common carotid is involved.

Factors contributing to erosion are excessively long or angulated tubes and prolonged cuff pressure.

Treatment of massive haemorrhage as in the case of thyroid goitre is limited. It was treated by removal of the tracheostomy cannula and insertion of an endotracheal tube. With inflation of the endotracheal tube cuff the bleeding was temporarily controlled and aspiration prevented allowing time to ligate the vessel.

Occasionally massive haemorrhage due to vessel erosion will be preceded by a heralding bleed. An irritating cough, aspiration of bloody secretion or retrosternal discomfort may precede the haemorrhage. Preventive measures include, performing the tracheostomy at or above the third tracheal ring, using a tube of proper length, observing the tube for possible pulsation. That is evidence that the tube is lying next to a great vessel. If pulsation is present the position of the tube should be changed or be replaced by a shorter tube.

Infections

Local infection at tracheostomy site was fairly common and tracheitis occurred to some degree in every patient having tracheostomy. Tracheitis occurs most commonly at the stoma, the tip of the tube and the area of the cuff. Ischaemia secondary to cuff pressure or the tube predisposes to infection as well as chemical tracheitis secondary to cleansing a tube in a strong antiseptic and reinserting without rinsing. Tracheitis can be lessened by meticulous asepsis, frequent irrigation and suctioning.

Pneumonia occurred in 03 patients. Pneumonia can be a complication of a tracheostomy if an aseptic technique is not used in suctioning the patient. Pneumonia also can be associated with burns or stomal infection. In one case in our series pneumonia occurred postoperatively in a patient who had chronic lung disease. The offending organism was pseudomonas aeruginosa probably from contaminated intermittent positive pressure-breathing apparatus.

Mediastinitis is a rare complication but it did occur once. It is usually secondary to a wound infection which extends into the mediastinum.

Lung abscess was reported in one case and was thought to be due to aspiration of infected material.

The infections were managed by antiseptic stomal toilet and systemic antibiotics.

Obstruction

Obstruction of tracheostomy tube was a common complication. The most frequent cause of obstruction was plugging of the tracheostomy tube with a crust or mucous plug. These plugs can also be aspirated and lead to atelectasis or lung abscess. Thick pulmonary secretions add to this problem. It is imperative that high humidity be provided either through a mist collar or tent. Instillation of sterile saline followed by tracheobronchial suctioning is helpful. The inner cannula should be removed and cleansed out as often as necessary but at least four times daily.

Careful monitoring of the patient in whom a properly sized and shaped tube has been placed is the best way to prevent this complication. We prefer a short tube approximately 80% the diameter of the tracheal lumen. The tracheostomy tube should be tied in place snugly but allow for the insertion of one finger between the tie and the neck [4].

Granulomas may produce obstruction and cannot always be prevented. When they occur they should be removed surgically with cautery of the base.

Displaced tube

One of the most striking direct complications of a tracheostomy is a displaced tube. This is likely to occur if the tracheostomy is too low or not in the midline. In the cases reviewed this event occurred 02 times. When this complication occurs a very careful rapid reexploration of the wound must be made, the edges of the trachea spread and the tube carefully reinserted.

Pneumothorax

Pneumothorax occurred once (1%) and there were no fatalities. This complication is much more common in children. This is due to the pleural domes in children lying higher in the neck and are therefore more prone to injury. Another cause is pneumomediastinum, leading to ruptured pleurae and pneumothorax. This is thought to occur from air being sucked through the tracheostomy wound and is more common in children due to the loose tissue in their necks. Minimal dissection of the pretracheal fascia is thought to lessen this complication.

All patients undergoing tracheostomies should have a Chest x-ray following the procedure and this is espe-

cially true in children. If pneumothorax is present, closed intercostal-chest tube drainage is usually necessary.

Atelectasis

Atelectasis occurred once for an incidence of 1%. This complication is due to aspiration of crusts or plugs and when it occurred, it necessitated removal of the plug with a bronchoscope.

Subcutaneous Emphysema

Emphysema also occurred in 14 cases. It is usually due to extensive dissection in the wound or closing the incision too tightly. Expired air, escaping from the trachea under the skin tightly closed may dissect through the sub cutaneous tissue into the neck or through the pretracheal fascia into the mediastinum. This resolved spontaneously by releasing the skin sutures.

Aspiration

This problem was seen in two patients. The easy access to the lower respiratory tract by the tracheostomy can allow the entry of unwanted foreign materials. More commonly presence of the tracheostomy tube leads to swallowing problems with the resultant aspiration of food. This is a difficult problem which is not easily solved. Presence of a cuff on the tracheostomy tube which can be inflated at meal time will prevent the food entering the lungs but the inflated cuff sometimes increases the dysphagia. Changing tube size and shape is sometimes helpful.

Tracheal stenosis

This occurred in only one patient and was managed by bouginage. With the increased use of the cuffed tracheostomy tube for assisted respiration the problem of tracheal stenosis is increasing. Onset of symptoms may vary between days to months after decannulation [5]. Treatment of tracheal stenosis may be conservative with dilatation or surgical with resection of the stenotic portion. Johnston [6] has reported satisfactory results by reopening the tracheostomy stoma and placing a portex tube through the stricture. In severe or low stenosis surgical excision of the stenosis with end to end anastomosis is sometimes necessary. In strictures greater than 2.5 cm in length extensive mediastinal mobilization through a sternal splitting incision may be necessary.

To prevent tracheal stenosis one should avoid opening the trachea above the second ring, avoid excessive removal of the anterior wall or create an anterior tracheal flap. In children remove no tracheal cartilage. Inflate the cuff with right pressure and replace the

cuffed tube with a noncuffed tube when the respirator is no longer needed.

Tracheo-Oesophageal fistula

This occurred in one patient. The patient developed violent cough while eating, leading to suspicion of tracheoesophageal fistula.

Fistula may be early secondary to incising the posterior tracheal and anterior esophageal walls or late due to erosion. The former can be prevented by making the tracheal incision with a sickle shaped 12 blade. It should not happen if the tracheostomy is performed with an endotracheal tube or bronchoscope in place. Late fistulas are usually the sequelae of prolonged endotracheal intubation with an inflated cuff.

The immediate treatment is to pass a longer cuffed tube beyond the level of the fistula. Surgical correction consists of separating the esophagus from the trachea and closure of both defects.

Persistent stoma

Failure of stoma to close was seen in a 10 years old child. Failure of tracheal stoma to close after removal of the tube arises when prolonged utilization of the stoma results in epithelialization over the scar between the skin and tracheal mucosa. This lesion results in unsatisfactory phonation, increased susceptibility to respiratory infection and skin irritation around the stoma. Tracheoplasty corrects this defect.

Aerophagy

This is an uncommon complication, in our series it was seen in one patient. It occurs due to the presence of the tracheostomy tube in the throat which gives a sensation of something in the throat leading to constant swallowing. This leads to gastric distension and may progress to paralytic ileus. Treatment is easy, consisting of deflation and removal of the tube. Nasogastric suction may be indicated if the patient continues to swallow.

Apnoea, severe hypotension, cardiac arrhythmia, and cardiac arrest

Apnoea, severe hypotension and cardiac arrhythmia can be very serious problems and may result in sudden death after tracheostomy. On correction of the anoxia by tracheostomy the respiratory drive diminishes or ceases hence it is not advisable to give a patient with chronic lung disease high levels of oxygen immediately following tracheostomy. Glass suggests that the high levels of carbon dioxide may also result in elevation of blood pressure due to action on the medullary centres.

Reduction of the blood carbon dioxide (after tracheostomy) can result in severe hypotension. We have seen this problem in only one patient.

Cardiac arrhythmia from intratracheal suctioning has been reported by Dugan [7]. He reports a case of ventricular fibrillation and death which developed during tracheal suctioning. Skim [8] studied 17 patients who were monitored with an electrocardiogram during tracheal suction. He found that 35% of the patients had episodes of transient cardiac arrhythmias during tracheal suction.

Difficult Decannulation

Difficult decannulation is usually seen in children and was reported in one case. The possible reasons for underlying difficult decannulation include (1) Failure to correct the reason for the tracheostomy. (2) Granulation tissue obstructing the airway. (3) Tracheomalacia (4) Disuse of the acquired reflexes controlling glottic closure and opening during breathing and swallowing (5) Psychological dependence on the tracheostomy.

Methods of decannulation consist of weaning the child from the tracheostomy by the corking method and gradual reduction in the size of the tracheostomy tube.

A close watch should be kept on the young child following decannulation and preparations made to reintubate the patient if necessary.

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