

Transmanubrial Approach for Fracture of Lower Cervical Spine (C7) in Elderly Patients: A Case Report

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Abstract

Background: Fractures of the cervical spine are a frequent injury in the elderly with potentially devastating consequences. In most cases surgical therapy is required, in hyperextension fractures most often with anterior cervical fusion.

Methods: We report a case of an 88-year old patient with a fracture of C7 (AO-type B3) who underwent anterior cervical fusion with manubrium sterni osteotomy for application of the caudal screws.

Results: The insertion-angle of the caudal screws could be optimized; a dorsal instrumentation could be spared.

Conclusion: We want to describe a technique that potentially simplifies addressing the vertebral bodies of the cervicothoracic junction for anterior cervical fusion in patients with difficult anatomical conditions and allows a safe and stable insertion of the caudal screws.

Level of evidence: Level V (case report).

Keywords: Cervicothoracic junction; Anterior fusion; Cervical spine fracture; Osteotomy

Introduction

Fractures of the cervical spine are a frequent injury in the elderly with potentially devastating consequences due to spinal cord injury. Cervical spine fractures in the elderly are most often caused by a low energy trauma like a fall from standing high whereas younger patients more often sustain a high energy trauma [1,2]. This is attributed to degenerative osseous changes and a lower bone density in the elderly [3]. Spinal level C7 is affected in about 3.6% of all spinal fractures [2]. In case of two adjacent cervical vertebrae being affected, C6/C7 is the most common level (14.5%) in the elderly [3]. Cervical spine fractures are reported to be mostly distraction fractures [2]. The surgical technique most often applied in the elderly with fractures of C3-C7 is the anterior cervical fusion [3].

The approach to the cervicothoracic junction (C7-Th4) is surgically demanding and multiple techniques have been reported [4]. Cauchoix and Binet published a transsternal approach in 1957 [5], Birch and Bonney reported a transclavicular-transmanubrial approach [4]. Huang et al. published a mini-open technique in a cadaveric study by creating an osteotomy window in the manubrium sterni in order to reach the cervicothoracic junction [6].

We report a case of an anterior cervical fusion via transmanubrial window in an elderly patient with C7-fracture. The aim of this article is to describe a technique that potentially improves addressing the vertebrae of the cervicothoracic junction with screws in anterior cervical fusion.

Case Report

An 88-year old patient presented in the emergency department with pain of his neck two days after he fell over the rim of a carpet and sustained a hyperextension trauma of his cervical spine. The clinical examination showed distinct pain of the lower cervical spine, no neurological symptoms were found. In plain x-rays and CT-scan a non-dislocated fracture of the cervical vertebra 7 AO-type B3 without involvement of the posterior elements was diagnosed. As preexisting condition the patient suffered from diabetes mellitus. Because of extensive degenerative anterior bridging the fracture qualified as a

bechterew-like lesion and indication for anterior stabilization was given aiming to provide a bony fusion by anterior spondylophytes (Figure 1).

The anterolateral approach was made after radiological localization via image intensifier on the right side along the Langer's lines (8cm). Preparation to the anterior longitudinal ligament in the usual technique followed. The longitudinal ligament did not appear extensively torn, so dissection of the ossified ligament and resection of the intervertebral disc was not performed. After preparing the later plate position a plate was inserted and fixed with two 16mm screws per vertebral body in levels C5, C6 and C7. The preoperative CT-scan had shown a limited accessibility to Th1 via supramanubrial approach because of the given individual anatomical conditions. A significant improvement via positioning of the patient during the operation was not expected, so the application-angle of Th1-screws appeared too steep to provide a proper stability and dorsal instrumentation in a second operation would have been necessary to achieve adequate stabilization.

After dissecting the retrosternal structures, a mini-open manubriotomy was performed via second median skin incision with the oscillating saw and a window was created that provided a reasonable angle and level for reaching vertebra Th1 (Figure 2 and Figure 3a). The window was located one finger breadth below the apex of the manubrium with an extend of approximately 20 by 20 millimeters (Figure 3b). The sternoclavicular joint was not affected during the procedure; retrosternal structures were dissected safely and preserved with careful employment of retractors. After insertion of the screws in Th1 the osteotomy was closed and fixed via cerclage.

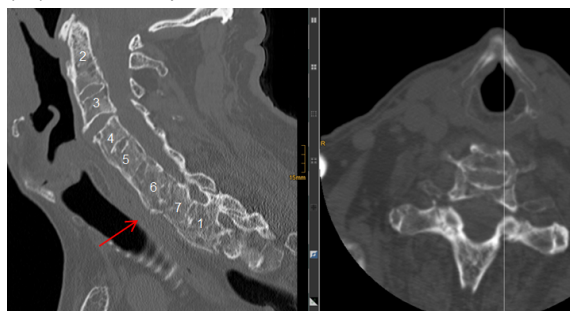
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(1a) Transversal plane at level C7.



(1b). Anterior bridging and fracture of vertebra C7 (Arrow: Fracture).

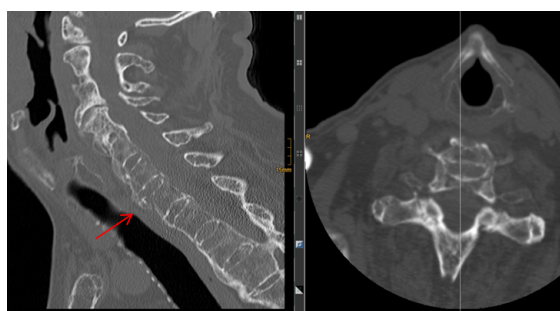


Figure 1: Pre-operative CT-scan of the patient's cervical spine in sagittal plane.

The initial postoperative course was uneventful. A soft neck brace was recommended for 6 weeks as postoperative regimen. The patient was discharged from hospital on postoperative day 3. Because of persisting pain another hospitalization for analgetic therapy followed one week after discharge. Radiological imaging showed a regular positioned plate without hint for dislocation of the implants (Figure 4). An infection of the urinary tract was treated with antibiotics and the patient could be released after 12 days for further rehabilitation. Unfortunately, the patient was lost for further follow up after the rehabilitation.

Discussion

Cervical spine fracture in elderly patients is a devastating injury with potentially severe consequences like spinal cords injury.

Conservative treatment - if possible - with cervical collar or halo vest is uncomfortable, requires bed rest that goes along with a higher incidence of pulmonary and decubitus complications [7]. Surgical therapy is required in most cases to provide adequate stabilization for mobilization of the patient [8]. Depending on the fracture level - upper (C1 and C2) or lower (C3-C7) cervical spine - and fracture type, different approaches and techniques are available. To address fractures of the cervicothoracic junction anterior, posterior or combined approaches are possible. In hyperextension fractures of the elderly anterior arthrodesis (plating) is recommended [3,8]. If the patient is suffering from ankylosing spondylitis a posterior approach is mandatory with or without additional anterior plating due to the long lever arms [7,8].

Williams et al. reviewed different surgical treatments of cervical spinal fractures and found the highest rate of complications in the combined anterior and posterior approach. The lowest rate was found in anterior-only approaches [9]. Following Pointillart et al. the posterior approach is accompanied by a more demanding postoperative care, higher rate of sepsis and more pain compared to the anterior approach [10].

Considering the above named reasons, the high age of our patient (88 years) and his impaired wound healing due to diabetes mellitus, the anterior stabilization as a single step procedure without posterior instrumentation was favored in order to achieve a fast mobilization.

Due to the patients anatomical condition (distinct kyphosis) vertebral body Th1 could not be reached in a reasonable angle for drilling via the standard anterolateral approach. Different techniques to extend the anterior approach caudally have been described.

Sundaresan et al. proposed a partly resection of the medial third of the clavicle and a portion of the manubrium sterni [11]. This technique provides a good view, the functional and cosmetic outcome has not been evaluated [10], and the risk of nonunion of the clavicle and instability of the sternoclavicular joint is well reported [6].

Cauchoux and Binet described an approach via complete sternotomy which provides an extended access to the cervicothoracic junction and even further caudally [5]. The complete splitting of the sternum comes with a high operative mortality and morbidity though [12].

Less invasive partial manubriotomy respectively sternotomy by inverse T-shaped osteotomy has been described [12,13]. Good access down to Th 4 was reported, transverse osteotomy of the manubrium, respectively sternum is needed though.

Huang et al. published a mini-open anterior approach via window osteotomy of the manubrium sterni in a cadaveric study and reported caudal access to Th5. Sternoclavicular joints were not afflicted, retrosternal structures could be successfully preserved [6].

In the described case the cervicothoracic angle (CTA) was too small because of kyphosis and a short neck to provide a suitable position for drilling and inserting the screws in Th1. By osteotomy of the manubrium sterni in an modified technique as described by Huang et al., a window could be established minimal invasively (Figure 2 and Figure 3b) that allowed safe and stable positioning of the screws. The sternoclavicular joints were not affected, which prevents from functional impairment. No complete transverse or axial sternotomy was needed, which lowers the risk of postoperative instability. The retrosternal structures could be preserved by careful employment of the retractors. The window was closed and refixed via cerclage.



Figure 2: Intraoperative situs with two incisions. (Upper incision: regular approach to lower cervical spine. Lower incision: additional approach for manubriotomy).

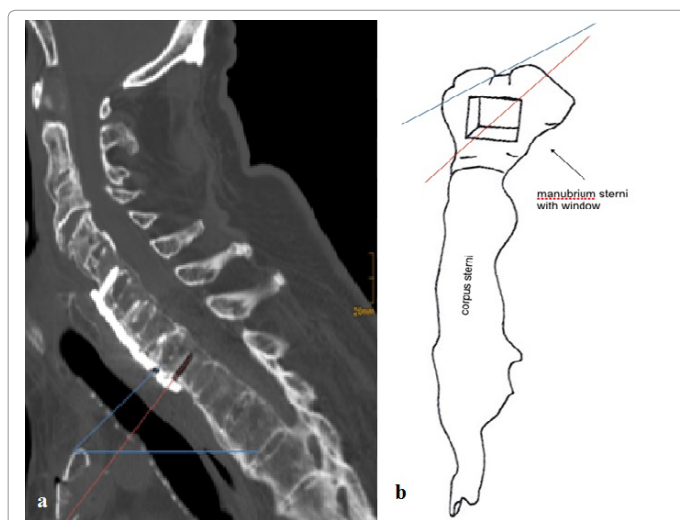


Figure 3: CT-scan of the patient's cervical spine in sagittal plane with inserted anterior plate and screws. (3a). Schematic drawing of the sternum with manubrium window. (3b). Blue line indicates the drilling angle via regular approach, red line indicates the drilling angle via manubrium-window.



Figure 4: Postoperative CT-scan of the patient's cervical spine in sagittal plane. (4a). Transversal plane at level C7. (4b). Anterior fusion by plate and 8 screws C5 to Th1. (Red arrow: reinserted manubrium-window).

This technique might be limited because it does not provide an extensive view to the more caudal vertebrae of the cervicothoracic junction. In this case, no more caudally access was needed for stabilization of the fracture and due to stable plate fixation via the windowed manubrium; a dorsal instrumentation could be spared. The patient could be mobilized and referred to further rehabilitation quickly without pulmonary or decubitus complications. Unfortunately the patient was lost to further follow up after rehabilitation.

This article describes a technique of a minimal invasive manubrium sterni-osteotomy for a safe and stable insertion of the caudal screws for anterior fusion of fractures in lower cervical spine fractures (C7) and difficult anatomical conditions, which potentially lowers the risks of before described transsternal approaches to the cervicothoracic junction.

Conclusion

The aim of this case report is to describe a technique that potentially simplifies addressing the vertebral bodies of the cervicothoracic junction with screws for anterior cervical fusion. The mini-osteotomy of the manubrium is less invasive than other described trans-sternal approaches to the cervicothoracic spine. Especially in patients with fractures on this level (C6/C7) and difficult anatomical conditions the caudal screws of an anterior plate can be established in a more effective angle and therefore possibly spare a second operation and dorsal instrumentation.

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