

Lateral Mass Fixation in Subaxial Cervical Spine: Anatomic Review

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Abstract

Introduction The cervical spine is a highly mobile segment of the spinal column, liable to a variety of diseases and susceptible to trauma. It is a complex region where many vital structures lie in close proximity. Lateral mass screw fixation has become the method of choice in stabilizing subaxial cervical spine among other posterior cervical fixation techniques whenever the posterior elements are absent or compromised.

Objective This study examined cervical specimens of cadavers and cervical computed tomography (CT) scans to minimize as much as possible complications of cervical lateral mass screw placement such as vertebral artery or nerve root injuries, facet joint violations, or inadequate placement.

Methods Forty normal cervical CT scans, obtained from the emergency unit as part of the trauma workup, were included in this study plus 10 cervical cadaveric specimens obtained from the Alexandria Neuro-anatomy laboratory. There were three fixed parameters for screw insertion in this study. First, the point of screw insertion was the midpoint of the lateral mass; it was the crossing point between the sagittal and axial planes of the posterior cortex of the lateral mass. Second, the direction of the screw in the craniocaudal plane was 30 degrees cranially to avoid facet joint penetration. Third, the exit point of the screw was located on the ventral cortex of the lateral mass just lateral to the root of the transverse process in the midaxial cut of each lateral mass, to make a sound bicortical fixation without injuring the vertebral artery or the nerve root. The selected screw trajectory in this study was the line drawn between the inlet and exit points. The depth and width of the lateral mass of the cervical vertebrae from C3 to C7 were measured as well as the angle of screw trajectory from the sagittal plane. All these measures were applied on the cadaveric specimens to make sure that no injury to the vertebral artery, nerve root, or facet joint occurred.

Results As regards the collected measurements of the lateral mass of all subaxial cervical vertebrae, the study revealed that the average depth of the lateral mass was 12.83 ± 1.28 mm. The average width of the lateral mass was 11.92 ± 0.96 mm. The average divergent angle of bicortical screw insertion without injury to the vertebral artery or the nerve root was 19.51 ± 1.83 degrees. As regard the cadaveric specimens, based on all the collected measurements taken from the CT scans, there was no reported injury to the vertebral arteries or nerve roots or penetration to the facet joints.

Conclusion Lateral mass fixation can be applied easily and safely for all levels of subaxial cervical spine from C3 to C6 with the following parameters: (1) the point of entry is the midpoint of the lateral mass; (2) the screw trajectory is directed 30 degrees cranially and 20 degrees laterally; (3) the screw length is 13 to 15 mm.

Keywords

lateral mass fixation - vertebral artery - nerve root - facet joint

下頸椎的側塊固定: 解剖回顧

引言 頸椎是脊柱中一個活動性很高的部份，易於患上各種疾病和易受到創傷。這是一個複雜的地區，許多維生的組織都很靠近。在後部要素不存在或受危及時，相比其他路內固定技術，側塊螺釘固定術已成為穩定下頸椎的首選方法。

目的 本研究檢查屍體頸椎樣本和頸椎電腦斷層掃描（CT），以盡量減少放置頸椎側塊螺釘時可能出現的併發症，如椎動脈或神經根損傷，脊椎小面關節的損害，或不足夠放置。

方法 包括 40 個在創傷後應急部門取得的正常頸椎電腦斷層掃描，另加 10 個在亞歷山大神經解剖實驗室獲得的頸椎屍體標本。在這項研究中有三個有關插入螺釘的固定限制。第一，螺釘插入點是側塊的中點，它是側塊後皮層矢狀面和軸面交界點。第二，螺釘在頭腳平面的方向是向頭顱 30 度，以避免穿過脊椎小面關節。第三，螺釘的出口處位於側塊的內側皮層，剛好在每個側塊的中軸切面橫突根部的側面，造成沒有傷及椎動脈或神經根的雙皮層固定。在這項研究中所選擇的螺釘軌跡是根據從入口和出口點之間所畫的線。從 C3 至 C7 的頸椎側塊的深度和寬度及螺釘軌跡在矢狀面的角度都量度過。所有這些方法都用在屍體標本上，以確保沒有損傷椎動脈，神經根，或脊椎小面關節。

結果 在所有下頸椎側塊收集的測量，研究顯示側塊的平均深度為 12.83 ± 1.28 毫米。側塊的平均寬度是 11.92 ± 0.96 毫米。雙皮質螺釘插入而不損傷椎動脈或神經根的平均發散角為 19.51 ± 1.83 度。有關屍體的樣本，從電腦掃描收集的數據上，沒有報告損傷到椎動脈或神經根或穿過脊椎小面關節。

結論 在以下因素下，側塊固定可以容易且安全地適用於下頸椎由 C3 至 C6 的各節段：（1）入口點是側塊的中點，（2）螺釘軌跡是向頭顱 30 度和橫向 20 度；（3）螺釘的長度為 13 至 15 毫米。