以有限元素法分析胸腰椎爆裂性骨折經後方脊椎內固定手術後對生物力學之影響

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摘要

目前臨床上對於胸腰椎爆裂性骨折病患，大部份外科醫師會以比較安全的後方固定系統來進行手術，後方固定系統主要是在爆裂節上下椎體中，打入椎弓根螺釘(Pedicle)並以垂直連接桿(Rod)連結之，目前對於後方固定方式並沒有一致的看法，有學者認為只須在爆裂節的上一節和下一節椎體中置入骨釘，即可提供脊椎應有的穩定度;但臨床上指出，此固定方式在長期追蹤下會有機率產生螺釘鬆脫或斷裂的現象，造成椎體塌陷，需要進行二次手術；另外也有學者認為需要以長節(上二節、下二節)來固定才是比較保險的手術方式，但置入愈多的螺釘和固定愈多的椎節數將會降低病人術後的活動度，也會增加病人的負擔。

本研究將脊椎模型利用 CT 掃描的方式，經過一系列的步驟建立起實體元素，接著切除部份模型模擬腰椎第一節發生爆裂性骨折，再以半手動方式建立螺釘以及連接桿，分別以上一下一節、上一下二節、上二下一節和上二下二節後方固定方式，置入脊椎模型中，最後以前彎、後仰、側彎以及扭轉四種動作，比較不同固定方式下，脊椎的穩定度和活動度以及螺釘內應力的生物力學影響。希望藉由有限元素分析的結果，提供骨科醫師手術上的參考。

關鍵字:有限元素法;胸腰椎爆裂性骨折;椎弓根螺釘;生物力學

Abstract

These days, most surgeons used "Posterior Fixations" on thoracolumbar burst fracture patients which was more safety in clinic. The posterior fixation method was implanting pedicle screws into the vertebrae which were upper and lower to the burst vertebrae and connected them with vertical rod. Presently, it is controversial for how to establish the posterior fixations. Some authors claimed that it offered enough stabilities for spine by implanting pedicle screws into the upper-one and lower-one vertebrae between the burst segment. However, this fixation had probability occurred "pull out" or "break" on pedicle screws after long term follow-up. Another authors considered that increasing more vertebras to be fixed like upper-two and lower-two was more safety. Nevertheless, it will limit more range of motions (ROM) when more segments fixed.In this study, 3D spinal FE models from the CT scan images were established to simulate the burst fracture by cutting L1 segment. In addition, the spinal model was fixed by pedicle screws and the rod which created by semi-manual in the FE software. Four different implanting fixations were used to the burst e.g.: upper-one and lower-one (U1L1), upper-one and lower-two (U1L2), U2L1 and U2L2 segments. Finally, spinal stabilities, ROM and the stress in the pedicle screws under four motions which include: Flexion, Extension, Lateral Bending and Rotation were compared.

Key words : Finite element analysis ; Thoracolumbar burst fracture ; Pedicle screws ; Biomechanics