PROLONGED (THERAPEUTIC) ENDOTRACHEAL INTUBATION

BY

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SUMMARY

In recent years there has been an increased use of therapeutic intubation. It is especially useful in conscious patients postoperatively for periods of a day or so when the need for respiratory assistance is short-lived. It can be utilized for many days but the likelihood of laryngeal damage is probably increased, although in the individual case the shortness of the period of intubation is no guarantee of laryngeal safety. Whether the advantages of prolonged intubation outweigh the disadvantages can only be decided when the results of a series of carefully followed-up cases of prolonged intubation can be compared with those of a series of patients who have a tracheostomy inserted early in their treatment and for approximately the same length of time as the endotracheal tube. The frequency and type of laryngeal pathology suggest that therapeutic intubation should not be used for more than a few hours if there is not a strong indication for an artificial airway, but the incidence of damage is not so high as to contraindicate a prospective study comparing it with tracheostomy under apparently the same conditions.

Prolonged (therapeutic) endotracheal intubation may be defined as the maintenance of an artificial airway by means of a translaryngeal tube for periods of more than a few hours, in conscious or unconscious patients, for purposes other than surgical anaesthesia. In recent years there has been increasing interest in prolonged intubation as an alternative or adjunct to tracheostomy, because of dissatisfaction with the results of tracheostomy in some patients (Lancet, 1967).

The advantages of translaryngeal intubation over tracheostomy are general and may be summarized as follows:

- It is easily and rapidly undertaken even in difficult locations.
- Should rapid improvement occur in the patient's condition, the endotracheal tube can be removed without the need for further attention to the airway. This is important in some states of coma (barbiturate overdosage, head injury) in which the duration of unconsciousness is unpredictable and the patient may make a complete recovery within a few hours of a tracheostomy which may take some time to close.
- Some of the complications of tracheostomy are especially worrying (McClelland, 1965a). Bleeding into the tracheobronchial tree, tracheal stricture and tracheocutaneous fistula are less likely with endotracheal tubes (Brit. med. J., 1967). In children, decannulation is often difficult with tracheostomies (McClelland, 1965b) and intubation can avoid this (McDonald and Stocks, 1965).
- In neonates and children, should obstruction of the tracheostomy tube occur, removal of the tube often leads to sudden respiratory obstruction as the soft tissues of the neck infold. When an obstructed endotracheal tube is removed a patent airway frequently remains for at least 1–2 hours. In neonates it may be easier to change an endotracheal tube than a tracheostomy tube.
- Prolonged intubation may avoid the necessity of repeated tracheostomy in patients with recurrent attacks of respiratory insufficiency, i.e. bronchitis, asthma and emphysema.
- Tracheostomy leaves a scar which may be permanently distressing to mentally disturbed patients.

Ultimately therapeutic intubation cannot be considered a procedure of value unless the complications are less frequent than they are following tracheostomy of similar duration. The purpose of this paper is to assess the incidence, type and aetiology of the laryngeal complications of pro-
longed intubation based on a review of the literature and the authors’ personal experience of nearly 400 cases.

HISTORY
There was little interest in therapeutic intuba-
tion until 1951 despite some historical precedence
in cases of respiratory obstruction (Macewen,
1880; O’Dwyer, 1887, 1894; Northrup, 1894) and
some more recent isolated case reports (Briggs,
1950; Urry, 1951). In 1951 Nilsson, in his paper
on the treatment of overdosage with barbiturates,
emphasized the importance of adequate ventila-
tion and an unobstructed airway. An endotracheal
tube proved satisfactory in achieving these aims
(Clemmesen, 1954; Bergström, 1960). It was a
logical step to employ therapeutic intubation in
other unconscious patients, especially those in
coma resulting from intracranial disease or trauma
(Barton, 1958; Hunter, 1960). Following some
initial disappointments (Sykes, 1960) the tech-
nique proved promising in neonates and children
(Brandstater, 1962) and subsequently was used
for a wide variety of disease-states of respiratory
depression or obstruction, ranging from the
respiratory distress syndrome to acute croup
(Thomas et al., 1965; Reid and Tunstall, 1965;
McDonald and Stocks, 1965; Allen and Steven,
1965). About the same time the value was realized
of IPPV through the endotracheal tube in patients
after open heart surgery (Dammann et al., 1963;
Dammann, 1965; McCrae and Masson, 1964). Finally
the method proved to be of benefit in
conscious patients with other types of respiratory
failure or with retained secretions, i.e. status asth-
maticus, chronic bronchitis, postoperative respira-
tory failure, shock (Tonkin and Harrison, 1966).

THE INCIDENCE OF LARYNGEAL COMPLICATIONS
The literature contains only a few reports of large
series of therapeutic intubation in adults and it is
not always easy to compare the severity of the
complications as described in different papers. It
is also difficult to evaluate the ultimate effect on
the patient of changes seen at laryngoscopy and to
correlate those changes with those seen macro-
scopically or microscopically at postmortem. For
this reason, in assessing the incidence of postintu-
bation laryngeal sequelae from the literature, the
authors considered only those complications caus-
ing surviving patients considerable laryngeal
trouble. Bergström (1962) described 173 cases of
barbiturate overdose with 7 (4.0 per cent) cases
of laryngeal damage, and Elbrond (1964) found
1 case of damage in 19 cases investigated retro-
spectively. In a series of 155 patients with various
pathological states the authors (Tonkin and Harri-
son, 1966) found 7 cases of marked damage (4.5
per cent). We now have a personal experience of
382 cases with 17 cases of severe laryngeal
damage. Most of these cases have been described
in detail elsewhere (Harrison and Tonkin, 1965,
1967). As two of the cases were referred from
other hospitals the actual percentage of damage
was 3.9 (15 cases in 380).

In neonates and children in whom the duration
of intubation is often very much longer than in
adults, McDonald and Stocks (1965) had two
cases in 50 (4 per cent); Allen and Steven (1965)
7 in 61 (11.4 per cent); Northway, Rosan and
Porter (1967) 1 in 32 (3.1 per cent); Aberdeen and
Glover (1967) 5 in 62 (8.0 per cent). In addition
Brandstater (1952), Thomas and associates (1965),
Reid and Tunstall (1966), and Crul and Wolffens-
perger (1965) have described 12, 18, 9 and 7
cases respectively without any laryngeal damage.

DISTRIBUTION AND TYPE OF LESION
The different types and sites of lesions which
have been described in the literature as complicating
prolonged intubation are:

Oedema
(i) subglottic;
(ii) supraglottic involving aryepiglottic folds;
(iii) posterior to arytenoid cartilage.

Ulceration
(i) subglottic;
(ii) of vocal cords;
(iii) supraglottic structure, especially epi-
glottis.

Granulation tissue
(i) subglottic;
(ii) vocal process of the arytenoid cartilage
(laryngeal granuloma).

Membrane formation (laryngotracheal).

Adhesions
(i) anterior end of vocal cords;
(ii) interarytenoid.
Fibrous tissue formation
(i) fixation of arytenoid cartilage;
(ii) subglottic stricture.
Commonly more than one site in the larynx is
involved and usually several types of lesion co-
exist.

Pathology.

Oedema.
This may be transitory, especially in the supra-
glottic tissues where it is an extremely common
finding at laryngoscopy after extubation even in
uncomplicated cases. As the mucous membrane
is closely attached over the vocal cords, the
oedema usually occurs in the aryepiglottic folds
and the area posterior to the arytenoids. In com-
parison, even when it is transitory, subglottic
oedema may be serious because there is very little
room within the cricoid area, especially in child-
ren, and the patient's life may be threatened by
respiratory obstruction requiring re-intubation
and/or tracheostomy. In addition, oedema must
increase the pressure effect of the tube on the
laryngeal mucosa, predisposing to the formation
of ulcers and granulation tissue.

When oedema persists after extubation for
longer than 24 hours despite adequate treatment,
it is almost always associated with more serious
lesions, either deep ulceration or a marked granu-
logomatous reaction.

Ulceration.
This appears to be the fundamental lesion from
which other complications arise. The ulcerated
areas were well described in cases who were intu-
bated for endotracheal anaesthesia by Dwyer,
Kronenberg and Saklad (1949). After 2–4 hours
congested areas appeared in the larynx and after
6 hours ulceration of the mucosa was seen.
Microscopic changes included necrosis of tissue,
fibrin deposition, inflammatory cells, vascular
congestion and oedema. Similar changes were
noted by Stein and associates (1960) and in addi-
tion 3 of their 42 cases showed a superficial fibrin-
ous membrane. They also described complete
healing of these microscopic changes in those
patients who survived 3–4 weeks. Lu, Tamura and
Koobs (1961) described the microscopic appear-
ances in chronological order as: (1) haemorrhage
and inflammatory changes; (2) epithelial dis-
organization with the formation of an ulcer
covered by a pseudomembrane consisting of fib-
rin, mucosa and sometimes necrotic remains of
epithelium; (3) separation of the pseudomem-
brane from the mucosa by oedema.

Hilding and Hilding (1962) showed that follow-
ing trauma the epithelium may be sheared off,
leaving an ulcer which heals by regeneration of
epithelium from the basement membrane. When
the basement membrane is destroyed, a much
slower process of repair must occur from the edges
of the ulcer. The importance of ulceration in the
development of laryngeal complications of long-
term intubation was stressed by Bergström,
Moberg and Orell (1962) who described the
changes as profound necrosis of the mucous mem-
brane with pronounced acute inflammatory
change. In extensive cases the underlying carti-
lage was involved. An interesting approach to the
aetiology of the pathological changes is the study
under experimental conditions in monkeys of the
reaction of the laryngeal mucosa to endotracheal
tubes (Way and Sooy, 1965).

Macroscopically the ulcers are usually situated
on the medial side of the vocal process of the
arytenoid cartilage, the intra-arytenoid notch or
the posterior part of the subglottic region under
the vocal process of the arytenoid process.

Granulation tissue.
The appearance of a granuloma is a further
stage in the repair of a deep ulcer. The usual
sites are the subglottic region or the medial side
of the vocal process of the arytenoid cartilage. In
some cases the latter type is small and flat and
confined to the vocal process, in others the whole
length of the vocal process is involved and rarely
the whole vocal cord. Granulomas on the ary-
tenoid cartilage commonly cause hoarseness, pain
and dysphagia and if large or accompanied by
marked oedema may cause respiratory obstruc-
tion, but this is more likely to occur with sub-
glottic granulomas which are seldom single and
may completely ring the cricoid area.

The microscopic appearance of a laryngeal
granuloma is that of a typical pyogenic granuloma
with an epithelial covering and infiltration with
chronic inflammatory cells.

Laryngotracheal membrane formation.
The formation of a laryngotracheal membrane
similar to that described as following endotracheal
intubation for anaesthesia (Muir and Straton, 1954) can also occur (see “Ulceration”). It is a particularly serious complication as a portion of the membrane may become detached, causing sudden and often unexpected respiratory obstruction. Removal of the membrane may not be easy because of the presence in it of areas of epithelium still attached to the underlying tissue.

Adhesions.
The fibrin covering of two adjacent ulcers may join to give acute adhesions between the anterior ends of the vocal cords or posterior ends in the inter-arytenoid area. This condition is of interest, as division of the adhesions may relieve respiratory obstruction without the need for tracheostomy (Tonkin and Harrison, 1966).

Fibrous tissue.
The formation of fibrous tissue as the end result of healing of ulcers or granulomas is the most serious complication of prolonged intubation. It may narrow the subglottic opening as a stricture, or immobilize one or both vocal cords, often close to the midline with resultant respiratory obstruction.

The authors have seen four of the latter type of case. In one case mobilization of the cord was undertaken. The crico-arytenoid joint appeared normal when opened, suggesting that the basic pathology was inter-arytenoid fibrosis rather than the result of suppurative arthritis of the joint, although infection of the tracheobronchial tract (bronchiectasis) was present in that and in the other three patients.

Prognosis.
The course of patients with laryngeal symptoms after prolonged intubation may be one of the following:

(a) Those who require no active treatment. In most patients with sore throat or hoarseness the condition settles without any specific treatment.

(b) Those who have severe laryngeal symptoms (severe persistent hoarseness, aphony or stridor) but settle without tracheostomy or operative interference. Most cases of superficial laryngeal ulceration, supraglottic oedema and cases of mild subglottic oedema can be managed conservatively. Treatment with humidification of the inspired air, antibiotics, corticosteroids and avoidance of overhydration usually produces a good response in 24 hours. In addition the classical granuloma on the vocal process of the arytenoid is self-healing provided sufficient time (up to several months) is allowed.

(c) Those who require operative treatment but in whom the laryngeal pathology settles quickly. Most cases of uncomplicated subglottic oedema, some cases of supraglottic oedema, and most cases of laryngotracheal membrane require tracheostomy, but with appropriate treatment the larynx returns to normal function within a few days or weeks. In addition it may be necessary to clear the vocal cords of adhesions by division by diathermy, sometimes using microsurgical techniques, or to use bronchoscopic suction to remove membrane.

(d) Those who require operative interference and have persistent laryngeal obstruction. The most dreaded complications are collections of granulation tissue in the subglottic area or inter-arytenoid space especially when the lesions heal by fibrosis rather than by repair with normal epithelium. The result is subglottic stenosis or fixation of the cords in close apposition because of the immobility of the arytenoids. The patient may require repeated laryngeal dilatation or mobilization of the arytenoids (Taylor, Nightingale and Simpson, 1966; Harrison and Tonkin, 1967). The patient may be faced with a semi-permanent tracheostomy and with a lesion the treatment of which offers great surgical difficulty (Allen and Steven, 1965; Sara, 1967).

(e) Remote complications. The possibility of remote changes in laryngeal function does not appear to have been investigated. A case of laryngeal web has been described possibly due to a 5-day period of intubation 2 years previously (Warner, 1967). Elbrond (1964), in a late follow-up, noted a few cases of persistent symptoms, as did Tonkin and Harrison (1966), despite normal appearances of the larynx. It is possible that minor changes in the joints of the larynx or in the shape of the vocal cords can produce alteration in vocal tone, intermittent aphonai or recurrent sore throat.

Aetiological Factors.

(1) Duration of intubation.
The period of time for which the tube may be left in place has been a source of dispute amongst
different authors and no agreement exists except that the “safe” period is longer in children. The following is a summary of the times mentioned as permissible.

**In adults**
- 8–12 hours (Lewy and Sibbitt, 1951).
- 24 hours (Leegaard 1960; Herzog, 1965; Bergström, Moberg and Orell, 1962).
- 36 hours (Bargh and Slawson, 1965).
- 48 hours (Bergström, 1960; Plum and Swanson, 1957).
- 72 hours (Dammann, 1965).
- 1 week (McClement, 1965; Sadoul, 1965).

**In children**
- 2–3 weeks (Rees and Owen-Thomas, 1966).
- 3 weeks (McDonald and Stocks, 1965).

Clemmesen believes that if the tube is to be left in place for some days it should be changed and the larynx inspected regularly to assess any degree of trauma; Bergström (1962) disagrees on the grounds that this procedure causes fresh trauma and infection and that it is difficult to estimate the extent of the laryngeal damage macroscopically.

There appears to be some correlation, however, between the macroscopic and microscopic changes in larynx and the length of time a tube has been in place. Dwyer, Kronenberg and Saklad (1949) observed traumatized, congested areas after intubation for anaesthesia for periods of 2–4 hours. Bergström (1962) noted that after intubation lasting approximately 12 hours the larynx showed diffuse swelling and redness. In postmortem studies he also found multiple areas of ulceration in the larynx which were deeper in patients who had been intubated longer—until in some cases the ulceration involved the laryngeal cartilages.

It is apparent that these lesions heal rapidly, as it is difficult to establish a close relationship between the clinical result and the duration of intubation. Very long periods of intubation have been reported (Urry, 1951), but the shortest period of intubation known to have been followed by complications is in the case reported by Wylie (1953); he described a laryngeal granuloma after 15 minutes intubation. In the individual case setting some time limit does not guarantee an undamaged larynx. In three of Bergström’s (1962) severe cases intubation was maintained for between 24 and 48 hours. In the 17 cases of the authors, the period of intubation in 6 was less than 24 hours, in 5 between 24 and 48 hours, and in 5 over 48 hours, whereas in most other cases in which intubation lasted over 48 hours the larynx was normal within a few days of extubation and the clinical course was straightforward. In practice, although therapeutic intubation has been used in a conscious patient for up to 19 days (Bookallil, 1966, personal communication), it is difficult and uncomfortable to maintain a tube in the conscious patient for more than 36–48 hours. It appears reasonable in unconscious patients to leave the tube in place if extubation can be anticipated within 3–4 days, and none of the other aetiological factors discussed below are present.

(2) Trauma at the time of intubation.

Trauma at the time of intubation may be responsible for laryngeal complications even when intubation is of short duration. The decreasing incidence of laryngeal sequelae after anaesthesia is in large measure due to the ease of insertion of tubes with the aid of muscle relaxants used by skilled anaesthetists. Unfortunately, therapeutic intubation must often be undertaken by junior medical staff in casualty or emergency wards. This contributed to some of the cases reported by Tonkin and Harrison (1966) as shown by a statistically significant difference of difficult and traumatic intubations in those with and without laryngeal damage. Bergström (1964) also believes that a traumatic intubation can cause later difficulties in these cases.

(3) Static pressure of the tube.

This is related to the total duration of intubation and the shape of the tube used. The predominance of the involvement of the arytenoid regions, posterior portions of the vocal cords, posterolateral areas of the subglottic space and posterior surface of the epiglottis as the common sites of ulceration, points to the importance of the static pressure of the tube (Lu, Tamura and Koobs, 1961; Bergström, Moberg and Orell, 1962). The susceptibility of the arytenoids to pressure
by the endotracheal tube has long been recognized (Dwyer, Kronenberg and Saklad, 1949; Barton, 1953). Bergström, Moberg and Orell (1962) have shown by means of cadaver and radiological studies how a Magill tube lies posteriorly in the larynx. With the relatively short Oxford tubes, the upper end of the inflated cuff may lie within the cricoid area as another source of pressure (Harrison, 1968). Extension of the head exaggerates the risk of pressure effects in the posterior parts of the larynx.

(4) Sex.
The female is more likely to suffer laryngeal damage than the male as a result of prolonged intubation (Tonkin and Harrison, 1966), as indicated by the higher incidence of granuloma following endotracheal anaesthesia in her sex (Howland and Lewis, 1956). This difference between the sexes may be attributed either to greater resistance of the male mucous membrane to trauma or to the diameter of endotracheal tubes which are commonly passed through the female larynx, which are large when compared with the laryngeal dimensions.

(5) Infection.
The effect of infection of the respiratory tract on the severity of laryngeal complications is uncertain. Bergström, Moberg and Orell (1962) believe it is not especially important because at autopsy extensive ulceration may be present without infective changes. On the other hand, in several of the authors’ most severe cases there was infection of the respiratory tract. Clinical experience of the complications of intubation for anaesthesia suggests that infection does increase the frequency of occurrence of oedema, granulomas (Howland and Lewis, 1956) and pseudomembrane (Muir and Stratton, 1954; Stein et al., 1960). It is difficult to imagine that a laryngeal ulcer bathed in infected secretions is not more likely to produce granulation tissue or oedema than an ulcer not so exposed.

(6) Movement of the tube.
Movement of the tube against the larynx or of the larynx against the tube can occur with swallowing, hiccoughing, coughing, movement of the patient’s head, breathing or IPPR from an automatic ventilator. Allen and Steven (1965) noticed that the laryngeal inflammatory reaction to the tube was more marked in children who were being subjected to artificial ventilation, and it is important to develop suitable means of fixing the tube (Rees and Owen-Thomas, 1966). It might be expected that laryngeal damage would be more common in conscious patients, but this is not necessarily so, because the duration of intubation is usually shorter and the attending staff tend to be more gentle when moving the head of the conscious patient. In addition, in the conscious patient the head is not usually extended, which position is most likely to cause pressure in the larynx with Magill or Oxford tubes (Bergström, Moberg and Orell, 1962; Harrison, 1967).

(7) Composition of the tube.
The material of which the tube is made can produce laryngeal damage in two ways. 
(a) A rough surface leads to an abrasive effect on the mucous membrane (Salt, Parkhouse and Simpson, 1960).
(b) Chemicals in the material cause irritation. Clinical evidence suggests that red rubber tubes provoke more secretions and are more irritating to tissues than latex rubber or modern plastics (Watts, 1963). Rubber contains materials which may irritate human tissues (Ellis and Seigel, 1948; Mallette and Von Haam, 1952; Handfield-Jones and Lewis, 1955). There is no clear evidence as yet that polyvinyl chloride tubes, which are suggested as the most suitable for prolonged intubation (Allen and Steven, 1965), have any advantage over red rubber tubes. Even the newer plastics are not free from risks as they contain catalysts, curing agents, heat stabilizers, antioxidants, plasticizers, fillers, etc., which may cause irritation (Little and Parkhouse, 1962). The cement used to fix the cuff to the tube may also produce tissue irritation (Salt, Parkhouse and Simpson, 1960).

There does not appear to have been an experimental study on the effect of the composition of the tube on the laryngeal or tracheal tissues. Evidence for such irritation is based on clinical impressions or the microscopic reaction of tissues elsewhere in the body to the particular material. The problem is at present under study by the authors.
(8) Fluid balance.

There is no direct evidence of the effect of fluid replacement on the risk of laryngeal oedema in therapeutic intubation. A marked difference was noted, however, in the number of laryngeal complications occurring in postoperative cardiac surgery patients, in whom fluids were restricted, and in the patients suffering from barbiturate overdose, who were markedly hydrated. This led the authors to suggest the possibility that overhydration might lead to laryngeal oedema when combined with other factors (traumatic intubation, static pressure, etc.).

(9) Size of the tube.

Attempts to pass through the larynx a tube larger than necessary can have serious effects in therapeutic intubation. These may be responsible for the higher incidence of damage in females, and in children the result may be especially disastrous (Allen and Steven, 1965; McDonald and Stocks, 1965). The outcome is a more traumatic intubation and greater static pressure in the cricoid region, which is the narrowest part of the larynx. The increased likelihood of damage to the mucous membrane being caused by an oversized tube has been shown experimentally (Way and Sooy, 1965).

(10) Miscellaneous.

Contact with substances left on the surface of the tube has been postulated as a source of tissue irritation. Disinfectants used in the sterilization of the tube may possibly cause trouble (Lu, Tamura and Koobs, 1961) and local anaesthetic agents might, on rare occasions, cause allergic reactions in the larynx; the evidence for any of these occurrences is not strong.

Disadvantages of the endotracheal tube.

An endotracheal tube is prone to the same general problem of obstruction by secretions, herniation of the cuff, etc., as a tracheostomy tube but in addition there are some special disadvantages of the endotracheal tube in addition to the risk of laryngeal damage. An oral endotracheal tube is less comfortable for the patient than a tracheostomy tube. This discomfort can be alleviated by the use of sedatives but, as these are given intermittently, the duration of intubation is sometimes limited by the restlessness of the patient or excessive arterial hypotension in response to the sedative drug. Nasal tubes are better tolerated than oral tubes but require greater technical skill for insertion and suction is often more difficult. Suction is rarely as easy as with a tracheostomy. The endotracheal tube often presents a picture which is more upsetting to visiting relatives than a tracheostomy tube.

REFERENCES


INTUBATION ENDOTRACHEALE (THERAPEUTIQUE) PROLONGEE

SOMMAIRE

Au cours des dernières années, l'intubation thérapeutique a connu une application de plus en plus fréquente. Elle est particulièrement utile chez les patients conscients en période postopératoire pour un jour environ, lorsque la nécessité d'aide respiratoire n'est que de courte durée. Elle peut être appliquée durant plusieurs jours mais les risques d'un endommagement laryngéen deviennent probablement plus fréquents, quoique la courte durée de l'intubation ne garantit pas dans chaque cas individuel son innocuité pour le larynx. Décider si les avantages d'une intubation prolongée l'emportent sur les désavantages, n'est possible qu'en comparant les résultats d'une série de cas...
bien-suivis d'intubation prolongée avec ceux d'une série de patients, ayant subi une trachéostomie tôt dans leur traitement et durant une période de temps approximativement identique à celle du tube endotrachéal. La fréquence et la nature de la pathologie du larynx suggèrent que l'intubation thérapeutique ne devrait pas être appliquée durant plus que quelques heures, s'il n'y a pas d'indication bien précise pour la voie d'air artificielle, mais l'incidence des troubles n'est pas assez grande pour constituer une contre-indication pour projeter une étude comparative avec la trachéostomie sous des conditions apparemment semblables.

VERLÄNGERTE ENDOTRACHEALE INTUBATION (ALS THERAPEUTISCHE MASSNAHME)
ZUSAMMENFASSUNG
In den letzten Jahren wurde die Intubation als therapeutische Maßnahme vermehrt angewendet. Sie ist besonders bei nicht bewußtlosen Patienten im postoperativen Zustand für die Dauer etwa eines Tags nützlich, wenn die Atmung kurze Zeit unterstützt werden muß. Sie kann viele Tage beibehalten werden, aber die Wahrscheinlichkeit einer Schädigung des Larynx nimmt zu, obwohl im einzelnen Fall die Kürze der Intubationsdauer keine Gewähr dafür bietet, daß der Larynx nicht verletzt wird. Ob die Vorteile einer verlängerten Intubation die Nachteile überwiegen, kann nur entschieden werden, wenn die Ergebnisse zahlreicher sorgfältig verfolgter Fälle mit verlängelter Intubation mit denen verglichen werden können, die bei ebenso vielen Patienten mit einer Tracheotomie erhalten werden, wobei diese am Beginn der Behandlung und für ungefähr dieselbe Zeitdauer wie die endotracheale Intubation durchgeführt worden sein muß. Die Häufigkeit und die Art pathologischer Befunde zeigen, daß die Intubation als therapeutische Maßnahme nicht länger als einige Stunden verwendet werden sollte, wenn keine strenge Indikation für einen künstlichen Luftweg besteht; die Verletzungshäufigkeit ist jedoch nicht so groß, daß eine prospektive Untersuchung zum Vergleich der Intubation mit der Tracheotomie unter offensichtlich denselben Bedingungen kontraindiziert erscheint.

COURSE OF PRACTICAL INSTRUCTION IN BLOOD GAS MEASUREMENT

A 1½-day Course in blood gas measurement has been organized by the University Department of Anaesthesia, Western Infirmary, under the auspices of the Glasgow Postgraduate Medical Board, and will be held on Friday, May 31, and the morning of Saturday, June 1. The Course is intended for senior anaesthetists wishing to learn, in broad outline, the theory of blood gas measurement and to gain practical experience under guidance in the use of common blood gas equipment. There will be ample opportunity for discussion of practical problems encountered with these techniques. The programme of the Course will be:

FRIDAY A.M. Lecture Demonstration on blood gas electrodes; techniques and errors of blood sampling.
FRIDAY P.M. Practical instruction in the use of Astrup equipment and other relevant instrumentation.
SATURDAY A.M. Further experience in the use of blood gas equipment followed by closing discussion group.

The fee for the Course will be five guineas. Application forms can be obtained from the DIRECTOR OF POSTGRADUATE MEDICAL EDUCATION, UNIVERSITY OF GLASGOW. In the nature of such a Course the numbers attending must be strictly limited, and so early application to the Director of Postgraduate Education is advised.