

Lateral Mass Fixation: New Technique

MOHAMED SAAD ABD EL-AZIZ, M.D.; MAGED AHMED HAMED ELGEBALY, M.D.;
MOHAMED SHABAN ABO ELELA, M.D. and MAHMOUD RAMADAN ADLY ALY, M.D.

The Department of Neurosurgery, Faculty of Medicine, Beni-Suef University

Abstract

Background: Anatomically, there is the cervical vertebrae in the cervical spine that are aligned with prominent cervical lordosis. The third, fourth, fifth, in addition to sixth cervical vertebrae have distinct features. The inferior and superior articular facets form the lateral mass, which positioned antero-lateral to the laminae.

Aim of Study: To describe the safety and efficiency of a novel method for cervical spine stabilization using lateral mass fixation.

Patients and Methods: A descriptive study was conducted using a cadaver specimen in the Anatomy Department Morgue, Beni Suef University, in April 2025. The novel technique was performed and evaluated using postoperative CT imaging.

Results: The entry point for screw insertion was 2 millimeters medial and inferior to the midpoint of the superior facet line. Screws were directed 35° caudally and 20° laterally. CT scans confirmed appropriate placement within the lateral mass, with no cortical breaches. Application was limited to levels C4 to C6.

Conclusion: The new lateral mass fixation technique shows potential as an alternative method for cervical stabilization but requires further studies for validation and refinement.

Key Words: Cervical spine – Cervical vertebrae – New technique – Lateral mass fixation.

Introduction

ANATOMICALLY, there is the cervical vertebrae in the cervical spine that are aligned with prominent cervical lordosis. The third, fourth, fifth, in addition to sixth cervical vertebrae had special characteristics [1].

The inferior and superior articular facets form the articular mass or lateral mass, anatomically the lateral mass positioned anterolateral to the laminae [2].

Articular processes are located directly posterior to transverse process and its foramen transversarium articular processes. There are two inferior and two superior processes. Each process has a smooth surface recognized as an articular facet. The two superior facets will articulate with the two inferior facets of the vertebra above, creating the zygapophyseal (or facet) joints. They can be defined as joints of the vertebral arch as the processes themselves form on lateral bony elements of the arch. The stacking of vertebrae forms a pathway for spinal nerves, referred to as the intervertebral foramen, through the articular processes, vertebral arch, and the zygapophyseal joints of the vertebrae that are adjacent. The intervertebral foramen permits the spinal nerves at every vertebral level to escape the vertebral canal. Lastly, the almost of the articular facets horizontal orientation in cervical spine contributes significantly to its extensive range and variety of motion [3].

Fixation of lateral mass is a prevalent operation that is carved out in cervical spine. Numerous modifications for the procedures were described like modification in the exist point, alterations entry point, as well as angulation of screw [4].

Fixation of lateral mass becomes the standard method for posterior cervical stabilization as well as fixation for a several cervical indications involving: Cervical trauma, cervical spondylosis, deformity, inflammatory illness, cancers, as well as revision operation [5].

Describe the effectiveness of this new technique in cervical spine stabilization and its safety.

Correspondence to: Dr. Mohamed Saad Abd El-Aziz,
E-Mail: saad16752@gmail.com

Material and Methods

A descriptive anatomical study was conducted using a cadaver specimen at the Anatomy Department, Beni-Seuf University, in December 2024. The aim was to describe and evaluate a new trajectory for cervical lateral mass screw fixation.

Operative technique:

- A midline posterior cervical incision was made.
- Musculature was dissected laterally, and self-retaining retractors have been located.
- The facet joints from C3 to C7 were exposed.
- Borders of lateral mass are well defined medial, lateral, superior and inferior.
- Laminectomy has been carried out from C3 to C7.
- The entry point has been identified 2 millimeters inferior and medial to the midpoint of superior facet line.
- Screws have been directed 35° caudally and 20° laterally.
- The technique was applied at levels C4 to C6. C3 was excluded due to facet breakdown; C7 was excluded due to small facet size.
- Screw length was limited to 12mm.

Evaluation:

Postoperative CT imaging was used to confirm screw trajectory and placement.

Results

The novel lateral mass fixation technique was successfully applied to a cadaveric cervical spine from levels C4 to C6. The designated entry point was located two millimeters medial and two millimeters inferior to the midpoint of the superior facet line. The screws have been directed at a caudal angle of 35° and a lateral angle of 20°, targeting inferolateral border of lateral mass.

Postoperative evaluation using CT imaging confirmed accurate screw placement within the lateral mass in all attempted levels, without cortical breach or involvement of the vertebral canal or neuroforamen. The technique was not applied at C3 due to facet breakdown encountered during dissection, and C7 was excluded owing to the facet joint small size. The maximum screw length used was 12 mm, constrained by the anatomical dimensions of the lateral mass and the proximity to neurovascular structures.



Fig. (1): Entry point and angulation for the lateral mass screw.



Fig. (2): Postoperative CT sagittal view showing the trajectory of the screw.

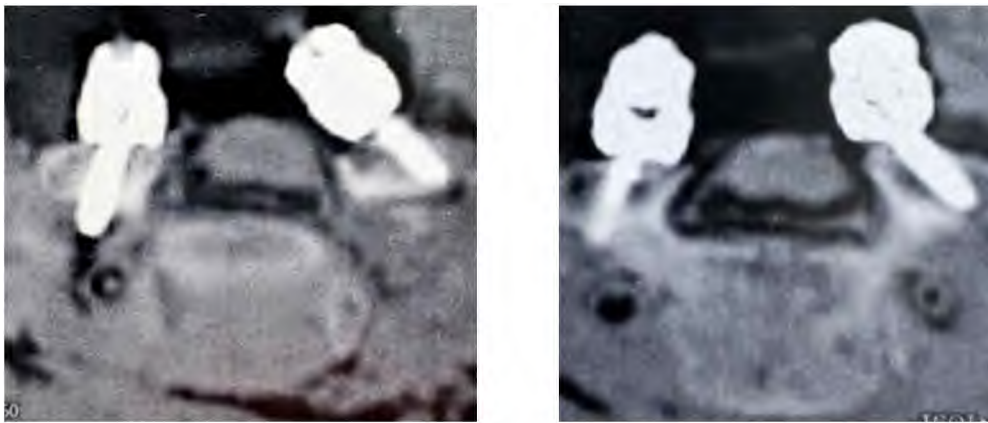


Fig. (3): Axial CT view demonstrating screw placement within the lateral mass.



Fig. (4): Postoperative 3D reconstruction showing direction of the screw into lateral mass.

Discussion

This research introduces a novel method for posterior cervical lateral mass fixation with a distinct entry point and screw trajectory. Unlike traditional methods that employ neutral or cranial screw orientation, this approach utilizes a caudal (35°) and lateral (20°) direction. The entry point is slightly inferior and medial to conventional landmarks, permitting for a modified trajectory that may offer unique advantages in specific anatomical or pathological scenarios.

Comparative analysis with established techniques highlights key variances. Roy-Camille et al. [6] described a mid-lateral mass entry with 10° lateral angulation and a perpendicular sagittal trajectory. Magerl's technique [7] positioned the entry point one millimeter medial and one millimeter cranial to the midpoint with twenty to thirty degree-lateral and cranial angulation parallel to the facet joints. Anderson [8] and an proposed similar entry points but emphasized cranial angulation ranging from 15° to 40° . An et al. [9,10] technique described an entry point 1mm medial to center of the lateral

mass from C3 to C6 with 30° lateral angulation and 15° cranial angulation.

The primary benefit of this technique lies in its inferolateral trajectory, which may reduce the likelihood of violating the facet joint or encroaching on the foramen in certain cases. However, the technique is not without limitations. The necessity to restrict screw length to 12mm may compromise bio-mechanical stability, particularly in osteoporotic bone. Additionally, anatomical variations, as observed at C3 and C7 in this cadaver, can limit the universal applicability of this approach.

Further biomechanical validation and clinical studies are warranted to determine the efficacy, reproducibility, and safety profile of this modified technique in live surgical settings.

Conclusion:

The new lateral mass fixation technique shows potential as an alternative method for cervical stabilization but requires further studies for validation and refinement. Further biomechanical validation and clinical studies are warranted to determine the efficacy, reproducibility, and safety profile of this modified technique in live surgical settings.

References

- 1- COOPER H.M. and YEAGER V.L.: Surgical Anatomy of the Cervical Spine and Surrounding Structures, in Microsurgery of the Cervical Spine, Chapter (1): 1-16, 2001.
- 2- KERN SINGH, KEVIN C. JACOB, MADHAV R. PATEL, TIMOTHY J. HARTMAN, JAMES W. NIE and ALEXANDER R. VACCRO: Operative Techniques in Spine Surgery. Procedure 12, Cervical Spine: Lateral Mass Screw Fixation. 4th Edition, pp. 96-104, 2025.
- 3- CAROLYN PERRY and FRANCESCA SALVADOR: Cervical Spine, Anatomy, Ligaments, Nerves and Injury, November 14, 2023.
- 4- SREERAMALINGAM RATHINAVELU, ARIFUL ISLAM, PANKAJ SHIVHARE and SANDIP CHATTERJEE: Lateral Mass Screw Fixation in the Cervical Spine: Introducing a New Technique. Asian Spine Journal, November 16, 15 (6): 849-855, 2020.
- 5- JEFFERY D. COE and ALEXANDER R. VACCRO: Spine Journal NASS, Volume 13, Issue 9, 2013.
- 6- ROY-CAMILLE R., SALIENT G. and MAZEL C.: Internal fixation of the unstable cervical spine by a posterior osteosynthesis with plates and screws. In: Sherk H.H., Dunn E.J., Eismont F.J., et al. eds. The cervical spine. 2nd ed. Philadelphia, PA: J B Lippincott, 390-403, 1989.
- 7- JEANNERET B., MAGERL F., WARD E.H. and WARD J.C.: Posterior stabilization of the cervical spine with hook plates. Spine (Phila Pa 1976), 16 (3 Suppl): S56-S63, 1991.
- 8- ANDERSON P.A., HEINLEY M.B., GRADY M.S., MONTASANO P.X. and WINN H.R.: Posterior cervical arthrodesis with AO reconstruction plates and bone graft. Spine (Phila Pa 1976), 16 (3 Suppl): S72-S79, 1991.
- 9- AN H.S. and COPPES M.A.: Posterior cervical fixation for fracture and degenerative disc disease. Clin. Orthop. Relat. Res., 335: 101-111, 1997.
- 10- AN H.S., GORDIN R. and RENNER K.: Anatomic considerations for plate screw fixation of the cervical spine. Spine (Phila PA 1976), 16 (10 Suppl): S548-S551, 1991.

تثبيت الكتلة الجانبية: تقنية جديدة

تناولت هذه الدراسة وصف لتقنية جديدة في تثبيت الكتلة الجانبية للفقرات العنقية وقد تم إجراء التقنية على جثة بمشرحة الكلية وقد تم اختيار نقطة بداية دخول المسمار بحيث تكون ٢ مللي أسفل وداخل منتصف الحدود العلوية للفقرة وأن يميل اتجاه المسمار إلى ٥٣ درجة للأسفل و ٢٢ درجة خارجي وقد تم اختيار طول المسمار ٢٢ مللي وهذه التقنية تحتاج لمزيد من الدراسة وذلك لتقييم جودتها على المدى البعيد.