Selective nonoperative management of pharyngoesophageal injuries secondary to penetrating neck trauma: A single-center review of 86 cases

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BACKGROUND: This article describes our experience with penetrating pharyngoesophageal injuries (PEI) in the light of a selective conservative approach, and has the objective to define criteria for nonoperative management (NOM).

METHODS: This retrospective single-center review of patients with penetrating neck injury treated for confirmed PEI over a 6-year period aimed to test our proposed hypothesis that NOM is safe for hemodynamically stable patients with PEI, who have no competing indications for exploration, have no established sepsis, and who have a water-soluble contrast swallow either showing no- or a contained extravasation.

RESULTS: Eighty-six (9%) patients with PEI (oropharynx, 17; hypopharynx, 40; esophagus, 29) of 948 patients with penetrating neck injury were included. Of the cohort 38 (44%) underwent NOM (oropharynx, 15 [88%]; hypopharynx, 18 [45%]; esophagus, 5 [17%]), and 48 (56%) were managed operatively. The median length of stay was 12 days (interquartile range, 19–8). Fifteen (17%) had a persistent leak and six (7%) mediastinitis. Five (6%) patients died but only one (1%) had isolated PEI. Retrospectively, 27 patients fulfilled our proposed criteria for NOM of which 23 had been treated actively by NOM (oropharynx, 8; hypopharynx, 12; esophagus, 3). For these patients, the length of stay was 10.0 days (interquartile range, 13–6), and none developed deep wound sepsis, mediastinitis, persistent leaks, or died. Of the remaining patients treated by NOM without fulfilling the proposed criteria, two were palliated (esophagus) and 13 were managed actively (oropharynx, 7; hypopharynx, 6). Only four of these patients (oropharynx, 1; hypopharynx, 3) were assessed with water-soluble contrast swallow, which showed noncontained extravasation, and three complicated with persistent leaks.

CONCLUSION: Nonoperative management of PEI is safe for a carefully selected subgroup of patients. However, most injuries to the caudal part of the cervical digestive tract mandate urgent exploration. (*J Trauma Acute Care Surg.* 2018;85: 541–548. Copyright © 2018 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Clinical Management Study, Level V evidence.

KEY WORDS: Penetrating neck injury; selective nonoperative management; digestive tract injury; esophageal injury; pharyngeal injury.

Pharyngoesophageal injury (PEI) secondary to penetrating neck injury (PNI) is rare.[1–6] These injuries disrupt the fascial planes of the neck, and are associated with a high incidence of concomitant injuries, whose treatment may by necessity take priority over the PEI.[2,7,8]

Selective nonoperative management (NOM) is the current approach to PNI in most trauma centers.[9–11] For confirmed PEI, most authors advocate early surgical exploration and repair.[1,3,6–8,12] There is, however, a small body of work which suggest that there is a role for the NOM of a specific well-defined subgroup of patients with these injuries.[4,5,11,13–19] However, many of these studies include patients with nontraumatic perforations as well as traumatic perforations.[4,5,18,19] In light of this, we reviewed our experience with PEI secondary to PNI. Our general approach to trauma is colored by a longstanding South African tradition of selective conservatism.[9] Our objectives in this study were to refine our diagnostic and therapeutic approach to these injuries and to define criteria for NOM of these potentially morbid injuries. We hypothesized that patients with PEI can be identified by physical examination in combination with radiological imaging assessing for deep surgical emphysema and that selective investigation with a water-soluble contrast swallow (WS-swallow) is generally adequate to exclude surgical significant PEIs. Furthermore, we wanted to test our hypothesis that NOM is safe for hemodynamically (HD) stable patients with PEI, who have no competing indications for exploration, have no established sepsis and who have a WS-swallow either showing no- or a contained extravasation.

METHODS

Patients with PNI treated for PEI at the Pietermaritzburg Metropolitan Trauma Service (PMTS), South Africa, between January 2011 and June 2017 were retrospectively identified from a prospectively maintained trauma registry.[20] Ethics approval has been granted, by the Biomedical Research Ethics Committee of the University of KwaZulu-Natal, for this registry and the

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use of its data for clinical research (Reference number: BE 207/09 and BCA 221/13).

Patients with confirmed PEI were identified and reviewed. Patients with isolated injuries to the oral cavity or nasopharynx were excluded. The oropharynx was defined as the portion of the digestive tract between the soft palate and the hyoid bone, the hypopharynx extending from the hyoid bone to the cricoid cartilage and the esophagus beginning below the cricoid cartilage. Patients were categorized according to their most caudal injury if they had multiple injuries. All WS-swallows were retrospectively reviewed by the primary author and extravasation classified as contained or noncontained. We defined a contained extravasation as a localized bleb of extravasation, which did not track down the fascial plains or communicate with the skin or mediastinum, nor breach the pleura.

Data pertaining to demographics, neck zone, the level of injury, clinical signs and symptoms of injury, physiology, associated injuries, investigations, management, time delay from injury to admission and surgery, and outcome were retrieved and analyzed. Subanalyses were performed with regards to the level of injury, prognostic factors and criteria for NOM.

Management of Pharyngoesophageal Injuries at the Pietermaritzburg Metropolitan Trauma Service

Generally, all HD stable patients who display signs or symptoms of PEI and all patients with gunshot wounds (GSW) to the neck are investigated with a WS-swallow using the contrast Omnipaque (iohexol). The following signs and symptoms are considered highly suspicious for the presence of a PEI: visible injury, external egress of saliva, hematemesis, odynophagia or dysphagia on swallowing water, and the presence of surgical emphysema either on palpation of the neck or on radiological imaging.

If computed tomography angiography is performed to exclude a vascular injury and demonstrates no deep surgical emphysema, no further imaging of the digestive tract is necessary.[21] We reserve flexible upper endoscopy for the uncooperative or intubated patient who cannot undergo WS-swallow. All asymptomatic patients are admitted and undergo serial neck examination for 48 hours. Identified oropharyngeal injuries are generally managed by NOM, whereas hypopharyngeal and esophageal injuries more often are managed operatively with debridement, repair, and external drainage. Subsequently, both NOM and postoperative management consist of intravenous antibiotics with Co-Amoxiclav, and the patient being kept strictly nil by mouth and fed via a nasogastric tube. A repeat WS-swallow is then performed after 10 days to confirm healing of the mucosal breach.

Irrespective of the mechanism of PNI, only patients presenting with obvious neurological fallout undergo cervical spine immobilization until an unstable associated fracture can be excluded.

Statistics

The Student's t test and the Mann-Whitney U test (nonparametric data) were used for numerical data. Categorical data were analyzed using the Pearson's χ^2 test and Fisher's exact test (for expected frequencies of less than 5).

RESULTS

Cohort

Eighty-six (9%) patients of a total of 948 patients who had sustained a PNI were included. The distribution of PEI is illustrated in Figure 1. The median age was 28 years (interquartile range [IQR], 36–24) and 74 (86%) were male. Fifty-seven (66%) were secondary to a stab wound and 29 (34%) to a GSW. Using Roon's classification of the neck zones,[22] the distribution of the external injury was: Zone I, 16; Zone II, 40; Zone III, 10; posterior triangle, 4; and multiple zones, 16. The median time delay from injury to admission was 10 hours (IQR, 16.1–5.9). This delay could be categorized for 82 of 86 patients into the following three groups: 0 hours to 12 hours, 53 (65%); longer than 12 hours to 24 hours, 17 (21%); and longer than 24 hours, 12 (15%).

Presentation

The median Injury Severity Score (ISS) was 16 (IQR, 25–13) and 31 (36%) patients presented with a threatened airway, 9 (11%) with a systolic blood pressure (SBP) less than 100 mm Hg, and 16 (19%) with a Glasgow Coma Scale (GCS) score of less than 15. The majority of patients had an associated injury (72%). Associated cervical injuries (vascular, 20; airway, 16; C-spine fractures, 14; cervical spinal cord, 2) were present in 43 (50%) patients.

Clinical signs and symptoms of PEI were present in 74 (86%) patients and included the following: odynophagia/dysphagia in 53 (62%), visible aerodigestive tract injury or saliva leaking from wound in 25 (29%), hematemesis/blood stained saliva in 14 (16%), and palpable surgical emphysema in 11 (13%). Only 12 patients had no clinical findings. Seven of these patients had a reduced GCS score, which prevented adequate clinical evaluation. Of the remaining five patients without clinical findings, three had associated vascular or cardiac injury, which took priority over the PEI. The remaining two had no odynophagia or dysphagia but both patients had deep surgical emphysema on CTA. Water-soluble contrast swallows revealed contained contrast extravasation, and the patients underwent NOM without complications.

Diagnosis and Investigation

In 19 patients, the diagnosis was established exclusively by operation. In seven, the oropharyngeal injury was directly visualized on clinical inspection of the oropharynx and in six delineating the missile trajectory on CTA identified the injury. Finally, in 54 patients, the injury was visualized by the use of WS-swallow and/or flexible upper endoscopy.

In total, 57 (66%) patients in the cohort were subjected to a WS-swallow. This investigation was positive in 48 (84%) patients (contained extravasation, 23; noncontained extravasation, 22; images unavailable for classification, 3). Water-soluble contrast swallow was false negative in nine (16%) of the investigated patients. Of these, seven had injuries to the oropharynx confirmed by visual inspection (5) and/or CTA (2), and all were managed conservatively without complications. The remaining two patients presented 2 and 4 days after injury. In one patient, endoscopy revealed a small hypopharyngeal injury, which was successfully managed conservatively and in the other patient CTA confirmed mediastinitis secondary to a neglected esophageal

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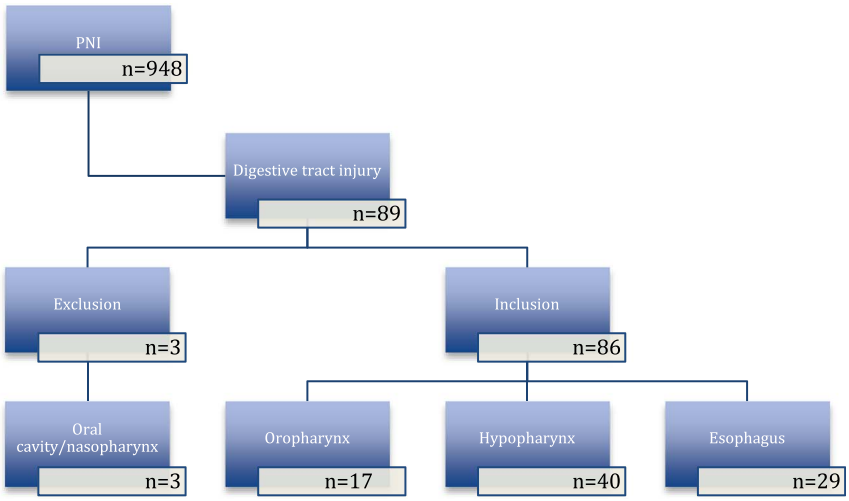


Figure 1. Study overview.

injury. The patient required mediastinal drainage. Eleven patients underwent a flexible endoscopy, which revealed two oropharyngeal, five hypopharyngeal, and four esophageal injuries.

Management

Of the cohort 38 (44%) were managed by NOM and 48 (56%) operatively. Of the ones managed operatively, 40 underwent debridement and simple repair, seven debridement and drainage, and one underwent a hybrid procedure consisting of endoscopic stenting of an esophageal injury and operative drainage of a fluid collection via a limited neck exploration. Preoperatively, a WS-swallow had revealed a noncontained extravasation at the thoracic inlet but due to concerns over an associated unstable spinal fracture at T2, a limited surgical exploration for drainage together with endoscopic stenting of the injury was performed. The patient went on to develop mediastinitis and ultimately required an esophagectomy and an esophageal replacement procedure.

The time delay from injury to operative management could be categorized for 47 of 48 patients into the following three groups: 0 hour to 12 hours, 16 (34%); 12 hours to 24 hours, 13 (28%); and longer than 24 hours, 18 (38%).

Outcome

The median length of stay (LOS) was 12 days (IQR, 19–8) with a maximum of 101 days. A total of 36 (42%) patients required intensive care. The following complications developed in 32 (36%) patients, some of whom developed multiple complications: leak from the digestive tract on repeat WS-swallow after treatment, 15; sepsis, 16 (mediastinitis, 6 but this was present in four at time of admission; superficial wound sepsis, 4; deep wound sepsis with sepsis of a vascular graft/repair and rebleed, 2; line sepsis, 1; and pneumonia, 5); retained hemothoraces, 5; cerebral infarcts, 5; duodenal fistula, 1; and a missed pseudoaneurysm of the subclavian artery, 1.

Five (6%) patients died. Two patients with destructive GSWs to the neck and esophageal injury managed by NOM were managed expectantly due to associated quadriplegia and low GCS score on presentation. They both died. Two patients who were managed operatively remained neurologically devastated postoperatively due to associated vascular injuries. Only one patient with an isolated digestive tract injury died. This patient was a 72-year-old patient who underwent repair of a preoperatively confirmed hypopharyngeal injury. Postoperatively, he developed multiple cerebral infarcts and died after a prolonged intensive care unit (ICU) stay.

No actively (operatively or nonoperatively) managed patients died as a result of sepsis from PEI.

Subanalyses

Level of Injury

Presentation, management, and outcome according to the level of injury are illustrated in Table 1. The table depicts a high incidence of false-negative studies with WS-swallow among patients with oropharyngeal injury. The ISS, need for ICU, LOS, need for operative management, morbidity, and mortality increase proportionally with more caudal levels of injury. Of patients with esophageal injuries, only 17% were managed by NOM; of patients with hypopharyngeal injuries, 45%; and of patients with oropharyngeal injuries, 88%.

Prognostic Factors for Outcome

We defined a poor outcome as a leak from the digestive tract on repeat WS-swallow post management, mediastinitis, or LOS longer than 14 days and found the following variables to be statistically significant prognostic factors for poor outcome: delay to surgery of more than 24 hours after injury, noncontained extravasation on WS-swallow, admission SBP less than 100 mm Hg, and a high ISS. These data are illustrated in Table 2.

Nonoperative Management

Table 3 illustrates a stratification of our data aimed at testing our hypothesis on NOM of PEI.

None of our patients managed actively by NOM for PEI were HD unstable, had competing indications for exploration or established sepsis, but not all had been investigated with a WS-swallow.

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TABLE 1. Presentation, Management and Outcome According to Level of Injury

	Oropharynx	Hypopharynx	Esophagus
n	17	40	29
Clinical signs of injury	15 (88%)	38 (95%)	21 (72%)
Threatened airway	6 (35%)	14 (35%)	11 (38%)
WS-swallow	10 (59%)	24 (60%)	23 (79%)
• False negative	7 (70%)	1 (4%)	1 (4%) (4 d delay)
• Positive	3 (30%)	23 (96%)	22 (96%)
Contained extravasation	2 (67%)	13 (57%)	8 (36%)
Noncontained extravasation	1 (33%)	9 (39)	12 (55%)
Not specified	0 (0%)	1 (4%)	2 (9%)
ISS median	16 (IQR, 18–11.5)	16 (IQR, 19.8-11)	25 (IQR, 25–16)
Nonoperative management	15 (88%)	18 (45%)	5 (17%)*
LOS median, d	8 (IQR, 14.8–5.3)	12 (IQR, 19–10)	12 (IQR, 20.5–7)
ICU	7 (41%)	15 (38%)	14 (48%)
Morbidity**	5 (29%)	15 (38%)	12 (41%)
• Leak	1 (6%)	7 (18%)	6 (21%)
• Mediastinitis	0 (0%)	2 (5%)	4 (14%)
• Superficial wound sepsis	3 (18%)	1 (3%)	0 (0%)
• Deep wound sepsis	0 (0%)	1 (3%)	1 (%)
Mortality	0 (0%)	2 (5%)	3 (10%)*

*Includes two patients managed expectantly with predicted deaths due to devastating neurology.
**Includes all morbidities.
WS-Swallow, water soluble contrast swallow; ISS, injury severity score; LOS, length of stay; ICU, intensive care unit.

Retrospectively, 27 patients fulfilled our proposed criteria for NOM of which 23 had been treated by NOM (oropharynx, 8; hypopharynx, 12; esophagus, 3). Besides two patients developing superficial wound sepsis, no deaths or morbidities secondary to PEI occurred, and the median LOS was 10 days (IQR, 13–6).

Fifty-nine patients did not fulfill these criteria of which 2 (both esophagus) were managed expectantly and 13 (oropharyngeal, 7; hypopharyngeal, 6) treated actively by NOM. Only four of these 13 patients (oropharynx, 1; hypopharynx, 3) were assessed with WS-swallow, and all had noncontained extravasation. Three (75%) of these four complicated with persistent leaks, and one developed superficial wound sepsis. The other nine patients, six with oropharyngeal injury (two identified with upper endoscopy and four by visual inspection/assessing bullet trajectory on CTA) and three with hypopharyngeal injury (two assessed with upper endoscopy as being high or minor injuries and one by bullet trajectory on CTA as a high injury) had no (pharyngoesophageal injuries) PEI-related morbidities after NOM.

DISCUSSION

The literature on PEI is challenging to interpret as most studies lack adequate numbers or are multicenter,[1–3] include iatrogenic and spontaneous perforations[4–6,18,19,23] or describe injuries to the cervical, thoracic, and/or abdominal esophagus.[3–8,12,18,19,23]

The deep position of the digestive tract in the neck means that PEIs are relatively rare but are associated with numerous concomitant injuries.[2,7,8] Fifty percent of our patients with PEI had associated cervical injuries. In our cohort all patients had either findings on physical exam or deep surgical emphysema on radiological examination. Earlier literature questioned the reliability of clinical examination,[8,22,24] but more recent studies suggest that surgically significant injuries can be excluded on thorough and repeated clinical examination and the assessment for surgical emphysema with a cervical x-ray or CTA.[10,11,17,21,25]

Among our cohort of patients with confirmed PEI, the false-negative rate was 16% (9 of 57) for WS-swallow and 0% (0 of 11) for endoscopy. Seven of these nine false-negative WS-swallows were for patients with oropharyngeal injuries. Endoscopy is probably better than WS-swallow at delineating upper pharyngeal injuries,[15,26] although in our opinion, most oropharyngeal injuries can be visualized by a combination of thorough clinical inspection of the oropharynx and CTA. The other two false-negative investigations were in patients who presented after 48 hours, and the injury had almost certainly already reepithelialized. Although combining upper endoscopy and WS-swallow will result in almost 100% accuracy,[27] in practice in our setting a negative WS-swallow generally suffices to rule out any significant PEI.[16,28]

Although only 56% of patients in this series were managed operatively, the generally accepted approach to these injuries is urgent exploration and repair.[1,3,6–8,12] However, regardless of whether the patient is treated operatively or by NOM, all patients are subsequently treated the same until a repeat WS-swallow after 10 days reveals healing of the injury.

Nonoperative management of PEI has been described for penetrating pharyngeal injuries above the tips of the arytenoid cartilages of the larynx,[13] minor injuries[11,15] and when no competing need for exploration exists.[14] Only two studies have described the NOM of esophageal injuries secondary to PNI.[16,17] In these two studies, patients with a contained extravasation on WS-swallow, defined in the first study as no gross leakage and

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TABLE 2. Prognostic Factors for Outcome

		Good outcome	Poor outcome*	*p*
n		52	28	
Level of injury	Oropharynx	13 (25%)	4 (14%)	0.264
	Hypopharynx	24 (46%)	14 (50)%)	0.742
	Esophagus	15 (29%)	10 (36%)	0.519
Presentation	Threatened airway	15 (29%)	14 (50%)	0.060
	SBP < 100 bpm	2 (4%)	6 (21%)	0.020
	HR > 100 mm Hg	12 (23%)	11 (39%)	0.127
	GCS score < 15	6 (12%)	6 (21%)	0.326
	Temp >38.5°C	0 (0%)	2 (7%)	0.120
Associated cervical injury	Airway	9 (17%)	6 (21%)	0.652
	Vascular	10 (19%)	7 (25%)	0.547
	Spinal cord	0 (0%)	0 (0%)	1.000
ISS	Median	16 (IQR, 18–13)	19 (IQR, 25–16)	0.030
Age	Median	27 (IQR, 36.8–23)	28.5 (IQR, 34.8–26)	0.757
Mechanism of injury	GSW	15 (29%)	10 (36%)	0.527
WS-Swallow		35 (67%)	18 (64%)	0.785
• Positive		29 (83%)	15 (83%)	1.000
	Contained extravasation	22 (76%)	1 (7%)	<0.001
Delay to admission	Median	10 (IQR, 16–7.5)	9 (IQR, 22.3–4.8)	0.771
	Unknown	1 (2%)	2 (7%)	0.279
	0–12	32 (62%)	17 (61%)	0.942
	>12–24	13 (25%)	4 (14%)	0.264
	>24	6 (12%)	5 (18%)	0.434
Delay to surgery	Median	18 (IQR, 28.8–11.8)	25 (IQR, 120.8–11.4)	0.153
	Unknown	0 (0%)	1 (5%)	0.350
	0–12	9 (39%)	6 (29%)	0.652
	>12–24	10 (44%)	2 (10%)	0.199
	>24	4 (17%)	12 (57%)	<0.001
Operative management		23 (44%)	21 (75%)	0.008

*Poor outcome was defined as one of the following: (1) leak on repeat WS-swallow, (2) mediastinitis, (3) LOS > 14 days. All mortalities (5) were excluded from this table as none died as a direct complication of digestive tract injury. One patient with an esophageal injury lost to follow-up after referral to a higher center for intervention was likewise excluded.

SBP, systolic blood pressure; HR, heart rate; bpm, beats per minute; mmHg, millimeter mercury; GCS, Glasgow coma scale, Temp, temperature; °C, Celsius degree; ISS, injury severity score; GSW, gunshot wound; WS-Swallow, water soluble contrast swallow.

in the latter as extravasation of contrast contained or localized to the neck and not trickling to the mediastinum, were managed by NOM.[16,17] However of concern is the fact that the latter of the two studies reported a median LOS of 18 days (range, 6–91 days).[17]

Hoping to reduce this seemingly long LOS, we have retrospectively elaborated on the criteria for NOM and now consider a contained leak as just a localized bleb of extravasation, which is not tracking down the fascial plains or communicating with the skin or mediastinum, nor breaching the pleura. The HD status of the patient, the presence of associated injuries, and the presence of sepsis must furthermore be considered before embarking on NOM.

Of the four patients actively treated by NOM in our study (oropharynx, 1; hypopharynx, 3), despite having noncontained extravasation on WS-swallow, 3 (75%) complicated with persistent leaks from their PEIs and one developed superficial wound sepsis but all eventually healed without surgery. Nonoperative management of pharyngeal injuries with noncontained extravasation on WS-swallow is feasible but seems associated with an increased leak rate and prolonged LOS. Another nine patients were treated by NOM without prior assessment with WS-swallow (oropharyngeal, 6; hypopharyngeal, 3) but caudal and extensive hypopharyngeal injuries were excluded with endoscopy, direct visual inspection, and/or assessment of bullet trajectory on CTA. The majority of oropharyngeal injuries can probably safely be managed by NOM without prior assessment with WS-swallow, which for these injuries was false-negative 70% of the time.

Although successful stent grafting of esophageal perforations has been described in a small series of primarily iatrogenic injuries,[23] we do not recommend this approach for patients with PNI.

Most authors agree that a delay to surgery of more than 24 hours greatly worsens outcome, and our data support this opinion.[1,3,6,8,12] Though the majority of our patients arrived at hospital within 0 hour to 12 hours from time of injury, 38% were operated on more than 24 hours after injury. This reflects logistical delays as well as a lack of appreciation of the need for immediate surgery.

Our overall median LOS was 12 days (IQR, 19–8), and the morbidity rate was 36%, but not all of these morbidities were related to the digestive tract. Mediastinitis was present in only 6

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TABLE 3. Retrospective Testing of Our Proposed Hypothesis on NOM of PEI

Qualified for NOM of PEI	Yes (27)		No (59)	
Management	NOM	Surgery	NOM	Surgery
n	23 (85%)	4 (15%)	15 (25%)	44 (75%)
WS-swallow	23 (100%)	4 (100%)	5 (33%)	25 (57%)
• Noncontained extravasation	0 (0%)	0 (0%)	5 (100%)*	17 (68%)
HD unstable, septic or with competing need for surgery	0 (0%)	0 (0%)	1 (7%)**	44 (100%)
Level of injury				
• Oropharynx	8 (35%)	1 (25%)	7 (47%)	1 (2%)
• Hypopharynx	12 (52%)	1 (25%)	6 (40%)	21 (48%)
• Esophagus	3 (13%)	2 (50%)	2 (13%)†	22 (50%)
Associated cervical injury				
• Airway	1 (4%)	0 (0%)	1 (7%)	14 (32%)
• Vascular	3 (13%)	1 (25%)	3 (20%)	13 (30%)
• Spinal cord	0 (0%)	0 (0%)	2 (13%)†	0 (0%)
Mechanism				
• SW	15 (65%)	0 (0%)	4 (27%)	34 (77%)
• GSW	8 (35%)	4 (100%)	11 (73%)	10 (23%)
ISS median	13.0 (IQR, 13–9)	20.5 (IQR, 25.8–12.3)	17.0 (IQR, 26–13)	16.0 (IQR, 25–16)
Delay to admission median, h	10.0 (IQR, 16.5–8.5)	13.8 (IQR, 24.1–5.6)	11.0 (IQR, 18–6)	8.8 (IQR, 16.1–4.8)
Delay to surgery median, h	NA	19.8 (IQR, 113.6–15.1)	NA	19.3 (IQR, 39.3–11.1)
LOS median, d	10.0 (IQR, 13–6)	12.5 (IQR, 17.5–6)	9.0 (IQR, 19–7)	12.0 (IQR, 21–10)
ICU	4 (17%)	1 (25%)	4 (27%)	26 (59%)
Morbidity				
• Leak	0 (0%)	0 (0%)	3 (20%)	11 (25%)
• Mediastinitis	0 (0%)	0 (0%)	0 (0%)	6 (14%)
• Superficial wound sepsis	2 (9%)‡	0 (0%)	1 (7%)‡	1 (2%)
• Deep wound sepsis	0 (0%)	0 (0%)	0 (0%)	2 (5%)
Mortality	0 (0%)	0 (0%)	2 (13%)†	3 (7%)

*Involved one oropharyngeal, three hypopharyngeal and one esophageal injury, the latter of which was palliated.
**HD unstable due to abdominal GSW and underwent laparotomy. On table endoscopy showed a minor hypopharyngeal injury and the PEI was managed by NOM.
†These two patients were managed expectantly; predicted deaths due to devastating neurology.
‡All secondary to oropharyngeal injuries and none required operative intervention.
NOM, non-operative management; PEI, pharyngo-esophageal injury; WS-Swallow, water soluble contrast swallow; HD, hemodynamically; SW, stab wound; GSW, gunshot wound; ISS, injury severity score; NA, not applicable; LOS, length of stay; ICU, intensive care unit.

(9%) of 86 patients. Two of these patients had hypopharyngeal injuries and presented with established mediastinitis more than 2 days after the injury. Pharyngeal injuries if not recognized early and managed appropriately carry similar risk to esophageal injuries of life-threatening sepsis.[15]

Our overall postmanagement leak rate was 17% (15 of 86) (esophageal, 21%; hypopharyngeal, 18%; oropharyngeal, 6%) and all but one with an esophageal stent closed after a period of NOM.

Our mortality rate of 6% (5 of 86) was lower than that generally reported in the literature from 6% to 44%.[1–3,12] This might be explained by the fact that very few of our patients with PNI had involvement of the thoracic esophagus, which is an independent risk factor for outcome.[3,6] Most deaths in our cohort were caused by associated injuries as is common for these injuries and only one patient with an isolated PEI died.[2,7]

Although the patients fulfilling our proposed criteria for NOM and those requiring surgery represent different subgroups of patients who are not directly comparable, our data support the contention that a number of carefully selected patients with PEI can be managed successfully by NOM.[11,13–17] This seems associated with a shorter median LOS and none of our patients fulfilling these criteria and treated by NOM complicated with mediastinitis, deep wound sepsis, prolonged leaks, or death.

Our suggested algorithm for PEI in patients with PNI is given in Figure 2. Nonoperative management is safe for HD-stable patients with PEI, who have no competing indications for exploration, have no established sepsis and who have a WS-swallow either showing a contained extravasation or none.

CONCLUSION

A selective NOM approach to patients with PNI safely identifies those who require imaging to exclude PEI. A select subgroup of patients with PEI can be managed by NOM. However, most injuries to the caudal part of the cervical digestive tract mandate urgent exploration.

AUTHORSHIP

A.S.M. participated in the literature search, study design, data collection, analysis and interpretation, writing and critical revision. G.V.O. participated in the study design, data collection, analysis and interpretation, critical revision. J.L.B. participated in the data collection, analysis and interpretation, critical revision. W.B. participated in the data analysis, interpretation and critical revision. G.L.L. participated in the data collection

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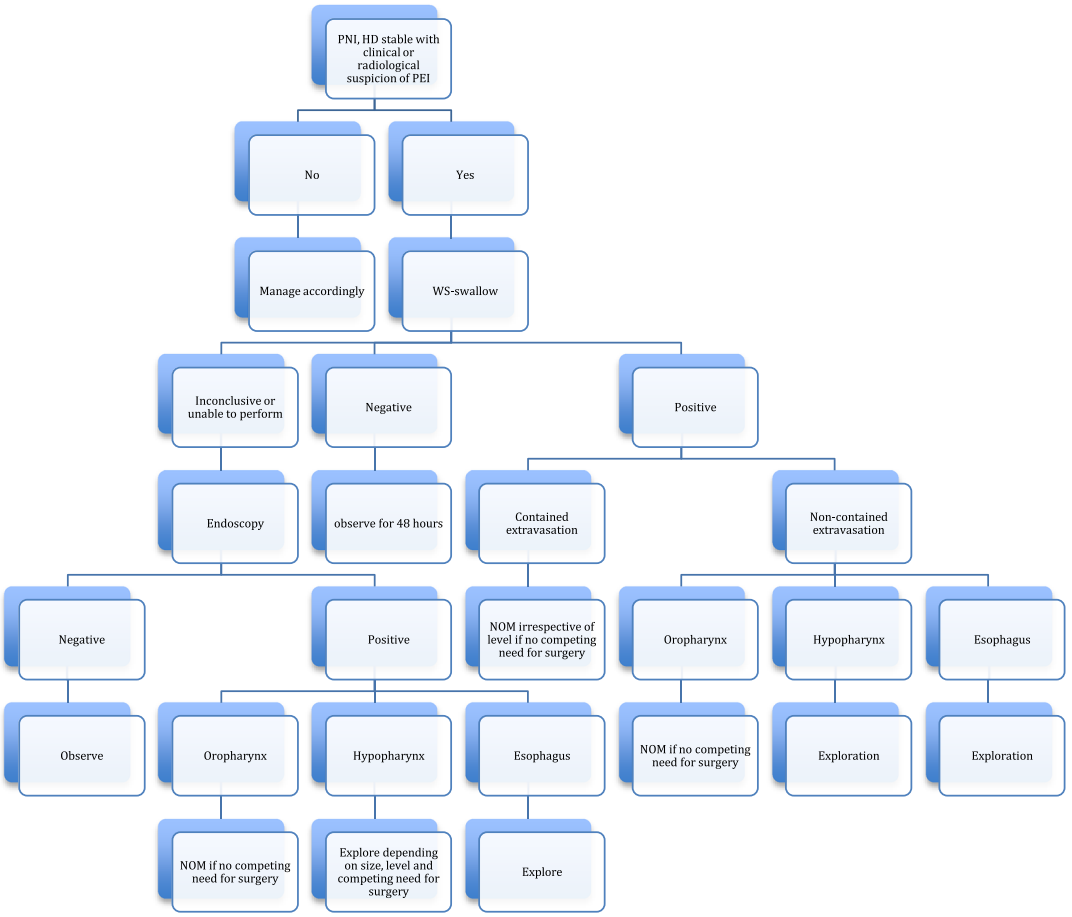


Figure 2. Our suggested approach to patients with PNI and suspected PEI.

and critical revision. D.L.C. participated in the literature search, study design, writing, critical revision and supervisor of higher degree.

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DISCLOSURE

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