TRANSORAL FUSION
FOR HIGH CERVICAL FRACTURES

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We report three patients having transoral fusion at C2/3 or C3/4 after fractures, with no infections or surgical complications and sound union. The operative technique and the relative merits of different approaches to the upper cervical spine are discussed and the transoral approach to the anterior aspect of the upper three cervical vertebrae is commended to the specialist surgeon.

Surgery in the region of second and third cervical vertebral bodies is traditionally performed through a posterior, lateral or anterolateral approach, even though access may be made difficult by the lower cranial nerves and major blood vessels. The transoral approach – originally described over 70 years ago by Kanavel (1919) – provides a direct route to the anterior aspect of the vertebrae but has not been popular, largely because of difficulty of access and the fear of infection and loss of the bone graft (Bonney and Williams 1985). With the use of specially designed instruments, microsurgical techniques and antibiotic cover, these dangers have receded (Crockard 1988). We report three cases in which anterior cervical discectomy and fusion at C2/3 or C3/4 were performed through transoral, transephyngieal approaches without significant problems.

CASE REPORTS

Case 1. A 25-year-old woman, driving without a seat belt or head restraint, sustained bipedicular fractures of the second cervical vertebra (Fig. 1a). She was referred 10 weeks later for persisting neck pain and restricted neck movements. She had no abnormal neurological signs. A CT myelogram showed slight anterior indentation of the theca without cord compression, and there was no evidence of bony fusion. In view of this and the instability at C2/3, even in the absence of cord compression or neurological deficit, an anterior bony fusion at C2/3 level was advised and performed via the transoral route.

Postoperatively, the patient made a good recovery and wore a SOMI brace for three months. The neck pain resolved and there were no neurological complications. Radiographs in flexion and extension showed good bony fusion, with no subluxation (Fig. 1b), and almost complete neck mobility in all directions was restored.

Case 2. A 45-year-old woman was referred and admitted eight weeks after a road accident in which she had sustained a compound depressed skull fracture, pedicle fractures of C2, and fractures of the right tibia and right first metacarpal. A subdural haematoma had resolved spontaneously but she had spastic quadriparesis with dysphasia and dysarthria.

In view of the potential danger of cord injury, the C2 pedicular fracture was stabilised by bone grafts between the vertebral bodies of C2 and C3 using the transoral route. A closely fitting preformed collar was used after operation. The patient made a good recovery, the wound healing completely. A check radiograph three months after operation showed good bony fusion and she regained full neck mobility.

Case 3. A 42-year-old man tripped and fell, sustaining an acute spinal cord injury which rendered him quadriplegic. After rehabilitation he was able to walk with the help of one person, but one year later he suddenly developed a profound increase in weakness in both arms and legs and was on the verge of respiratory failure.

Radiography showed backward displacement of the bodies of C2 and C3, and a CT myelogram in flexion and extension revealed C3/4 instability with anterior and posterior compression in relation to congenital narrowing of the canal at this level (Fig. 2a). Operation by the
transoral route for C3/4 discectomy and fusion resulted in good decompression (Fig. 2b). His postoperative course was stormy with severe chest infection requiring tracheostomy and long-term ventilation. His respiratory function ultimately improved but there was little recovery in his limbs.

OPERATIVE TECHNIQUE
The anaesthetic technique has been described in detail elsewhere (Calder 1987), but in summary intubation is performed under fibre optic endoscopic control by a transoral route, and a nasogastric tube is inserted, for postoperative emptying of the stomach and for later feeding. The patient's head is held in a Mayfield holder, which provides firm fixation and some distraction throughout the procedure. A self-retaining oral retractor is inserted to depress the tongue and pull it forward to provide a good view of the posterior pharyngeal wall. The soft palate is retracted and the nasotracheal and nasogastric tubes are held aside by attachments (Codman instruments) on the main retractor (Figs 3a and b). The illumination and magnification provided by an operating microscope are essential.

Figure 1a – Case 1. Lateral radiograph of the cervical spine showing bipedicular fractures of the second cervical vertebra. Instability was shown on the CT myelogram. Figure 1b – The postoperative radiograph shows sound fusion.

Figure 2a – Case 3. Pre-operative CT myelogram showing compression of the theca opposite C3 and C4 vertebral bodies. Spinal cord compression was shown on the transverse views at this level. Figure 2b – Postoperative CT myelogram showing relief of anterior compression. This was confirmed on the transverse views.
A midline incision is made after infiltrating the posterior pharyngeal wall with 1% lignocaine and 1:200 000 adrenaline. The incised edges are held apart by a self-retaining retractor and the C2/3 interspace is identified radiographically. The intervertebral disc and the vertebral end plates are removed and an angled high-speed drill is used to create a hole approximately 12 mm in diameter down to the posterior longitudinal ligament (Cloward 1958). After adequate decompression of the spinal canal, a piece of bone from the iliac crest is fashioned to form a tight graft and is gently hammered into position. The pharynx is closed in two layers with Vicryl stitches.

Recovery from the anaesthetic is allowed in a preformed collar or a SOMI brace, without the use of skull traction or a halo-body jacket. The nasotracheal tube is kept in for 48 hours and the nasogastric tube for five days. A check radiograph is taken to ensure a satisfactory position of the graft and to exclude significant retropharyngeal swelling. Antibiotic cover is provided for the whole peri-operative period.

**DISCUSSION**

The upper part of the cervical spine can be approached by various routes. Where instability is the main problem or the predominant compression is from behind, a posterior approach for decompression and stabilisation has been preferred. If however, the main compression is anterior, as in cervical spondylosis or in disc prolapse, this approach fails to stop the progress of the disease and may often make the neurological signs worse. In these cases, anterior decompression and stabilisation allows good neurological recovery, preserves the anatomical integrity of the joints and ligaments, and permits good postoperative movement. It does not produce the complications associated with laminectomy such as kyphosis and angulation (Crockard 1988).

Access to the anterior aspect of the upper cervical spine is either through a transoral route or through the side of the neck, in front of, behind or through the divided sternocleidomastoid. These lateral and anterolateral approaches provide an excellent exposure of the mid and lower cervical spine with minimal tissue dissection and blood loss, but the exposure becomes increasingly difficult higher up in the neck, where dissection is made difficult by the parotid gland and the mandible, and there is need to retract major blood vessels which are relatively fixed at the base of the skull. In addition, branches of the external carotid artery and lower cranial nerves pass across the operative field (Fang and Ong 1962). In patients with short fat necks, or where extension and lateral rotation of the neck is precluded by a structural lesion such as postlaminectomy kyphosis, only an oblique view is possible and the operation can only be performed with considerable difficulty and risk of complications (Whitesides and Kelly 1966).

The alternative trans-thyrohyoid approach described by Fang and Ong (1962) has not been popular. With this approach there is a risk of severing the epiglottis; it also endangers the superior laryngeal artery and internal laryngeal nerve. Moreover, prolonged tracheostomy for six weeks after surgery is advocated; this is not only unnecessary but has a significant morbidity.

In contrast, the transoral approach is simple and provides a direct midline view of the upper cervical vertebrae. Only the pharyngeal mucosa and the constrictor and prevertebral muscles cover the anterior aspect of the cervical spine. The approach is relatively avascular.
with no intervening cranial nerves and the vertebral arteries are at least 14 mm away from the midline. For these reasons, the transoral route is attractive and, with appropriate instruments, the procedure is relatively straightforward, providing an excellent view of the front of the cervical spine, from the rim of the foramen magnum down to C3 and even C4 vertebral bodies.

The incidence of infection has been high in some reported series using the transoral approach, but this can be reduced by gentle handling of the tissues and the use of an operating microscope and appropriate antibiotic cover. In none of the three cases we report was there infection of the pharyngeal wound or bone graft, and we have had no such problems in any of 130 transoral procedures performed for other indications. Orthopaedic surgeons and neurosurgeons have been reluctant to attempt transoral bony fusion, but it is worth remembering that in maxillofacial surgery, bone grafts are used routinely around the oral cavity without major problems. When the graft has been placed under compression there is no need for immobilisation by a halo-body cast or by traction.

Although we report only a small number of operations on the C2/3 area, their success, with no significant difficulties or complications, encourages us to suggest that experienced surgeons should consider the use of this approach.

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REFERENCES