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Concussion in facial trauma patients: a retrospective analysis of 100 patients from a UK major trauma centre

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Abstract

Concussion is a common and potentially debilitating condition. Research has shown that one-third of patients admitted with facial trauma have concurrent concussion. This study aimed to investigate the burden and management of concussion in patients presenting with acute facial trauma, and to identify potential risk factors within this population. A retrospective observational study was conducted at a UK major trauma centre between 1 January 2019 and 1 February2020. One hundred randomly selected patients who attended the acute clinic responsible for managing facial trauma were identified. No parametric data were included. The Mann-Whitney test was used to detect differences for continuous data, the X^2 test for categorical data. Clinical significance was defined as $p < 0.05$. Forty of 100 patients (40%) had evidence of concussion, of which only 4/40 (10%) had evidence that head injury advice had been given. There was no statistically significant difference between the non-concussed and concussed groups for age ($p = 0.145$), gender ($p = 0.921$), mechanism of injury ($p = 0.158$), or location of facial injury ($p = 0.451$). Clinical features of concussion were found in 40% of patients suffering from facial injury. Despite this, we found that head injury advice was rarely given. In addition, we identified no risk factors for concussion within this population, highlighting the need to screen all patients who present with facial injury. To improve the identification and management of concussion in these patients, future work should focus on the development of simple screening tools for use in clinic, and the signposting of patients to existing written and online concussion resources.

Keywords: Concussion; Traumatic brain injury; Facial injury; Outpatient

Introduction

Every year across England and Wales, 1.4 million people present to the emergency department (ED) following a traumatic brain injury (TBI).[1] The vast majority (90%) of TBI are classified as mild, that is, demonstrating a post-resuscitation Glasgow Coma Scale (GCS) of 13-15. Concussion is a sub-category of mild TBI (mTBI) in which no evidence of structural brain injury is found on computed tomography (CT).

A diagnosis of concussion relies solely on history and examination and it can therefore be difficult to identify. A recent consensus by the American Congress of Rehabilitation Medicine (ACRM) concluded that "the diagnostic label 'concussion' may be used interchangeably with 'mild TBI' when neuroimaging is normal or not clinically indicated".[2] In line with this recommendation, we have therefore used the terms 'concussion' and 'mTBI' synonymously throughout the manuscript.

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The signs and symptoms of concussion can be non-specific and can be categorised as physical, cognitive, behavioural, and sleep-related (Table 1).

Where symptoms persist beyond four weeks following injury, the term post-concussive syndrome (PCS) is used.[3] PCS is wide-ranging in its clinical presentation, with a variety of non-specific symptoms including headache, dizziness, fatigue, irritability, difficulty with concentration and performing mental tasks, impairment of memory, insomnia, and reduced tolerance to stress, emotional excitement, or alcohol.[4] Specialist referral may be required for the management of cervicogenic symptoms, migraine and headache, cognitive and psychological difficulties, balance disturbances, vestibular signs, and oculomotor manifestations. Any of these in isolation or in combination can lead to significant impairment in quality of life, and can have an impact on many aspects of psychosocial well-being.[5] Identifying concussed patients is important, as around 40% of those discharged from the ED with concussion have evidence of post-concussion syndrome (PCS) at six months.[6] Research has shown that early intervention can reduce the likelihood of developing PCS, so identifying those at risk is paramount in the improvement of patient care.[7]

The facial skeleton is in direct continuity with the calvarium and facial fractures are therefore closely related to TBI. Previous research has reported concussion in around one third of patients with facial injury who presented to a UK major trauma centre (MTC).[8] These findings were based on a cohort that was largely admitted directly from the ED, and almost 20% of them required admission to the intensive care unit (ITU). Not all facial trauma patients require admission, however, and most units follow up such patients within a few days in an acute outpatient clinic, as they will be within the window for surgical intervention if required.

The primary aim of this study was to determine the prevalence of concussion in patients reviewed in clinic with identified or suspected facial trauma, and to identify what head injury management they received. The secondary aim was to identify potential risk factors for concussion in this patient cohort.

Material and methods

This retrospective observational study was undertaken using patients with confirmed or suspected facial trauma who were managed at a regional trauma service based at a UK major trauma centre. Institutional approval was granted by the host NHS Trust.

Population

A sample of 100 patients who attended a specific acute facial injury clinic between 1 January 2019 and 1 February 2020 was identified. These dates were chosen to avoid any compounding factors introduced due to the COVID-19 pandemic. To avoid any seasonal variation in injury profile, a free, online random date generator was used to identify dates from which the patient records were sampled.

Variables

Demographic data were collected, including age, gender and referral source. Injury details included mechanism of injury (MOI), time from injury to clinic (days), and the facial and neurosurgical injuries identified. Maxillofacial injuries were categorised as midface fractures, mandibular fractures, frontal bone fractures, and other.

Concussion was identified based on the presence of documented symptoms at any point in their patient journey, including referral, ED department, or outpatient clinic. Visual disturbance was not used in isolation to diagnose concussion in midface fractures where the injury was likely to be the cause of the visual disturbance.

Evidence of head injury advice being given was categorised as written, verbal, none documented, or notes unavailable. Subsequent attendance at the TBI clinic was also noted.

Statistical analysis

Continuous data were tested for normal distribution prior to analysis; no parametric data were included. Non-parametric data are presented as median with IQR, and the Mann-Whitney was used to detect differences between groups. The X^2 test was used for categorical data. Clinical significance was defined as $p < 0.05$. Analyses were performed using GraphPad ® Prism version 8.4.3 for Windows® (GraphPad Software, www.graphpad.com).

Table 1
Clinical signs and symptoms of concussion.

Symptoms	Headache, “pressure in the head”, neck pain, nausea or vomiting, dizziness, blurred vision, photophobia, phonophobia, “don’t feel right”, fatigue, more emotional, irritability, sadness, nervousness or anxiety, confusion, feeling like “in a fog”, feeling “slowed down”, difficulty concentrating, difficulty remembering, drowsiness
Physical signs	Loss of consciousness, amnesia, neurological deficit (transient), speech disturbance, lethargy, appears dazed
Balance impairment	Gait unsteadiness
Behavioural changes	Irritability, emotional lability, personality changes
Cognitive impairment	Slowed reaction times, confusion, disorientation
Sleep/wake disturbance	Somnolence, drowsiness

Results

Demographics

One hundred patients were included in the analysis. The median age was 34.5 years (IQR 25.8–50.8) and 22% were female. The referral source distribution was external ED 54%, MTC 37%, not documented 7%, and dental practice 1%.

Injury details

The most common MOI was assault (66%), followed by fall <2 m (21%), sport (8%), and other (5%). The median (IQR) time from injury to clinic was 6 (4–9) days. This was not documented in three cases. Midface fracture was the most common type of injury (79%), followed by mandibular fracture (10%), other (10%), and frontal bone fracture (1%). The 'other' category included patients with dental trauma or soft tissue injury without bony fractures. Intracranial injury was identified in 2% of cases, with one suffering temporal contusions and one an incidental chronic subdural haematoma. There were documented symptoms of concussion in 40% of patients. In 56% no positive symptoms of concussion were documented and in 4% of cases it was unclear. There was evidence of screening for concussion in the neurology rapid access (HOT) clinic in 18% of cases.

Concussion symptoms and management

Sixty-three signs or symptoms of concussion were documented in 40 patients (Table 2). Concussion was diagnosed with a single symptom in 23 cases, with two symptoms in 12 cases, three symptoms in three cases, and four symptoms in two cases. No documented head injury advice was given in the ED in 21 cases. Notes were not available for 13 cases, written advice was given in three, was not applicable in two, and only one patient received verbal advice.

Risk factors

The concussed group had a median age of 32.5 years, and the non-concussed group had a median age of 36.0 years. A Mann-Whitney test indicated that this difference was not statistically significant ($U(N_{concussed}=40,\ N_{non\text{-}concussed}=60) = 992.5$, $p = 0.145$). No statistically significant difference was identified for gender, facial injury category, or MOI between the concussed and non-concussed groups (Table 3).

Table 2
Breakdown of symptoms in concussed group.

Symptom	No. of patients with symptoms
Loss of consciousness	23
Nausea and/or vomiting	12
Amnesia	8
Headache	7
Dizziness	5
Visual disturbance	4
Confusion	2
Fogginess	1
Light-headedness	1
Total No. of symptoms	63

Discussion

The facial skeleton acts as a 'crumple zone' to protect the brain from structural injury.[9] A systematic review of concomitant facial trauma and TBI reported the most injured area as the midface (52.4%) followed by lower-third fractures (20.6%).[10] Our data support these findings with 85% of our concussed cohort having midface trauma and 5% mandibular fractures. As the aforementioned systematic review did not include any participants without TBI, facial fractures were not assessed as a risk factor for concussion.[10] Results from our study showed no significant difference between concussed and non-concussed for demographic factors or injury patterns. It can be concluded therefore that we could not identify any group of patients in the acute facial trauma clinic that was more likely to have suffered concussion so everyone should be screened.

In our study, 40% of patients who attended an acute facial trauma clinic had concussion. This is likely to be an underestimation as more subtle symptoms such as difficulty concentrating and mental fogginess are not frequently screened for or documented.[7] Screening for concussion in an acute facial trauma clinic would therefore result in a high pick-up rate and provide an opportunity for early intervention. Whilst all patients at risk of concussion should ideally be identified in the ED, we suggest that the facial trauma clinic provides a further opportunity to identify concussion that might have been missed or forgotten in the presence of concurrent facial injury. Screening in clinic would also act as a safety net since the majority of these patients do not appear to be getting advice on head injury in the ED. It is also important that the diagnosis is made and reported to the patient's GP if symptoms of PCS are delayed more than half of the concussed patients in this study did not receive advice, either written or verbal, from the ED.

We suggest several hypotheses for this. First, that facial injury is 'distracting' and focus is shifted towards onward referral and management of the maxillofacial injury. Secondly, that there is an assumption that the facial trauma team will manage the concussion. The National Institute for Health and Care Excellence (NICE) head injury guidelines outline what should be included in the written advice provided to patients on discharge from the ED.[1] Currently this focuses on recognising neurological red flags and when to seek further medical help. Whilst this is important in the very acute stages of a mTBI, there is a paucity of detail surrounding self-care guidance, occupational advice, and how to access further help if PCS persists. Identifying (or re-identifying) concussed patients in clinic would offer an opportunity to signpost more detailed mTBI/concussion

Table 3
Factors in concussed vs non-concussed group. Data are number (%).

	Concussed (n = 40)	Non-concussed (n = 60)	X^2	df	p value
Gender:			0.010	1	0.921
Male	31 (76)	47 (78)			
Female	9 (23)	13 (22)			
Facial injury:			2.637	3	0.451
Midface fracture	34 (85)	45 (75)			
Mandibular fracture	2 (5)	8 (13)			
Frontal bone fracture	0	1 (2)			
Other	4 (10)	6 (10)			
Mechanism of injury:			5.198	3	0.158
Assault	31 (78)	35 (58)			
Fall <2m	4 (10)	17 (28)			
Sport	3 (8)	5 (8)			
Other	2 (5)	3 (5)			

advice - for example, details of the Headway charity website.[11]

There is no national guidance for the follow up of patients with concussion, which leads to great variation in how they are managed in different regions. The sheer number of patients suffering from concussion makes follow up for everyone a logistical impossibility. There is also no strong evidence to suggest which patients may be more at risk of developing PCS, so selected follow up of predetermined 'at risk' cohorts is also not possible. Lack of ownership of the condition is another hurdle to overcome. The ED is most often the first and only contact such patients have with healthcare services,[12] but who is to provide ongoing care – neurosurgery, general medicine, neurology, exercise medicine, or primary care? Although primary care is a common answer to this question, experience suggests that patients suffering from PCS require an in-depth history, physical examination, and neuropsychological assessment, which is simply not possible in a short primary care consultation. Specialist tests that are frequently requested in cases of PCS, such as pituitary profiling and magnetic resonance imaging (MRI) brain scans are again not readily available for GPs to request directly. Additionally there is a general lack of confidence amongst GPs about how to manage concussion[13] so further education of primary care clinicians would be required management to improve, current head injury guidelines should be updated and extensive investment into mTBI services would be required.

Ultimately, concussion is difficult to diagnose given the lack of an objective diagnostic test. Previous work has reported that only 23% of patients presenting to the ED with concussion ever have the diagnosis made.[14] The task of diagnosis is complicated further when there is concurrent intoxication, a mental health condition, pre-existing cognitive impairment, or a lack of information surrounding the injury itself. Both NICE and the Concussion in Sport Group (CISG) have recommended the identification of diagnostic biomarkers as a priority for TBI research.[1,5] Until such biomarkers become a clinically validated tool, however, the authors suggest that use of a structured symptoms screening tool for all at-risk patients should be implemented in both the ED and facial trauma clinic settings.

The authors recognise several limitations within this study in addition to its retrospective nature. First, the study is not powered and so a larger sample of patients may be required to identify any significant differences in the risk factors assessed. Secondly, the ED notes were not available for 13 of the concussed patients so we could not determine whether they had had any advice on head injuries from their referring hospitals. We also did not examine any maxillofacial-specific outcome data so cannot comment on whether concurrent mTBI has an impact on surgical outcomes in facial trauma. This would be an area for further research.

Conclusion

Concussion is common and can become a disabling disease. Early intervention can improve outcomes for patients so it is important they are identified. Forty per cent of patients who presented to an acute facial trauma clinic had symptoms suggestive of concussion at the time of injury, but very few received formal advice on head injury. We did not identify any significant risk factors for concussion, and would suggest that all patients attending such clinics should be screened for it. Until an objective diagnostic test becomes available, future work should focus on the development of simple screening tools for use in clinic, and the signposting of patients to existing written and online concussion resources.

Conflict of interest

We have no conflicts of interest.

Ethics statement/confirmation of patient permission

Formal Regional Ethics Committee application was not sought as advised following completion of the Health Research Authority (HRA) decision tool online. Patients' permission not applicable.

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