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Traumatic intracranial haemorrhage in conscious patients with facial fractures – A review of 1959 cases

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SUMMARY. Objective: **Facial fracture patients who are conscious with a Glasgow Coma Scale (GCS) score of 15 in the absence of clinical neurological abnormalities are commonly not expected to have suffered severe intracranial pathology. However, high velocity impact may result in intracranial haemorrhage in different compartments.** Methods: **Over a 7-year period, 1959 facial fracture patients with GCS scores of 15 and the absence of neurological abnormalities were analysed. In 54 patients (2.8%) computed tomography scans revealed the presence of accompanying intracranial haemorrhage (study group). These patients were compared with the 1905 patients without intracranial haemorrhage (control group).** Results: **Univariate analysis identified accompanying vomiting/nausea and seizures, cervical spine injuries, cranial vault and basal skull fractures to be significantly associated with intracranial bleeding. In multivariate analysis the risk was increased nearly 25-fold if an episode of vomiting/nausea had occurred. Seizures increased the risk of bleeding more than 15-fold. The mean functional outcome of the study group according to the Glasgow Outcome Scale was 4.7 ± 0.7.** Conclusion: **Intracranial haemorrhage cannot be excluded in patients with facial fractures despite a GCS score of 15 and normal findings following neurological examination. Predictors, such as vomiting/nausea or seizures, skull fractures and closed head injuries, enhance the likelihood of an intracranial haemorrhage and have to be considered. © 2008 European Association for Cranio-Maxillofacial Surgery**

Keywords: **intracranial haemorrhage, facial fractures, conscious patients, GCS, neurological injury, maxillofacial trauma**

INTRODUCTION

Sport and traffic accidents have emerged as some of the principal causes of severe injury in the western world (*Gassner* et al., 2003). In most cases, the victim has little facial protection commonly resulting in severe maxillofacial trauma. Patients sustaining facial fractures are at great risk of accompanying injuries. Localized injury to the face resulting in fractures may also involve the brain and meninges. In many cases, facial fractures distract attention from more critical, often life-threatening injuries (*Hohlrieder* et al., 2004). Conscious patients with a Glasgow Coma Scale (GCS) score 15 and no obvious neurological abnormalities are commonly not expected to suffer from severe intracranial pathology. However, high velocity impact with enough force to fracture facial bones may also cause rupture of intracranial vessels leading to haemorrhages in different compartments. Recognition of such life-threatening conditions is critical, because a traumatic intracranial haematoma is a major cause of morbidity and mortality. Early detection may lead to improved results as prompt evacuation of an intracranial haematoma is crucial to improve the outcome of head injury patients (*Mendelow* et al., 1979; *Haug* et al., 1992; *Jiang* et al., 2005; *Atzema* et al., 2006; *Bouamra* et al., 2006). The objective should be to identify patients at risk before deterioration takes place.

In this case–control study, we analysed a subgroup of alert, neurologically normal patients within a large number of facial fracture patients. All of them were admitted to the emergency department with GCS scores of 15 developing later signs of intracranial haemorrhage. By means of univariate and multivariate analyses the association between intracranial haemorrhage and the presence of potentially predictable clinical features were assessed.

PATIENTS AND METHODS

Over a 7-year period (1991–1997) 6649 patients with cranio-maxillofacial injuries were treated at the University Hospital of Innsbruck. Patient information was gathered and stored in databases allowing analyses of various parameters. Two thousand one hundred and ninety-five

patients (33.0%) sustained facial fractures, diagnosed on the basis of computed tomography (CT) and judged by a radiologist. Excluded from this study were 236 facial fracture patients (10.8%) because of admission with neurological abnormalities or GCS scores lower than 15 or not assessable because of deep sedation. The remaining 1959 patients (89.2%) were conscious with GCS scores of 15 and had no neurological abnormalities detected after standardized neurological examination including mental status evaluation as well as assessment of motor, sensory, cerebellar and reflex function. In 54 patients (2.8%) CT − mainly performed because of apparent or presumptive facial fractures − revealed the presence of an intracranial haemorrhage (study group). This patient cohort group was compared with the 1905 alert facial fracture patients without intracranial haemorrhage (control group).

Both groups were analysed and compared with respect to age, sex, cause of injury, mechanism of injury, type and location of the facial injury, associated injuries, type and location of intracranial haemorrhage and skull fractures, occurrence of vomiting/nausea, seizures, raised intracranial pressure (ICP), brain oedema, loss of consciousness or amnesia, duration of stay in critical care unit and duration of stay in the hospital overall. In the study group, we additionally assessed the necessity of surgical intervention and Glasgow Outcome Scale (GOS) scores in detail.

The causes of injury were classified into categories as follows: sports, traffic, industrial accidents, assault, activities of daily living (ADL) and play accidents. The classification of the injury mechanism included falls, collisions, hits/pushes/kicks and others. Concomitant injuries were included when they necessitated surgical care. Open brain injuries were diagnosed on the basis of cerebrospinal fluid leakage. Facial fractures were summarized as fractures of the orbit, zygoma, mandible, maxilla and nose. Fractures of the Le Fort I−III categories were also included in the zygomatic or nasal complex group as these bones were involved. Besides cervical spine fractures, skull fractures were reviewed and further classified as fractures of the cranial vault (CV) or the base of skull. The location of epidural haematoma (EDH) and subdural haematoma (SDH) was frontal, temporal, parietal or occipital. Intracerebral haematomas (ICHs) were additionally localised as being in the brainstem and the basal ganglia area. The category "closed head injury (CHI)" was defined by either a witnessed transient loss of consciousness or a patient's report of temporary loss of awareness and/or post-traumatic amnesia. The necessity of surgical intervention was exclusively related to the intracranial haemorrhage. The decision to perform craniotomy was based on the opinions of on-site neurosurgeons. The occurrence of vomiting/nausea and/or seizures was only registered at the trauma scene or during transport. Patients presenting with vomiting/nausea or seizures in the emergency department were classified as neurologically abnormal and were not considered within the group of 1959 neurologically normal, alert patients. Patients with nausea were only considered in the category "vomiting/nausea" if they were actually about to vomit. Functional outcome was evaluated at discharge from the hospital by the GOS as follows: 1 = death, 2 = vegetative state, 3 = severe disability, 4 = moderate disability and 5 = good recovery.

Statistics

Statistical calculations performed included descriptive as well as conclusive analysis. By means of univariate and multivariate analyses the association between intracranial haemorrhage and the presence of potentially predictive clinical features was assessed. To test for differences between the study and the control group the Pearson's chi-square test and the Fisher's exact test (when the expected counts were less than five) was used for categorical variables. Continuous variables were tested with the use of the Student's *t*-test. *p*-Values less than 0.05 were considered significant. Multivariate logistic regression analysis was performed to determine the odds ratios (ORs) and 95% confidence intervals (CIs) for different potential predictors of intracranial haemorrhage. Thus, selection of variables was based on clinical relevance and univariate comparisons (entry criteria $p < 0.05$).

RESULTS

Age and sex

During the study period 54 patients were identified with CT-proved intracranial haematomata (study group) while 1905 alert facial fracture patients without intracranial

Table 1 − Demographic characteristics, cause and mechanism of injury of 1959 patients in a univariate analysis

	Total (%, $n = 1959$)	Study group (%, $n = 54$)	Control group (%, $n = 1905$)	*p*-Value	OR	95%CI
Age	34.8 ± 19.1	41.1 ± 21.1	34.6 ± 19.1	<0.05	−	−
Sex	1443 (73.7)	43 (79.6)	1400 (73.5)	ns	1.41	0.72−2.76
Traffic accident	310 (15.8)	17 (31.5)	293 (15.4)	<0.005	2.53	1.41−4.55
Industrial accident	118 (6.0)	3 (5.6)	115 (6.0)	ns	0.92	0.28−2.98
Sports accident	731 (37.3)	18 (33.3)	713 (37.4)	ns	0.84	0.47−1.48
Assault accident	287 (14.7)	0 (0)	287 (15.1)	<0.001	−	−
ADL accidents	513 (26.2)	16 (29.6)	497 (26.1)	ns	1.19	0.66−2.16
Falls	851 (43.4)	22 (40.7)	829 (43.5)	ns	0.89	0.52−1.55
Hits/pushes/kicks	427 (21.8)	1 (1.9)	426 (22.4)	<0.001	0.07	0.01−0.48
Collisions	209 (10.7)	3 (5.6)	206 (10.8)	ns	0.49	0.15−1.57
Other mechanisms	472 (24.1)	28 (51.9)	444 (23.3)	<0.001	3.54	2.06−6.11

ns: Not significant.