



An audit of penetrating neck injuries in a South African trauma service



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ARTICLE INFO

Article history:

Accepted 18 July 2015

Keywords:

PNI
SNOM
CTA
Clinical assessment

ABSTRACT

Introduction: This study reviews and validates the practice of selective non-operative management (SNOM) of penetrating neck injury (PNI) in a South African trauma service and reviews the impact new imaging modalities have had on the management of this injury.

Methodology: This study was performed within the Pietermaritzburg Metropolitan Trauma Service, in the city of Pietermaritzburg, Kwazulu-Natal, South Africa. A prospectively maintained trauma registry was retrospectively interrogated. All patients with PNI treated over a 46-month period were included within the study.

Results: A total of 510 patients were included in the study. There were 452 stab wounds (SW) and 58 gunshot wounds (GSW). A total of 202 (40%) patients sustained isolated PNI, the remaining 308 (60%) patients sustained trauma to at least one additional anatomical region. An airway injury was identified in 29 (6%) patients; a pharyngo-oesophageal injury in 41 (8%) patients and a vascular injury in 86 (17%) patients. Associated injuries included three penetrating cardiac injuries (PCI) and 146 patients with haemo-pneumothoraces. Of the total cohort, 387 patients (76%) underwent CT Angiography (CTA), of which 70 (18%) demonstrated a vascular injury. Formal catheter directed angiogram (CDA) was performed on 16 patients with positive CTA but confirmed injury in only half of these patients. Of 212 patients (42%) who underwent water-soluble contrast swallow (WS-swallow), an injury was demonstrated in 29 (14%) cases. A total of 401 (79%) patients were successfully managed conservatively for PNI and 109 (21%) surgically or by endovascular intervention. Only five (1.2%) patients failed a trial of SNOM and required surgery. The in-hospital mortality rate was 2%. No deaths could be attributed to a failure of SNOM.

Conclusion: SNOM of PNI is a safe and appropriate management strategy. The conservative management of isolated pharyngeal injuries is well supported by our findings but the role of conservative treatment of oesophageal injuries needs to be further defined. The SNOM of small non-destructive upper airway injuries seems to be a safe strategy, while destructive airway injuries require formal repair. Imaging merely for proximity, is associated with a low yield. CTA has a significant false positive rate and good clinical assessment remains the cornerstone of management.

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Introduction

Mandatory neck exploration for penetrating neck injuries (PNI), leads to a high rate of negative exploration and selective non-operative management (SNOM) of PNI has long been established as a management philosophy in South Africa [1–9]. Most of the original work documenting the applicability of SNOM to PNI dates from the era prior to the advent of new imaging technologies such as CT angiography (CTA) and endovascular surgery. On-going audit

is essential to help us contextualize these new modalities and to ensure that they are integrated positively into our existing management algorithms in a way that adds value rather than merely complicates clinical scenarios. There are also subsets of injuries particularly those of the aero-digestive tract, in which the optimal management strategies still remain controversial [10,11, 17–20]. This retrospective review of a prospectively maintained electronic registry and medical record system was undertaken to review the current spectrum and burden of the problem and to review the outcomes of our management strategy in light of the advent of newer technologies. It was also hoped that with the new powerful method of capturing clinical data we would be able to analyse the controversial subsets of injuries in more detail.

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Methodology

The Pietermaritzburg Metropolitan Trauma Service (PMTS) maintains a prospective digital trauma registry, which captures data at our institutions. Ethics approval to maintain the registry has been obtained from the Biomedical Research Ethics Committee (BCA221/13 BREC) of the University of KwaZulu-Natal and from the Research Unit of the Department of Health [12]. Patients with PNI treated from January 2011 to November 2014 were included in the study and data pertaining to the following criteria were collected and reviewed: demographics and injury severity score, mechanism of injury, anatomical site of wounds, special investigations, method of management, anatomical injuries and outcome. Furthermore the number of fatalities from PNI captured and recorded at the state mortuary for the same period was retrieved. Data were exported into Microsoft Excel and analysed using standard statistical tests. Student's *t*-test was used for numerical data and Pearson's Chi-square test was used for categorical data.

Management of PNI

All neck wounds are classified as either posterior to the posterior border of the sternocleidomastoid muscle, or anterior to the posterior border of the muscle [2,3]. Anterior wounds are subclassified according to zone as described by Roon and Christensen [3]. All non-responders and transient responders to resuscitation are subjected to urgent operative exploration.

All responders and stable patients are examined clinically and selectively investigated. Antibiotics are only administered if a digestive tract injury is suspected or confirmed and all patients are observed in hospital for 48 h prior to discharge. Indications for vascular imaging include hard signs of vascular injury such as controlled haemorrhage, pulsatile hematomas, bruits, thrills, cerebral ischemia or pulse discrepancy, or soft signs like small hematomas, a history of severe bleeding or hypotension or focal neurological deficits. With the increased access to CTA proximity alone has increasingly become an indication for investigation in our institutions. Aero-digestive tract injury is suspected if odynophagia, surgical emphysema, haematemesis, haemoptysis or an active, blowing wound is present. CTA is the first line of imaging to exclude a vascular injury. Formal catheter directed angiography (CDA) is reserved for equivocal CTA findings, or where artifacts compromise CTA interpretation. CDA may also be used with therapeutic intent. Water-soluble contrast swallow (WS-swallow) is the investigation of choice to exclude a digestive tract injury. Oesophagoscopy is reserved for select cases or where a swallow cannot be performed for logistical reasons. Rigid or flexible bronchoscopy is used selectively for suspected tracheal injuries.

We explore and repair almost all oesophageal injuries but manage pharyngeal injuries conservatively [10]. Patients with small, contained oesophageal injuries where the contrast on WS-swallow does not track downwards into the mediastinum may be candidates for conservative management [11,17]. Conservative management consist of intravenous antibiotics, with the patient being strictly nil per mouth and receiving all feeds through a nasogastric tube (NG-tube). A repeat WS-swallow is done on day ten to confirm healing of the defect.

Results

Demographics and mechanism of injury

Over the 46-month study period, 510 patients, (452 males and 58 females) were managed for PNI. The mean age was 29.2 years (range 8–73 years). A total of 452 (89%) patients sustained stab

wounds (SW) and 58 (11%) sustained gunshot wounds (GSW). A total of 202 (40%) patients sustained an isolated PNI, whilst 308 (60%) patients sustained trauma to at least one other additional anatomical region. This was for the majority of patients due to concomitant extra-cervical penetrating wounds.

Anatomical site of neck wound

A total of 387 (76%) patients sustained wounds to the anterior triangle of the neck, distributed as following: Zone I: 207 (41%), Zone II: 142 (28%), Zone III: 38 (7%). There were 61 (12%) patients with wounds to the posterior triangle and 46 (9%) patients with wounds to two or more regions of the neck. In 16 (3%) patients the wounds were not classified in the registry.

Concomitant penetrating wounds

Concomitant penetrating wounds were located to the chest in 133 (26%) patients, to the head and face area in 124 (24%) patients, to the extremities in 89 (17%) patients and to the abdomen in 48 (9%) patients.

Special investigations

A total of 387 (76%) patients underwent a CTA, of which 70 (18%) demonstrated a vascular injury. Three patients returned with a pseudo-aneurysm despite having a normal CTA on admission. This provides a false negative rate for CTA of less than one per cent (3 out of 317 negative CTAs were false negative). CTA demonstrated a vascular injury in 70 patients and of these 16 (23%) patients proceeded to have a CDA. In only 8 (50%) of these patients did CDA confirm the injury identified on CTA and a further patient with an injury demonstrated on CTA underwent a negative exploration. Nine out of 70 positive CTA's were therefore falsely positive giving a false positive rate for CTA of 13%. Of the 212 (42%) patients who underwent WS-swallow, an injury was demonstrated in 29 (14%) cases. Fifteen (3%) patients underwent endoscopy of which 11 (73%) confirmed an injury.

Management

A total of 373 (73%) patients did not require any surgical intervention and 401 (79%) were managed conservatively for PNI. Therapeutic interventions were required for 137 (27%) patients, of which 109 (21%) were for a penetrating neck wound and 28 (6%) for concomitant injuries. Of the 109 patients requiring interventions for PNI seven (6%) underwent an endovascular intervention, two (2%) a thoracoscopy for retained pleural collection, one (<1%) an incision and drainage of a neck abscess, and two (2%) required a tracheostomy without a neck exploration. The remaining 97 (89%) patients underwent formal open neck exploration. Of the 109 patients who underwent intervention for PNI 28 (26%) patients underwent emergency surgery without prior imaging. The following incisions were used: anterior lateral SCM or collar incision neck, supra-infra-clavicular incision, local wound exploration and sternotomy/thoracotomy. Only three patients underwent a negative neck-exploration, constituting 0.6% of the entire cohort and 3% of all patients explored. Two patients required open neck explorations for removal of retained blades but without any findings of further injury noticed.

Airway injury

A total of 29 (6%) patients sustained an airway injury. This included seven laryngeal injuries, which were all managed operatively, 18 cervical tracheal injuries, of which 10 were

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