Occipitocervical fusion

see Occipitocervical junction

see Occipital fixation system (for materials and surgical technique).

**History**

Foerster firstly proposed the occipitocervical fusion with free vascularized fibular grafting in 1927. After then, many different kinds of posterior occipitocervical fusion and fixation techniques have been reported. Occipitocervical bone grafting with additional sublaminar wiring may be more stable than single bone grafting. However, the patient still need bed rest for 12 weeks. Spinal cord injury and rotational instability often occurred in those patients.

Ransford described a novel technique in 1986. An anatomically contoured steel loop was secured to the occiput via small burr holes and to the vertebrae by sublaminar wiring. It afforded a rigid stabilization. The patient could mobilise with a cervical collar or cervicodorsal brace only.

In early 1990s, occipitocervical plate had been applied, and then screw-rod system. In 2000, universal vertebral pedicle screw has been widely used. The posterior occipitocervical fixation could provide more stable fixation, which is relatively easier to perform and less risky.
Indications

Occipitocervical fusion is indicated in the management of craniocervical instabilities resulting from trauma, rheumatoid arthritis, tumors and congenital anomalies of the craniocervical junction. Accurate imaging studies and proper patient selection are the keys to a successful outcome. Occipitocervical fusion procedures can be performed with low morbidity. A comprehensive knowledge of the anatomy of the occipital-cervical junction is imperative. A wide variety of stabilization techniques and instrumentation systems are currently available, each of which has its own advantages and disadvantages.

Types

Occipitocervical fusion in pediatric patient.

C2 entry point
Complications

Occipitocervical fusion Complications.

Videos

Case series

2016

The study population consisted of 20 boys and 20 girls, with a mean age of 7.3 years. Trauma (45% [n = 18]) was the most common cause of instability, followed by congenital etiologies (37.5% [n = 15]). The condyle-C1 interval had a diagnostic sensitivity of 100% for atlantooccipital dislocation. The median number of fixated segments was 5 (occiput-C4). Structural bone grafts were used in all patients. Postsurgical neurological improvement was seen in 88.2% (15/17) of patients with chronic myelopathy and in 25% (1/4) of patients with acute myelopathy. Preoperatively, 42.5% (17/40) of patients were neurologically intact and remained unchanged at last follow-up, 42.5% (17/40) had neurological improvement, 12.5% (5/40) remained unchanged, and 2.5% (1/40) deteriorated. All patients had successful fusion at 1-year follow-up. The complication rate was 7.5% (3/40), including 1 case of vertebral artery injury.

Occipitocervical fixation is safe in children and provides immediate immobilization, with excellent survival and arthrodesis rates. Of the radiographic tools evaluated, the condyle-C1 interval was the most predictive of atlantooccipital dislocation.\(^6\)

2010

799 adult patients who underwent posterior occipitocervical fusion were analyzed for radiographic and clinical outcomes including fusion rate, time to fusion, neurological outcomes, and the rate of adverse events.

No articles stronger than Class IV were identified in the literature. Among the patients identified within the cited articles, the use of posterior screw/rod instrumentation constructs were associated with a lower rate of postoperative adverse events (33.33%) (p < 0.0001), lower rates of instrumentation failure (7.89%) (p < 0.0001), and improved neurological outcomes (81.58%) (p < 0.0001) when compared with posterior wiring/rod, screw/plate, and onlay in situ bone grafting techniques.

The surgical technique associated with the highest fusion rate was posterior wiring and rods (95.9%) (p = 0.0484), which also demonstrated the shortest fusion time (p < 0.0064). Screw/rod techniques also had a high fusion rate, fusing in 93.02% of cases. When comparing outcomes of surgical techniques depending on the disease status, inflammatory diseases had the lowest rate of instrumentation failure (0%) and the highest rate of neurological improvement (90.91%) following the use of screw/rod techniques.
Occipitocervical fusion performed for the treatment of tumors by using screw/rod techniques had the lowest fusion rate (57.14%) ($p = 0.0089$). Traumatic causes of occipitocervical instability had the highest percentage of pain improvement with the use of screw/plates (100% improvement) ($p < 0.0001$).

Based on the existing literature, techniques that use screw/rod constructs in occipitocervical fusion are associated with very favorable outcomes in all categories assessed for all disease processes. For patients requiring occipitocervical arthrodesis for the treatment of inflammatory diseases, screw/rod constructs are associated with the most favorable outcomes, while posterior wiring and onlay in situ bone grafting is associated with the least favorable outcomes. Occipitocervical arthrodesis performed for the diagnosis of tumor is associated with the lowest rate of successful arthrodesis using screw/rod techniques, while posterior wiring and rods have the highest rate of arthrodesis. The nonspecified disease group had the lowest rate of surgical adverse events and the highest rate of neurological improvement 7).

**Case reports**

Vertebral artery arteriovenous fistula (AVF), after iatrogenic vertebral artery injury (VAI), is a rare but serious complication of upper cervical spine fixation surgery.

Qian et al., report a case of a 59-year-old female patient who had a vertebral AVF following transpedicular occipitocervical fixation surgery. Endovascular embolization of the AVF was successfully performed using ethylene vinyl alcohol. From this case they learned that preoperative evaluation of the course of the vertebral artery is necessary, and vertebral artery embolism is an effective and safe method to treat vertebral AVF after proof of a patent second vertebral artery 8).

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1) Foerster O: Die Leitungsbahnen des Schmerzgefühls und die chirurgische Behandlung der Schmerzzustände. 1927, Berlin: Urban & Schwarzenburg