Case Report = Спостереження з практики = Наблюдение из практики

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Transoral osteosynthesis for C1 fractures: two cases report

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The upper cervical spine fractures are rare and often fatal injuries so immediately with the traumatic event. Due to the amplitude of the spinal canal in the upper cervical region, only 16% of the survivors exhibit neurological compromise, so they can go unnoticed for emergency care. C_1 injuries are rare. We report two cases in relation to our experience in the management of this injury through transoral.

Key words: *upper cervical spine fractures; cervical spine fusion; spinal instrumentation.*

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Трансоральный остеосинтез при переломах C_1: наблюдение двух пострадавших

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Перелом верхних шейных позвонков – редкое повреждение, часто со смертельным исходом в момент травмы. В связи с подвижностью позвоночного канала в верхнешейном отделе позвоночника только у 16% выживших обнаруживают неврологический дефицит, вследствие чего неотложная помощь им не показана. Травмы C_1 редки. Приведены два наблюдения стабилизации позвоночника при травме C_1 с применением трансорального доступа.

Ключевые слова: *перелом верхних шейных позвонков; стабилизация шейного отдела позвоночника; стабилизирующие системы позвоночника.*

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Трансоральний остеосинтез при переломах C_1: спостереження двох потерпілих

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Перелом верхніх шийних хребців — рідкісне пошкодження, часто зі смертельним наслідком в момент травми. Через рухливість хребтового каналу у верхньошийному відділі хребта тільки у 16% пацієнтів, які вижили, виявляють неврологічний дефіцит, внаслідок чого невідкладна допомога їм не показана. Травми C_1 рідкісні. Наведені два спостереження стабілізації хребта за травми C_1 з використанням трансорального доступу.

Ключові слова: *перелом верхніх шийних хребців; стабілізація шийного відділу хребта; стабілізуючі системи хребта.*

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Introduction. The anterior aspects of the upper cervical spine continues to challenge despite the steady progress made over the past 60 years [1]. Injuries of the atlantoaxial complex account for roughly one fourth of all cervical spine injuries and are notorious for causing diagnostic and therapeutic problems because of the complexity of structures and trauma mechanisms involved [2].

Being the first of 7 cervical vertebrae, the atlas, or C1, is responsible for transmitting loads from the skull to the cervical spine [3]. Some anatomic considerations convert C1 into a unique vertebrae, its vertebral body is incorporated into the odontoid process and instead of a vertebral body, the atlas has 2 large lateral masses connected by an anterior and posterior arch [3].

The oblique position of the occiput-C1 joint in the coronal plane results in compressive loads from the skull that radiate outward into the C1 ring [3]. These articulations allow for 50% of the total cervical flexion and extension at the occiput-C1 joint and 50% of the total cervical rotation at the C1-C2 joint [4].

We present two cases of transoral osteosynthesis for C1 fractures and discussion regard surgical technique.

Case 1. A twenty-year-old man presented fall motorcycle at high speed. He denied loss of consciousness and complained only of neck pain. Intense cervical referred pain. We show tomographic anterior arch fracture of C1 ***(Figure)***. We proceeded to perform surgery with transoral osteosynthesis. The patient had a satisfactory outcome, had no complications. Continuous ambulatory management for neurosurgery.

Case 2. A twenty-year-old man presented fall motorcycle at high speed. At admission presented mild neck pain, had no neurological deficit. CT scan evidence Showed of healing of the anterior arch. Flexion and extension films showed no motion across the occipitocervical junction nor was there a demonstrable increase in the atlanto-dens interval. We performed transoral approach with fusion and plate placement. The patient had satisfactory postoperative evolution. He was discharged a week. Continuous controls for neurosurgery.

Discussion. Currently there are many treatment strategies for the injured structures of the upper cervical spine mainly due to the complexity of the involved trauma mechanisms [2]. Possible treatment strategies are listed in ***Table***. Acute C1 fractures account for 6.4% to 13% of all cervical spine fractures [5, 6].

Most atlas fractures are thought to occur through axial load that drives the occipital condyles distally into the atlas, fracturing the ring of C1 and displacing the lateral masses outward [3]. Anterior arch fractures of C1 typically occur in the axial plane through the tubercle and represent an avulsion of the longus colli muscle, as a consequence of a hyperextension moment [3]. C1 fractures can range from isolated fractures of the anterior or posterior arches up to complex fracture patterns along the atlas, with or without affecting the Massa lateralis, and to burst atlas fractures [7, 8].

Isolated fractures of the C1 arches can be treated purely by immobilization, without surgical intervention [7, 9]. If the sum of the total overhang of both C1 lateral masses on C2 is >7 mm, consider disruption of the transverse ligament [10]. Fractures of the atlas are often associated with other cervical spine injuries with prevalence ranging from 30% to 70% [11].

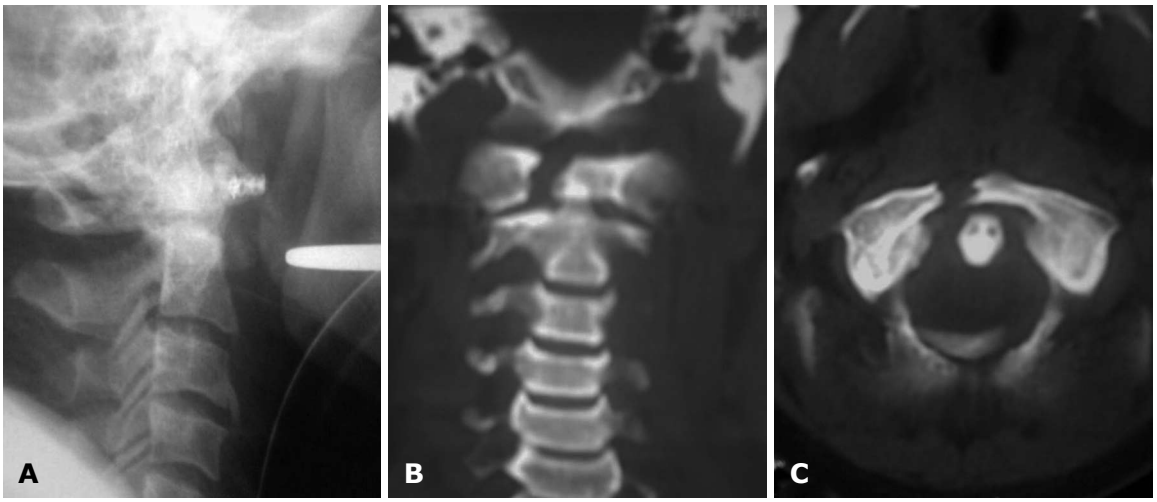
Because lateral approaches require an extensive dissection, risk of injury of the vertebral artery, of the jugular bulb, and of the hypoglossal nerve, they are reserved for massive tumor masses involving lateral structures [12, 13, 14]. The classical operative approaches to the cervical spine include the posterior one and the anterior exposure along the sternomastoid muscle. However, neither of these are helpful in exposing the upper cervical vertebrae, especially the odontoid process, atlas, and axis [15]. The transoral approaches (TOA) consent to reach directly the site of the lesion staying away from laterally placed neurovascular structures [13], however, it is technically demanding, and requires careful anatomical study and "hands-on" workshop training before reach competences [16].

The TOA appears to be relatively easy, it is associated with minimal complications and provides excellent exposure of the odontoid and upper cervical vertebrae for a microneurosurgical work [1, 15, 16, 17]. Modifications of this approach include incision of the soft palate, excision of a portion of the hard palate, and, occasionally, transmandibular median labio-mandibulo-glossotomy (Trotter's) approach [15].

Avulsion fractures of the anterior ring or transverse process fractures are treated symptomatically with a cervical collar because they are stable injuries. Lateral mass fractures of the atlas that are minimally displaced can be treated in a rigid cervical collar for 8-12 weeks. Radiographic follow-up should also assess C1-C2 stability with lateral flexion-extension images [3].

Comminuted or significantly displaced lateral mass fractures can be treated with either a rigid cervical orthosis or traction reduction followed by a halo vest [18].

Ruf et al [19] reported transoral reduction and primary C1 osteosynthesis in 6 patients with Jefferson fractures



Tomographic anterior arch fracture of C1. A - sagittal; B - coronal; C – axial.

Treatment strategies for C1 traumatic lesions. Adapted from [2]

Isolated fracture of the anterior/posterior arch	Immobilization with stiff neck collar for 3 months
Ring fracture without instability	Immobilization with halo orthosis for 3 months
Ring fracture with instability	Operative stabilization
Persistent pain after C1 fracture	Relative indication for atlantoaxial fusion

associated to rupture of the transverse ligament. Reduction was performed by direct manipulation followed by the osteosynthesis of the anterior ring and the lateral masses of C1; they implanted anterior lateral mass screws with a connecting bar between the screws. Authors conclude that reduction and osteosynthesis C1 is a technique that allows maintenance of rotatory mobility in the C1-C2 joint and restoration of congruency in the atlanto-occipital and atlantoaxial joints. None of the patients had symptoms of postoperative instability of C1-C2.

The surgical technique. The TOA has been modified by various authors, including Menezes et al [20], Crockard [1], and the Sonntag's group [21] to improve exposure and reduce the complications. The most common indications for this approach are removal of odontoid process for chronic dens dislocation, pseudobasilar invagination caused by rheumatoid arthritis, ventrally located craniocervical tumors, injuries of the upper cervical column and congenital malformations at the skull base [22].

As has been manifested, TOA provides a direct route to the surgical field, without any neurovascular manipulation and passing through the oropharynx, without injuring major neurovascular structures [22]. Intravenous prophylactic antibiotics is given, administered intraoperatively and postoperatively (Cefazoline 2 g/day) [23]. Patient is put in mild Trendelemburg position with the head stabilized in a Mayfield holder [13]. Nasogastric tube is passed to prevent postoperative regurgitation of gastric contents which might compromise the pharyngeal wound, other measures for reduce this possibility are the preoperative hyosine and postoperative antiemetics use [1].

The tubercle of C1 is identified with the aid of a neuronavigation system; using conventional microsurgery, a midline longitudinal incision on the posterior pharyngeal wall is performed and the longus colli, longus capitis muscles are mobilized laterally and held in place with tooth-bladed lateral pharyngeal retractors to expose the inferior clivus, anterior arch of C1, and C2 vertebral body [23]. Once in this step, can be performed the corrections to the C1 vertebrae. Closure can be obtained by approximating the mucosal layers with 3-0 vicryl interrupted sutures [23]. It is recommended to obtain a complete postoperative radiological set (MR imaging, CT scan and X-ray assessment) before discharge and every 3 months up to the complete bone fusion assessment, which required not more than 6 months. X-rays every month checked the stability of the construct [23]. Meticulous attention to hygiene is provided in the postoperative period and the patient is maintained on tube or intravenous fluid and alimentation for three to five days to allow wound healing [1].

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