



## Pathology & Biology Section – 2008

### G93 Cervical Spine Injuries in Fatal Traffic Crash Victims: Microscopy and Diagnostic Imaging Findings

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The objective of this presentation is to familiarize the attendees with the presence of discrete lesions in the cervical spine facet joints in fatal traffic crash victims based on a large case-control forensic autopsy study utilizing advanced diagnostic imaging procedures and histological methods.

This presentation should encourage forensic specialists and researchers to include detailed examination of the posterior elements of the spinal column in the evaluation of trauma victims. Furthermore, clinical sciences should consider these findings as potentially relevant in cases of cervical spine symptomatology after severe road traffic crashes despite negative diagnostic imaging evaluation.

Occult lesions have previously been identified in the cervical spine in case studies on autopsy material using diagnostic imaging procedures and microscopy; very few case-control studies have, however, been performed.

The lower cervical spine facet joints from 42 subjects (20 fatalities from passenger car traffic crashes (cases) and 22 decedents due to non-traumatic causes (controls)) were removed *en bloc* during autopsy. The specimens were examined with: (1) advanced diagnostic imaging procedures (conventional x-rays, computed tomography and magnetic resonance imaging), (2) stereomicroscopy of 3-mm thick anatomical slices, and (3) microscopy of 10µm thick stained histological sections. Each facet joint was examined and described systematically with each of the three methods. The diagnostic imaging examination included evaluation of fractures and bleeding, the stereomicroscopy included evaluation of fractures, bleeding and damage to the synovial folds, and the microscopy included evaluation of fractures, bleeding in and disruption of the folds and haemarthrosis. Furthermore, age-related changes were evaluated microscopically with regard to cartilage fibrillation and fissures, vascular invasion of the tidemark and semi-quantitative histomorphometric measurements of the cartilage thickness, subchondral bone thickness, cartilage length, and percentage overlap of the anterior and posterior folds. Results from the diagnostic imaging procedures and the stereomicroscopy were compared to the microscopical findings.

Lesions in the lower cervical spine facet joints were common, particularly in the soft tissues, including bleeding in the joints spaces and the synovial folds. Among the diagnostic imaging procedures, computed tomography was the most sensitive towards identifying facet fractures, whereas soft tissue lesions could not be identified reliably in any of the diagnostic imaging procedures. None of the stereomicroscopical findings correlated significantly with the microscopical findings. Microscopical examination was the most sensitive method and identified all facet fractures, haemarthrosis, and bleeding in the folds. The microscopical findings correlated well with the exposure to trauma. None of the osseous or soft tissue lesions in the cervical spine facet joints were identified during the autopsy. Furthermore, histomorphometric data were collected for the normal anatomy of the lower cervical spine facet joints.

Discrete injuries in the lower cervical spine facet joints are common after fatal road traffic crashes. Osseous lesions of the facet joints can be reliably identified on computed tomography whereas soft tissue lesions can not. Stereomicroscopical examination does not reliably identify lesions in the facet joints in comparison to microscopical examination which identifies both osseous and soft tissue lesions in great detail.

This presentation should encourage forensic specialists and researchers to include detailed examination of the posterior elements of the spinal column in the evaluation of trauma victims. Furthermore, clinical sciences should consider these findings as potentially relevant in cases of cervical spine symptomatology after severe road traffic crashes despite negative diagnostic imaging evaluation.

#### Fatal Traffic Crash, Cervical Spine Injury, Investigation