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Surgical management of Hangman's Fracture- A systematic review

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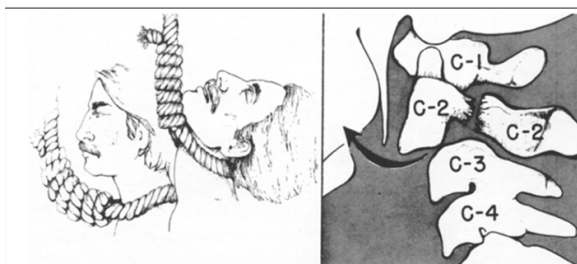
Introduction: Hangman's fractures are bilateral fractures of the C2 pars interarticularis produced during hyperextension injuries. The Levine-Edwards classification divides these fractures according to stability. Whilst it is accepted stable fracture patterns are managed conservatively, prolonged traction required in unstable fractures may be superseded by surgery in its practicality. Surgical approaches can be divided into anterior and posterior: anterior access can allow discectomy and longitudinal ligaments, and is used for anterior cervical discectomy and fusion (ACDF); posterior approaches include C2 direct pedicle screw (DPS), which preserves motion segments and may be done under navigation with a minimally invasive (MIS) approach; multi-level fusion with rod and screws provides the strongest biomechanical fixation. The aim of this systematic review is to compare indications, complications and functional outcomes of different surgical approaches.

Methods: A search of multiple databases with keywords "Hangman Fracture", "Hangman's Fracture", "Axis Fracture" and "C2 Fracture" was conducted; articles were included if they described the surgical technique and included one of the primary outcomes: functional outcomes, complication rates, operation time and blood loss.

Results: 1889 abstracts were screened, 137 full texts were analysed and 36 were included, yielding a combined total of 627 patients. ACDF is preferred in unstable fracture patterns. Pre and post-operative visual analog scale (VAS) improved in all groups, with MIS DPS producing lowest VAS scores. Approaches had excellent neurological improvement and fusion rates. Reported complication rates were generally low, most commonly self-limiting dysphagia in anterior approach, and vastly higher volumes of blood loss by the posterior approach: open posterior-255.9mls, MIS-75.8mls and ACDF-64.3mls.

Conclusion: All Hangman's fracture fixation approaches have their indications and advantages, and surgeons should be equipped to perform all. Anterior approaches may be preferred for their lower blood loss and access to the disc; however MIS and navigation techniques may improve outcomes in posterior approach.

Figure 1 – Left- how a submental knot produces hyperextension; right- a lateral view of a cervical spine showing how the hyperextension-distraction force would produce this fracture through the pars interarticularis (12). Incidentally, subsequent investigations have found that judicial hanging only produces this characteristic fracture pattern only around 10% of the time (6).



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Recent Publications

1. Bhimani AD, Chiu RG, Esfahani DR, Patel AS, Denyer S, Hobbs JG, et al. C1-C2 Fusion Versus Occipito-Cervical Fusion for High Cervical Fractures: a Multi-Institutional Database Analysis and Review of the Literature. World Neurosurg [Internet]. 2018;119:e459–e466.
2. Ying Z, Wen Y, Xinwei W, Yong T, Hongyu L, Zhu H, et al. Anterior cervical discectomy and fusion for unstable traumatic spondylolisthesis of the axis. Spine (Phila Pa 1976). 2008;33(3).
3. Singh PK, Garg K, Sawarkar D, Agarwal D, Satyarthee GD, Gupta D, et al. Computed tomography-guided C2 pedicle screw placement for treatment of unstable hangman fractures. Spine (Phila Pa 1976). 2014;39(18).

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