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Detecting severe injuries of the upper body in multiple trauma patients

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ABSTRACT

Background: The clavicle limits the upper thoracic cage and connects the body and upper extremities. The clavicle is easy to examine and is visible on standard emergency room radiographs. We hypothesized that clavicular fracture in polytrauma patients would indicate the presence of further injuries of the upper extremities, head, neck, and thorax.
Methods: A population-based trauma registry was used. All patients were documented between 2002 and 2013. Inclusion criteria were age ≥16 y and injury severity score (ISS) ≥16. Patients were divided into two groups according to the presence or absence of a clavicular fracture (group C+ and group C−). Scoring was based on the abbreviated injury scale, ISS, and new injury severity score. Trauma mechanisms, demographics, and the posttraumatic clinical course were compared.
Results: In total, 4790 patients with clavicular fracture (C+) and 41,775 without (C−) were included; the mean ISS was 30 ± 11 (C+) *versus* 28 ± 12 (C−). Patients with clavicular fracture had a longer stay on the intensive care unit with 12 ± 14 *versus* 10 ± 13 d. Injuries to the thoracic wall, severe lung injuries as well as injuries to the cervical spine were significantly increased in C+ patients. Thoracic injuries as well as injuries of the shoulder girdle and/or arm showed an increased abbreviated injury scale in the C+ group.
Conclusions: A clinically relevant coincidence of clavicular fractures with injuries of the chest and upper extremity was found. As clavicular fractures can be diagnosed easily, it might also help to reduce the incidence of missed injuries of the chest and upper extremity. Therefore, special attention should be paid on thoracic as well as upper extremity injures during the second and tertiary surveys in case of clavicular fractures.

Advances in knowledge: This is the first study with a considerable number of patients focusing on clavicular fracture as an indicator of further injuries in severely injured patients.

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1. Introduction

Accidents are the leading cause of death in children and young adults. In 2011, 20,406 people died in Germany after a severe accident [1]. The S3 guideline on treatment of patients with severe and multiple injuries published in 2010 by the German Trauma Society (Deutsche Gesellschaft für Unfallchirurgie [DGU]) and different treatment programs for the management of acute trauma cases (e.g., Advanced Trauma Life Support, developed by the American College of Surgeons [ACS] Committee on Trauma [COT] and was first introduced in the USA and abroad in 1980) [2] emphasize the importance of standardized algorithms of diagnostic and therapeutic procedures for early detection and treatment of life-threatening injuries. However, overlooked injuries still represent a common problem in this patient population. In this context, Pfeifer *et al.* [3] reported on a widespread distribution of missed injuries and an incidence of approximately 15%–22% of missed injuries that were clinically significant. Compared with injuries of the chest, abdomen, and long bones, injuries to the spine and extremities are overlooked more frequently [4]. Buduhan *et al.* and Kalemoglu *et al.* [5,6] reported of 33.3%, respectively, 38.2% of upper extremity injuries that were initially missed. Focusing on the arm, wrist, and hand, missed injury rates of 15.1%, 17.2%, and 21.7%, respectively, were published [7].

In general, the presence of clavicular fractures is clinically easy to assess. Furthermore, because of standard procedures in the emergency department involving taking plain thoracic X-rays during initial assessment, additional radiological information on the presence of clavicular fractures can be drawn. Therefore, we hypothesized that located in a triangle of the neck, thoracic body, and upper extremity, a clavicular fracture would be suggestive of additional injuries of these body regions in polytrauma patients.

2. Materials and methods

The TraumaRegister DGU (TR-DGU, founded in 1993 by the German Trauma Society [DGU] and located in Cologne/Germany) of the DGU is a multicenter, prospective, standardized, and anonymous documentation of severely traumatized patients at four consecutive stages: A, prehospital phase; B, emergency room and initial therapy until admission to intensive care unit (ICU); C, treatment on ICU; and D, discharge from acute care hospital and outcome. Until 2013, 552 hospitals were affiliated with the TR-DGU, mostly from Germany, but also from Austria, Belgium, Finland, Luxembourg, Slovenia, Switzerland, The Netherlands, China, and the United Arab Emirates. The database contains detailed information on demographics, injury pattern, comorbidities, preclinical and clinical management, time course, relevant laboratory findings, and outcome of each individual. All data were collected centrally and checked for completeness and plausibility before storage. Injuries were coded according to the abbreviated injury scale (AIS, version 2005, Association for the Advancement of Automotive Medicine, Barrington, IL). This analysis was approved by the review board of the DGU.

2.1. Inclusion and exclusion criteria

All adult patients (age ≥16 y) with an injury severity score (ISS) ≥16 documented in the TR-DGU from 2002–2011 were included in the present study. Patients were divided into subgroups with (C+) and without (C–) a clavicular fracture. The prevalence of upper extremity injuries (fracture of the scapula, humerus, and forearm; and injuries to the shoulder and elbow joints, wrist, vessels, and radial nerve) and thoracic injuries (rib fracture, lung contusion or laceration, hemothorax, and pneumothorax), as well as injuries to the neck and carotid vessels was evaluated in both groups. Severity of injuries was recorded according to the AIS as 1 (minor), 2 (moderate), 3 (severe, not life-threatening), 4 (serious, life-threatening), 5 (critical, survival uncertain), and 6 (maximum, currently untreatable).

2.2. Statistics

Formal statistical evaluation of differences of patients with and/or without a clavicular fracture was performed with chi-squared test for counts, and Mann–Whitney's *U* test for continuous variables. Differences in prevalence rates were described as relative risk (risk for a certain diagnosis in the C+ group, divided by the respective risk in the C– group) and odds ratio (OR). For the OR, the 95% confidence interval was calculated. Statistical significance was defined as $P < 0.05$, or, for OR, if the neutral value 1 lay outside the 95% confidence interval. However, because of the large number of cases, statistical significance would be found even in minor and not clinically relevant differences. Interpretation should therefore concentrate on clinical relevance rather than on significance. All statistical analyses were performed using SPSS (SPSS 18.0; IBM Inc, Armonk, NY).

3. Results

A total of 46,565 patients could be included. Of this group, 4790 patients (10.3%) had a clavicular fracture (C+), whereas 41,775 patients (89.7%) did not have a clavicular fracture (C–). Demographics of the two groups were comparable (Table 1). A significantly higher number of patients with clavicular fracture were involved in motorbike and bicycle accidents (Table 3). Patients with clavicular fracture presented a higher ISS and new

Table 1 – Demographics: patients with clavicular fracture (C+) and without (C–).

Demographics	C+	C–	P
n	4790	41,775	>0.05
Age (±SD)	47 ± 19	48 ± 21	>0.05
Male (%)	73.1	73	>0.05
ISS	30 ± 11	28 ± 12	<0.001
NISS	35 ± 13	34 ± 14	<0.001
ICU (d)	12 ± 14	10 ± 13	<0.001
Hospital stay (d)	25 ± 25	24 ± 26	<0.001
Hospital mortality	12.5	18.9	<0.001

NISS = new injury severity score.