Original article

Penetrating injuries to the cervical oesophagus: is routine exploration mandatory?

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Background: There are differing views regarding the management of oesophageal injuries with some authors advocating mandatory operation while others prefer a selective, conservative approach. This study was undertaken to establish whether conservative management of cervical oesophageal injuries is safe and effective.

Patients and Methods: This is a retrospective study carried out over 5 years (1994–1998). Of 1358 patients with neck trauma, 220 presented with odynophagia, of whom 28 were shown on contrast swallow to have cervical oesophageal injury (17 stabs, 11 firearms). Median age was 26 years (range, 11–44 years). There were 23 males (M:F ratio, 6:1). All patients with contained extravasation were managed non-operatively irrespective of the delay from injury to admission. Repair was undertaken in patients with major disruption and those requiring exploration for another reason. Associated tracheal injuries were repaired primarily with or without tracheostomy. Patients were fed using fine bore enteral feeding tubes. Oral feeding was recommenced after a water soluble contrast swallow had confirmed healing.

Results: All patients presented with odynophagia. Seven had clinical surgical emphysema, and 15 had retropharyngeal air on lateral neck X-ray. Chest X-ray showed surgical emphysema in 8, haemothorax in 2 and pneumothorax in 2. Seventeen patients were managed non-operatively. Sixteen recovered with no complications, while one developed local sepsis. Eleven patients underwent exploration (debridement in 7 and primary repair in 4). There were 6 associated tracheal injuries, all of whom underwent primary repair with tracheostomy performed in four. Thirteen patients were admitted to the intensive care unit. Median duration of enteral tube feeding was 18 days (range, 5–40 days) and median hospital stay was 18 days (range, 6–91 days). Two patients with firearm injuries died from associated injuries.

Conclusion: Non-operative management of penetrating injuries to the cervical oesophagus is safe and effective.

Key words: Penetrating injuries – Cervical oesophagus – Management

Because of its protected position, penetrating injuries to the oesophagus are uncommon even in busy urban trauma centres.^{1–3} For this reason, most series describing

experience with oesophageal injuries are descriptive and involve small numbers of patients. The most commonly afflicted region is the cervical oesophagus.^{1,4}

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Despite improved diagnostic modalities, a perforation or leak from the oesophagus remains a major source of morbidity and mortality regardless of the cause.⁵ The signs and symptoms are often subtle and, if not actively sought, the diagnosis may be delayed with compromise to the patient.^{2,6} Hence, successful diagnosis and management of oesophageal injuries require a high index of suspicion on the part of the treating physicians.

There are divergent views regarding the appropriate management of these injuries, with some authors advocating mandatory exploration while others prefer a conservative approach. The problem with these series is that they report multifactorial causes of oesophageal perforation or injuries including many cases with pre-existing disease.⁵⁻⁷ The debate over selective *versus* mandatory neck exploration continues because of lack of data showing conclusively that one approach is superior to, or more cost effective than, the other.⁸

This study was undertaken to establish whether conservative management of cervical oesophageal injuries is safe and effective.

Patients and Methods

This is a retrospective study in which the records of all patients suffering penetrating injuries to the cervical oesophagus admitted to the King Edward VIII Hospital in Durban, South Africa, over a 5-year period (1994–1998) were reviewed. All patients with neck injuries were managed according to a local protocol. In this protocol, all patients with injuries penetrating the platysma were admitted to hospital and, thereafter, a selective approach to exploration was adopted. Oesophageal injury was suspected by the presence of odynophagia, cervical surgical emphysema, the presence of prevertebral air on lateral neck X-ray and confirmed by a water-soluble contrast swallow. Patients in whom the extravasation of contrast was contained or localised to the neck by cervical structures and did not trickle to the mediastinum were managed non-operatively irrespective of the delay from injury to admission. This was defined as a 'contained' extravasation.

Indications for exploration of the oesophagus were complete disruption, trickling of the contrast widely and into the mediastinum and surgical exploration for other reasons. Prophylactic antibiotics were given during the induction of anaesthesia. A longitudinal incision anterior to the sternocleidomastoid muscle was always used. Injuries that were less than 12-h old were repaired primarily by interrupted absorbable material while older injuries were merely debrided. A drain was left *in situ* in all patients. Associated tracheal injuries were repaired primarily using absorbable suture material with or without tracheostomy.

Table 1 Patient profile

Total number of trauma admissions in 5 years	44,926
Neck trauma	1358
Proportion of patients with neck trauma	3%
Patients with odynophagia	220
Proportion of patients with neck injuries presenting with odynophagia	1.6%
Number of patients with cervical oesophageal injuries	28
Proportion of patients with neck injuries penetrating into the cervical oesophagus	2%
Age (years)	
Median	26
Range	11–24
Male:female ratio	6:1

Regardless of the method of management, all patients were given nothing-by-mouth other than enteral feeding via a fine-bore nasogastric tube until healing was confirmed by a subsequent contrast swallow. Enteral tube feeding was then stopped and the patient discharged from hospital.

Results

Patient profiles are shown in Table 1. Of the 44,926 patients admitted with trauma during the study period, 1358 suffered neck trauma, of whom 220 presented with odynophagia and required contrast oesophagography. This investigation demonstrated cervical oesophageal injury in 28 patients, who constituted 2% of all neck injuries. Twenty-three patients were male (M:F ratio, 6: 1) and the median age was 26 years (range, 11–44 years). Injury was due to stabs in 17 and firearms in 11 patients. Delay between injury and presentation to hospital ranged between 2–48 h. Twenty-one patients presented within 24 h of injury. All patients had odynophagia at the time of presentation.

There was retropharyngeal air on lateral neck X-ray in 15 patients, clinical surgical emphysema in seven patients, and saliva dribbling from the wound in four. Chest X-ray showed surgical emphysema in eight patients, haemothorax in two, and pneumothorax in two. There were six associated tracheal injuries and other associated injuries in three patients with firearm wounds, namely carotid artery (1), mandible (1) and cervical spine (1). There were no missed injuries.

Seventeen patients were managed non-operatively. Eleven patients required exploration (10 because of associated injuries and one with major disruption and an uncontained extravasation), of whom seven underwent

debridement and four had primary repair. There were six patients with associated tracheal injuries, all of whom underwent primary repair of the tracheal injury with four having additional tracheostomy. The median duration of enteral tube feeding was 15 days (range, 5–40 days) and the median hospital stay was 18 days (range 6–91 days). Thirteen patients required management in the intensive care unit. One of the 17 patients managed conservatively developed local sepsis, which required open drainage. Local complication rate, therefore, was 3% (6% of those managed conservatively). There were 2 deaths (7%). One patient with a carotid injury died on the operating table immediately after primary repair of the oesophageal and carotid artery injuries. The other, with a cervical spine injury, died a day following debridement of the oesophageal injury. There were no late deaths.

Discussion

There is debate with regard to routine *versus* selective exploration of neck injuries with undetermined oesophageal injury.^{9–11} This paper addresses the role of selective *versus* mandatory exploration only in patients with a determined oesophageal injury and proposes that the selective policy has merit in patients with proven oesophageal injury.

Penetrating injury to the cervical oesophagus is uncommon because of its central and protected location, occurring in 3–6% of neck injuries.^{9–11} Oesophageal injuries occurred in 2% of neck injuries in this series. There was an average of 4–5 oesophageal injuries per year, which falls within the rate of 2–9 cases per year reported by most busy trauma centres.^{6,7} These 28 patients constituted 13% of patients with odynophagia associated with neck injuries. These findings are in keeping with those of Ngakane *et al.*,⁹ where only 14% of patients with odynophagia were shown to have cervical oesophageal injury. Both these studies confirm that odynophagia alone is not pathognomonic of cervical oesophageal injury.

Early investigation is of great importance in the successful management of cervical oesophageal injuries.¹² It confirms the site of injury, identifies the extravasation from the oesophagus, documents the size of the leak, and demonstrates if it is contained or not. The most commonly used modalities are contrast oesophagography and flexible oesophagoscopy. A water-soluble contrast medium is preferable, as it is less reactive with the body tissues than barium.¹ Water-soluble contrast oesophagography has a sensitivity of 48–100%,^{3,4,13} and a reported false-negative rate of 10–20%,³ whereas flexible oesophagoscopy has reported accuracy rates of 85–97%.^{11,13–15}

A low index of suspicion as well as difficulties and delays in establishing the diagnosis of cervical oesophageal

injuries are important contributing factors to morbidity and mortality.^{5–7,16} Delay in treatment from 12–24 h allows enough leakage of saliva and bacteria, as well as refluxed acid, pepsin, and bile into the surrounding loose areolar tissues, to produce suppurative infection and an intense necrotising inflammatory response.^{6,16} This inflammation may allow rapid spread of infection into the mediastinum under the force of gravity and negative intrathoracic pressure if the leakage is not drained away from the deep neck spaces.^{7,16} This increases morbidity and mortality and attempting repair in these patients is unlikely to succeed.^{2,7,17} Armstrong *et al.*¹⁶ showed that delay in treatment increases the incidence of prolonged leak from 20% for less than 12 h to 43% for longer. The longest delay in this series was 48 h due to late referral. There were no missed injuries in the present series and this explains our low mortality. This is the result of the strict protocol in our hospital for the management of neck injuries, whereby all patients with wounds penetrating the platysma are admitted and observed closely, and are aggressively investigated if there is suspicion of aerodigestive injury. Furthermore, two local studies^{9,10} have shown that the selective management of penetrating neck injuries is safe and effective provided patients are closely monitored in hospital. This is confirmed by the fact that there were no missed injuries in the present series.

Oesophageal injuries may be managed conservatively or by surgical exploration with primary repair or debridement depending on the delay between the time of injury and arrival in hospital. Both conservative and operative approaches are accompanied by a course of antibiotics, nothing-by-mouth and surgical nutrition. While some authors advocate mandatory exploration of all penetrating wounds to the cervical oesophagus,^{2,16,18–20} others favour a selective approach, exploring only those patients with symptoms, signs or investigative evidence of injury to the trachea and oesophagus.^{6,9,10,17,21} Proponents of the mandatory approach argue that clinical and radiological assessment is unreliable and that major, potentially fatal, injuries may be missed. Those employing the selective policy cite the high incidence of negative exploration with its attendant morbidity if routine exploration is employed. Triggiani and Belsey¹⁷ demonstrated that cervical oesophageal perforations can be managed conservatively with 80% healing spontaneously and 20% developing a localised cervical abscess which will require open drainage. Local complication following conservative management was 6% in this series.

The most important aspect of the management of these injuries is deciding whether to institute conservative or operative management. Our policy is non-operative management for contained extravasation and surgical

exploration if it is not contained. Several studies have shown that small perforations can heal spontaneously, thus supporting our selective policy. It is well recognised that isolated injuries of the oesophagus or trachea may present with minimal symptoms and signs.¹¹ Subsequently, Ngakane *et al.*⁹ proposed that a negative-contrast study indicated either no injury or such a minimal injury that surgery is not indicated. In 1981, Keszler and Buzna²¹ demonstrated that very small perforations may not be detected on contrast oesophagography and will heal within hours.

Surgical management of oesophageal injuries presenting to hospital within 12 h of injury is by direct suture repair and drainage. Delay increases morbidity and mortality and attempting repair in these patients is unlikely to succeed;¹⁷ these patients should ideally undergo debridement and drainage without attempted repair.^{2,7,9,17,21} Although some authors use double-layer repair,^{1,8,22} other studies have shown that repair with a single layer is safe and effective both in traumatic^{16,23} and non-traumatic situations.^{24,25} Our policy is to use a single layer suture. A watertight closure of an external penetrating injury into the cervical oesophagus is not essential and a loose approximation of the oesophageal wall is acceptable as long as a salivary leak is anticipated and adequately drained externally, away from other deep neck spaces and the mediastinum.¹⁶

The place of diversion of the cervical oesophagus to the skin, to prevent the development of mediastinitis in delayed injuries, as is often done to protect a thoracic oesophageal injury from salivary flow, is controversial. Some authors advocate its use for all injuries greater than 16-h old and those with extensive tissue loss.^{7,17,18} Others suggest its use only in instances where purulence is found to have already advanced into the mediastinum, where oesophageal violation extends below the level of the thoracic inlet, where there is prolonged direct contamination of the mediastinum as well as in patients with failed primary repair.^{9,10,16} We share this latter view. All patients should be monitored closely, and returned to the operating room immediately for repeat neck exploration if signs of infection develop.¹⁶ Patients treated without a diversion procedure should regain near-normal swallowing function, but those treated with a diversion are at high risk for developing oesophageal obstruction.¹⁶ A T-tube splinting method has been used by some authors for spontaneous oesophageal ruptures.²⁶ Hatzitheofilou *et al.*¹² employed this method in four patients with delayed presentation of traumatic cervical oesophageal injury, one of whom died. This method has not received wide acceptance in the literature and it needs further evaluation.

Patients who sustain combined tracheal and oesophageal injuries are at risk of developing major complications including tracheo-oesophageal fistula, oesophageal leaks,

pneumonia and mediastinal abscess.²² The number of complications can be lowered by prompt recognition of the injuries and repair of the trachea and oesophagus.²² With a narrow 6.5 mm endotracheal tube in place, the trachea can be trimmed and repaired with ease.²³ The blood supply of the trachea is lateral and segmental, so care must be taken when mobilising and debriding the trachea to avoid devascularisation, which can result in tracheomalacia, tracheal stenosis, and breakdown of the repair.²² While some authors use non-absorbable material,²² others prefer only absorbable sutures.²³ The injured tracheal tissue is debrided to viable tissue before the sutures are placed. Repair is by lateral suture or end-to-end anastomosis depending on the extent of injury.²²

Some authors advocate placing a muscle flap between the repairs of the trachea and oesophagus.²² Mohlala *et al.*²³ employed successful repair without muscle interposition in 19 of 20 patients with combined oesophageal and tracheal injuries. Furthermore, Armstrong *et al.*¹⁶ did not show any advantage of muscle interposition in preventing prolonged salivary leaks in patients with combined tracheo-oesophageal injuries.

Injuries to the oesophagus carry a mortality rate of 15–23%, mainly attributed to associated vascular injuries, intrathoracic penetration, combined airway and oesophageal injury, septic complications of repair dehiscence as well as missed injuries.^{3,6,12,18} The mortality rate in the present series was 7% and both patients died as a result of associated injuries due to firearm wounds rather than from the oesophageal injury *per se*. This demonstrated that firearm injuries are more devastating than stab injuries. Armstrong *et al.*¹⁶ have shown that firearm injuries had twice the risk of developing a prolonged oesophageal leak or neck abscess. Back *et al.*³ also showed that firearm wounds to the cervical oesophagus were associated with significant morbidity and mortality. Other local studies dealing with colonic²⁷ and pancreatic²⁸ injuries have also demonstrated this trend.

In 1984, Sharma and Odell reviewed 13 patients with oesophageal injury and noted a mortality and morbidity rate of 23% and 31%, respectively. The problem with their study was that all but one of their patients presented more than 24 h after injury (between 4 days and 3 weeks) and these injuries had been missed by the referring hospital. This explains their bias towards mandatory exploration. In the present series, delay was 2–48 h with only 7 patients presenting more than 24 h after injury.

Further management of these patients, irrespective of initial treatment, consists of a course of antibiotics, nothing-by-mouth, and surgical nutrition.^{9,21} In contrast to some authors^{1,21} who suggest the use of total parenteral nutrition (TPN), we advocate the use of enteral nutrition through a fine-bore feeding tube, as it is convenient,

simple, safe and effective and avoids the complications related to TPN.^{2,29} The length of time required for closure is variable and has been reported between 5 days and 3 weeks.^{2,8,9} Keszler and Buzna²¹ make a point that surgical and conservative methods of management should not be viewed competitively. Both methods have a role and each patient must be managed on an individual basis. We share this view. The selective management policy of penetrating neck injuries in our institution has been shown to be safe and effective provided patients are closely monitored in hospital.^{9,10} This is confirmed by the fact that there were no missed injuries in the present series following this approach.

Conclusions

Non-operative management of cervical oesophageal injuries is safe and effective and should always be considered. The following criteria are essential in making decision between conservative and operative management.

1. It is essential to establish whether the extravasation is contained or not.
2. Operative management is essential in high-velocity injuries, uncontained extravasation, and where there are other indications for neck exploration.
3. The decision between debridement and primary repair depends on delay between the time of injury and surgery.
4. Tube feeding and close monitoring are essential during the period of observation.

Acknowledgement

Presented, in part, at the Congress of the Association of Surgeons of South Africa on 7 November 2000.

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