FURTHER CONSIDERATIONS ON TRACHEAL SUCTION CATHETERS

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SUMMARY
A tracheal suction catheter should be straight and rigid enough to be directed when held with one hand at its proximal end, yet flexible enough to follow easily the curves of the airway. The orifice should be at the tip of the catheter and not smaller than the internal diameter of the catheter. The external diameter of the catheter should approach but not exceed half the internal diameter of the airway. Each catheter should be in a sterile packet labelled with its size and that of the airway for which it is suitable, and should have a standard proximal end.

Tracheal suction catheters are now available already packed and sterilized. Many of them are intended to be used only once, so avoiding much of the risk of introducing or spreading infection. This is all to the good, so far as it goes. However, many other factors in addition to sterility must be considered in the design of a tracheal suction catheter, not only to provide further for the safety of the patient but also to ensure that suction is carried out in the most efficient way.

SAFETY OF THE PATIENT
Excessive negative pressure in the respiratory tract, trauma, or infection can each occur if a tracheal suction catheter is misused, or if it has been badly designed.

Excessive negative pressure in the respiratory tract.
The magnitude of the negative pressure produced in the respiratory tract by suction can be limited by restricting the ratio between the external diameter of the suction catheter and the internal diameter of the airway. If this ratio is not more than 1:2 then the pressure in the respiratory tract, and hence in the thoracic cavity, does not become low enough to cause harm, no matter what the negative pressure reached by the suction apparatus (Rosen and Hillard, 1960, 1962). The suction catheter should be immediately available in a number of sizes so that one which complies with this requirement can be chosen (table 1). Even if this condition is met, the catheter must be sufficiently rigid to prevent any possibility of its becoming coiled up within the airway.

Trauma.
The tip and external surface of the catheter must be smooth and rounded so that there is little friction while it is passed into the airway, and so little likelihood of scraping the wall of the trachea. It must be flexible enough to follow easily the curvature of the airway, so that undue force, which might cause damage to the mucosa, is not required when the catheter is inserted.

Trauma caused when tissue is sucked into the orifice of the catheter, can be prevented if a gentle to-and-fro movement is maintained while suction is being performed.

Infection.
A sterile, packed, disposable catheter ensures sterility before use. However, the catheter may become contaminated if it is handled while it is being passed into the airway. This must occur if the catheter is too flexible, too long, or has to be straightened out when it is taken out of its packet.

One catheter can be used on the same patient throughout an operation provided it does not become contaminated during the periods when suction is not being performed. This can be prevented if the packet is so designed that the catheter can be replaced in it without handling. Both the catheter and the packet can then be thrown away at the end of the operation.

EFFICIENCY OF SUCTION
The catheter must be connected to the suction apparatus, be passed into the trachea, and have
its orifice brought into contact with the secretions before these can be removed. The speed and efficiency of the suction is affected by the ease with which this can be done.

**Connection to the suction apparatus.**

So that any catheter can be connected quickly and easily to suction apparatus, the proximal ends of all catheters should be a standard fitting.

**Introducing the catheter.**

The catheter should be straight and rigid enough to be directed easily when held with one hand at the proximal end.

**Making contact with the secretions.**

**Position of the orifice.** In order that secretions can be removed quickly and easily the orifice should be at the tip of the catheter. A catheter which has an orifice at the side must be passed beyond the secretions and may need to be rotated before the orifice comes into contact with the secretions.

**The length of the catheter.** The catheter must be long enough to pass into the main bronchi, but excessive length will make it inconvenient and too flexible. The largest catheter need not be more than 45 cm long. Smaller catheters can be proportionally shorter (table I).

**Table I**

Suggested dimensions for tracheal suction catheters.

<table>
<thead>
<tr>
<th>Endotracheal tube size (British Standard 1962)</th>
<th>Suitable suction catheter</th>
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<tr>
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<td>External diameter (mm)</td>
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**The removal of secretions.**

**The number of orifices.** A catheter which has only one orifice permits maximum suction to develop rapidly after the orifice is in contact with secretions. When a catheter has two or more orifices it is unlikely that more than one at a time becomes occluded by secretions, so that air is drawn through the open orifice, and maximum suction is not developed.

**The orifice size.** The orifice should be the same size as the internal diameter of the catheter so that unnecessary resistance to the passage of secretions is not added.

**General considerations**

**The wall thickness of the catheter.** The wall must be sufficiently thick to prevent the catheter collapsing during suction.

**The internal diameter.** The larger the internal diameter the more rapid is the removal of any secretions. The internal diameter is, however, fixed by factors already discussed limiting the external diameter, and the wall thickness. The material from which the catheter is manufactured should be chosen so that minimum wall thickness can be used compatible with the right degree of flexibility and resistance to collapse.

**Transparency.** A transparent catheter makes it instantly possible to see whether secretions are being removed.

**Conclusions**

If the external diameter of the catheter is not more than half the internal diameter of the airway then excessive negative pressure in the respiratory tract is avoided.

A tracheal suction catheter should be clearly labelled with external diameter and the internal diameter of the endotracheal tube or airway through which it can be used with safety.

The catheter should be straight when packed so that it can be easily introduced into the endotracheal tube with minimal handling.

There should be a single orifice at the tip of the catheter which should be smooth and rounded. There should be no restriction of the lumen of the catheter at this point.

The material from which the catheter is made should be chosen so that the walls may be thin (and hence the internal diameter large), while
retaining resistance to collapse under negative pressure and while obtaining the required degree of flexibility. This material should preferably be transparent.

The connection of all sizes of catheters to the suction apparatus should be standard. The packet should be designed so that the catheter can be easily replaced in it, thus enabling one catheter to be used throughout the operation on the same patient.

REFERENCES

SOMMAIRE
Une sonde d'aspiration trachéale doit être assez résistante et rigide pour pouvoir être dirigée par une main qui en tient le bout proximal; d'autre part elle doit être assez flexible pour suivre facilement les sinuosités des voies respiratoires. L'orifice doit être situé au bout de la sonde et son diamètre ne doit pas être inférieur au diamètre intérieur de celle-ci. Le diamètre extérieur de la sonde doit se rapprocher de la moitié du diamètre intérieur des voies respiratoires tout en ne pas la dépassant. Chaque sonde doit être contenue dans un emballage stérile mentionnant sa taille et celle des voies respiratoires pour lesquelles elle convient. Les bouts proximaux doivent être standardisés.

ZUSAMMENFASSUNG

BOOK REVIEW


As indicated in the preface, the introduction of muscle relaxants into anaesthetic practice still further reduced the use of local analgesic agents and, along with the danger of sequelae, wellnigh struck a death blow to spinal techniques. The growing practice of epidural block, however, indicates that the interest of the anaesthetist in the finesse and value of conduction anaesthesia is by no means dormant, and if more time was available there is little doubt that advantage would be taken of at least some of the uses of local analgesia. This small book should do much to stimulate this interest and to remind anaesthetists of the relative simplicity of some valuable nerve-blocks and their application to surgery as well as to prognosis, diagnosis and the therapeutic relief of pain or trauma. To many the information contained in this book will be insufficient, but for them there are excellent references at the end of each chapter, and a final list for wider reading is appended. For the majority, the book covers a good field of local analgesia and provides an adequacy of practical detail, simply and clearly expressed. Nor does the author omit to mention useful points gained from his own experiences and too often taken for granted.

A brief indication of other methods of identifying the epidural space might have encouraged those who are less confident about the "loss of resistance" test. A reviewer likes to find something to criticize so attention is drawn to the inadvisability of using amethocaine for infiltration in concentrations of 0.1 to 0.5 per cent (page 12); and to table 3 on page 52, where the weight of lignocaine is given in grams, a misprint for milligrams. Clearly printed, adequately indexed, and attractively and seasonably bound, many anaesthetists will find this book a valuable and inexpensive addition to their library.

H. H. Pinkerton