With ready access to non-invasive imaging techniques, compression at the cranio-cervical junction can be readily demonstrated in a way that was hazardous when myelography and angiography were the only tools available. Compression of the neuraxis in this region can be accurately visualized, providing a greater understanding of the pathophysiological mechanisms underlying the clinical symptoms and signs. The conventional posterior fossa or high cervical laminectomy approach to lesions anterior to the neuraxis is fraught with complications particularly when the pathology is extradural. Even when the lesion is a bony compression in the area, experience has shown that decompression posteriorly may not achieve the desired effect and, instead, may cause a deterioration in the patient's condition. It seems logical to approach the area from the front when the pathology is anteriorly placed, but surgeons have been reluctant in the past to adopt a transoral approach on a routine basis because of the reported incidents of complications and difficulty with the exposure.

The purpose of this article is to demonstrate some of the more common pathological conditions which may be present and to illustrate that the surgical procedure can be relatively straightforward. The author's experience of using specially designed equipment in over one hundred transoral procedures both for extradural and intradural lesions has shown that the rate of complications may not be any higher than the more conventional posterior approaches.

**Surgical Pathology**

There is a broad spectrum of disease which can affect the cranio-cervical junction and cause compression of the brain stem and upper cervical cord. **CONGENITAL MALFORMATIONS** are relatively common and may result in basilar invagination and/or subluxation of the odontoid peg causing either a fixed compressive lesion as in osteogenesis imperfecta and the Klippel-Feil Deformity (Figure 1) or an intermittent compression as noted in Down's Syndrome. **TRAUMA** may affect the area and while it is often fatal, the patient may survive to develop secondary neurological signs consequent on instability or compression due to malunion. **INFLAMMATORY AND DEGENERATIVE DISEASE**, such as rheumatoid arthritis (Figure 2) and ankylosing spondylitis, may compress the neuraxis by soft tissue inflammatory formation or by erosion of the joints leading to translocation of the odontoid peg through the foramen magnum. The ligaments may rupture as part of the inflammatory process leading to instability. **EXTRADURAL TUMORS** (Figure 3) may be present in this area. Chordomas are the commonest primary tumor in the clival region and metastases may produce intractable occipital pain when involving the occipital condyle or the first two cervical vertebrae. Very occasionally **DURAL** or **INTRADURAL TUMORS** are found in the midline and being surrounded by the lower cranial nerves and vertebral artery may be relatively inaccessible by a posterior approach. Occasionally **ANEURYSMS** of the midbasilar region have been approached transorally. Occasionally, too, the anterior compression is due to an inappropriate posterior fossa decompression or high cervical laminectomy which causes instability and allows posterior subluxation of the odontoid peg to compress further the cranio-cervical junction.

**INDICATIONS FOR ANTERIOR APPROACH**

The general principles on which the surgical approach should be decided are based on the following questions:

What exactly is the abnormality? Will there be structural stability? Is the neurological condition be stable after surgical intervention?

Magnetic Resonance Imaging and Computed Myelotomography have revolutionized the understanding of the pathological mechanism in the area. Both techniques not only display the bony abnormalities of the extradural compressive mass but show the exact position of the neuraxis, the degree of compression, and on many occasions the position of the vertebral and basilar arteries. Flexion and extension studies with either technique allow determination of cranio-cervical stability. It is this degree of visualization that is required in the detailed planning of an anterior surgical approach. Conventional polytomography or routine myelography do not provide enough information.

The main indications for a transoral approach is that the lesion is anterior to...
the neuraxis and that the degree of compression is significant and likely to be made worse by a posteroior postero-lateral approach. In addition, if there is cranio-cervical instability a posteroior fixation alone might increase the degree of brain stem and spinal cord compression. While most intradural lesions are still more easily approached from a postero-lateral conventional approach, if the lesion is exactly in the midline and the cranial nerves and vertebral arteries are pushed posteriorly by the lesion, it is the author's contention that an anterior approach may allow removal of the lesion without sacrifice to the lower cranial nerves. With meticulous attention to the techniques described below, the risks of transoral cerebro-spinal fistula are low indeed. In patients in whom cranio-cervical instability is present, the author prefers to perform the transoral decompression and the posterior fixation during the same anaesthetic. In this way, the patient recovers from anaesthesia, decompressed and stable, and thus can be mobilized more rapidly following surgery.

TECHNIQUE

1. Anaesthesia: For all lesions in which there is cranio-cervical instability, fiberoptic nasotracheal intubation with local anaesthesia is performed in the awake patient. This reduces considerably the risk of compression during induction. The nasotracheal tube post-operatively is well tolerated by most patients and, it and a nasogastric tube passed pre-operatively are used to divert all pulmonary and gastric secretions from the operative site in the immediate post-operative period with considerable reduction in wound problems.

Monitoring of such patients is difficult. Respiratory pattern in the spontaneously breathing patient is still the most reliable method in our hands. Cortical evoked motor potentials and somato-sensory evoked potentials have been used but are less reliable. Close cardio-vascular monitoring is essential. The detailed technique is outlined by Calder.

2. Surgery: A retraction system has been developed which allows a wide exposure of the posterior pharynx up to the anterior rim of the foramen magnum without division of the soft palate. The tongue retractor and the soft palate retractors are fixed on a circumoral halo to which additional suction and fibrelight may be added. For lesions above the foramen magnum, the soft and occasionally the hard palate are divided and a specially designed retractor separates them and allows the exposure of the naso-pharyngeal mucosa. The pharynx is divided in the midline down to the spinal column and again the retraction system will allow a wide exposure and protection of laterally placed structures such as the carotid artery (Figure 4). The operating microscope is essential and the bone is removed using a high speed air drill. If dura is opened inadvertently in an extradural procedure or by design for a dural or intradural surgical approach, then the defect is closed with fascia lata and surgical patch which is held in position with a fibrin glue, TISSEAL™. A lumbar drain is inserted to reduce CSF pressure and remove surgical debris and, five days later the lumbar drain is converted into a lumbo-peritoneal shunt. With this technique the complication of CSF fistula and meningitis have been all but eliminated. Whether the dura is opened or not the pharyngeal wound is closed in two layers of absorbable suture.

Post-operatively the patients are kept in an intensive care unit until they have fully recovered. Elective ventilation may be used for a brief period post-operatively. The most important post-operative points are the prevention of gastric and pulmonary soiling of the wound. The nasotracheal tube is left in position for one to five days. The nasogastric tube is used to empty the stomach for 24 hours, and when bowel sounds have returned, parenteral feeding is commenced. The patient is mobilized out of bed as quickly as possible. In those who are judged unstable, a posterior occipito-cervical fusion is used.

SUMMARY

The transoral route to the anterior aspect of the cranio-cervical junction is recommended for further study. With appropriate retraction and instrumentation, the surgery is relatively straightforward, complications are avoided by sound wound closure, diversion of CSF where necessary and meticulous post-operative care.

REFERENCES


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