TRACHEOBRONCHIAL SUCTION IN INFANTS AND CHILDREN

BY

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SUMMARY

Angulated and straight catheters were passed through endotracheal tubes in a series of infants and young children and the position in the tracheobronchial tree was verified by chest radiography. In twenty-nine out of thirty-four attempts in one cadaver and eighteen children the angulated catheter entered the left main bronchus, whilst in nineteen out of twenty-two attempts a straight catheter entered the right main bronchus. The use and advantage of an angulated catheter for tracheobronchial suction are discussed.

Tracheobronchial suction may be performed either blindly by a catheter passed through an endotracheal tube or tracheostome, or under direct vision through a bronchoscope.

In the adult a straight catheter introduced into the trachea most commonly enters the right main bronchus, which has a more vertical alignment with the trachea compared with the left main bronchus.

Adriani and Griggs (1954) suggested that the tracheobronchial tree in young children differed geometrically from that in the adult. Using post-mortem specimens they found that in all children under the age of 3 years the right and left main bronchi diverge from the trachea at equal angles (fig. 1).

It would seem, therefore, that, providing there is no distortion of the tracheobronchial tree, in children of this age group a straight catheter should enter the right and left main bronchi with equal ease.

An investigation was therefore undertaken to determine the value of straight and angulated catheters for tracheobronchial suction in children of this age group.

METHOD AND RESULTS

An initial assessment was made using two fresh cadavers who had no demonstrable chest lesions. Each child was intubated with an endotracheal tube, a catheter was passed and an X-ray film exposed. This procedure was repeated ten times. In the first child, aged 5 weeks, a straight catheter was passed and lodged in the right main bronchus on all ten occasions, whilst in the second child aged 9 weeks an angulated catheter only was passed, and was visualized in the left main bronchus on eight and in the right main bronchus on two occasions.

To demonstrate the efficiency of using an angulated catheter to reach the left main bronchus, a series of six subjects whose ages ranged from 6 to 23 months, and who were undergoing routine surgery, were investigated. Following intubation with an endotracheal tube, an angulated catheter was introduced twice on each subject and the chest X-rayed. The following table shows the position of the catheter on the 12 occasions that it was passed.

<table>
<thead>
<tr>
<th>Position of angulated catheter.</th>
<th>Right main bronchus</th>
<th>Left main bronchus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>... ... ... 1</td>
<td>... ... ... 11</td>
</tr>
</tbody>
</table>

FIG. 1

Showing suggested differences between trachea and main bronchi of adults compared with children under three years (after Adriani and Griggs, 1954).
FIG. 2 Showing straight catheter in right main bronchus.

FIG. 3 Showing angulated catheter in left main bronchus.
In order to exclude variations in configuration of the tracheobronchial tree, twelve children, aged between 2 and 24 months, undergoing routine surgery, were investigated in this series. Figures 2 and 3 show the straight catheter in the right main bronchus and the angulated catheter in the left main bronchus in the same child. After intubation with an endotracheal tube, straight and angulated catheters were passed on the same child and the position of the catheter tip was checked by radiography. The results are shown in the table.

<table>
<thead>
<tr>
<th>Position of catheter</th>
<th>Right main bronchus</th>
<th>Left main bronchus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight catheter</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Angulated catheter</td>
<td>2</td>
<td>10</td>
</tr>
</tbody>
</table>

DISCUSSION

The use of an angulated catheter to apply suction to the left main bronchus is not original. During the severe epidemic of poliomyelitis in Denmark in 1953, Lassen used a Tiemann catheter introduced via a tracheostome. Since the Tiemann catheter is too short to reach the left main bronchus when passed via an endotracheal tube in adults, Pinkerton (1955) extended the catheter so that it could be used via an endotracheal tube during adult thoracic surgery. However, no evidence was produced to confirm that the catheter entered the left main bronchus. Opie and Crampston Smith (1959) investigated the use of a catheter with an angulated tip, introduced via a tracheostome in adults. On being directed to the left the catheter entered the left main bronchus in six out of seven attempts. A straight catheter similarly introduced entered the right main bronchus in nine out of ten attempts. An angulated catheter has yet to be assessed for tracheobronchial suction in children.

From the tables in this paper it can be seen that nineteen out of twenty-two attempts strongly suggests that there is a difference in the angle that the right and left main bronchi radiate from the trachea.

Rees (1958) has shown how, following neonatal surgery, it is possible to re-expand atelectatic areas of the lung using suction and positive pressure ventilation. Nesbit and Wilson (1958) demonstrated the importance of maintaining a clear tracheobronchial tree in infants, with acute respiratory infection. Hitherto it was often necessary to resort to bronchoscopy to clear the left main bronchus in these cases but this procedure is particularly hazardous in ill infants and children. Providing an angulated catheter is used with care, bronchoscopy need not be performed to clear the left main bronchus of secretions. This point is well illustrated by the following case.

A full-term neonate required endotracheal intubation and oxygen for the relief of asphyxia at birth. Because of the poor general condition, the endotracheal tube was left in situ for 18 hours. Following extubation respirations were still laboured and an X-ray of the chest showed collapse of the left lower lobe. After 48 hours there was almost complete collapse of the left lung (fig. 4). The baby was intubated with a size OA Magill endotracheal tube and suction was applied to the left main bronchus with an angulated catheter. Some mucus plugs were aspirated, the lungs inflated with oxygen, and the endotracheal tube removed. A chest X-ray then showed re-expansion of the left lung (fig. 5).

Tracheobronchial suction should only be performed when there is evidence of accumulation of secretions in the main bronchi. Trauma, caused either during intubation or by the endobronchial catheter, can be avoided by a careful technique. It is surprising how easily intubation can be performed in these ill children though, if necessary, a short-acting muscle relaxant may be used to facilitate intubation. An advantage of this technique, particularly in infants, is that removal of secretions by suction may be the only possible method of obtaining a specimen of infected material from which the causative organisms may be isolated and their antibiotic sensitivities determined.

Several practical points emerge from this study. The angulated catheter (fig. 6) should be introduced into the endotracheal tube and then rotated to the left or right depending on which side of the tracheobronchial tree requires aspiration. Providing there is an easy passage of the catheter.
FIG. 4
Showing almost complete collapse of left lung.

FIG. 5
Showing re-expansion of left lung after tracheobronchial suction with angulated catheter.

FIG. 6
Angulated catheter. Note that there is only one orifice which is situated terminally. Note the beak on the proximal end.
within the endotracheal tube, the break on the proximal end is a reliable guide that the tip is pointing in the same direction. It is important that the endotracheal tube is of the correct length for the child. On one occasion when the angulated catheter was demonstrated in the right side of the chest, it was clear from the X-ray film that the tip of the endotracheal tube was lying in the right main bronchus. The correct length for the endotracheal tube can be calculated from the formulae suggested by McIntyre (1957) and Levin (1958). The size of the catheter used should match the size of the tube used; that is to say the 3EG catheter for an OO Magill tube, and 4 EG for an OA and O Magill tube and so on.

Lastly, when using this catheter the usual precautions should be observed: absolute sterility, gentle introduction with the catheter nipped so that suction is only applied as the catheter is being withdrawn and, following suction, careful positive pressure ventilation to re-expand any atelectatic areas caused by the disease or by the suction.

ACKNOWLEDGMENTS

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REFERENCES
