

## SURGICAL MANAGEMENT OF LIFE THREATENING PENETRATING NECK INJURIES – A SINGLE HANDED EXPERIENCE

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**ABSTRACT: AIMS AND OBJECTIVE:** To evaluate demographics, management and outcome of life threatening penetrating neck injuries (PNI). **MATERIAL AND METHOD:** A total of thirty four patients of severe PNI were referred to us between August 2003 and Feb.2013. Simple emergency investigations like hemogram and X rays or in few cases CT scan were enough to decide emergency exploration. Patients who were in shock required resuscitation. **RESULT:** Out of 34 patients, males in active phase of life (24 patients, 70.59%) predominate. Road traffic accident (RTA) (11 Patients, 32.35%), bullet injuries (10 patients, 29.41%) and sharp object (11 patients, 32.35%) were most common cause of injuries. Homicidal injuries predominates. Bleeding was the most common presentation seen in all cases from neck vessels. Aero digestive, neurological, lung and pleura involvement were other injuries encountered. Patients have maximum injuries at Zone I region (19 patients, 55.88%) and managed by supraclavicular approach (16 patients, 47.06%). We had 1 (2.94%) mortality. **CONCLUSION:** Emergency surgical exploration and ICU management saved life of most of life threatening PNI. We recommend time should not be delayed in detail diagnosis and evaluation of such injuries.

**KEYWORDS:** Penetrating neck injury (PNI), vascular injury, neck zone, Road traffic accident (RTA)

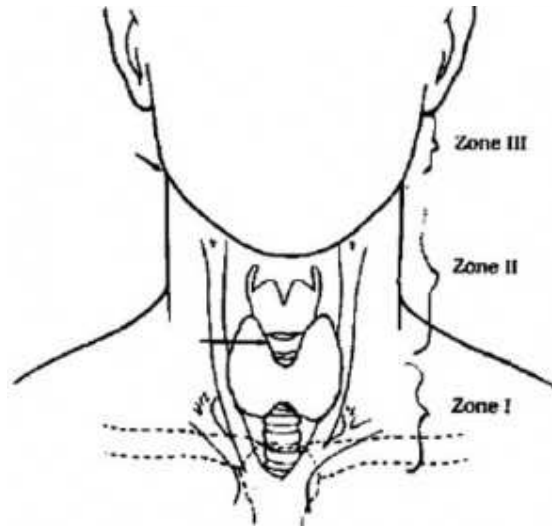
**INTRODUCTION:** Life threatening penetrating neck injuries is one of the most lethal of all injuries. Fogelman and Stewart in 1956 advocated surgical exploration of all penetrating neck injuries encountered in civilian practice. The issue has been extensively debated in literature<sup>(1)</sup>. Many patients die before reaching the hospital. However patients who reach alive may die if rapid surgical intervention is not taken on a high index of suspicion. The safest, most expeditious method of managing a penetrating injury of neck is still prompt surgical exploration. Patients with positive physical examination have definite indications for surgery<sup>(2)</sup>. As a consequence of high likelihood of injury to the aero digestive, major blood vessels and nerve chord, accurate and aggressive initial evaluation and treatment are required to optimise outcome.

**MATERIAL AND METHOD:** The present study was conducted between August 2003 to Feb. 2013 in department of cardiothoracic and vascular surgery, Maharana Bhopal Government Hospital under Ravindra Nath Tagore Medical College, Udaipur. In this study 34 patients were included with life threatening PNI who were referred to us for surgical intervention. Age and

sex distribution, pattern of injuries, Clinical presentation, anatomical distribution of injuries, operative approaches, Zone distribution and mortality were analysed in detail.

Initial management comprised of securing airway, endotracheal intubation or tracheostomy if needed, inserting intravenous line for fluid and blood transfusion. Inotropes were given if patients were in shock. Continuous monitoring of vital parameters was started immediately in all patients. Clinical examination and basic investigations like Haemogram, X ray chest /cervical region, and CT angiography in selected patients were enough to take patients for emergency surgery.

**NECK ZONES:** We considered neck zones as describe by Roon and Christensen classification (As shown in figure)



**Surgical detail:** All patients were operated under general anaesthesia. Different approaches were used depending on site of injury and visceral involvement. Combined approach was required if there were multiple injuries or vital structures at other sites were also involved.

**Approaches: Sternocleidomastoid approach:** Incision was given along anterior border of sternocleidomastoid, platysma and cervical fascia divided, carotid sheath opened, great vessels looped proximally and distally, and repair of carotid artery, jugular vein, aero digestive tract was done accordingly. No drain kept. With extension of same incision to submandibular region, injury to zone III and salivary gland were managed.

**Supraclavicular approach:** A transverse supraclavicular incision was given, may need extension if injury was extending posteriorly. Platysma and fascia divided. Strap muscles divided for better visibility. Subclavian artery looped and nerve chords observed. Repair or thrombectomy of vessel was done accordingly after control of vessel proximally and distally. Brachial plexus injuries were managed afterward.

**Anterior or Posterolateral thoracotomy** was required when entry or exit wound extend into thorax or if we found difficulty in approaching proximal subclavian artery.

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Postoperatively patients were shifted to Intensive Care Unit, close monitoring of all parameters like ECG, invasive and non-invasive BP, Pulse oximetry and urine output was done. Inotropic supports along with ventilator care were required in selected cases.

**RESULTS:** Most of the patients belonged to age limit 21 to 45 years (n=26, 76.47%). Males (n=31, 91.18%) outnumber female patients (n=3, 8.82%) with male to female ratio of 10.33:1 (Table 1). Causes of neck injuries were RTA (n=11, 32.35%), bullet injuries (n=10, 29.41%) and sharp object injuries (n=11, 32.35%) including 1 arrow injury (Table 2). Homicidal injuries dominate all injuries (n=15, 44.12%).

Most of the patients (n=31, 91.18%) presented with profuse bleeding from external wound. Thrombosis of carotid and subclavian artery (n=4, 11.76%) presented with cerebral and limb ischemia respectively. Haemorrhagic shock preoperatively was seen in 1/3<sup>rd</sup> of patients (Table 3).

Vascular injuries were seen in almost all patients. Subclavian artery (n=10, 29.41%), carotid artery (n=12, 35.29%) and jugular vein (n=17, 50%) were most commonly injured. Lung injury with or without pulmonary vessel involvement (n=8, 23.53%) was the most common Cause of haemorrhagic shock and morbidity. It has resulted mortality in one patient (Table 4). 32 out of 34 patients (94.12%) were operated immediately and 2 patients (6.66%) with thrombosis of great vessels who were referred from other Department, investigated with CT angiography and operated later.

Isolated supraclavicular approach (n=16, 47.06%) was most common approach as zone I involves predominantly (n=19, 55.88%) (Table 5 and 6). Thoracotomy (n=7, 20.59%) was required if there was lung or pleural injury and in few cases to control proximal subclavian artery. Six patients (20%) were kept on ventilator postoperatively with mean duration of ventilation 2.83 days (range 2-4 days). All these patients required inotropic support post operatively. Mortality was seen in 1 case (2.94%).

**DISCUSSION:** Neck injuries have been reported since middle ages but the first authentic report and management of neck injury was by Ambrose Pare (1510-1590). He ligated lacerated carotid artery and jugular vein of wounded soldier.<sup>(3)</sup> Historic review revealed mortality rate range from 7% - 18% in wars but in civilian arena it is reported to range from 0 to 11%.<sup>3</sup> Neck trauma accounts for 5-10% of all serious traumatic injuries.<sup>(4)</sup>

In our series most of the patients belong to age group 20 to 45 years (n=26, 76.47%) with male to female ratio 10.33: 1 (Table 1). Other series have also reported a predominance of males, ranging from 71 to 91%, and mean ages ranging from 25 to 34.5 years<sup>(5,6,7,8)</sup>. This finding reveals that male in active phase of life are more prone for such injuries.

We observed homicidal penetrating neck injuries (n=15, 44.12%) caused by bullet or sharp objects dominates. This was also observed by B. Vishwanatha et al<sup>(9)</sup> which reveal that 73.8% of their patients had homicidal penetrating neck injuries. Their higher incidence may be due to larger series (42 patients) than ours. This should be taken as serious matter as this is preventable and needs strict measures.

Exploration was mandatory in all of our patients as profuse bleeding was the most common presentation in most of the patients (Table 3). Most injuries involved major arteries and vein of the neck in which laceration, transection and avulsion of vessel were seen. Roon and Christensen<sup>(10)</sup> and Mehemoodie et al<sup>(11)</sup> as also observed that in 74% and 67.2% respectively of their patients who require exploration, bleeding and expanding hematoma by vascular

injuries was the most common cause. This was followed by aero digestive injuries which precipitated stridor, hoarseness of voice, dyspnoea and surgical emphysema (Table 3) among patients. They were managed by tracheotomy, Ryle's tube insertion and primary closure. Brachial plexus injury with contusion and transaction seen in 8 patients were not managed primarily and were referred for secondary repair afterward.

According to Roon and Christensen<sup>(10)</sup> Zone I injuries were most commonly seen as life threatening neck injuries and were associated with the highest morbidity and mortality rates. About 30% of these cases were accompanied by injury outside of the neck zones as well, mainly thoracic. In our series zone I injuries were most common, seen in 19 patients (55.88%) and thoracotomy was required in 7 patients (20.59%). Hemothorax was seen in 8(23.53%) patients with injury to first part of subclavian artery, pulmonary artery, Pulmonary vein and lung injury (Table 4).If we look into the approach of exploration supraclavicular approach was most commonly used approach (n=16, 47.06%), followed by sternocleidomastoid approach (n=10, 29.41%) (Table4) as life threatening injuries mainly involve Zone I.

The current mortality rate in civilians with penetrating neck injuries ranges from 3-6 %.<sup>(3, 12, 13)</sup> Higher mortality rates occur with injuries to large vessels, such as the carotid or subclavian arteries and veins. In our series one patient died post operatively (mortality rate 2.94%). This patient had high velocity missile wound with entry from zone I and exit through chest posteriorly leading to subclavian artery laceration and long lung laceration involving pulmonary artery and vein injury with severe shock. He was taken directly in emergency operation theatre. Posterolateral thoracotomy done, subclavian artery laceration repaired, left lower lobectomy with repair of pulmonary vessels done. Patient was managed on ventilator and inotropic supports but died on 4<sup>th</sup>post-operative day due to toxemia and septicemia. We came across with marble chip (n=5, 14.71%) and arrow injury (n=1, 2.97%) as our city is surrounded by marble industries and tribal community. We often come across with these kinds of injuries.

**CONCLUSION:** Majority of neck injuries were seen in males in their active phase of life. Clinical evaluation is enough to decide emergency surgery in life threatening PNI. Supraclavicular approach and sometimes Thoracotomies are required for zone I injuries while Sternocleidomastoid approach with extension is required for zone II and zone III injuries. Emergency surgical decision as well as ICU management is the key of successful outcome.

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Table 1: Age and sex distribution

Age group	Male	Percentage	Female	Percentage
0 -20	5	14.71%	1	2.94%
21-45	24	70.59%	2	5.88%
➤ 45	2	5.88%	0	0%

Table 2: Pattern of injury

Pattern of injury		No. of cases	Percentage
RTA		11	32.35%
Sharp injuries	Stab wound	5	14.71%
	Marble chip injury	5	14.71%
	Arrow injury	1	2.94%
Bullet injuries		10	29.41%
Blunt injuries		2	5.88%

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Table3: Emergency presentation

Predominant Bleeding	External	31	91.18%
	Internal	3	8.82%
Haemorrhagic shock		11	32.35%
Acute thromboembolism		4	11.76%
Neurological manifestation (numbness, tingling, weakness)		10	29.41%
Severe Dyspnoea		11	32.35%
Strider and hoarseness		2	5.88%

Table 4: Anatomic distribution of injuries

	Structure	No.	%
Vascular (arterial)	Carotid and its branches	12	35.29%
	Subclavian art.	10	29.41%
	Others (Pulmonary, post. Triangle branch arteries etc.)	9	26.47%
Vascular (venous)	External jugular vein	6	17.65%
	Internal jugular vein	5	14.71%
	Anterior jugular vein	6	17.65%
	Others (pulmonary, subclavian etc.)	13	38.24%
Others	Brachial plexus	8	23.53%
	Pleura, lung, haemothorex	8	23.53%
	Oesophagus	3	8.82%
	Trachea ,larynx	3	8.82%
	Salivary gland (submandibular, parotid gland)	2	5.88%

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Table 5: Operative approach to patients of neck trauma

Operative Procedure	Patients	Percentage
Supraclavicular approach	16	47.06%
Sternocleidomastoid approach	10	29.41%
Submandibular approach	1	2.94%
Thoracotomy	7	20.59%

Table 6: Zonal distribution of neck injuries

Injury Zone	Total patients	Percentage	Mortality
Zone I	19	55.88%	1 (2.94%)
Zone II	07	20.59%	Nil
Zone III	02	5.88%	Nil
Zone I+II	04	11.76%	Nil
Zone II+III	02	5.88%	Nil