Failed intubation revisited: 17-yr experience in a teaching maternity unit

L. HAWTHORNE, R. WILSON, G. LYONS AND M. DRESNER

Summary

We have reviewed 5802 Caesarean sections performed during general anaesthesia. Our use of general anaesthesia had decreased from 83 % in 1981 to 23 % in 1994. Despite this, the incidence of failed intubation has increased from 1 in 1984 to 1 in 250 in 1994. The problems associated with general anaesthesia in the obstetric population are increasing. Asians and African/Afrocaribbeans were represented disproportionately because of the increased use of general anaesthesia in these patients. Exposure of trainees to obstetric general anaesthetics has decreased by one-third. (Br. J. Anaesth. 1996; 76: 680–684)

Key words
Intubation, tracheal. Anaesthesia, obstetric.

Failed tracheal intubation has been an important cause of anaesthetic-related maternal morbidity and mortality. In the North American closed claims study, difficult tracheal intubation and oesophageal intubation comprised 23 % of damaging events associated with obstetric general anaesthesia [1]. In the Confidential Enquiries into Maternal Deaths in Great Britain for 1985–1987, four of six deaths directly attributable to anaesthesia were associated with failed tracheal intubation [2], but in the report for 1988–1990, only one of four deaths was a result of problems related to tracheal intubation [3]. Maternal deaths associated with anaesthesia at the beginning of the last decade comprised 13 % of all direct maternal deaths, but by the end of the decade this had decreased to 2.2 % [3, 4]. Maternal mortality related to anaesthesia has probably reached its nadir, and it may be reasonable to suggest that efforts to reduce maternal mortality further might be more effective if directed at the management of haemorrhage. It has been suggested that the decrease in mortality is a result of the declining use of general anaesthesia [5]. In 1981 general anaesthesia was used for 83 % of Caesarean sections in this unit, but by 1990 this had decreased to 33 % (fig. 1); currently the incidence is 23 %. Despite this, we have gained an impression that failure to intubate is no less common today than it was in 1985 when we last reviewed the performance of our unit [6]. Since 1985, we have expanded our data collection, introduced the laryngeal mask, pulse oximetry, capnography and a difficult intubation procedure (fig. 2). It seemed opportune that, at its 10th anniversary, we should revisit this topic, assess the impact of changes in clinical practice and verify our impressions.

Patients and methods

Between 1978 and 1994 we conducted a prospective audit of failure to intubate the trachea in our maternity unit. Failure to intubate was defined as intubation that was not accomplished with a single dose of suxamethonium, and therefore initiated the failed intubation drill (table 1). All women were visited after operation, the anaesthetist involved was interviewed and the information obtained was recorded. At the time of the postoperative visit, appropriate counselling was given, the significance of the incident for future anaesthesia explained and the case notes visibly annotated. The information recorded on our proforma is shown in table 2.

To support the review of these data, we sought additional information on subsequent anaesthetics by retrieval of case notes. The Birth Registers for each year were examined to provide details of the number of Caesarean sections performed, the percentage performed during general anaesthesia, whether the procedure was elective or emergency and time of operation. This was divided into three groups according to time of day and week: group 1, 08:00–17:00; groups 2, 17:00–21:00; group 3, 21:00–08:00 and the weekend. During normal working hours (group 1), theatre staff were designated to the obstetric theatre and consultant anaesthetists were available to oversee the work of trainees. In group 2 (17:00–21:00), theatre staff were available and medical staff cover was provided by the duty doctors for that day. In group 3 (21:00–08:00 and weekends), midwives provided the nursing staff cover, an operating department assistant was available from the general theatres in another section of the hospital and medical cover was again provided by the duty doctors.

Data collected were collated and presented against the background unit activity.

Results

Between 1978 and 1994, 5802 Caesarean sections were performed during general anaesthesia; there

L. A. HAWTHORNE, FRCA, R. C. WILSON, MRCP, FRCA, G. LYON, FRCA, M. DRESNER, FRCA, Department of Anaesthesia, St James’s University Hospital, Beckett Street, Leeds LS9 7TF. Accepted for publication: December 23, 1995.
Failed intubation revisited

were 23 (0.4%) failures to intubate the trachea. Our incidence of failed tracheal intubation had increased from 1 in 300 general anaesthetics in 1984 to 1 in 250 in 1994. Patient data are shown in table 3. Thirteen (56%) of the patients were white; there were five (22%) Asian patients and five (22%) were of African/Afrocaribbean origin.

GRADE OF ANAESTHETIST

The grade of anaesthetist was a senior house officer or registrar in 18 (78%) of the 23 incidents, a senior registrar or consultant anaesthetist in three (13%), and in two cases (9%) the anaesthetist was not named. The distribution workload of obstetric general anaesthesia in our unit is summarized in table 4.

TIME OF OPERATION

Sixteen (69%) of 23 failures occurred in group 3; five cases (22%) occurred in group 1, and two (9%) in group 2. This was compared with a typical 12-month period in table 5.

URGENCY

In two instances (9%) surgery was elective, emergency surgery was performed in 20 (87%), and there was one planned emergency (4%). This latter case was performed out of hours on a woman who was booked to have an elective Caesarean section but was...
admitted in labour. Elective operation normally comprises 56% of the total Caesarean sections (table 5).

PREOPERATIVE ASSESSMENT

All patients had been seen by an anaesthetist before operation but difficulty in tracheal intubation was anticipated in only one-third. Of these, two patients were noted to have a short neck and four had a receding jaw, two of whom also had prominent teeth. When recorded, Mallampati score [7] was either grade II or III. In 14 patients (61%) the trachea had been intubated successfully either before or subsequent to this.

LARYNGOSCOPY

At attempted intubation the Cormack and Lehane grade was described as 3 (only epiglottis visible) in 15 patients [8]. In one patient there was severe massesteric spasm and mouth opening was impossible. This patient was referred for muscle biopsy and suspected malignant hyperthermia; unfortunately she failed to attend follow-up appointments and eventually declined further investigation. Laryngeal oedema was reported in six patients; of these two had pre-eclampsia and another two had generalized oedema but were normotensive and had no evidence of proteinuria.

MANAGEMENT

Ventilation with a bag and face mask was described as difficult in seven patients (30%) and impossible in two (9%). Eighteen patients were allowed to waken and a regional technique was used; extradural anaesthesia in 10 (43%), spinal in five (22%) and combined spinal–extradural in three (13%). In three patients a laryngeal mask was inserted; in two the lungs were difficult to ventilate with a bag and face mask. Laryngeal oedema was noted in all three patients, two of whom had pre-eclampsia. Cricoid pressure was maintained and they all resumed spontaneous respiration. In a fourth patient a laryngeal mask was inserted but oxygenation proved impossible. It was removed and ventilation with a face mask was used until the patient resumed consciousness. This patient was a large woman (105 kg) with a short neck; she was oedematous but the cords were not seen.

One patient in whom ventilation was described as impossible had an attempted minitracheostomy which failed and was managed subsequently with a face mask and airway when spontaneous respiration unexpectedly resumed. In another case the patient’s trachea was subsequently intubated by the same anaesthetist after the failed intubation drill had been instigated, as a good view of the cords was obtained in the left lateral position.

OUTCOME

Despite the indications being fetal distress in seven cases, outcome was good for mother and baby in all but one patient. In the seventh, the mother’s outcome was good but her twins had cerebral damage.

FOLLOW-UP

All patients were visited after operation and examined, with particular reference to head, neck and jaw movements, mandibular size and awkward or prominent teeth. Postoperative examination details were not recorded for four patients. The commonest postoperative finding on examination was the presence of a receding jaw (nine patients) followed by limited mouth opening (seven patients); five patients had both these abnormalities. Prominent or awkward teeth were present in five patients, four of these also had a receding jaw. Limited head and neck movements were found in only three patients, associated with limited mouth opening in each case. One patient had all of these findings.

INVESTIGATIONS

Postoperative investigations included indirect laryngoscopy (six patients) and radiographic examination of the cervical spine (five patients) and mandible (five patients). In recent years we have excluded indirect laryngoscopy and X-rays from our regimen.

Discussion

Failed tracheal intubation is well documented in the obstetric population, with an incidence almost eight times higher than in other groups [9]. Against a relative background of declining use of general anaesthesia, the incidence of failure to intubate has increased in our maternity unit, from 1 in 300 general anaesthetics in 1984, to 1 in 250 in 1994. The working practice in our unit mirrors that of the nation as a whole [10]; an increase in the number of Caesarean sections, an increase in the percentage performed under regional anaesthesia and no change in the total number of obstetric general anaesthetics. The national mortality has decreased to approximately 1 in 100 000 Caesarean sections, but in common with most other units, we have no data to compare with this. On the other hand, our series has shown an increase in morbidity (failure to intubate). Whether or not this also reflects a national trend is...
bony structures are unchanged from the non-
case, therefore acting as their own controls. As
potentially contributory factors may also be

In the Confidential Enquiry into Maternal Deaths for 1976–1978 there was an inference that dark-
skinned patients were over-represented [11]. A
proportionately large number (46 %) of patients in
our series were Asian or Black, while this group comprised less than 20 % of all patients delivering in
our obstetric unit. Since the introduction of pulse
oximetry, cyanosis is no longer undetected. In a
review of maternal deaths in Michigan, inability to
establish airway patency was the main cause of
anaesthesia-related death in recent years; 13 of 15
deaths occurred in black patients and the three cases of failed tracheal intubation which resulted in fatality
were in this group [12]. Why should Asian and
African patients represent such a large proportion in
our series? This could be because of a higher incidence of Caesarean section in this group, but we
have not found this to be the case. A more likely
explanation is the increased use of general anaesthesia. In a recent audit (1994) of the Asian
population in our unit, 39 of 89 (44 %) of those
undergoing Caesarean section had a general anaesthetic compared with 179 of 847 (21 %) in non-
Asians. Asian women were 2.1 (95 % confidence
interval 1.8–2.4) times more likely to have a general
anaesthetic compared with 179 of 847 (21 %). We failed to demonstrate laryngeal oedema as a common contributory factor. This may be because of the fact that patients were referred for an ENT opinion when any oedema had subsided. In our review the commonest finding at
laryngoscopy was Cormack and Lehane grade 3.

We have commented on the anatomical and
physiological factors that can result in failure to
intubate, but there are environmental factors on the
labour ward that may contribute. The majority of
cases of failed intubation were emergencies, oc-
curring out of normal working hours and involved
trainees (senior house officers and registrars) working with “skeleton” theatre staff. Experience of general
anaesthesia for Caesarean section is diminishing,
especially among trainees. The annual mean in-
dividual case load of obstetric general anaesthetics in
these grades has decreased in the past decade, from
18 in 1984 to 12 in 1994. In 1984 there were 230
obstetric general anaesthetics performed; this inci-
dence had increased to 258 in 1994. This implies
that reduced exposure to general anaesthesia in
obstetrics is because of an increased number of
trainees rather than a decreased number of general
anaesthetics. As we have reported, the commonest
Cormack and Lehane grade was 3. Any procedure
must teach the management of intubation when
Cormack and Lehane grade 3 is found at laryn-
goscopy. We have aimed to do this, although we have
not been able to provide simulation in routine
operating lists as suggested [8]. Other factors which
may be relevant in the difficult obstetric intubation
include thoracic lift from a badly placed wedge
and over-enthusiastic cricoid pressure. This probably
explains why tracheal intubation was achieved
successfully in the left lateral position, but im-
possible when supine, in one of the patients in our
review.

In only one patient was neonatal outcome poor.
This may have been secondary to antepartum factors
and not associated with the delay in delivery because
of failed intubation. In one of the patients in our
review, oxygen saturation was recorded as low as
17 %. Despite this, both mother and neonate had a
favourable outcome. This is the only documented
case of severe hypoxia in our review. We believe that
in the event of failure to oxygenate the lungs of the
mother, further attempts at maternal resuscitation
should persist. There is now evidence to suggest that
neonatal outcome is more dependent on chronic
hypoxia and other antepartum factors [14] rather than the acute anoxia associated with temporary
inability to ventilate the lungs of the mother.
Delivery of the neonate should be expedited, how-

<table>
<thead>
<tr>
<th>Year</th>
<th>Asians</th>
<th>Regional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>45 (64 %)</td>
<td>25 (36 %)</td>
<td>70</td>
</tr>
<tr>
<td>1993</td>
<td>38 (43 %)</td>
<td>50 (57 %)</td>
<td>88</td>
</tr>
<tr>
<td>1994</td>
<td>39 (44 %)</td>
<td>50 (56 %)</td>
<td>89</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Non-Asian</th>
<th>Regional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>202 (27 %)</td>
<td>560 (73 %)</td>
<td>762</td>
</tr>
<tr>
<td>1993</td>
<td>192 (25 %)</td>
<td>587 (75 %)</td>
<td>779</td>
</tr>
<tr>
<td>1994</td>
<td>179 (21 %)</td>
<td>668 (79 %)</td>
<td>847</td>
</tr>
</tbody>
</table>

Table 6 Number of Asian and non-Asian patients undergoing Caesarean section and method of anaesthesia from 1992 to 1994. Chi-square = 73.14, significant at P < 0.0001 (for proportion of Asians undergoing general anaesthesia (GA))
ever, if maternal cardiac arrest is imminent, as this provides the best chance of neonatal survival and maternal resuscitation is usually impossible with a term fetus \textit{in utero}.

Since the last review of failed tracheal intubations in our unit in 1984, enthusiasm for postoperative investigations has waned. Indirect laryngoscopy was reported as normal in all patients during the past 17 yr. Although cervical spine radiographs yielded abnormalities in two patients in the previous review [6] we now feel that anatomical factors are less important.

In the last review of failure to intubate in our unit, the laryngeal mask airway had not gained widespread use. Recently however, the laryngeal mask airway has been used when intubation has not been possible. It was interesting that all three patients in whom successful use of the laryngeal mask was used had laryngeal oedema. Two of these patients had undergone tracheal intubation on a previous occasion and all three had normal postoperative findings. This would suggest that the use of the laryngeal mask in this clinical situation may be particularly justified.

The importance of maintaining cricoid pressure should be emphasized and gastric emptying with a stomach tube should be considered. Although protection against aspiration is not ensured, the laryngeal mask can help maintain oxygenation in patients whose lungs are difficult to ventilate with a bag and face mask or where life-threatening haemorrhage is imminent and surgery must be continued.

The successful use of the laryngeal mask for failed intubation in Caesarean section has been reported previously by McClune, Regan and Moore [15] and Chadwick and Vohra [16]. As suggested by Benumof [17], we have introduced a difficult intubation regimen, but we have not seen a reduction in failure to intubate. We have now modified our difficult intubation regimen to include the laryngeal mask airway (fig. 2).

\textbf{References}


