ANAESTHESIA FOR TRACHEAL RESECTION. MODIFIED USE OF THE CARDEN TUBE

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RESECTION of tracheal stenosis poses problems of ensuring adequate ventilation with the minimum of interference to the surgical procedure. This case report describes a modified use of a Carden tube¹ and bronchoscope injector^{2,3} both to maintain adequate ventilation and to permit unrestricted surgical access to the trachea.

CASE REPORT

A 56-year-old Chinese female was seen at the Intensive Care Unit, General Hospital, Kuala Lumpur, Malaysia, with acute respiratory difficulty resulting from Guillain-Barre syndrome. She was given assisted respiration through a "Portex" nasotracheal tube for over a month, with frequent replacements. Her respiratory effort gradually improved, but upon extubation she had severe stridor due to subglottic stenosis, for which a tracheostomy was done.

Over a year later she was evaluated for the possibility of tracheal reconstruction. The tomogram (Figure 1) showed a complete block of the proximal trachea. Tracheoscopy revealed a pinhole stenosis at 17 cm, just above the tracheostomy tube, that precluded decanulation. Hence, tracheal resection and anastomosis was contemplated.

METHOD

The patient was premedicated with meperidine 50 mg and promethazine 12.5 mg one hour before operation. Alfathesin 3 ml was used for induction, followed by succinylcholine 50 mg.

A Carden laryngoscopy tube, size 6.0 mm internal diameter, was then inserted through the tracheostomy stoma after removal of the tracheostomy tube. The modification (Figure 2) consisted of insertion of a suction catheter through the lumen of the Carden tube. The catheter served both as an expiratory outlet and as a suction catheter. Upon insertion of the Carden tube, the cuff was inflated to ensure an

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FIGURE 1 Arrow in the tomogram showing complete absence of trachea above the tracheostomy stoma.

adequate seal of the tracheal lumen and to achieve a firm hold of the tube on the tracheal wall above the carina. Oxygenation was maintained by intermittent ventilation through the ventilating limb of the Carden tube, using a venturi ventilating apparatus.^{2,3} The inflation pressure was limited to 103.41 to 137.88 kPa (15 to 20 p.s.i.). Clinically the movement of the chest and air-entry was satisfactory. Muscle relaxation was maintained with d-tubocurarine 30 mg. Anaes-

FIGURE 2 Carden tube as modified, showing: A: Conventional limbs; B: Insertion of suction catheter.

thetia was maintained entirely by the intravenous method^{4,5} using alfathesin given continuously through a drip infusion. Alfathesin 25 ml was diluted to 100 ml with normal saline. A total of 50 ml was used over a period of four hours. In addition, intravenous phenoperidine 1 mg was given hourly. Blood gas analysis done during operation after one hour of artificial ventilation showed: H^+ 45 nmol/litre (pH 7.35); PO_2 21.01 kPa (158 mmHg); and PCO_2 4.89 kPa (36.8 mmHg).

OPERATIVE FINDINGS AND PROCEDURE

At operation, a tubular stenosis one centimetre long which admitted only the tip of a pin was found immediately above the tracheostomy opening. The thoracic trachea was mobilized through a sternal-split incision. The stenotic area was incised vertically and the rim of fibrous tissue at the edges of the trachea was then excised and an end-to-end anastomosis was done.

With clear access the repair of the posterior wall was first carried out. Upon completion, a 6.0 mm cuffed "Portex" tracheal tube was introduced orally. The Carden tube was then withdrawn and the tracheal tube was advanced further so that the tip of the tube was distal to the site of anastomosis but above the carina. Anastomosis was then completed by suturing of the anterior wall. Oxygenation was maintained by manual intermittent positive pressure ventilation (IPPV), but intravenous anaesthesia was continued until the end of the operation.

Curarization was reversed with neostigmine 2.5 mg and atropine 1.2 mg. Recovery from the muscle relaxant appeared good, but it took about 30 minutes before the patient regained consciousness with no recollection of the whole surgical operation. The immediate post-operative chest X-ray showed bilateral clear lung fields.

DISCUSSION

Surgical procedures involving sharing of the airway between the anaesthetist and the surgeon, such as bronchoscopy, microlaryngeal surgery and tracheal resection in particular impose special problems on the anaesthetist. On the one hand, the surgeon requires unrestricted access to the operating site. On the other, the anaesthetist must ensure adequate anaesthesia, oxygenation and carbon dioxide elimination, preferably with no contamination of the lung fields.

Several anaesthetic techniques have been described to circumvent this problem. Cardiopulmonary bypass has been used to maintain oxygenation, especially in tracheal stenosis situated near or involving the carina. Deliberate endobronchial intubation and light clamping of the pulmonary artery on the unventilated side may be necessary to minimize arterial desaturation.⁶ The disadvantage of this technique is the elaborate equipment needed and the danger of intrapulmonary haemorrhage following the necessary use of anticoagulants.⁶

The more commonly employed technique is the use of a tracheal or an endobronchial tube⁷⁻⁹ so that anaesthesia can be maintained using conventional IPPV with or without inhalational agent supplementation. A small-size bronchoscope may be substituted for the tracheal tube. This technique is relatively easy and although the tracheal tube acts as a splint, as claimed,⁹ it is of questionable help in the reconstruction procedure.¹⁰ Rather, the tube may obscure the posterior suture line and distort the lower tracheal segment.¹¹ As the tracheal intubation technique requires a patent though stenosed trachea, the complete occlusion in this case precluded its use.

Perhaps the use of a bronchoscope injector^{2,3} to inflate the lungs by means of a catheter¹²⁻¹⁴ may be more applicable. Oxygen can be injected through the catheter and anaesthesia maintained with intermittent thiopentone,¹² or a suitable "oxymix"¹⁴ composed of varying proportions of oxygen and nitrous oxide. This technique is commonly favoured by the surgeons as surgical access is unrestricted and oxygenation is adequate.¹³ It has been suggested that difficulty can be experienced in the use of thiopentone to maintain stable anaesthesia.⁸ Likewise, the use of the injector, while maintaining ventilation, may cause suction of blood into the lungs accompanying air-entrainment during inspiration.⁹ Frequent suction by the surgical team is therefore required to prevent aspiration.¹³ In addition,

satisfactory ventilation may be difficult to achieve as catheters are known to be displaced within the distal tracheal segment.¹³ Hence, to prevent this, a retaining suture would be indicated.¹⁰

In contradistinction to these methods, the present two-stage technique initially employing a modified Carden tube through the tracheostomy stoma until the posterior tracheal segment has been sutured and subsequently inserting an orotracheal tube seems a better alternative in such cases. The advantages are self-evident in that oxygenation and carbon dioxide elimination were assured. Little or no soiling of the lungs was detected. The expiratory and/or suction catheter seemed to drain blood and the expired air continuously. Suction was seldom needed. The continuous drainage of blood could be due to gas escaping through the catheter during both phases of the respiratory cycle.¹ The technique was eminently satisfactory as it provided a clear operative field.

Furthermore, suturing of the anterior tracheal segment posed no problem despite the presence of the tracheal tube, as only a small tube was used. Undoubtedly retrograde insertion of the tube upwards through the proximal tracheal segment and into the oral cavity may ensure better asepsis.

The use of continuous alfathesin infusion^{4,5} with phenoperidine supplementation proved to be satisfactory, as assessed clinically by moderately constricted pupils and absence of sweating and tachycardia.⁴ The delay in regaining consciousness could possibly have resulted from either overdosage of alfathesin and/or phenoperidine or from delayed metabolism of drugs due to hypothermia from prolonged exposure to operating room air-conditioning.

In the management of this case a two-stage anaesthetic technique has been described. The conventional techniques in use have been described and their merits and demerits discussed. This successful experience testifies to the feasibility of this procedure and the advantages described make it eminently suitable for reconstructive surgery of complete tracheal stenosis.

SUMMARY

Surgical procedures involving sharing of the airway between the anaesthetist and surgeon, such as bronchoscopy, microlaryngeal surgery and tracheal resection impose special problems on the anaesthetist. The surgeon requires unre-

stricted surgical access, whereas the anaesthetist must ensure adequate and safe pulmonary ventilation and anaesthesia.

This case report describes a two stage technique for management of the airway and ventilation during tracheal resection for stenosis. Initially a modified Carden tube with a ventilating injector was used through a tracheostomy stoma and subsequently an orotracheal tube was substituted. Anaesthesia was maintained entirely by the intravenous route. The surgical access was unrestricted and there was no pulmonary contamination.

RÉSUMÉ

On rapporte ici un cas de résection de sténose trachéale sous anesthésie intraveineuse (curare et alfathésin). La perméabilité et l'étanchéité des voies aériennes ont été assurées dans un premier temps au moyen d'un tube de Carden à ballonnet introduit dans l'ouverture de trachéostomie, la ventilation étant contrôlée par une technique à injection intermittente de gaz; un cathéter relié à une succion continue et placé dans la lumière du tube de Carden assurait un drainage continu en plus de recueillir les gaz expirés. Après résection de la partie sténosée et resuture bout à bout de la portion trachéale postérieure, on a substitué un tube orotrachéal au tube de Carden, ce tube étant descendu juste au-dessus de la carène de façon à pouvoir gonfler le ballonnet et compléter la suture de la trachée sous ventilation contrôlée conventionnelle. Cette technique assure une protection efficace des voies aériennes tout en facilitant la chirurgie.

ACKNOWLEDGEMENTS

The author wishes to thank Professor Q.M. Iqbal for his guidance on the preparation of this article, the departments of Medical Illustration and Medical Museum, Faculty of Medicine, National University of Malaysia for the photographic illustrations and to Miss Khadijah Mahmood for secretarial assistance.

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