ORIGINAL
PROF-1589

TRACHEAL STENOSIS SURGERY;
AIRWAY MANAGEMENT

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ABSTRACT... Objective: To highlight the problems and solutions in airways management in patients with tracheal stenosis undergoing surgical interventions and to highlight the alternative methods of airway control where high frequency ventilatory facility is not available. **Study Design:** Case series study. **Place and Duration:** Combined Military Hospital Rawalpindi from 1st Jan 2004 to 30th June 2007. **Patients and Methods:** Twenty nine patients of both sex and all age groups presenting with difficulty in breathing due to tracheal stenosis undergoing surgical intervention on trachea have been included. All the patients were managed under general anaesthesia. Nasogastric tube 10 Fr, suction catheter, laryngeal mask airway or mask ventilation was used for initial ventilation where conventional endotracheal tube of even smallest size did not work. **Results:** Small size endotracheal tube were used in twenty four patients. Difficulty was faced in five patients. In these patients endotracheal tube of smallest size available could not be passed and we had to provide ventilation by innovative measures like nasogastric tube 10Fr in one, suction catheter 10Fr in two, laryngeal mask airway in one and mask ventilation in one. There was no mortality. **Conclusions:** Adequate ventilation during tracheal stenosis surgery can be very difficult in some cases. Therefore a thorough understanding, a tier of flexible plans and a variety of ventilating means should be arranged before administering anaesthesia.Nasogastric tube 10Fr or suction catheter of similar size are suitable alternative if facility for high frequency ventilation is not available.

Key words: Airway Management, Tracheal Stenosis, Endotracheal Intubation

INTRODUCTION

Tracheal stenosis is a relatively uncommon condition. It frequently has an insidious onset and gives a time for patient evaluation and elective airway management[1]. Few cases present with life threatening airway obstruction. In these cases if airway is not secured immediately patient's chances of survival are remote. When patient's airway is secured and general condition is optimal, the definitive curative surgery can be carried out[2]. In very few cases airway control is not reliable especially in patients with very low and severe tracheal stenosis. In that case surgery has to be carried out on semi-urgent basis. Management of the airway during tracheal surgery is the biggest challenge for the anesthetist[4]. High frequency ventilation especially jet ventilation is commonly used for this type of surgery[14]. We don't have this facility in our center so we used small size endotracheal tube for straightforward cases[13]. Smallest size endotracheal tube used in our study is 2.5mm.There were cases in which stenosis was so severe that smallest size endotracheal tube i.e. 2.5mm could not be negociated.we used 10 Fr nasogastric tube which has internal diameter 2mm. Other problem with small size endotracheal tube is there length.

Length of smallest endotracheal tube is 18 cm.

If stenosis is lower down the trachea, length of endotracheal will be insufficient to bypass the stenosis. In these circumstances we used 10 Fr nasogasric tube or suction catheter of similar size[10]. We can not find any report or study in which airway has been managed in this way. This study highlight different options available for airway management of these types of cases.

MATERIAL AND METHODS

Inclusion criteria was;(1) Symptomatic tracheal stenosis patients from all age groups of both sexes. (2) Requiring general anesthesia for surgical intervention on trachea.

Exclusion criteria was; (1)Compromised patients unsuitable for surgical intervention(2) Having supraglottic obstruction. (3) Having extensive malignant growth.

Airway was assessed and premedication was given with Inj. Morphine 0.1 mg/kg and patients were induced with

Inj thiopentone sodium 4-7 mg/kg or only sevoflurane 3-8%with spontaneous ventilation if airway adequacy was uncertain after preoxygenation. Otherwise muscle relaxation was achieved with Atracurium besylate 0.7 mg/kg and small size endotracheal tube was passed to provide ventilation. Anaesthesia was maintained with isoflurane 0.6- 2.5% and nitrous oxide 50-60% with oxygen 50-40 %. In those patients where small size endotracheal tube was not appropriate due to its short length or large diameter, 10 Fr nasogastric tube or a suction catheter was passed and manual ventilation was carried out. In those few cases where endotracheal intubation by available means could not be achieved, spontaneous ventilation by laryngeal mask airway or face mask was maintained till the incision of trachea and distal intubation. Post operatively, normal sized armoured orotracheal tubes were passed and secured and most of the patients were kept paralysed and ventilated electively for 48-72 hours and then extubated.

RESULTS

Total of twenty nine patients from both sexes (21 male, 8 female) of all age groups presenting for tracheal stenosis surgery were included. In sixteen cases ventilation was provided through a small sized (>5mm ID)endotracheal tube which could be passed beyond the obstruction. In eight cases ventilation was provided by endotracheal tubes smaller than the appropriate size(<5mm ID). The smallest size used by us was a 2.5 mm non cuffed orotracheal tube.

We faced real difficulty in five patients. In one patient ventilation was provided with 10 Fr nasogastric tube as smallest size endotracheal tube could not be negotiated because of severe stenosis. In two patients ventilation was provided with 10 Fr suction catheter as the small diameter endotracheal tubes could not be passed beyond the stenosed segment due to its short length. In one patient spontaneous ventilation was maintained till the distal tracheostomy and in another one patient ventilation was provided by laryngeal mask airway[11] and then by distal tracheostomy. In last two cases neither endotracheal tube nor nasogasric tube 10 Fr could be negotiated.

DISCUSSION

Tracheal stenosis is defined as cicatricial narrowing of endotracheal lumen. It is most common in subglottic area[1]. The subglottic airway is the narrowest part of the airway, since it is a complete nonexpendable and non pliable ring unlike trachea which has posterior membranous section and larynx which has posterior muscular section. The most common cause of tracheal stenosis is trauma[2]. About 95 % of tracheal stenosis are due to trauma. Trauma can be internal (prolonged endotracheal intubations, tracheostomy, endotracheal burns, irradiation) or external (blunt or penetrating).

Other causes of tracheal stenosis are tumors, inflammatory process, recurrent goitre, foreign body, vascular malformations and congenital abnormalities[3].

Prolonged endotracheal intubations remains the most common cause of tracheal stenosis.Duration of intubation is the most important factor in development of tracheal stenosis. Although tracheal stenosis has been reported after only 17 hrs of intubation however intubation upto two weeks is generally considered safe[4]. We have managed a case who developed severe tracheal stenosis only after four hours of endotracheal intubation for submucosal resection of the nasal septum. Stenosis usually develops at the site of cuff of the endotracheal (ETT) tube and stoma of tracheostomy tube. Pressures at the site or friction are the most important causes. Capillary pressure of tracheal mucosa is about 25 cm of H_2O and cuff pressure exceeding 25 cm of H_2O decreases blood flow. It becomes even more important in patients who require prolonged intubation. Other factors such as size of endotrocheal tube, friction and frequent movement of tube because of faulty fixation and traction on tube due to ventilatory tubings are also contributory. Incidence of tracheal stenosis was 20% in patients who were having prolonged intubation before 1980 because of the design of cuffed endotracheal tubes which were high pressure low volume type. After the introduction of high volume, low pressure cuffs, the

incidence of tracheal stenosis has been reduced and recent studies show incidence of less than 0.37 %.But in case of inhalation burn injuries the incidence of tracheal stenosis remains 5.47%[5].

Adults with mild congenital stenosis are usually asymptomatic and they are diagnosed after a difficult intubation or while undergoing endoscopy for other reasons[19].

Patients with acquired stenosis are diagnosed on the basis of history and clinical presentation from a few days to 10 years or more following initial injury. The majority of cases are diagnosed within a year.

Symptoms include dyspnea (may be on exertion or on rest, depending on severity of the stenosis), stridor, hoarseness, barassy cough, recurrent penumonitis and cyanosis.

Many patients would have been diagnosed with asthma and recurrent bronchitis prior to discovery of stenosis. A high index of suspicion is warranted with the onset of respiratory symptoms following history of intubation, regardless of the duration of intubation.

Bronchoscopy remains the gold standard for diagnosis of tracheal stenosis however computerized tomography (CT) scan and magnetic resonance imaging (MRI) are very useful. MRI is more useful in delineating length and extent of the stenosed segment. Chest radiographs also give good clue regarding air column in the trachea. Respiratory flow-volume loops can be helpful in the follow up of these cases.

TREATMENT OPTIONS INCLUDE

I. Long Term Tracheostomy for patients who are high risk group for major surgical interventions[6].

II. Endo Tracheal Stent or T. Tube for the cases in which end to end anastomosis can not be carried out or there is long length of stenosed tracheal segment[6,7,20,21].

III. Endoscopic dilatation is a useful time buying measure but restenosis rate is very high[7].

IV. Laser Ablations is effective in selected cases where localized stenosis is because of granulationt issue[8].

V. Resection and end to end Anastomosis is the gold standard technique for tracheal stenosis[1,12,13,14,15,16,17,18].

AIRWAY MANAGEMENT

There are many challenges faced by anaesthetist during tracheal surgery. The biggest challenge for anaesthetist is the management of airway and adequate ventilation of the patient[9]. Anaesthetist must have very clear plans how to manage the airway. There should be first, second and third options to manage the airway in case particular plan do not work for the patient. Airway management can be divided in to three phases.

1- MANAGEMENT OF THE STENOSED AIRWAY

This is the most difficult part of airway management. In majority of cases it is possible to pass a small size endotracheal tube through the stenosed segment.
Problems with small size tube are:

I. High pressure is required for effective ventilation.
II. Length of tube may be too small to negotiate the stenosis.
III. Frequent blockade of the tube due to secretions, blood or kinking
IV. Inadequate emptying of the lungs during exhalation phase.

High pressure is required to over come resistance in small diameter tube which is not transmitted to the lungs. We have ventilated manually a young patient for 36 hours with 2.5 mm ID tube, who required peak pressure of more than 70cm H_2O.
Length of 2.5mm ID tube is only 18 cm, if stenosis is lower down it does not reach the stenosed segment[9]. In that case suitable size nasogastric tube or suction catheter

can be used[10]. We have used 10 Fr nasogastric tube having internal diameter of 2mm. It can be attached with breathing circuit by placing a connection of 2.5 mm endotracheal tube at proximal end of the nasogastric tube and manual ventilation can be provided. Other techniques include keeping the lower end of the endotracheal tube above the stenosis or using LMA, which is a risky procedure as the lungs may not be ventilated. In case secretions block the stenosed segment then the patient will go into asphyxia. There are reports where LMA has successfully been used in such circumstances[11]. We used LMA in one patient and mask ventilation in another because small endotracheal tube, nasogastric tube 10Fr or suction catheter could not be used effectively.

Our aim has been to bypass the stenosis with some sort of tubing so that airway patency could be ensured all the time but we were unable to bypass stenosis in two cases out of twenty-nine.

MANAGEMENT OF RESECTED AIRWAY

When surgeon has dissected the trachea then endotracheal tube of appropriate diameter for that patient can be passed distal to stenosis and attached with breathing circuit. Position of tube should be carefully checked ensuring the bilateral air entry. If stenosis is lower down and space does not allow bilateral air entry then tube should be pushed to one lung and one lung ventilation be maintained or two tubes may be passed in both bronchi distal to the site of dissection and connected with two different ventilators to optimize ventilation in compromised situations[12].

MANAGEMENT OF REPAIRED AIRWAY

When stenotic part has been resected and posterior anastomosis completed, at this stage armoured edotracheal tube of appropriate size for age should be passed orotracheally so that cuff of tube should not lie at the repaired site[13]. Cuff should be below or above preferably below the repaired segment to avoid disruption or ischemic necrosis. As neck is kept flexed postoperatively and for this purpose chin to chest suture are placed. It is our practice at CMH Rawalpindi to keep the patient paralysed and sedated for 48 hours and then gradually extubate the patient over 72 hrs. Other centers around the world have different practices, some extubating the patient right on the table while others taking variable time for extubation[17,18].

CONCLUSION

Patients with tracheal stenosis need well co-coordinated and experienced team (anaesthetists, surgeons, intensivist) working in well equipped operation theatre and intensive care unit. High frequency jet ventilation is ideal for tracheal surgery but this facility is not available in most of centers in Pakistan.In this situation 10 Fr nasogasric tube or suction catheter of similar size can be used for tracheal stenosis surgery where even small size endotracheal tube can not be negotiated.

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Article received on: 07/12/2009 Accepted for Publication: 15/04/2010 Received after proof reading: 14/11/2010

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Article Citation:
Ahmed S, Janjua S. Tracheal stenosis surgery; Airway management. Professional Med J Dec 2010;17(4):638-642.