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# Diagnosis and treatment of craniocervical dissociation in 48 consecutive survivors

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## ABSTRACT

*Study type:* Case series

*Introduction:* Craniocervical dissociation (CCD) is an uncommon and frequently fatal injury with few reports in the literature of survivors. Advances in automobile safety and improved emergency medical services have resulted in increased survival. Timely diagnosis and treatment are imperative for optimal outcome. Regrettably, the presence of multiple life threatening injuries, low clinical suspicion, and lack of familiarity with the upper cervical radiographic anatomy frequently lead to missed or delayed diagnosis.

*Objective:* This paper represents the largest series of surgically treated CCD survivors. The goal of this study is to determine if any improvements have been made in the timely diagnosis of CCD while performing a complete patient evaluation.

*Methods:* Following institutional review board approval, a search of the Harborview Medical Center (HMC) trauma registry was conducted for all surgically treated CCD patients between 1996 and 2008. Forty-eight consecutive cases were identified. A retrospective review of the radiological and clinical results with emphasis on timing of diagnosis, modality used for diagnosis (**Figures 1 and 2**), clinical effect of delayed diagnosis, potential clinical or imaging warning signs, and response to treatment was performed. Thirty-one patients treated from 2003 to 2008 were compared to 17 patients that were treated from 1996 to 2002 and reported previously [1].

All patients sustained high-energy injuries and were evaluated according to standard Advanced Trauma Life Support (ATLS) protocols. Once CCD was identified or suspected, provisional stabilization was applied and MRI evaluation performed (**Figure 3**). Definitive surgical management with rigid posterior instrumentation and fusion was performed as soon as physiologically possible (**Figures 4 and 5**).

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**Results:** Craniocervical dissociation was identified on initial cervical spine imaging in 26 patients (84%). The remaining five patients (16%) were diagnosed by cervical spine MRI. Twenty-three patients (74.2%) were diagnosed within 24 hours of presentation, four (22.6%) were diagnosed between 24 and 48 hours, and one (3.2%) experienced a delay of greater than 48 hours (Table 1). In comparison, four (24%) of the previously treated 17 patients were diagnosed on initial cervical spine imaging. Four patients (24%) were diagnosed within 24 hours of presentation, nine (52%) were diagnosed between 24 and 48 hours, and four (24%) experienced a delay of greater than 48 hours.

There were no cases of craniocervical pseudarthrosis or hardware failure during a mean nine-month follow-up period. Four patients expired during their hospital course. The mean American Spinal Injury Association (ASIA) motor score of 47 improved to 60, and the number of patients with useful motor function (ASIA Grade D or E) increased from eight (26%) preoperatively to 17 (55%) postoperatively.

**Conclusions:** Improvements have been made in time to diagnosis of CCD in recent years. Increased awareness and the routine use of CT scan as part of the initial ATLS evaluation account for this progress. Expedited diagnosis has decreased preoperative neurological deterioration. However, differences in length of follow-up between the two groups preclude conclusions about its effect on long-term neurological outcome.

Table 1

Delay in diagnosis	No. of patients from previous study (%)	No. of patients from current study (%)
Less than 24 hours	4 (24%)	23 (74.2%)
Between 24 and 48 hours	9 (52%)	7 (22.6%)
More than 48 hours	4 (24%)	1 (3.2%)

## REFERENCES:

1. Bellabarba C, Mirza SK, West GA, et al (2006) Diagnosis and treatment of craniocervical dislocation in a series of 17 consecutive survivors during an eight-year period. *J Neurosurg Spine*; 4(6): 429–440.

Figure 1 **Initial lateral C-spine radiograph obtained as part of the initial ATLS survey demonstrating an occiput C1 distractive injury.**



Figure 2 **Sagittal C-spine CT scan obtained as part of the initial ATLS survey demonstrating an occiput C2 distractive injury.**



Figure 3a–b **Preoperative coronal T2 MRI sequences demonstrating increased signal intensity on the occiput-C1 and C1-2 joints.**



Figure 4 **Postoperative lateral C-spine x-ray showing rigid posterior instrumented fusion from occiput to C2.**



Figure 5 **Postoperative sagittal C-spine x-ray showing rigid posterior instrumented fusion from occiput to C2.**

