DIFFICULT LARYNGOSCOPY—THE "ANTERIOR" LARYNX AND THE ATLANTO-OCCIPITAL GAP

H. C. Nichol and D. Zuck

SUMMARY

The atlanto-occipital distance is the major factor which limits extension of the head on the neck. It varies widely in the population at large. When the posterior tubercle of the atlas is already in contact with the occiput in the neutral position, attempts to extend the head result in anterior bowing of the cervical spine, and forward displacement of the larynx. This may be a cause of difficult laryngoscopy.

Despite the importance of tracheal intubation in the practice of anaesthesia, the problems of exposing the larynx have received surprisingly little attention. Probably Gillespie (1941), and Bannister and Macbeth (1944), provided the first analyses of the anatomical factors involved in difficult laryngoscopy. For Gillespie the solution was to attain adequate depth of anaesthesia and muscular relaxation; for Bannister and Macbeth it was so to position the head that the axes of the mouth, pharynx and larynx came into line. With the introduction of myoneural blocking drugs intubation became much easier, but some difficulties remained. Cass, James and Lines (1956) described five cases of difficult intubation, and attempted to relate the difficulties to the dimensions of certain anatomical features, such as the angle of the mandible and the distance from the incisors to its posterior border.

White and Kander (1975) determined one ratio and one measurement by which they distinguished the difficult group; the ratio of the posterior depth of the mandible to the effective mandibular length, and the distance from the occiput to the atlas.

Value of predictions

The importance of difficult or failed intubation of the trachea as a cause of death in obstetric anaesthesia is recognized, and it would be useful to have some clinical means of determining those patients likely to present problems. Although some early observations confirmed the findings of White and Kander (Zuck, 1976), experience since, and consideration of the mechanics of head extension, has suggested that the factor that may be relevant in the greater number of patients is the atlanto-occipital distance. To this end we have been conducting an investigation into the range of extension at the atlanto-occipital joint, and attempting to establish a measurement outside which difficulty might be expected, and so anticipated. This investigation, although embarked upon as a result of empirical observations, directed our thoughts to the mechanics of laryngoscopy, and we would offer the following observations as a contribution towards the understanding of the difficulty that is sometimes described as the "anterior larynx". Let us say at once that our remarks apply to patients whose upper incisors are still present; with the exception of young babies this type of difficulty is not encountered in its extreme form in the edentulous—not because the anatomy is different, but because the absence of teeth enables the laryngoscope blade to be inserted at an angle more obtuse to the larynx.

Anatomical factors

Almost all of the extension of the head on the neck that is helpful to the laryngoscopist takes place at the atlanto-occipital joint, and the amount of extension that can be achieved is limited by the abutment of the occiput against the posterior tubercle of the atlas. "The atlas or first cervical vertebra is a ring of bone. It has no body and no spine . . . a spine has not been developed on it because it would hamper the backward movement of the head" (Brash and Jamieson, 1937). It follows, therefore, that the greater the atlanto-occipital distance in the neutral position, the greater the degree of extension that is possible. Conversely, if the occiput and the atlas are already in contact in the neutral position, no extension can take place at the atlanto-occipital joint.
Our observations, in line with those of White and Kander (1975), have shown that there is a wide variation in the atlanto-occipital distance, to the extent that it would be inappropriate to speak in terms of normal and abnormal (figs 1, 2A). In those people at one extreme of the range, however, the occiput appears to be actually in contact with the atlas in the neutral position (figs 2A, 3A), and our experience indicates that this is not uncommon. Examination of radiographs of several individuals in whom this condition was observed leads us to suggest that this was a result of what appeared on the radiographs to be a scaphoid configuration of the atlas, a variation which does not seem to have been described previously. In these individuals extension at the atlanto-occipital joint is impossible; and although, contrary to what the anatomy text-books would have us believe, some extension may take place between atlas and axis (fig 2B) in some individuals, in general attempts to extend the head result in bowing forward of the cervical spine, which lifts the larynx forwards out of the line of view (figs 2B, 3B). This can be demonstrated easily in appropriate cases. Instead of the head extending on the neck when backward rotational pressure is exerted on the vertex, there is an unmistakable sense of springy rigidity, and when viewed from the side the neck can be seen to arch forwards, pushing the larynx in front of it. Age is not a factor; figures 3A and 3B are radiographs of a child of 9 years-of-age, in whom laryngoscopy was very difficult. Whether a small atlanto-occipital distance is usual in the very young, in whom the larynx is described as orientated more anteriorly, is something we have not felt justified in investigating. However, the mechanism we describe is implicitly recognized by Hatch and Sumner (1981): “The head should not be extended at the neck, but at the atlanto-occipital joint, producing a “sniffing” position . . . the assistant presses the baby’s shoulders firmly onto the surface of the operation table with both palms while his fingers hold the head steady on either side. The position of the head is crucial for successful intubation. The shoulders must not be allowed to rise from the table.”

FIG. 1. Ample atlanto-occipital clearance.

patients it is even more important than usual to raise the occiput above the shoulders. Head extension is limited not only in pathological conditions such as spondylosis and rheumatoid arthritis; it may be very much limited by anatomical variation in people who are otherwise regarded as normal. Conversely, the ability to achieve a good degree of extension at the atlanto-occipital joint in patients with an otherwise rigid cervical spine would explain why intubation in such patients is not always difficult.

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REFERENCES


CONCLUSION

A number of anatomical variables have been proposed as having an influence on the mechanics of direct laryngoscopy. White and Kander (1975), for example, have clearly demonstrated the significance of two of these. We suggest, however, that of these the atlanto-occipital distance may be the more important. Pre-anaesthetic assessment of head extension at the atlanto-occipital joint will provide warning of likely difficulty with laryngoscopy. In such
ZUSAMMENFASSUNG


SUMARIO

La distancia atlanto-occipital constituye el mayor factor que limita la extensión de la cabeza en el cuello. Varía grandemente en la población en general. Cuando el tubérculo posterior del atlas se encuentra ya en contacto con el occipucio en su postura neutra, los esfuerzos para extender la cabeza resultan en una inclinación anterior de la espina cervical y un desplazamiento hacia adelante de la laringe. Esto puede causar una laringoscopía difícil.