FACTOR ANALYSIS IN PATIENTS WITH A HISTORY OF FAILED TRACHEAL INTUBATION DURING PREGNANCY

L. FAHY, W. A. HORTON AND P. CHARTERS

SUMMARY

Eight patients with a history of failed tracheal intubation during pregnancy were investigated by x-ray laryngoscopy after delivery. Partial elevation of the epiglottis with no view of glottic structures was found in five patients who were therefore considered to still present difficulty. In each of these five patients the blade tip failed to make contact with the hyoid and in four this was explained by the tongue being compressed into a pear shape such that it prevented sight of the larynx. Relatively few abnormal anatomical indices were seen in these patients and this was in keeping with the level of difficulty encountered. An angular measure of jaw protrusion from a line joining the upper incisors and a point just above and anterior to the vocal cords, to the mid-point on the inner surface of the mandible was useful: the lower angle of this triangle was as important as the angle at the incisors.

KEY WORDS


Patients presenting difficulty at laryngoscopy during the later stages of pregnancy are sometimes assumed not to be difficult when not pregnant. Certain factors may be peculiar to the later stages of pregnancy (such as mammamegaly, oedema of the larynx, a floppy large tongue and the wedged position), and anxiety about failed intubation, aspiration and maternal death on the part of the anaesthetist is also important [1]. X-ray laryngoscopy was used to investigate the soft tissue factors in a group of these patients.

METHODS AND RESULTS

Over a 4-yr period (1983–86), the Anaesthetic Events Records of a District General Hospital with 4500 deliveries per annum, contained 12 cases of difficult tracheal intubation in pregnancy. (This was estimated as an incidence of 1 in 140 general anaesthetics in the Maternity Unit.) Following local Ethics Committee approval, 10 of these patients were traced and, after explanation, eight agreed to take part in the study. Their mean age was 34 yr (range 28–44 yr) and the patients were investigated between 1 and 4 yr (mean 3 yr) after the time of delivery.

The original reports did not usually allow a laryngoscopy grading to be inferred with accuracy, but in each patient it was clear that a failed intubation procedure had been undertaken because of difficulty at laryngoscopy, no view of the vocal cords having been obtained. The anaesthetists concerned were of at least registrar grade with a minimum of 3 years’ anaesthetic experience. The obstetric procedures were: retained placenta (three), postpartum sterilization (one), vaginal extraction (for breech) (one), Caesarean section (three, one of which was elective). In only one patient was difficulty with intubation anticipated.

The x-ray laryngoscopy technique and the laryngoscopy grading were as reported for our group of abnormal patients, and the results were analysed in the same way. The reader is referred to an accompanying paper [2] for an explanation of methodology and terminology. Approximation to the standard intubating position during x-ray laryngoscopy was confirmed in each subject by
TABLE I. X-ray features, neck and jaw characteristics. Abnormal indices are as defined previously [2]: *P < 0.05. Eol° = "Ease of Introduction" angle: Com° = "complementary" angle

<table>
<thead>
<tr>
<th>Subject No.</th>
<th>Grade</th>
<th>Eol°</th>
<th>Com°</th>
<th>X-ray features</th>
<th>Soft tissues</th>
<th>Jaw comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>E2</td>
<td>14.5</td>
<td>8.0*</td>
<td>—</td>
<td>—</td>
<td>Large JIT*</td>
</tr>
<tr>
<td>2</td>
<td>E2</td>
<td>10.5*</td>
<td>8.0*</td>
<td>Relatively large tongue (hyoid asymmetrical)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>E2</td>
<td>13.5</td>
<td>8.5*</td>
<td>Unusual curved epiglottis</td>
<td>Air gap anterior to tip</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>E3</td>
<td>20.5</td>
<td>13.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>E2</td>
<td>9*</td>
<td>6.5*</td>
<td>Relatively large tongue</td>
<td>Short neck*</td>
<td>Short mandible/maxilla*</td>
</tr>
<tr>
<td>6</td>
<td>E4</td>
<td>9*</td>
<td>6.5*</td>
<td>Very short epiglottis</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>7</td>
<td>E3</td>
<td>18</td>
<td>11.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td>E2</td>
<td>17</td>
<td>11.5</td>
<td>Relatively large tongue</td>
<td>—</td>
<td>Bull neck*</td>
</tr>
</tbody>
</table>

"face line" and "tracheal alignment" measurements. Cervical vertebral alignment was variable and only patient No. 6 exhibited the expected normal pattern—straight until C4 and progressively increasing extension above.

The main results are documented in Table I. Close proximity of the blade tip to the hyoid body occurred in three patients in whom the view was grade E3 or E4. Patient No. 3 had an airspace between the blade tip and the hyoid and an unusually angled epiglottis. The airspace was probably caused by a "V-shaped" hyoid bone which occurs in 5% of normal subjects [3]. In the remaining four patients the blade tip was well back from the body because of the previously described "partial peardrop" effect [2].

Comparison with expected mid-line angles showed that only V01 and 1ST differed from normal (P < 0.01 and P < 0.05, respectively). The mandibular symphysis protruded less than in normal subjects, but mouth opening was similar. In the 1ST triangle comparisons, "Ease of intubation" angle (EoI) and "complementary" angle differed equally from normal values (P < 0.01, in each case). One or both of these angles was reduced in five patients and this corresponded with a restricted view of the larynx in all except patient No. 6 in whom the posterior commissure was visible. This patient had a particularly short epiglottis. Patient No. 8 had normal EoI and complementary angles, despite being the only patient considered clinically to be an obvious difficult intubation risk. Relative to the space available, the tongue was large in three patients (Nos 2, 5 and 8), so that the major part of its posterior surface was in contact with the posterior pharyngeal wall during laryngoscopy.

COMMENT

In 1985 Lyons described a series of eight failed intubations which occurred in the late stages of pregnancy [4]. Five had lateral x-rays of the cervical spine and abnormalities accounted for the difficulty in two. Four underwent indirect laryngoscopy by an Ear, Nose and Throat surgeon and were considered normal. The present study indicates that such assessments may not be helpful because the peardrop effect occurs only as a result of direct laryngoscopy. X-ray laryngoscopy demonstrates the contribution of soft tissue factors to the difficulties encountered on direct laryngoscopy.

Unusual angulation of the epiglottis has been demonstrated with magnetic resonance imaging and suggested as a cause of tracheal intubation difficulty [5]. This was evident in patient No. 3 (but not suspected during laryngoscopy). A V-shaped hyoid could account for the additional finding of an unexpected airspace between the blade tip and hyoid body in this patient, as this would limit approximation. There was indirect evidence to support this explanation because, anatomically, the hyoid is described as fitting into the inner surface of the mandible and, from traced lower border outlines, this was the most V-shaped of any mandible in our three reported study groups.

Comparison between these results and those for the abnormal group is instructive. Fewer indices of abnormality were found in this study but, even so, only two patients had no abnormality as judged by the indices and both were E3, which we have described as minimally difficult. In contrast, more difficult cases tend to have a number of
abnormalities as defined by the objective assessment indices, and further experience refining this simple approach may be expected to improve its discriminating potential.

Several women who do not appear to be at risk of difficulty with tracheal intubation have been shown to be difficult when not pregnant; soft tissue factors were important. If the tongue appears large for the space available in the non-pregnant state, any further increase in size may have important implications for intubation during pregnancy. When soft tissue factors contribute to difficulty this may imply more room for manoeuvre than with rigid restrictions (such as limited mouth opening). Most commonly, however, there is a combination of factors and the appearance of the tongue is as large relative to the space available rather than one of absolute macroglossia.

REFERENCES