

Safety Zones for Cervical Spine Fixation with Lateral Mass Screw

Essay

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Summary

The surgical approaches for cervical fractures include anterior, posterior, and combined approaches. Lateral mass plating is widely accepted as one of the posterior fixation methods for the lower cervical spine fractures from the C3 through C7 vertebrae.

This approach is also useful for instability occurring after multiple-level anterior cervical fusion, multiple laminectomies due to myelopathy, cervical tumor removal, and surgery for degenerative diseases.

Although excellent results have been reported using lateral mass screw plating, neurovascular complications may potentially result from this approach because of its anatomic proximity to vital structures, such as the vertebral artery, cervical nerve root, and spinal cord.

Brain complications such as cerebellar or brain stem infarction secondary to Vertebral artery injury are very rare, although the screwing procedure may injure the vertebral artery during the operation.

Several screw placement techniques have been previously described. The most common two techniques are that described by Roy-Camille and Magerl. The technique developed by Roy-Camille et al places the screw halfway between the articular surfaces of the facets and halfway between the lamina facet line and the lateral margin of the lateral mass. The screw is placed at the midpoint of the lateral mass and angled 10 degrees laterally, this method provides an easy technique for lateral mass screw placement, yet it utilizes unicortical screws only to avoid screw penetration into the foramen transversarium and vertebral artery injury, which affects the screw pullout strength, and other techniques have been advised to overcome such problems.

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الملخص العربي

يعتبر التثبيت الخلفي للعمود الفقري العنقي وسيلة فعالة لعلاج عدم استقرار الفقرات العنقيه الناتج عن الكسور أو التآكل نتيجة الأورام، هذا الأسلوب من تثبيت مفيد بشكل خاص، في تلك الحالات مع عدم الاستقرار حيث الجزء الخلفي غائب (بعد الضغط) أو غير كفاء (بعد كسر).

هناك طرق تقليدية أخرى مثل التثبيت باستخدام الأسلاك المعدنية ولكنها تتطلب إضافة مستويات المشاركة أعلى أو أسفل مستوى الاندماج المطلوب. هذه الطرق لا يمكن تأديتها إلا إذا بقي بعض أجزاء من العناصر الخلفية للفقرات سليمة. ومع ذلك، نظراً لأنه في حالات كثيرة يكون الجزء الخلفي للفقرات غير موجود أو غير كاف، في هذه الأحيان لا يجوز استخدام تقنيات التثبيت بالأسلاك. لهذا أحدث التثبيت الخلفي للفقرات العنقيه باستخدام مسمار الكتلة الجانبية تقنياً كبيراً.

بالإضافة إلى أن استخدام الشرائح المعدنية و المسامير لتثبيت العمود الفقري العنقي من الخلف قد يقلل من العيوب المتأصلة في كثير من طرق التثبيت الأخرى.

هذا ومن أهم استخدامات مسمار وشريحة الكتلة الجانبية للتثبيت الخلفي لفقرات العنق هي حدوث أصابه للجزء العظمي الخلفي أو الارتبطه الخلفية للفقرات بالاضافه إلى عدم لاستقرار الفقاري الناتج عن استئصال الأجزاء الخلفية للفقرات، أيضاً في حالات الازاحه الفقارية للعنق.

وقد وصفت عدة تقنيات مختلفة لإدراج مسامير في الكتلة الجانبية. اشتركت جميعها في منطقة بدء إدراج المسمار و هي غالباً ما تكون بالقرب من مركز الكتلة الجانبية أو انسيا أكثر من ذلك، بزواوية ميل وحشيه في المحور

العرضي، أما بالنسبة للمحور الجانبي يتم توجيه المسامير بحيث تكون عموديه على السطح الخلفي للكتلة الجانبية أو رأسيا قليلا. حتى تكون مقاربه لزاوية المفاصل الجانبية للفقرات.

وقد تبين أن كلما كانت زاوية توجيه المسمار في المحور الجانبي رأسيه أكثر كلما سمح ذلك باستخدام مسمار ذى طول أكثر و تفاعل إدراج المسمار بالمفاصل الجانبية للفقرات، هذا و تختلف التقنيات الكلاسيكية الموصوفة من قبل الجراحين ماجريل أو روكامي لإدراج المسمار من حيث نقطة بدء إدخال المسمار أو زوايا التوجيه في المحور الجانبي أو الرأسي.

و حيث أن تشريح الجزء العنقي لفقرات العنق يبين اختلافات كبيرة. فان إدراج مسامير في هذه المنطقة من الفقرات العنقيه يعتبر غير مقبول على نطاق واسع بين الجراحين ، بالرغم من أن هناك العديد من الدراسات التي تحاول تثبيت المسمار في هذه المنطقة مع نتائج جيدة.

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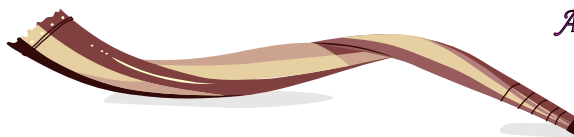
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List of Abbreviations

<i>Abbreviation</i>	<i>Refers to</i>
C	The Cervical vertebra- The Cervical nerve root (According to the text)
Oc	The Occipital bone
SSCa	Semispinalis Capitis muscle
SSCe	Semispinalis Cervicis muscle
CT	Computed Tomography
MRI	Magnetic Reasonance Imaging
VA	Vertebral Artery
LM	Lateral Mass

Introduction

The posterior plate fixation of the cervical spine is an effective method for the treatment of traumatic and degenerative instability. This method of fixation is particularly useful, in those cases with cervical instability requiring posterior stabilization where the spinous processes and laminae are absent (after decompression) or incompetent (after fracture) .

Traditional methods such as spinous process and sublaminar wiring require the addition of involved levels above or below the desired fusion level. Most wiring techniques can be performed only if some portions of the posterior elements are left intact. However, since in many clinical situations posterior elements are absent or insufficient, the use of wire fixation techniques is frequently precluded. Providing an effective stabilization in this situation has been revolutionized during the past decade with the introduction of plate screw fixation.

The use of metal plates and screws to stabilize the cervical spine from posterior approach minimizes the disadvantages inherent in many of the other operative procedures .

The main indication for posterior cervical plating is traumatic instability especially injury to the posterior bony and ligaments structures. Additionally, posterior plating have also been used in cervical spondylotic myelopathy and post laminectomy instability.

Several different techniques have been described for insertion of screws into the lateral mass. All involve screw insertion sites near the center of the lateral mass or more medially, angled laterally in the transverse plane. In the sagittal plane, the screws are directed perpendicular to the posterior

Introduction and Aim of the Essay

surface of the lateral mass or cephalad, approximating the angle of the facet joints.

The more cephalad-directed screw insertions have been shown to provide a longer screw length and avoid violation of the inferior facet joint., The classic screw insertion techniques are described by Magerl and Roy-Camille, they differ widely with respect to starting position, lateral and cephalad angulation .

Since pedicle anatomy in cervical spine shows great variations, screw insertion into the cervical pedicles is not widely accepted, although there are many studies attempting screw fixation in this region with good results.

The stability of the cervical spine plating system is dependent on a number of factors. One of these factors is the strength that the screw has in terms of bony purchase. The initial description of the technique utilized bicortical screw purchase.

Complications related to the insertion of lateral mass plates and screws are mostly limited to injury to neurovascular structures,they include nerve root injury ,direct vertebral artery injury , violation of the facet joint , and screw pullout .

The challenge to the surgeon is balancing what is safe versus what is biomechanically sound. The added benefit of bicortical purchase must be weighted against the increased risk of injury to nerve roots and the vertebral artery.