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C-spine injury and mandibular fractures: lifesaver broken in two spots

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ABSTRACT

Background: Trauma is a leading cause of injury and mortality and may involve mandibular fractures and cervical spine injuries. Manipulation of the spine during trauma protocols and operative treatment has the potential to cause serious spinal cord injuries. The purpose of this study was to identify risk factors associated with cervical spine injury (CSI) in patients with mandibular fractures.

Methods: The National Trauma Databank (2007-2010) was used to identify patients with mandibular fractures.

Results: A total of 59,028 patients were identified and separated into adult and pediatric cohorts. There were 50,711 adults (86%) and 8317 children (14%). There were statistically significant lower rates of associated CSI in pediatric patients than adults (3.5% *versus* 7.3%, $P < 0.01$). Predictors of associated CSI in mandible fractures for both adults and children were older age, lower Glasgow Coma Scale, thoracic injuries, firearm or motor vehicle accident mechanisms, and symphyseal fractures. In the pediatric cohort, body, ramus, and subcondylar fractures were significantly associated with CSI. In adults, female gender, and upper extremity, abdominopelvic, and head injuries were also significantly associated with CSI.

Conclusions: Multiple mandibular fractures were inversely correlated with CSI. One possibility is that energy dissipation in the mandible with multiple fractures is protective of the C-spine leading to fewer fractures. Children and adults had different associations in the pattern of mandible fractures concomitant with CSI. This has implications in management, imaging, and workup of trauma patients.

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Introduction

Mandibular fractures are a common occurrence in the setting of high energy blunt force trauma.[1,2] The relationship of the mandible and its surrounding structures can logically lead to the conclusion that high energy impacts can dissipate into those structures. It has been proposed that the mandible forms a ring that is bounded posteriorly by the cervical spine.[3] Forces that cause one break in the ring may lead to other sites of damage, just like a lifesaver candy cannot be broken in just one spot. This is clinically relevant as manipulation of the spine during operative mandibular fracture treatment has the potential to cause serious spinal cord injuries. The reported incidence of cervical spine injury (CSI) in the setting of mandibular fractures is between 0.0% and 11%.[4,5]

Physical examination and radiographic imaging can diagnose multitrauma injuries, but knowledge of mechanism of injury and fracture patterns associated with other severe injuries can supplement provider clinical judgment and treatment planning. The purpose of this study was to identify risk factors and predictors of CSI in adults and children with mandibular fractures.

Methods

The National Trauma Database (NTDB) from 2007 to 2010 was used to identify all patients with mandibular fractures. The NTDB is maintained by the American College of Surgeons Committee on Trauma and is the largest available US trauma registry of voluntarily reported data from over 1000 participating trauma centers.

All patients with mandibular fracture were included in this study. Mandible fracture was identified using the *International Classification of Diseases, Ninth Revision* (ICD-9) diagnosis codes, 802.2 (closed fracture of mandible) and 802.3 (open fracture of mandible). Based on the presence of CSI, the patients were divided into to groups of CSI and non-CSI patients. CSI was identified with ICD-9 diagnosis codes, 805.0 (cervical fracture without spinal cord injury); 806.0 (cervical fracture with spinal cord injury); 839.0 (cervical dislocation); and 952.0 (cervical spinal cord injury without evidence of spinal bone injury).

Variables analyzed included demographics, mechanism of trauma, site of mandibular fracture, and concomitant injuries. Using ICD-9 diagnosis codes, the sites of mandible fracture were grouped into condyle, subcondyle, ramus, angle, symphysis, alveolar border, other body, and multiple. Due to physiological differences between adults and children, the pediatric (<18 y) and adult (≥18 y) patients were analyzed separately.

Concomitant injuries were identified using Abbreviated Injury Scale predot code. The Abbreviated Injury Scale predot codes reflect the body region of patient's injury. In this study, concomitant injuries to the following body regions were evaluated: head (other than mandibular fracture), trunk, upper extremities, and lower extremities. Using ICD-9 codes, supplementary classification of external cause of injury, the mechanisms of injury were identified and categorized as motor vehicle accidents (MVAs), firearm, intentional trauma (other than firearm related), fall, blunt force, and non-MVAs.

Within each age group, the correlation of CSI with demographics, mechanism of trauma, site of mandibular fracture, and concomitant injuries was assessed using the chi-square test for categorical variables and *t*-test for continuous variables. Finally, logistic regression was used to identify predictors of CSI. All data analyses were performed using SAS 9.4 (SAS Institute, Inc, Cary, NC) and a *P* value of <0.05 was considered significant.

Results

A total of 59,028 patients were identified, with 8317 patients (14%) in the pediatric cohort and 50,711 (86%) in the adult cohort. There were statistically significant lower rates of associated CSI in pediatric patients compared with adults (3.5% *versus* 7.3%, $P < 0.01$). Most patients were white males in both cohorts (Table 1). The most common associated injury was head trauma for both groups. The most common mandible fracture type was multiple fractures for both groups, and the most common location was symphyseal (18.1%,

Table 1 – Characteristics of the patients with mandibular fracture.

Variable	Children (%); N = 8317	Adults (%); N = 50,711
Demographics		
Female	27.98	18.28
White	62.01	62.79
Concomitant injury		
Head	36.73	42.1
Thoracic	17.92	22.79
Abdominopelvic	11.76	10.98
Upper extremity	20.28	22.4
Lower extremity	19.49	19.86
Site of mandibular fracture		
Condylar process	16.64	11.3
Subcondylar	8.97	9.15
Ramus	7.84	10.64
Angle	14.49	15.17
Symphysis	18.08	15.69
Alveolar border	4.85	3.73
Body (other)	13.17	15.3
Multiple	35.42	34.55
Etiology		
Motor vehicle	43.98	33.72
Nonmotor vehicle	8.06	2.13
Fall	13.94	13.92
Firearm	4.56	7.68
Other intentional trauma	19.89	36.79
Struck	9.84	11.23