Operative Timing and Management of Spinal Injuries in Multiply Injured Patients

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Abstract
Spinal injuries occurring in polytrauma patients are caused by high impact trauma. Due to high velocity mechanism, trauma of the vertebral column may be accompanied by injuries of adjacent body cavities such as thorax, abdomen, and pelvis. Neurologic examination is mandatory and has to be documented preferably using the ASIA/IMSOP-classification. Clinical symptoms may point towards spinal injury. However, absence of clinical symptoms is not sufficient to rule out spinal injuries. Two diagnostic pathways may be followed to assess the spine: (1) Conventional X-ray diagnostics of the entire spine followed by selective CT scanning of suspected lesions and CT scanning of the upper cervical spine region C0–C3 in unconscious patients. (2) Whole body polytrauma-multislice-spiral-CT scanning from head to pelvis without conventional X-ray playing the key role in the algorithm of modern ER management. In this study, 287 polytrauma patients with associated spinal injuries were analyzed prospectively from a cohort group of 731 polytrauma patients treated from 2002 to 2004 in our institution. Indications for surgery include neurologic deficit, instability, as well as malalignment and dislocation. In polytraumatized patients, indication for primary surgery is given in complex spinal injuries with associated vascular, neurologic, or organ injuries as well as multi-level spinal fractures or unstable spinal injuries. In patients with unstable spinal injuries cardio-pulmonary instability and life threatening intracranial pressure are contra – indications for immediate spinal surgery. On the day of injury ventral spondylodesis of unstable cervical spine fractures of C3–C7 and dorsal spondylodesis of unstable thoraco-lumbar fractures using internal fixator are the standard procedures. Polytrauma patients benefit from early stabilization of spinal fractures including reduction of ventilation and ICU treatment, pneumonia rate, general complications, as well as hospital stay. However, it is controversial if mortality rate and neurologic outcome are affected by the time point of operative stabilization.

Key Words
Spine ∙ Poly trauma ∙ Spine surgery

Introduction
Approximately 25% of all relevant spinal injuries affect the cervical spine, 75% the thoracic and lumbar spine. In spinal injuries with traumatic plegia the rate of cervical spine injuries is increasing up to 40%. Ten percent of patients present with two level injuries of the vertebral column. Predominately, patients aged 20–30 suffer from spinal injury due to multiple trauma.

Predominate injuries of the upper cervical spine are odontoid fractures with 55%, followed by hangman fractures with 20% and axis ring fractures with 17%. In the lower cervical spine, segments C5/C6 and C6/C7 are affected in two out of three cases. In the thoraco-lumbar spine the junction and therefore segments T11–L2 is the predilection point and demonstrates the majority of fractures (62%).

These data originate from prospective analysis of 731 polytrauma patients treated in our institution from 2002 to 2004. In this cohort group, 287 patients (39%) presented with associated spinal injuries.

Mechanisms of Injury
Spinal injuries occurring in polytrauma patients are caused by high velocity and high impact trauma such as
motor vehicle or motorbike accidents (50%), fall from big height, pedestrians hit by a car, sports injuries, and suicides. Alcohol and drugs predispose for these injuries. Spinal injuries are significantly correlated with head injuries specifically if Glasgow Coma Scale (GCS) is falling below 8. Predominate mechanisms of injury include axial compression as well as forced extension and flexion of the vertebral column. In motor vehicle passengers, deceleration differences between the core body that is firmly attached to the car seat by the seat belt, and the unsupported head is the critical pathomechanical factor.

Due to high velocity mechanism, trauma of the vertebral column may be accompanied by injuries of adjacent body cavities such as thorax, abdomen, and pelvis. Thoracic spine injuries are predominately combined with pulmonary contusion, rib fractures and hemato-pneumothorax (Figure 1). In the abdomen, the typical combination of injuries is the chance fracture accompanied by visceral injuries, specifically small intestine in restrained car passengers. In blunt high-speed trauma, parenchymal organs including spleen, liver, and kidney in decreasing order may be injured (Figure 1).