

## Anterior cervical Corpectomy with cage and plating in subaxial fractures: A review of 20 cases.

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### Abstract

**Background Data:** Anterior cervical corpectomy was the best solution in some cases of subaxial fracture but this defect was a problem to fill after corpectomy, so this study was to show the efficacy and safety of carbon cage and plating in the treatment of this problem.

**Study Design:** A clinical case series review

**Purpose:** To review the safety, efficacy and outcome of anterior cervical corpectomy with cage and plating in the management of subaxial cervical fractures.

**Patients and Methods:** From January 2009 to January 2014, twenty patients underwent anterior cervical corpectomy with cage and plating for the treatment of subaxial spinal injuries. The functional status was assessed using the modified Japanese Orthopedic Association Score preoperatively and at 1, 3 and 6 months postoperatively. Radiological assessment was done preoperatively with MRI, CT scan and plain radiograph, and at 1, 3 and 6 months postoperatively by plain radiograph and CT scan.

**Results:** Patients' ages ranged from 17 to 60 years (mean 38.5 years); 14 patients were males. Fourteen patients underwent one-level corpectomy and six patients underwent two-level corpectomy. Of our 20 patients; 16 patients (80%) had satisfactory significant recovery (one point or more on (mJOA) score), while four patients (20%) had no clinical improvement (same preoperative points on (mJOA) score). There was no case of cervical instability, instrument break down, or fusion failure during follow up period.

**Conclusion:** The anterior cervical corpectomy with cage and plating is a safe and effective technique in subaxial spinal injuries in selected patients. (2013ESJ057)

**Key Words:** Subaxial fracture, cervical spine, anterior approach, corpectomy.

## Introduction

Anterior cervical corpectomy is a common procedure for degenerative disorders, trauma, instability, infection, deformity, and tumors.<sup>8</sup> Spinal trauma can result in devastating injuries. In all spinal injuries, subaxial cervical spine injuries are the most common.<sup>3</sup> Spinal cord compression and spine instability are important issues when selecting appropriate treatment, whether surgical or non-surgical, anterior, posterior, or both.<sup>17,19</sup> Several radiological tools, including MRI and reformatted CT, yield precise details of the injured spine and allow the treating physician to determine which, if any, fixation technique offers the best chance of recovery with the least amount of risk.<sup>7</sup>

Anterior cervical corpectomy has become a highly successful procedure for treatment of degenerative spondylosis and certain types of spinal instability. With the addition of plate fixation, greater construct rigidity has decreased the risk of pseudoarthrosis. The use of structural allograft as an interbody spacer currently makes it possible to avoid the morbidity and complications associated with the harvesting of iliac crest bone graft. In properly selected patients with allograft, comparable fusion rates to autograft have been reported to be as high as 95% in single level surgery.<sup>1,2,7</sup>

The aim of this work was to study the clinical, radiological and operative outcome of the anterior cervical corpectomy in the management of subaxial spinal injuries.

## Patients and Methods

This work included 20 patients (14 males and 6 females) with subaxial cervical fractures admitted and operated by anterior cervical corpectomy during the period from January 2009 to January 2014. We included patients with; burst fractures with retropulsed fragment, traumatic ruptured disc, traumatic subluxation with ligamentous injuries, or fracture dislocation. Patients who required posterior lateral mass plating were excluded from this work.

The functional status was assessed using the modified Japanese Orthopedic Association Score preoperatively and at 1, 3 and 6 months postoperatively. The patients were subjected to clinical examination and investigations such as routine laboratory work up and neuroimaging. Anterior-posterior (AP) and lateral radiographs,

Magnetic Resonance Imaging (MRI), and Computerized Tomography (CT) scan of cervical spine were carried out in all patients to study bony detail and type of injury.

### **Operative Procedure:**

Patients were placed supine on a table that has a radiolucent portion at the cephalic end of the table. The patient's neck is built into lordosis. A preoperative x-ray is taken. We used the patient's right side. After sterile preparation and drape, a transverse cervical skin incision is made, based on the preoperative x-ray, and preferably in a skin crease for cosmetic purposes but in some cases longitudinal incision is done for exposure of multiple cervical segments.

Once the skin incision has made, the platysma is identified and entered longitudinally in its midportion. Then dissection has performed between the musculovisceral columns medially and the sternocleidomastoid and carotid sheath laterally down to the prevertebral fascia, which is both bluntly and sharply dissected. A spinal needle is then placed into the suspected disc space, and a cross-table lateral x-ray is taken.

Once the disc space has been identified, the longuscolli are dissected and elevated bilaterally. A self-retaining retractor is placed. The disc above and below the corpectomy is then removed under the help of operative microscope using a combination of knife and curettes. Then the antero-inferior aspect of the superior vertebral body is taken down with a 2 mm Kerrison, allowing identification of the endplates both above and below; placement of Caspar distracter pins are then placed in the mid portion of the vertebral bodies, and gentle distraction is placed across the disc space to allow proper visualization, and a complete discectomy through the sub cartilaginous endplates out to each uncovertebral joint is performed.

In cases of fracture dislocation with retropulsed fragments as most of our cases in this study, we continue decompression by corpectomy using high speed drill to remove the compressing fragments on the cervical cord till the uncovertebral joint. When completed, the corpectomy trough should measure approximately 15 to 16 mm in width. This ensures a thorough decompression across the entire epidural space. Then we prepare proper size of corpectomy cages either PEEK cage or Expandable cage filled

with bone from corpectomy then the Caspar pins and distractive device are removed with bone waxing for hemostasis and application of properly sized plate over the cage and application of screws is done under C-arm imaging both anteroposterior and lateral x-rays, A screw between the plate and the cage to prevent downward compression on the cord. Then good hemostasis should be insured. Drain may be needed then the platysma and subcutaneous layer, and skin closed in subcuticular manner. After surgery, a hard neck collar is prescribed for 12 weeks. Follow up: Follow-up evaluations were performed at 1, 3 and 6 months after operation clinically and radiologically by x-ray and CT scan. Postoperative images were evaluated for the following variables: curve, fusion, stability, decompression, cord signal and instrument break down.

## Results

A total of 20 patients with subaxial fractures were operated by anterior cervical corpectomy between January 2009 and January 2014. The highest incidence of this study was found in the 3rd decade of life with male predominance 14 patients (70%) and females 6 patients (30%). The most common mode of trauma was motor vehicle accidents 14 patients (70%), four patients had falling of heavy object (20%), one patient falling from height (5%) and one patient had diving injury (5%).

The mean preoperative (mJOA) score was 10.3 points, with forward improvement over the following 12 months after surgery. The postoperative mean (mJOA) score was 12.1 with a one year mean

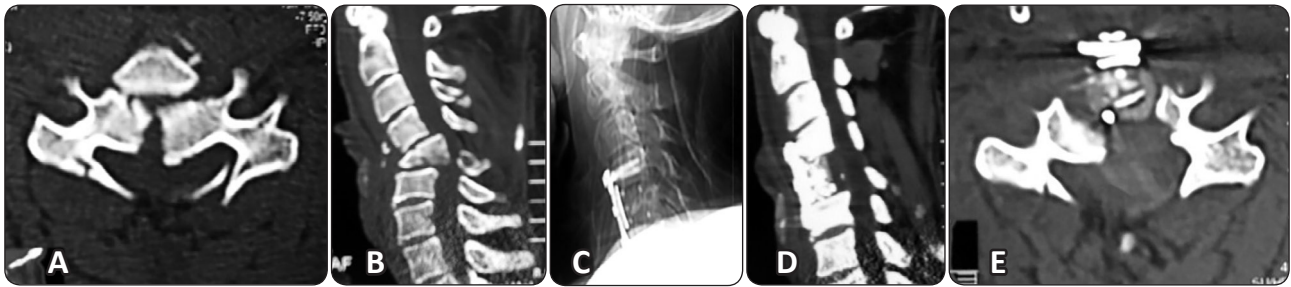
improvement of 1.8 points. Of our 20 patients; 16 patients(80%) had satisfactory significant recovery (one point or more on (mJOA) score), while four patients (20%) had no clinical improvement (same preoperative points on (mJOA) score). Table (1)

Cervical X-ray, CT and MRI were done for proper evaluation of patients; CT was superior to MRI in delineating bony anatomy & fractures while MRI was mandatory to evaluate cord pathology. In our study, all the patients were operated by corpectomy and application of corpectomy cage filled with bone graft and plate fixation. The cervical curve was restored intra operatively through traction and fixation, decompression of the cord was achieved in all the cases but the cord signals still appear in the follow up MRI.

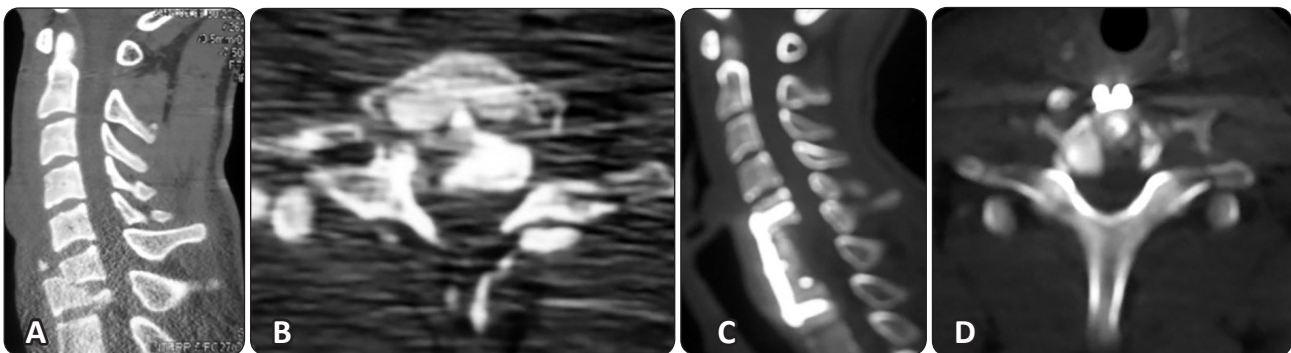
Fourteen cases had single level corpectomy and anterior plating (Figure 1), while six cases had two-level corpectomy and anterior plating (Figure 2). In this study the mean follow up time was 12 months (from 5 month to 5 years). In this study, of our 20 patients; 16 patients (80%) had satisfactory significant recovery (one point or more on (mJOA) score), while four patients (20%) had no clinical improvement (same preoperative points on (mJOA) score). The postoperative images were evaluated during follow up period by CT scan and x-rays, CT scan and MRI. The cervical curve showed satisfactory post operative x-ray films. Also bone fusion, stability and decompression were achieved in all the cases. Cord signal improved (the hyper intense in MRI image was less intense). No cases of instrument break down in our series.

**Table 1.** Data of 20 Patients Included in this Study.

Parameters	Item	Results
Type of injuries	Compression flexion injury	9
	Distraction flexion injury	8
	Extension injury	3
Clinical presentation: According to mJOA score	Preoperatively	10.3
	Postoperatively	12.1
MRI finding	Mild neural canal compression	3
	Cord compression & cord signal	11
	NAD	6
Included cervical segments	One levels corpectomy	14
	Two levels corpectomy	6



**Figure 1.** Preoperative (a) axial and (b) sagittal CT scan showing C5 dislocation fracture with retropulsion. Post operative (c) lateral radiograph showing C5 corpectomy with cage and plating, Ct scan (d) axial and (e) sagittal showing complete canal clearance.



**Figure 2.** Pre CT scan (a) sagittal and (b) axial showing C6/7 fracture dislocation. Postoperative CT scan (d) sagittal and (e) axial showing C6/7 corpectomy with cage and plating with complete canal clearance.

## Discussion

Advances in spine biomechanics, instrumentation and improved radiologic imaging have greatly expanded our understanding of cervical subaxial traumatic injuries. Whereas most cervical subaxial trauma was treated by posterior approaches in the past, there is now significant evidence suggested that an anterior approach is similarly effective for stabilization.<sup>24</sup> The anterior approach is less traumatic and provides interbody grafting with reconstruction and maintenance of lordosis.<sup>16</sup>

The neurosurgeon is frequently faced with conditions in the cervical spine in which anterior corpectomy forms part of the solution. The surgeon has to deal with gap left after corpectomy. The cervical spine can be reconstructed using autograft, allograft or bone cement.<sup>9</sup>

Usually cervical corpectomy is performed to treat trauma-induced cervical cord compression that may result from flexion compression fracture with ventral canal compromise, and hyperextension injuries that cause central cord injury.<sup>15</sup> The use of an anterior

cervical plate in the treatment of degenerative spine disease has several biomechanical advantages. The increased stability across the operative segment decreases motion between the graft and vertebral endplate and increases the chance of solid fusion. A reduced incidence of graft-related complications has also been observed with the use of anterior cervical plates.<sup>5</sup>

The plate not only acts as a boundary preventing graft extrusion, but decreases the extent of graft collapse and subsidence. It can also maintain sagittal balance and preserve the normal biomechanics of the adjacent cervical segments, contributing to a decreased incidence of postoperative axial neck pain and reduced potential for adjacent-level disease.<sup>12</sup>

The rate of neurological improvement for patients with CSM undergoing ventral surgical decompression has been reported to be 39 to 83%.<sup>6,13,14,17,19</sup> They reported neurological improvement rates of 83%, 73%, and 66% following one-level, two levels, and three-level corpectomy, respectively, with grafting and plating. Twenty patients of subaxial cervical trauma were operated

by anterior cervical corpectomy and application of corpectomy cage filled with bone graft and plate fixation. One level corpectomy was performed in 14 patients and two levels corpectomy in 6 patients. In more than one level corpectomy posterior lateral mass fixation may be needed to increase the stability of the construct. In Belirgen et al study, only one segment was instrumented in each patient in the anterior group using a plate and screw construct with interbody graft in 18 patients.<sup>4</sup>

The functional assessment pre and postoperatively were done with the modified Japanese Orthopedic Association Score (mJOA) for our patients which matches the functional assessment score used by Belirgen et al,<sup>4</sup> Ozgen et al,<sup>15</sup> and Lotfy et al.<sup>12</sup> The percentage of patients postoperatively who showed clinical improvement postoperatively in our series was (80%) which showing similarity to that of author for post operative percentage of patients who showed clinical improvement.<sup>6,12,13,14,17,19</sup>

The mean follow up time was 12 month (from 5 month to 5 years) no cases show implant failure, while in the series of Belirgen et al,<sup>4</sup> the mean follow-up time was 12 months (range 6–30). No considerable intraoperative complications were found but some patients show postoperative complications as follow; three patients developed chest infection (pneumonia) two of them ventilated and became ventilator dependent then died and the other patient treated conservatively and improved. In this study two cases (10 %) died due to chest infection.

The use of instrumentation following ventral cervical surgery is, however, associated with instrumentation related complications, such as screw back-out, screw malposition, and esophageal fistulas. In this series, there was no screw malposition or esophageal, tracheal, or vascular injury.<sup>2</sup> Soft-tissue complications related to cervical corpectomy can be minimized by careful anterior exposure and adequate release of all tissue planes over the cervical spine. Secure positioning of self-retaining retractors will further minimize the risk of soft-tissue injury. When in place, the retractors should be intermittently released to limit the effect of long-term pressure on the adjacent anatomical structures.<sup>2,23</sup> The rates of dysphagia following anterior cervical surgery are highly dependent on the magnitude and duration of retraction. Reported

rates of dysphagia following anterior cervical discectomy and fusion ranged from 0% to 24%.<sup>10,21,22</sup>

## Conclusion

Advances in surgical techniques and spinal stabilization methods have expanded the role of corpectomy for the management of various degenerative and traumatic disorders of cervical spine. The anterior cervical corpectomy with plating is a safe and effective technique in subaxial spinal injuries in selected patients. Good health care and rehabilitation centers for patients with cervical spine injuries are strongly recommended.

## References

1. Aebi M, Zuber K, Marchesi D: Treatment of cervical spine injuries with anterior plating. Indications, techniques, and results. *Spine* 16:S38–45, 1991
2. Alaa A. Farag: Anterior Cervical Corpectomy; Evaluation of the Outcome. *Egyptian Journal of Neurosurgery* 28(4): 61-66, 2013.
3. Arnold PM, Bryniarski M, McMahan JK: Posterior stabilization of subaxial spine trauma indications and techniques. *Injury* 36(2):36-43, 2005
4. Belirgen M, Dlouhy BJ, Grossbach AJ, Torner JC, Hitchon PW: Surgical options in the treatment of subaxial cervical fractures: A retrospective cohort study. *Clin Neurol Neurosurg* 115(8):1420-8, 2013
5. Cheng NS, Lau PY, Sun LK and Wong NM: Fusion rate of anterior cervical plating after corpectomy. *Journal of Orthopaedic Surgery* 13 (3):223-227, 2005
6. Connolly PJ, Esses SI, Kostuik JP: Anterior cervical fusion: outcome analysis of patients fused with and without anterior cervical plates. *J Spinal Disord* 9:202–206, 1996
7. Do Koh Y, Lim TH, Won You J, Eck J, An HS: A biomechanical comparison of modern anterior and posterior plate fixation of the cervical spine. *Spine* 26:15–21, 2001
8. Dvorak MF, Fisher CG, Fehlings MG, Rampersaud YR, Oner FC, Aarabi B, et al: The surgical approach to subaxial cervical spine injuries: an evidence-based algorithm based on the SLIC classification system. *Spine* 32:2620–9, 2007
9. Elsaghier H and Boehm H: Anterior versus

- Posterior Plating in Cervical Corpectomy. Arch Orthop Trauma Surg 120:549-554, 2000
10. Fehlings MG, Smith JS, Kopjar B, Arnold PM, Yoon ST, Vaccaro AR, et al: Perioperative and delayed complications associated with the surgical treatment of cervical spondylotic myelopathy based on 302 patients from the AOSpine North America Cervical Spondylotic Myelopathy Study. Presented at the 2011 Spine Meeting. J Neurosurg Spine 16:425-432, 2012
  11. Kyung-Jin Song, Kwang-Bok Lee: Anterior versus combined anterior and posterior fixation/fusion in the treatment of distraction-flexion injury in the lower cervical spine. Journal of Clinical Neuroscience 15:36-42, 2008
  12. Lotfy M, Anbar A, Sawan M and Ayoub B: Anterior Cervical Corpectomy for Cervical Spondylotic Myelopathy. EJNS 21(1):61-74, 2006
  13. Macdonald RL, Fehlings MG, Tator CH, Lozano A, Fleming JR, Gentili F, et al: Multilevel anterior cervical corpectomy and fibular allograft fusion for cervical myelopathy. J Neurosurg 86:990-997, 1997
  14. Okada K, Shirasaki N, Hayashi H, Oka S, Hosoya T: Treatment of cervical spondylotic myelopathy by enlargement of the spinal canal anteriorly, followed by arthrodesis. J Bone Joint Surg Am 73:352-364, 1991
  15. Ozgen S, Naderi S, Ozek MM and Pamir MN: A retrospective review of cervical corpectomy: indications, complications and outcome. Acta Neurochir (Wien) 146:1099-1105, discussion 1105, 2004
  16. Reindl R, Ouellet J, Harvey EJ, Berry G, Arlet V: Anterior reduction for cervical spine dislocation. Spine 31:648-52, 2006
  17. Rowland LP: Surgical treatment of cervical spondylotic myelopathy: time for a controlled trial. Neurology 42:513-521, 1992
  18. Roy-Camille R, Saillant G, Laville C, Benazet JP: Treatment of lower cervical spinal injuries—C3 to C7. Spine 17(10):442-446, 1992
  19. Seifert V and Stolke D: Multisegmental cervical spondylosis: treatment by spondylectomy, microsurgical decompression, and osteosynthesis. Neurosurgery 29:498-503, 1991
  20. Silber JS, Anderson DG, Daffner SD, Brislin BT, Leland JM, Hilibrand A, et al: Donor site morbidity after anterior iliac crest bone harvest for single level anterior cervical discectomy and fusion. Spine 28:134-139, 2003
  21. Smith JS, Fu KM, Polly DW Jr, Sansur CA, Berven SH, Broadstone PA, et al: Complication rates of three common spine procedures and rates of thromboembolism following spine surgery based on 108,419 procedures: a report from the Scoliosis Research Society Morbidity and Mortality Committee. Spine 35: 2140-2149, 2010
  22. Uribe JS, Sangala JR, Duckworth EA and Vale FL: Comparison between anterior cervical discectomy fusion and cervical corpectomy fusion using titanium cages for reconstruction: analysis of outcome and long-term follow-up. Eur Spine J 18:654-662, 2009
  23. Wang JC, Hart RA, Emery SE and Bohlman HH: Graft migration or displacement after multilevel cervical corpectomy and strut graft. Spine 28:1016-22, 2003
  24. Woodworth RS, Molinari WJ, Brandenstein D, Gruhn W, Molinari RW: Anterior cervical discectomy and fusion with structural allograft and plates for the treatment of unstable posterior cervical spine injuries. J Neurosurg Spine 10:93-101, 2009

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## الملخص العربي

استئصال الفقرات العنقية الأمامية مع القفص والشريحة في الكسور تحت الفقرة المحورية: استعراض ٢٠ حالة.

المقدمة: استئصال الفقرة العنقية في إصابات كسور تحت المحور الأمامي كان هو الحل في بعض الحالات وكانت هناك مشكلة لسد هذه الفجوة بعد استئصالها، لذا كانت هذه الدراسة لإظهار فاعلية وأمان القفص الكربوني والشرائح والمسامير في علاج هذه المشكلة.

تصميم الدراسة: مراجعة الخبرة والنتائج في علاج ٢٠ من المرضى الذين يعانون من كسور تحت المحور الأمامي بعمل استئصال للفقرة العنقية المصابة وتركيب قفص كربوني مكانها وتثبيتها بشريحة معدنية ومسامير تيتانيوم. الهدف: لمراجعة سلامة وفعالية ونتائج التثبيت الأمامي بعد استئصال الفقرة العنقية المصابة وتركيب قفص كربوني مكانها وتثبيتها بشريحة معدنية ومسامير تيتانيوم، وذلك لعلاج كسر الفقرات العنقية تحت المحور الأمامي. عينة المرضى: مابين يناير ٢٠٠٩ وحتى يناير عام ٢٠١٤، خضع عشرون مريض بكسر بالفقرات العنقية تحت المحور الأمامي بعمل استئصال للفقرة العنقية المصابة وتركيب قفص كربوني مكانها وتثبيتها بشريحة معدنية ومسامير تيتانيوم، وذلك لعلاج كسر الفقرات العنقية تحت المحور الأمامي. ولقد تم حساب درجة التحسن طبقاً للتقييم الياباني العظمى المعدل قبل العملية عند شهر و ثلاثاً اشهر و ستة اشهر بعد العملية. لقد تم عمل فحوصات تقييم قبل الجراحة مع التصوير بالرنين المغناطيسي، الأشعة المقطعية والتصوير شعاعي عادي، وبعد الجراحة أيضاً بالأشعة العادية والأشعة المقطعية.

النتائج: تراوحت أعمار المرضى من ١٧ إلى ٦٠ سنة (يعني ٣٨.٥ سنة) وكان ١٤ مريضاً من الذكور، خضع أربعة عشر مريضاً لإستئصال فقرة واحدة، وخضع ستة مرضى لإستئصال فقرتين وكانت نتائج المتابعة مرضية مع التحسن (درجة أو أكثر طبقاً للمقياس الياباني العظمى) في ١٦ مريض، بينما ٤ حالات لم تتحسن (نقص المقياس قبل وبعد الجراحة). لا توجد حالات فيها عدم ثبات للفقرات أو كسر للمسامير أو عدم التئام للفقرات أثناء فترة المتابعة بعد العملية.

الخلاصة: أن استئصال الفقرة العنقية المصابة تحت المحور الأمامي وتركيب قفص كربوني مكانها وتثبيتها بشريحة معدنية ومسامير تيتانيوم هو تقنية آمنة وفعالة في إصابات العمود الفقري تحت المحور.