Selective Approach in Managing Penetrating Neck Injury

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ABSTRACT

Background: Penetrating Neck Injuries (PNI) management represents a challenge to most surgeons in civilian trauma, in weighing selective versus mandatory exploration of all cases in different circumstances. Data are encouraging surgeons to adopt the former approach.

Objectives: The study aims to assess the selective approach in our war and terror time events in Al-Yarmouk teaching hospital.

Type of the study:A retrospective study.

Methods: Data of patients presented to the Thoracic and Vascular ward in Al-Yarmouk teaching hospital with PNI were assessed retrospectively, from March 2013 to March 2015, and analyzed for epidemiology, mechanism of trauma, management methods, associated organ injuries, complications and mortality.

Results: Among 83 patients (76 males and 7 females) who presented with PNI, the mean age was 28.5±15 years with a peak incidence in third decade. Shell injury (52.2%) was the most common mechanism and zone II was the most frequently injured (49.4%). Therapeutic exploration of neck in 82% of the cases, a decision of surgical exploration (87%) patients. Vascular injuries were the most identified neck structures (39.5%). Chest injuries (35%) were the most common associated injuries identified in patients who had additional anatomic region injury (41%) beside PNI. Complication rate of 18% and infection (26.6%) were most common and mortality rate was 8%.

Conclusions: Still the selective approach is preferable in management of PNI in our war and terror time circumstances and limited resources of country.

Keywords: Neck, Penetrating, Trauma.

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The neck is one of the most susceptible regions of the human body that contains a high density of vital structures in a relatively small and unprotected anatomic region, so it is most vulnerable body areas for all injuries [(1).] Injuries to the neck can be secondary to both blunt and penetrating trauma [(2)]. Approximately 10% of all trauma patients represent penetrating neck injuries (PNI) [(3)]. PNI still a challenge to every even skilled surgical trauma team[(4)] and may present an immediate threat to life due to airway compromise or bleeding that dictates accurate and aggressive initial evaluation and management to optimize the outcome [(5).] Management of neck wounds that violate platysma has generated a lot of debate among clinicians, leading to some favor mandatory surgical exploration of all penetrating neck wounds, while others refuse it owing to high rate of negative explorations [(6)], and adopt selective conservative management ,by observing the patient carefully with the use of ancillary diagnostic tests to define clinically undetectable significant internal neck injuries.

Since this selective conservative approach has gained wide popularity of most health care professionals in developed world, we aimed our study to assess the usefulness and safety of this individualized approach in PNI management in our developing country where trauma services are generally inadequate with limited resources and does not meet the escalating number of terror victims in civilian and war casualties.

The management of PNI follows one of two approaches:

First is routine exploration of all neck wounds that violate platysma, the proponents of which owe it to high rate of significant injury in penetrating neck trauma, inability to diagnose potential lethal injury without operation and increased morbidity and mortality of delayed treated occult injuries [(7,8,9,10)] and this approach emerged from the military data during war times [(11,12)]. Opponents to this method criticized it due to high rates of negative neck explorations that vary from 30 to 89%, more operation room demands for mandatory explorations [(6)]. However, it is advisable at places where requisite facilities and staff are not available.

Second is selective conservative management involving periodic physical examination and judicious use of ancillary diagnostic tests to detect significant internal damage.

Patients and Methods: In this retrospective descriptive study, data of patients who were referred to thoracic and vascular department in Al-Yarmouk Teaching Hospital who sustained PNI from March 2013 to March 2015 were reviewed. On the arrival of patient, the management was prioritized according to Advanced

Trauma Life Support guidelines. All patients with evidence of platysma penetration were admitted. In local neck examination, the wound localization was classified into different zones. Zone I includes the thoracic inlet (clavicles to the cricoid cartilage). Zone II includes the structures of the mid-neck (cricoid cartilage to the angle of mandible). Zone III includes structures near the skull base (angle of mandible to the base of skull)[7]. Diagnostic studies such as plain chest and neck radiographs, computerized tomography (CT) scan, Doppler ultrasound imaging, barium swallow, bronchoscopy, esophagoscopy were done on a case to case basis depending on the clinical findings. Treatment differed from continuous careful observation to delayed or immediate (within 6 hours) surgical intervention. Severe active bleeding, shock not responding to treatment, large expanding hematoma absent or weak peripheral pulses, air bubbling through the wound, major hemoptysis and respiratory distress required immediate surgical intervention. Surgery was considered a therapeutic exploration when an injury was found and repaired i.e. exploration of major vessels of the neck or aero digestive tract (larynx, trachea, pharynx and esophagus) otherwise it was reported as non-therapeutic if no structural injury was discovered. Most of PNI were approached via the standard incision parallel to the sternocleidomastoid muscle, though laryngotracheal injuries were approached via anterior collar incision. Injured vessels were repaired or ligated. Primary repair and closed drainage (wounds above cricopharynx) or nothing per oral for 2 weeks (wounds below this level) managed pharyngoesophageal injuries. Repair of soft tissues, evacuation of large hematomas, fixation of unstable fractures, managed laryngeal injuries. Adjuvant procedures like tracheostomy were done as needed. The associated injuries were dealt with accordingly.

Results: Among 83 patients (76 males (91.5%) and 7 females (8.5%)) (table 1) included in this study, the mean age of patients was (28.5±15)(table 2),with age varied from 9 years to 64 years old. Although PNIs occurred in all age groups, we notice a peak incidence in the third decade.

Sex	Patient no.	percentage
Male	76	91.5%
Female	7	8.5%
Total	83	100%

(Table 1) Distribution of Sex

Patients age	Patient number	percentage
1 -9	1	1.2%
10- 19	12	14.4%
20- 29	32	38.5%
30- 39	16	19.2%
40-49	13	15.6%
50- 59	7	8.4%
60- 69	2	2.4%
Total	83	100%

Table (2)distribution of Age

Mechanism of trauma included shell injury (54.2%), bullet (37.4%), and stab wound (8.4%) (Table 3).

Trauma mechanism	Patient number	%
Bullet	31	37.4%
Shell	45	54.2%
Stab	7	8.4%
Total	83	100%

Table (3)Distribution of patient in relation to trauma mechanism

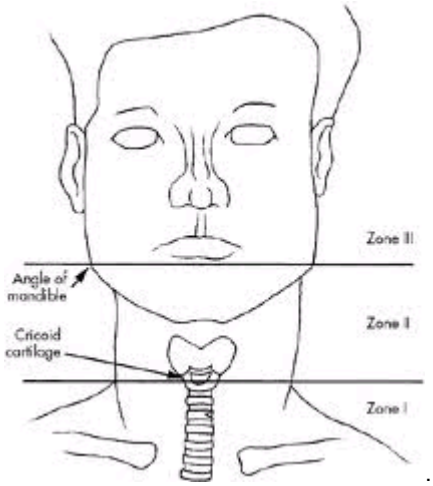

Figure (1) zones of neck

The most frequently injured zone was zone II (49.4%), followed by zone I (18.1%), then zone I,II (13.2%) and zone III (10.8%) while least was in zone II,III (8.5%) (table 4).

Neck Zone	Patient number	%
Zone I	15	18.1%
Zone II	41	49.4%
Zone III	9	10.8%
Zone I ,II	11	13.2%
Zone II , III	7	8.5%
Total	83	100%

Table (4)Distribution of patients in relation to Neck Zones

Of the 83 patients who sustained PNI and were evaluated with various clinical and radiographic

modalities, only 11 patients (13%) have been able to be managed conservatively where their investigations were inconclusive of any significant vascular or aero digestive injury and were stable on clinical follow up with the use of ancillary diagnostic tools employed including plain radiographs of neck and chest, barium swallow and esophagoscopy for patients that presented with dysphagia or subcutaneous emphysema raising suspicion of esophageal injury, bronchoscopy for suspected tracheobronchial injuries, Doppler ultrasonography of neck vessels for the stable patients in whom vascular injuries were suspected and CT angiography, while 72 patients (87%) needed surgical exploration either as an immediate decision on presentation in 54 patients (65%)(with hard signs of vascular injury, exsanguinating hemorrhage, shock or airway obstruction that were admitted directly to the operating room for emergent exploration), or delayed in 18 patients (22%) after more than 6 hours of conservative follow up where those stable patients were evaluated by CT which assisted in identifying missile trajectory and guided the use of CT angiography and endoscopy (table 5).

Management		Patient no.	Percentage
Conservative		11	13%
Surgery	Immediate	54	65%
	Delayed	18	22%
Total		83	100%

Table (5)Distribution of patient in relation to Line of Management

Non-therapeutic exploration, where negative results were obtained was identified in 13 patients (18%) while therapeutic exploration, when results were positive was identified in 59 patients (82%) (Table 6).

Type of Exploration	Patient number	Percentage
Non Therapeutic (-ve)	13	18%
Therapeutic (+ve)	59	82%
Total	72	100%

Table(6)Distribution of patient in relation to Exploration results

Vascular injuries were the most common vital structures to require therapeutic intervention in 27 patients (39.7%) followed by laryngotracheal injuries in 17 patients (25%), pharyngeal injury in 11 patients (16.1%), esophageal injury in 6 patients (8.8%), spine injury in 3 patients (4.5%), cranial nerves injuries in 2 patients (3%) and salivary gland and thoracic duct injury 1 patient for each (1.4%)(table 7).

Injured Neck structure	Number of injured structures	%
Vascular	27	39.7%
Esophageal	6	8.8%
Pharynx	11	16.1%
Laryngotracheal	17	25%
Salivary gland	1	1.4%
Cranial nerves	2	3%
Spine	3	4.5%
Thoracic duct	1	1.4%
Total	68	100%

Table (7) Injured Neck structures

Thoracic injuries predominated the associated injuries in 12 patients (35%) while pelvic injury was the least in only one patient (3%) (Table 8) of the 34 patients (41%) whom where other injuries in addition to PNI were identified.

Associated injuries	Patient number	%
Chest	12	35
Abdomen	5	15
Extremities	9	27
Head & Face	7	20
Pelvis	1	3

Table (8) Associated Injuries encountered in PNI patients

Complications with a rate of (18%) varied from infection as the most commonly encountered in 4 patients (26.6%) to Cerebrovascular Accidents, aspiration pneumonia and permanent nerve damage as least common with 1 patient (6.5%) for each (table 9).

Complication	Patient number	Percentage
Prolonged intubation and Tracheostomy	2	13.3%
Cerebrovascular Accident	1	6.6%
Deep Venous Thrombosis	2	13.3%
Infection	4	26.6%
Aspiration pneumonia	1	6.6%
Permanent nerve deficit	1	6.6%
Hematoma	2	13.3%
Fistula	2	13.3%

Table (9) Complications encountered in PNI patients

Hospital stay for patients ranged between 2-13 days with a mean of 4.5 days but most of them stayed from 2-8 days. Mortality rate was (8%) as seven patients died because of severity of injury, comorbidity and complications.

Discussion: Due to the high dense congregation of vital organs, the neck is considered as one of the most

important topographic areas where it lacks protection offered by bone and other compact tissues that limit the damage to internal organs. It is estimated that about 5% to 10% of all traumas involve penetrating neck trauma [13]. Demographically, in our study the majority of our patients (91.5%) were males, with a peak incidence in third decade and mean age (28.5±15 years), a percentage that correlates with other studies of Mahmoodie et al [14]and Suleiman et al [15] but S.M.H. Zaidi, R.Ahmad the male percentage declined to 82.6%. These results can be attributed to the fact of special circumstances of our society facing terror war in front lines where young males are the backbone of military forces whereas in other studies civilian injuries were the main bulk. This fact led to make the shell injury (54.2%) as the main causative pattern of injury while Mahmoodie M. et al, Bell et al [16] stab injuries (85.93%) [14], and Lydiatt[17] firearm were the main cause.

The most frequently injured zone was zone II, a finding consistent with other studies by Sriussadaporn et al in 2002 [18] and others [19, 20]. This correlation may be due to susceptibility of this zone for trauma as it is the most exposed part of neck [15].In our study, the most commonly injured structure in PNI were the blood vessels (39.5%) followed by laryngotracheal injuries (25%) and pharyngeal injury (16%), matching with results of Mahmoodie M. et al [14], Haba et al [20] and Elhassani et al [19]. In contrast, Albadri et al reported laryngotracheal injuries as the top followed by pharyngeal and esophageal injuries, whereas vascular injuries came next to them [16]. A difference in the specialties of the authors and the mechanism of injury may explain that.

Because of the proximity to the neck, chest trauma was the most associated trauma in our study (35%) followed by extremities, a result coincide with others [14,19,20,22] but the total patients who presented with associated injuries (41%) has surpassed other studies like Mahmoodie (11.9%) due to mechanism of injury most commonly encountered in war and terror time [14]. In our study, (87%) of patients required neck exploration, a much higher percentage in comparison to Mahmoodie M. et al (52.1%)[14], Roden et al (40%) [23] and Gracias (50%) [24]. this difference may have resulted from difference in severity and mechanism of trauma.

Our treatment protocol was based on a selective management protocol according to neck zones, barium swallow test, CT, evaluation and management of neck wounds. However, because of angiography was impossible in our hospital as an emergency test, vascular injury was suggested by history and physical examination or sometimes Doppler study in day time. Despite this fact and due to difference in severity and trauma mechanism, in our study negative non therapeutic neck exploration was (18%), a close result to Mahmoodie M. et al (15.6%) [14], Or Moore in Denver, Colorado 4 studies series (16%) [25].

In our study, complications were reported in 18% of cases with infection as the most common complication (26.6%). This result supreme other studies of Mahmoodie M. et al (9.3%) [14] with the need for intubation was the most common complication (55.6%) and study of Bell et al (10.7%)[16]. This may be explained by also the mechanism of trauma most common, associated injuries high rate and prolonged time of transfer from scene of accident in frontlines to hospital casualty and hence mortality rate of this study was 8%, a high rate in comparison to Mahmoodie M. et al (1.5%) [14], Bell et al (3%) [16] while it is less than Kedall J.L. et al series (11%) [13].

Conclusion: In a country like Iraq where terror civilian victims and war-injured militaries are high in number with a parallel limited health resourcesand incomparable few health personnel, the mandatory exploration of all cases of PNI becomes impractical while selective approach of management is still safe and preferable without significant increase in morbidity when close observation is provided to patients with the use of modern diagnostic tools.

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