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Imaging the oesophagus after penetrating cervical trauma using water-soluble contrast alone: simple, cost-effective and accurate

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ABSTRACT

Aim: This audit aims to gauge the safety and efficacy of iso-oncotic water-soluble contrast media as the sole imaging evaluation of the distal pharynx and cervical oesophagus after penetrating cervical trauma.

Methods: A retrospective audit was performed over a 4-year period of all patients with penetrating cervical trauma to zones 1 and 2 of the neck who were subjected to imaging evaluation as part of a selective non-operative management policy for penetrating cervical trauma. The outcome was reviewed and the sensitivity, specificity and predictive values of the investigation were determined. The surgical management of identified injuries is also described.

Results: Four hundred and sixty-five contrast studies were included with 11 studies positive for pathology (9 injuries, 2 incidental findings). Surgery was undertaken in 4 patients with cervical oesophageal injuries and conservative management was carried out in 5 cases of distal pharyngeal injury. No missed injuries and no significant adverse events were identified during the study period.

Conclusion: A contrast study of the oesophagus with water-soluble iso-oncotic contrast media as the sole diagnostic imaging modality is safe (avoiding the risk of aspiration pneumonia), reliable (identifying all injuries) and cost-efficient (avoiding the need for additional expensive investigations) in cases of penetrating cervical trauma.

Traditionally, the management of patients presenting with penetrating trauma to the cervical region was routine surgical exploration to identify and repair vascular or aerodigestive tract injuries.¹ However, subsequent studies proved that the morbidity and mortality of penetrating cervical trauma was not increased through selective exploration and appropriate imaging of the stable patient. This resulted in a selective conservative approach to these patients in higher volume centres.²⁻⁶

Controversy remains, however, with regard to the optimal diagnostic modality and management of possible cervical oesophageal injury. Clinical features have been shown to be unreliable in determining the presence or absence of an injury.⁷ As recently as 2007 a group from Texas⁸ still advocated the use of barium combined with selective endoscopy to evaluate the oesophagus. These methods are cumbersome, with well-described potential morbidity (mediastinal fibrosis), require patient cooperation and equipment available for endoscopy. This study is an audit gauging the efficacy of using an iso-oncotic

water-soluble contrast oesophagogram as the sole imaging modality for a possible cervical oesophageal injury in patients presenting to our high-volume level 1 equivalent trauma centre in the northern suburbs of Cape Town, South Africa.

The aim of this study was to determine if the policy was safe, cost-effective and reliable in detecting all injuries without a significant false negative rate.

METHODS

The study was undertaken over a 4-year period between June 2002 and the end of May 2006. On arrival at the hospital all patients with penetrating trauma to the neck were resuscitated and evaluated according to standard guidelines derived from the Advanced Trauma Life Support⁹ philosophy and accepted surgical practice. Unstable patients with active bleeding were rapidly transferred for operative intervention, while those with evidence of platysmal penetration who remained stable were evaluated clinically and radiologically. Any patient with an injury to zone 1 underwent selective angiography and routine contrast oesophagography, while those with an injury to zone 2 with no clinical signs of vascular injury underwent only contrast oesophagography.¹⁰ Patients in whom an injury was detected by contrast swallow were managed by the surgical team, whereas those with negative studies underwent ongoing clinical assessment to detect any missed injury. On discharge from the hospital, an "open door" policy allows for any patient developing symptoms to return directly to the unit for review.

RESULTS

During the study period the trauma centre treated an average of 16 124 patients per year. Those who were not admitted for penetrating neck trauma were excluded. A total of 2172 patients were admitted with penetrating neck injury and, of these, 257 were taken directly to surgery for active bleeding or other hard signs of an injury. The majority of injuries either did not penetrate the platysma or were to zone 3 of the neck. There were 465 patients, mainly due to stab wounds (only 27 were gunshot wounds, all low velocity) with an entry wound in either zone 1 or 2 who subsequently underwent a contrast oesophagogram using either Omnipaque (Iohexol, GE Healthcare, UK) or Ultravist (Iopropamide, Bayer, Germany), both of which are iso-oncotic water-soluble contrast agents similar to Hexabrix (Mallinckrodt, Hazelwood, Missouri, USA) which is the agent used in other previous reports. Most



Figure 1 Incidental finding of achalasia after penetrating neck trauma.

patients with injuries in zone 1 underwent additional vascular imaging (either CT-angiography or formal arch and neck vessel catheter angiograms).

Eleven oesophogograms were reported to show an abnormality presumed to be due to an injury. All were stab wounds, except one low-velocity gunshot wound. Two were diagnosed eventually as non-traumatic lesions (one each of achalasia (fig 1) and an oesophageal diverticulum), while 9 injuries of either the distal pharynx (n = 5) or cervical oesophagus (n = 4) were identified (fig 2). Those with injuries to the pharynx only were managed non-operatively with placement of a feeding tube and observation for 7 days, while those with an injury to the oesophagus at or below the C6 vertebral level were explored via a standard neck incision and repaired with the placement of a closed suction drain abutting the repair. No false negative studies were identified after clinical and subsequent “open door return” periods of follow-up. Post-mortem examinations are a legal requirement for all unnatural deaths in this country, so any unexpected death due to a missed injury where the patient may have died subsequently at home without returning to the hospital would have been identified. No such instance arose during the study period.

These results provide a sensitivity of 100%, a specificity of 99.8% and a negative predictive ratio of 99.6%, which implies that the use of an iso-oncotic water-soluble swallow technique is both simple and effective in identifying injuries to the pharynx and upper oesophagus.

DISCUSSION

Oesophageal injury is uncommon, even in penetrating trauma, with a reported incidence of around 6% overall. The majority occur in the cervical oesophagus.⁸ The incidence in this study is 1.9% of patients undergoing an imaging study, which is in keeping with previous publications from South Africa documenting an average incidence of 3% in all patients with cervical penetrating trauma.^{2,3} A number of injuries were present in patients who underwent surgery without imaging, but these are not relevant here as this study primarily examined the role of iso-oncotic contrast media.

The consequence of cervical oesophageal injuries is considerable as the morbidity and mortality of a missed injury or delayed diagnosis may be high.^{11,12} Some of these injuries, when affecting solely the distal pharynx, may be managed less

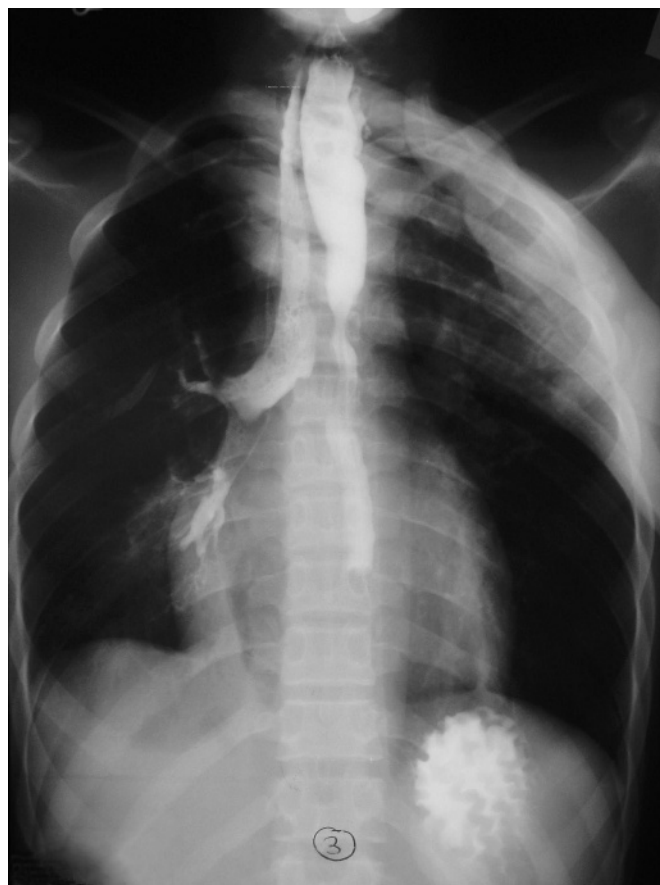


Figure 2 Abnormal swallow study demonstrating leak of contrast from the oesophagus and tracheo-oesophageal fistula.

aggressively.^{2,3} We adopted this policy in such patients with a favourable outcome. However, we would consider it prudent to attempt to identify and quantify the extent of the injury in order to plan treatment appropriately, as management purely on a clinical basis has been shown to be inaccurate.⁷ Additionally, we would advocate routine exploration and repair of injuries below the C6 vertebral level, especially when an associated pneumothorax or haemothorax is present.

No study to date has examined specifically the safety and efficacy of using iso-oncotic contrast media as the sole imaging modality in penetrating trauma to the neck. Some studies have suggested that this is adequate,^{2,3} but the primary focus was management of the injury rather than the diagnostic process. Two older studies^{13,14} examined the relative risks and benefits of a number of diagnostic approaches to evaluate the upper aerodigestive tract, and concluded that iso-oncotic agents were preferable to image patients at risk for aspiration and barium extravasation. Our findings concur with these reports and demonstrate that these agents are safe in the trauma subpopulation, with a high sensitivity and negative predictive value. This study did not examine whether the use of imaging led to a time delay in clinical management as suggested previously,¹¹ but morbidity after diagnosis and repair was minimal and not related to the oesophageal injury (one drip site thrombophlebitis).

A recent clinical practice guideline from the Eastern Association for the Surgery of Trauma¹⁵ examined the available literature concerning the management of zone 2 injuries of the neck and concluded that selective management is safe, with high resolution CT scanning as the diagnostic investigation of

choice. However, the authors caution that oesophageal injury may be missed using this modality alone if the wound tract is in proximity to the oesophagus. This is further corroborated by a small study published in 1990 where the authors recommend that the perforation should be confirmed by contrast study if suspected on CT scanning when extraluminal air or fluid collections are noted, as these may come from other sources in the chest.¹⁶ However, as the quality of CT images improves, this modality may become the investigation of choice. The authors of the clinical guideline advocated early use of oesophagography or endoscopy to rule out an oesophageal injury, given that clinical examination alone is not entirely reliable.¹⁵ They did not advocate using a combination of both modalities in all patients. Some earlier reports^{17 18} had suggested that oesophagography alone may miss an injury of the oesophagus, with sensitivities between 62% and 90%, which is in contrast to this study where the sensitivity was 100% and negative predictive value 99.6%.

CONCLUSION

This study has shown that iso-oncotic water-soluble contrast media are safe and reliable in identifying injuries of clinical significance and they may detect other coincidental pathology not previously suspected by the clinician. This approach appears to be cost-effective by avoiding the need for an after-hours endoscopy service and the risks of barium in the mediastinum. The potential cost saving compared with the need for additional sedation and analgesia during flexible oesophagoscopy or general anaesthesia for a rigid oesophagoscopy is considerable. The purchase and maintenance of expensive equipment is prevented, as is the need for operating room availability and additional personnel to provide anaesthesia and recovery. These considerations are of the utmost importance in units such as ours situated in a resource-challenged country with budgetary and human resource constraints.

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Competing interests: None.

Ethics approval: This study constituted a retrospective chart audit with total patient anonymity and, as such, was exempted from formal ethics committee approval. It was, however, approved by the Department of Surgical Sciences Research Committee.

Contributors: LN identified the patients from the database, analysed the data, reviewed the surgical procedures and outcomes, prepared the PowerPoint presentation and presented the research at the 2007 Annual Academic Research Day. LWJ assisted in accessing the patient radiology files, collating the data into the database and reviewing the contrast studies to assess the accuracy of the radiological reports. TH conceived the idea for the study, supervised the data collection and assisted in the preparation of the abstract and presentation at the Research Day and undertook the literature review and prepared the final manuscript. TH acts as the guarantor of the study.

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