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Blunt neck trauma at a level I trauma centre: six-year retrospective case note review

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Abstract

Background. Blunt neck trauma can cause serious morbidity and mortality rates of up to 40 per cent, but there is a paucity of literature on the topic.

Method. A retrospective case note review was performed for all blunt neck trauma cases managed at the Queen Elizabeth Hospital Birmingham between 1st January 2011 and 31st December 2017.

Results. Seventeen cases were managed, with no mortality and limited morbidity. Most patients were male (70.6 per cent) and road traffic accidents were the most common cause of injury (41.2 per cent). The median age of patients was 40.6 years (range, 21.5–70.3 years). Multidetector computed tomography angiography of the neck was performed in 9 patients (52.9 per cent) with 'hot' reports made by on-duty radiology staff matching consultant reports in all but 1 case. Six patients underwent operative exploration yielding a negative exploration rate of 33.3 per cent. Imaging reports matched operative findings in 3 cases (60 per cent).

Conclusion. Blunt neck trauma is uncommon but usually presents in polytrauma. Imaging has inaccuracies when compared with operative findings, regardless of radiological experience.

Main Article

Dr N Sharma takes responsibility for the integrity of the content of the paper

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Introduction

Blunt neck trauma describes a neck injury resulting from a non-penetrating mechanism that does not breach the platysma muscle.[1] The majority of blunt neck trauma is secondary to road traffic accidents.[2] The typical history is of an unrestrained driver colliding with the steering wheel with a hyperextended neck, although blunt neck trauma from motorcycle accidents is now increasingly prevalent.[3] Other causes of blunt neck trauma include assault, falls, hanging and strangulation, sporting injuries such as clothesline trauma (an outstretched arm tackle direct to the neck, which is deemed illegal in some sports) in American football or rugby, or injuries from a hockey or lacrosse ball striking the neck.[4–6] Reporting of blunt neck trauma in the academic literature typically focuses on two groups of injuries: blunt laryngeal and blunt vascular injuries. The incidence, mortality and management differ between these groups, but the mechanisms of injury are similar.

Blunt laryngeal trauma comprises less than 1 per cent of blunt external trauma admissions in major trauma centres,[6,7] and rates are decreasing alongside stricter safety regulations for vehicles (e.g. seatbelts, air bags and speed limits) and better protective equipment in sport.[6] Nevertheless, mortality can be as high as 40 per cent, often due to asphyxiation.[8] Laryngeal injuries vary in severity from minor soft tissue oedema to fractures of the laryngeal skeleton.[6] Symptoms of laryngeal injury include neck pain, dysphonia, dysphagia, odynophagia, dyspnoea and haemoptysis. Signs include ecchymosis, neck and laryngeal tenderness, haematoma, and subcutaneous emphysema.[2,6,7] However, no symptom correlates well with injury severity, and up to one third of patients are asymptomatic in the first 24–48 hours.[6,7] Moreover, delayed diagnosis and treatment is associated with poorer airway patency and phonation outcomes,[9] emphasising the need for a high index of suspicion in laryngeal injuries.

Once the airway and cervical spine are stable, patients should be assessed with imaging studies and more invasive investigations such as flexible nasoendoscopy (FNE). Flexible nasoendoscopy is essential in assessing airway patency, vocal fold mobility and pharyngeal integrity, whilst high resolution computed tomography (CT) scans are the 'gold standard' for visualising the laryngeal framework and soft tissues.[10] Depending on the severity of injury, management can be conservative, consisting of bed and voice rest, corticosteroid treatment and serial FNE examinations to exclude delayed laryngeal oedema, or can be surgical.[3,10] Surgical interventions should be performed as early as possible, preferably within 24 hours, to achieve the best airway and phonation outcomes.[11] In practice, this is often difficult due to infrequent presentation, specialist equipment requirements and lack of operative experience.

Table 1. Data variables and sources

Variable	Source within online patient database
Gender	Demographic data
Date of birth	Demographic data
Admission & discharge date from Queen Elizabeth Hospital Birmingham	Discharge letter
Mechanism of injury	Emergency department trauma notes
Glasgow Coma Scale score	Emergency department trauma notes
Laterality of injury	Emergency department trauma notes, imaging reports & operative reports
Associated injuries	Emergency department trauma notes, imaging reports & operative reports
Findings on physical examination	Emergency department trauma notes
Imaging requests & findings	Imaging reports
Correlation between 'hot' reports & consultant reports	Imaging reports
Definitive treatment (i.e. conservative or surgical management)	Emergency department trauma notes & operative reports
Findings of internal injury on open exploration	Operative reports
Correlation between 'hot' reports, consultant reports & operative findings	Imaging & operative reports
Correlation between physical & operative findings in the absence of imaging	Emergency department trauma notes & operative reports
Specialties involved in management	Emergency department trauma notes, operative reports & discharge letter
Mortality & date of death	Death certificate
Discharge destination	Discharge letter
Follow-up plan	Discharge letter
Requirement for long-term tracheostomy	Discharge letter
Reoperations for treated injuries	Operative reports
Missed injuries	Clinic letters & operative reports after discharge date

Blunt vascular neck injury mainly affects the carotid and vertebral arteries and is often referred to as blunt cerebrovascular neck injury. Symptomatic patients present with focal neurological signs although blunt cerebrovascular neck injury can be asymptomatic for up to 48 hours after the initial trauma.[12] This is demonstrated by the incidence of blunt cerebrovascular neck injury in blunt trauma patients increasing from 0.24 per cent to 0.86 per cent after screening in one report. Importantly, 52 per cent of the patients with a blunt cerebrovascular neck injury were asymptomatic at presentation, emphasising the need for a high index of suspicion.[13] Particular mechanisms of injury such as hanging with anoxic injury and severe cervical hyperextension, rotation or hyperflexion, as well as associated injuries such as severe facial trauma and cervical spine and basilar skull fractures should increase the suspicion of blunt cerebrovascular neck injury even in asymptomatic patients.[14,15]

Multidetector CT angiography of the neck is the most accurate imaging modality for blunt cerebrovascular neck injury, with a reported sensitivity and specificity of 97.7 per cent and 100 per cent, respectively, when compared with 146 angiographically proven blunt cerebrovascular neck injuries.[16] The management of blunt cerebrovascular neck injury is guided by the radiological grade of injury, which can vary from mild intimal injury to vessel transection with extravasation.[17] Management options include observation (most common), anticoagulation, and endovascular techniques such as stenting and pseudoaneurysm coil embolisation.[15]

Despite the significant morbidity and mortality associated with blunt neck trauma, there is a paucity of literature on it. Therefore, this study aims to report the experience of blunt neck trauma over a six-year period at the Queen Elizabeth Hospital Birmingham, a UK level I trauma centre that serves a population of almost 6 million.[18] This study also aims to assess the degree of correlation between 'hot' imaging reports, often reported immediately after the trauma scan by junior radiologists, and subsequent specialist consultant imaging reports, and between these reports and operative findings.

Materials and methods

Study design and setting

A retrospective case note review was conducted for all civilian patients with blunt neck trauma that was managed at the Queen Elizabeth Hospital Birmingham between 1st January 2011 and 31st December 2017.

Participants

Patients were identified for inclusion through medical coding and an electronic medical records review by one reviewer (B Zakaria). Blunt neck trauma was defined as a blunt injury involving the anterior neck, thereby excluding purely orthopaedic and neurosurgical injures to the spine. Penetrating neck injuries and warzone-related neck injuries were excluded from analysis. This generated a cohort of 17 cases for inclusion. Any uncertainties about inclusion were discussed at weekly meetings with senior colleagues. CJ Coulson was the final arbiter of any uncertainty.

Variables and data sources

Data were collected using emergency department notes, imaging reports, operative notes, discharge letters and, if applicable, follow-up appointments in the clinic (Table 1).

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Table 2. Mechanism of injury in blunt neck trauma

Mechanism of injury	Frequency	Percentage of injuries (%)
Road traffic accident	7	41.2
Fall from bicycle	3	17.6
Hanging	3	17.6
Blunt assault	2	11.8
Lacrosse ball	1	5.9
Strangulation	1	5.9
Total	17	100.0

Imaging was 'hot' meaning it was reported by the on-call radiologist, usually a registrar, and later checked by a specialist consultant radiologist. If the consultant agreed with or authorised the 'hot' report, they were considered as matching. Any discrepancy meant they were considered as not matching. Both the 'hot' report and the consultant report were individually compared with the operative report if the patient underwent surgical exploration. Any injury predicted by imaging but not noted in the operative report (false positive) and any injury not predicted by imaging but noted in the operative report (false negative) was recorded. If no imaging was performed prior to surgical exploration, the physical examination findings were compared with the operative reports and any discrepancies were noted.

Discharge data, including destination (home, psychiatric facility or rehabilitation facility), planned follow up (clinic with managing specialty, clinic with non-managing specialty, psychiatry or general practice) and requirement for tracheostomy, were also recorded, except in cases of self-discharge or death. The author of the discharge letter determined the managing specialty. Reoperations were classified as any procedure performed in the operating theatre after the initial exploration. Missed injuries were classified as any injury considered a result of the initial neck trauma that presented after discharge.

Statistical methods

The data were analysed using SPSS® (version 24) statistical software. The median and range were calculated for the age variable because of its skewed nature. For all other variables, results were calculated as percentages.

Ethical considerations

This study was registered as a clinical audit and approved by the clinical governance department at the Queen Elizabeth Hospital Birmingham. No data collection or analysis that required additional patient consent was performed.

Results

Patient demographics and mechanism of injury

Seventeen patients were managed at the Queen Elizabeth Hospital Birmingham for blunt neck trauma over the six-year study period. Of these, 12 patients (70.6 per cent) were male and 5 (29.4 per cent) were female. The median age was 40.6 years (range, 21.5–70.3 years). The most common mechanism of injury was a road traffic accident in 41.2 per cent of cases, followed by falls from a bicycle and hanging in 17.6 per cent of cases each (Table 2).

Table 3. Imaging procedures used in assessment of blunt neck trauma

Imaging procedure	Frequency	Percentage of total patients (%)
CT head	11	64.7
Multidetector CT angiography neck	9	52.9
Thoracic imaging	7	41.2
Abdominal imaging	7	41.2
Pelvic imaging	7	41.2
CT cervical spine	5	29.4
Flexible nasoendoscopy	5	29.4
MRI cervical spine	4	23.5
Upper limb imaging	4	23.5
X-ray mandible	3	17.6
CT neck	2	11.8
Pharyngoscopy	2	11.8
CT face	2	11.8
X-ray orthopantomogram	2	11.8
Lower limb imaging	2	11.8
CT angiography aortic arch & carotid both	1	5.9
Laryngoscopy	1	5.9
X-ray cervical spine	1	5.9

CT = computed tomography; MRI = magnetic resonance imaging

Physical examination

Eleven (64.7 per cent) patients presented neurologically intact with a Glasgow Coma Scale score of 15, one patient (5.9 per cent) had a Glasgow Coma Scale score of less than 15 and greater than or equal to 13, and one patient (5.9 per cent) had a Glasgow Coma Scale score of less than or equal to 12 and greater than or equal to 9. The remaining 4 (23.5 per cent) patients had a Glasgow Coma Scale score of less than or equal to 8.

The neck injuries were bilateral in 10 patients (58.8 per cent), right-sided in 4 patients (23.5 per cent) and left-sided in 3 patients (17.7 per cent). Head injuries were the most common associated injury, present in 52.9 per cent of patients, followed by facial soft tissue injuries in 41.2 per cent, upper limb injuries in 29.4 per cent, lower limb injuries in 17.6 per cent, thoracic injuries in 11.8 per cent and abdominal injuries in 5.9 per cent of patients. On physical examination, airway injury was suspected in 4 patients (23.5 per cent) and vascular injury was suspected in 3 patients (17.6 per cent). Muscular and skeletal injuries were suspected in 6 (35.3 per cent) and 4 patients (23.5 per cent), respectively.

Imaging

Computed tomography of the head was the most common imaging procedure (Table 3). It was performed in 11 patients (64.7 per cent), whereas multidetector CT angiography of the neck was only performed in 9 (52.9 per cent). Whole-body trauma CT scans, often used following road traffic accidents, meant that thoracic, abdominal and pelvic imaging was performed in 7 patients (41.2 per cent). Given the higher rates of spinal injury in blunt trauma, CT and magnetic resonance imaging of the cervical spine were also common imaging modalities.

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The 'hot' reports and consultant reports matched for all head and neck imaging procedures apart from one (11.1 per cent) multidetector CT angiography neck scan and one (9.1 per cent) CT head scan. After imaging, 18 injuries (7 muscular, 3 skeletal, 1 pharyngeal, 3 tracheolaryngeal, 2 non-jugular veins, 1 internal jugular vein and 1 vertebral artery) were suspected in 15 patients.

Definitive management

Out of 17 patients, 9 were managed conservatively, 6 had their neck wounds explored in the operating theatre, 1 was sutured in the emergency department and 1 patient was taken to the operating theatre for closure of their wound without exploration. Of the 6 patients who had exploration, internal injuries were found in 4 patients, resulting in a negative exploration rate of 33.3 per cent. In one positive exploration, a minor muscular injury to the infrahyoids was identified. Another patient sustained injuries to the sternocleidomastoid, the submandibular gland and the facial vein. The third patient had a brachial plexus avulsion injury with damage to the sternocleidomastoid, and the fourth patient sustained a fracture to the left thyroid lamina.

Physical examination, imaging and operative report correlation

One patient was taken to the operating theatre after only undergoing FNE meaning no comparison could be made between 'hot' reports, consultant reports and operative findings for this patient. However, the findings from the physical examination matched the operative findings. For the remaining 5 patients explored in the operating theatre, 'hot' reports and consultant reports matched operative findings in 3 patients (60 per cent). Only false negative findings were reported in the two patients where discrepancy existed between imaging and operative reports, which were the submandibular gland and brachial plexus injuries described previously.

Morbidity and mortality

Survival was 100 per cent over the study period, and there were no missed injuries. One patient who presented with a Glasgow Coma Scale score of less than or equal to 8 after a road traffic accident required a tracheostomy for 12 days while hospitalised, but this was decannulated prior to discharge. No other patients required a tracheostomy. Only the patient with the brachial plexus avulsion injury required reoperation procedures. These were an open reduction and internal fixation of the clavicle, and intercostal nerve grafting for further repair to the brachial plexus.

Discharge and follow up

Fourteen patients (82.4 per cent) were discharged home, 2 patients (11.8 per cent) were discharged to a rehabilitation facility and 1 patient who had attempted suicide by hanging was discharged to a psychiatric in-patient facility. Three patients (17.6 per cent) had no planned follow up in place, but the remaining 14 were followed up by the managing specialty in clinic (11 patients, 64.7 per cent), by a general practitioner (5 patients, 29.4 per cent), or by a psychiatry practitioner (1 patient, 5.9 per cent). Three patients were followed up by both the managing specialty and their general practitioner.

The ENT team was primarily involved in the management of 10 patients (58.8 per cent). Other specialties involved included the trauma and orthopaedic teams for 8 patients, (47.1 per cent), the neurosurgery team for 5 patients (29.4 per cent), and both burns and plastics teams as well as the maxillofacial surgery team for 4 patients (23.5 per cent).

Discussion

Blunt neck trauma that is severe enough to require specialty referral and management is uncommon, so although the cohort of 17 patients in this study was small, this is not to say that it is an unrepresentative sample of blunt neck trauma cases in the UK. The gender distribution and median age of 40 years are typical of other reports, as are the prevalence of the different mechanisms of injury.[6,7] Head injuries are commonly seen in road traffic accidents and falls, so it is not surprising that a relatively high percentage of patients presented with neurological deficits, as shown by the Glasgow Coma Scale scores on admission in this study.

Multidetector CT angiography was the most common imaging technique used to evaluate the neck as recommended for laryngeal and vascular injuries.[10,15] All but one of the multidetector CT angiography 'hot' reports matched the consultant reports. This demonstrates that inexperience in reporting trauma scans of this nature does not hinder the accuracy of the reports. This is particularly relevant for smaller centres where fewer radiologists are experienced in assessing trauma scans.

There were, however, two instances of false negative findings when compared with the operative reports. One of these was a substantial avulsion injury to the brachial plexus. Given that road traffic accidents are a common mechanism for brachial plexus injuries, it is important to clarify the value of multidetector CT angiography in assessing these injuries. To date, there is a distinct lack of literature on the topic. Flexible nasoendoscopy was performed in only five patients, which seems unusual in a blunt neck trauma population. However, four patients were intubated on admission, preventing FNE from being performed. In the remaining eight patients who did not undergo FNE, airway injury was not suspected on physical examination, and no tracheolaryngeal injury was discovered with further investigation. Nevertheless, given that up to a third of patients with a blunt laryngeal injury are asymptomatic in the first 24–48 hours,[6,7] the importance of FNE in assessing airway patency and vocal fold mobility should be communicated to clinicians and form part of the management plan for blunt neck trauma patients.

Three patients had tracheolaryngeal injuries of which two were successfully managed conservatively. The third patient underwent an open reduction and internal fixation of the left thyroid lamina with miniplates nine days after trauma from a lacrosse ball. Although the phonation and swallowing outcomes were generally very good, the patient did report occasional minor issues with vocal strain and voice crackling. This may have been avoided had the repair been performed sooner after the initial trauma. It has been reported that favourable airway and phonation outcomes can be achieved in 87 per cent of patients undergoing surgery within 24 hours compared with 69 per cent 2 to 7 days post-trauma, and only 27 per cent after a week.[11] However, as is often found, the infrequent presentation means that specialist equipment and operative experience are lacking meaning that delayed treatment can be the safer option. The only patient with a blunt cerebrovascular neck

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injury underwent exploration in order to repair a facial vein and submandibular gland injury. The blunt cerebrovascular neck injury itself was successfully managed conservatively, as is commonly seen.[15]

Despite blunt neck trauma having a reported mortality of up to 40 per cent,[8] there were no deaths and very little morbidity in this cohort. This may have been due to appropriate and timely management or because relatively minor injuries were treated during the study period. Almost 80 per cent of patients received some element of follow up, which is important even for minor injuries in order to ensure good phonation and swallowing outcomes. Only one of three patients that attempted suicide by hanging received psychiatric follow up. Given that hanging is a relatively common mechanism by which suicide is attempted, these follow-up rates should be improved to reduce the risk of future patient harm.

This study is a retrospective case note review performed at a single institution. Consequently, it is subject to the biases associated with retrospective studies including recall and recording bias. With regards to recording bias, the accuracy and detail of the medical notes was poor in a few cases, which could have detrimentally affected the data collection and analysis. Furthermore, despite being performed at a large level I trauma centre, the sample size is smaller and the generalisability of the findings to the entire UK population is less valid than if it was a large multicentre study.

- Blunt neck trauma typically presents in young male patients in a setting of polytrauma following road traffic accidents
- Radiological inexperience does not adversely affect the accuracy of multidetector computed tomography angiography trauma scan reports for blunt neck trauma
- Imaging reports correlate well with operative findings, although this conclusion needs further investigation with regard to nerve injuries
- There was no mortality and very little morbidity in this cohort from a UK level I trauma centre
- Multicentre prospective studies are needed to further evaluate the management of blunt neck trauma in the UK and develop evidence-based management strategies

Conclusion

This is the first UK study to report on the experience of blunt neck trauma as a whole. The study reported on 17 cases of blunt neck trauma that were successfully managed at the Queen Elizabeth Hospital Birmingham. It shows that inexperience does not adversely affect the accuracy of multidetector CT angiography trauma scan reports for blunt neck trauma and that these imaging reports correlate well with operative findings, although this conclusion with regards to nerve injuries needs further investigation. Multicentre prospective studies are needed to further evaluate the management of blunt neck trauma in the UK and develop evidence-based management strategies, given the current paucity of guidance on the topic.

Competing interests. None declared

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