

Penetrating Tracheal Injuries – A Kashmir Experience**A.M. Dar¹, S.A. Salati², M.A. Dar³, A.G. Ahangar⁴**¹Associate Professor of Cardiovascular & Thoracic Surgery, Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, Kashmir, J&K, India²Registrar Surgery, Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, Kashmir, J&K, India³Associate Professor of Cardiovascular & Thoracic Surgery, Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, Kashmir, J&K, India⁴Professor of Cardiovascular & Thoracic Surgery, Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, Kashmir, J&K, India**Correspondence to:** Dr Sajad Ahmad Salati, Assistant consultant Surgical SpecialitiesKing Fahad Medical City, Riyadh, KSA. Email : docsajad@yahoo.co.in

Mobile Telephone : 00966530435652

Background: The increased incidence of tracheal injuries encountered during war like situation in the valley of Kashmir has prompted us to conduct this study.**Method:** The study was conducted retrospectively on 29 patients managed in the past in our hospital and 7 patients were managed after the study was undertaken.

After recording the observations made in managing the patients of penetrating tracheal trauma, the results were analyzed and entered in the individual patients' protocol.

Results: There was a predominance of males with a male to female sex ratio of 5: 1. The majority (69% had fire arms trauma. Hissing wounds, respiratory distress and haemoptysis were the commonest presenting complaints. There were 4 deaths. Complications were observed in 16 (50%) of the 36 patients who survived and included hoarseness in 6 and tracheal stenosis in 5 cases.**Conclusion:** It was concluded that earliest possible diagnosis followed by securing of airway and prompt repair is the mainstay of management of penetrating tracheal injuries.**Introduction**

Traumatic injuries to the trachea are infrequent, but when they occur, they may produce an immediate threat to life as well as contribute to long-term disability. Prompt recognition and appropriate care can convert a life-threatening situation into one that can be successfully managed in a high percentage of cases. The first recorded attempt of suture repair of a traumatic tracheal injury was made in the 16th century by the French surgeon Ambroise Pare¹. He operated upon two patients with penetrating injuries to the cervical trachea suffered in the battlefield, both resulting in death. It was only in 1957 when Beskin reported the first successful repair of ruptured cervical trachea². The field of tracheal injuries did not progress much until 1960s & 1970s when workers like Symbas^{3,4}, Grillo^{5,6}, Pearson⁷, Harrington⁸, Sheely⁹ and Hood¹⁰ and others brought in a revolution in this

field. As elsewhere, penetrating injuries of trachea were quite uncommon in this part of world (i.e., Indian side of Kashmir valley) up to 1990 ,when armed insurgent movement started here changing the entire trauma pattern in this Sub Himalayan area with a population of more than ten million. The purpose of this study is to evaluate the management policy in the penetrating tracheal injuries at Sher-i-Kashmir Institute of Medical Sciences, Soura, Srinagar, Kashmir, India - the 650 bedded, tertiary care health center.

Patients and Methods

A study was undertaken of 36 cases admitted in this hospital with penetrating injuries of cervical trachea from Jan 1990 to Dec 2006. Twenty nine cases admitted up till Dec 2003 were studied retrospectively and 7 cases admitted from Jan 2004 to Dec 2006 were studied prospectively Excluded

from this study were all the patients who suffered major injuries to other organs besides neck. Patients who arrived “lifeless” (cardiac arrest or non-palpable pulses and no blood pressure) at the Accident & Emergency Department were also excluded.

Results

Thirty (86%) cases were males and 6 (14%) were females. They ranged in age from 15

to 67 years with an average age of 32 years. The etiology of these injuries is as depicted in Table 1. Most of the injuries were located between cricoid and fourth tracheal ring due primarily to greater accessibility of area. Among the 36 tracheal injuries, 15 were simple lacerations, 4 were through and through perforations, 8 were complete transections and 9 were tangential injuries.

Table 1. Causes Of Injury

Causes	No. of Patients	Male	Female
Fire Arm Injuries	25 (69%)	21	04
Bear Maul	06 (17%)	03	03
Automobile Accidents	03 (8%)	02	01
Stab Wounds	01 (3%)	01	00
Razor Blade Injuries	01 (3%)	01	00
TOTAL	36	28	08

Table 2. Nature of Tracheal Injuries

Type of Injury	Number of Patients (%)
Lacerations	15 (42%)
Tangential Injuries	09 (25%)
Complete Transections	08 (22%)
Through & through perforations	04 (11%)

Table 3. Symptomatology

Symptom	Number of Patients
Respiratory Distress	23
Shock	10
Subcutaneous Emphysema	15
Hissing Wounds	27
Haemoptysis	17
Hoarseness	8

Table 4. Other Associated Injuries

Carotid/Vertebral artery Injuries	5
Jugular veins	4
Esophagus	3
Thyroid gland	4
Cervical Spine	2

Table 5. Complications among Survivors

Wound / Chest Infection	5 (16%)
Hoarseness	6 (19%)
Tracheal Stenosis	5 (16%)
Total	16 (50%)

The presenting symptoms included respiratory distress, circulatory shock, and subcutaneous emphysema, hissing wounds in the neck, haemoptysis, and hoarseness. Respiratory distress was present on admission in 23 patients and 10 patients presented with a systemic blood pressure less than 80/0 mm Hg. Radiographic / CT scan findings of extravasated air in the neck, pneumothorax, haemothorax, pneumomediastinum, and discontinuity of trachea aided in diagnosis. The time lag between injury and reception at this center ranged from 2 hrs to 48 hrs with an average delay of 5 hrs. The average time lapse between the time of reception in hospital and operation theatre was 40 minutes.

The patients were received in Accident and Emergency Department and initial resuscitation & diagnostic workup were conducted according to Advanced Trauma Life Support principles¹¹, the securing of free airway with inline stabilization of cervical spine being the first concern. Routine anteroposterior roentgenograms of neck and chest were taken by equipment available in the resuscitation rooms. After the stabilization of the patient's condition, CT scan of the neck and chest were performed in the adjacent Radiology Department. Diagnosis was established in each case preoperatively. 23 patients underwent bronchoscopy preoperatively and all patients were broncoscoped postoperatively during follow up to evaluate the operative repair. Laryngoscopy was performed in 6 patients who were hoarse.

The operations were performed in the adjoining Emergency Operation Theatre under general anesthesia after endotracheal intubation. 4 patients required tracheostomy either preoperatively or at the end of the operation. Tracheostomy was performed below the site of injury/repair. The injuries

were approached through a transverse incision anterior to sternocleidomastoid 3 cms above the suprasternal notch.

Wounds were thoroughly debrided, haemostasis was achieved and bronchial lavage and suctioning was performed. All the tracheal injuries were repaired primarily with interrupted Vicryl sutures. Simple lacerations and tangential injuries were managed with relative ease as compared to more severe injuries which required the tracheal release by dissection in pretracheal plane both above and below the injury. Injuries to adjoining structures were dealt with as required.

In all the patients 25^o – 35^o of neck flexion was maintained postoperatively for few days by placing a “chin stitch” where in a heavy gauge suture was placed in the midline, from the soft tissue under the chin to the upper anterior chest or in some patients by using a Minerva like jacket postoperatively. The patients were monitored postoperatively in Surgical Intensive Care Unit and depending on the condition of the patients, 4 patients required active mechanical ventilation though our goal was to restore spontaneous breathing earliest to avoid the stress on tracheal suture lines. The patients were administered antibiotics as per the hospital protocols. Measures were taken to optimize pulmonary toilet and airway patency which included judicious intravenous fluids, humidified oxygen, and intravenous steroids for initial 24-48 hours after repair. Oral alimentation was begun on 2nd or 3rd postoperative day and thickened fluids and semisolids were offered initially to minimize the possibility of aspiration. Stitch removal, gradual neck extension, removal of tracheostomy and active movements of neck were followed slowly with active support from physiotherapy department.

Among the 36 patients of cervical tracheal injuries seen during the past 17 years, there were 4 deaths. All the patients who died had reported in a state of haemodynamic instability and their hospitalization after injury had got delayed by more than 12 hrs; in fact one of the cases had managed to report here 48 hrs after getting injured. One of the patients died while being operated upon and another one developed Acute Respiratory Distress Syndrome and died on third postoperative day. Two other patients developed features of Multiple Organ Failure and Sepsis and died on fifth and eleventh postoperative day respectively.

Complications occurred in 16(50%) patients. 6 (19%) patients continued to be hoarse due to recurrent laryngeal nerve, though initially 8(25%) cases had presented with hoarseness and 2(6%) cases showed recovery of normal voice during the 6 months follow up. Five (16%) cases developed wound and/or chest infections- all the cases had reported 36 hours after having got injured. After proper debridement and repair of trachea, the patients were treated with antibiotics, initially empirically by broad spectrum ones and later on as per the culture/sensitivity reports of wound swabs taken at the time of presentation to Accident and Emergency Department, regular dressings and supportive therapy. 3 of the patients healed uneventfully where as one of the patients was among the unfortunate ones to have developed sepsis and Multiple Organ Failure and death on eleventh postoperative day. One patient developed a tracheocutaneous fistula which required an uneventful tracheoplasty 6 months after the initial repair. A local pedicled muscle flap was used to cover the repair.

Five (16%) cases manifested with features of tracheal stenosis; among them 2 had complete transections and 2 had through and through perforation at the time of presentation whereas the fifth patient developed stenosis at the site of tracheostomy (Table 5). All these patients

were subjected to tracheoplasty - 4 patients recovered uneventfully and were asymptomatic up to 8 years of follow up. The fifth patient required two more operations and ultimately was lost in follow up. In none of the patients, stents or artificial grafts were used. In all, 32 patients survived. There were 4 Deaths

Discussion

In isolated airway injuries or associated with other systemic injuries, early diagnosis and repair is the key to management.^{12,13,14,15,16,17} Management begins by securing an adequate airway and rapidly restoring ventilation when necessary. However even in the best of conditions, securing a patent airway may be challenging.¹⁸ It is the delay in initiating the right treatment that makes even those injuries lethal or highly morbid, which could otherwise be managed rather easily most of the times.^{19,20,21,22,23,24}

In the present study we have considered the management of penetrating tracheal trauma in this highest medical care facility of Indian side of Kashmir valley. As is true of other war torn areas of the world, the overall incidence of penetrating injuries has sharply increased in Kashmir valley in last 18 years. But still the incidence of tracheal injuries constituted only 0.35% of all hospital admissions with penetrating injuries. This is primarily due to the fact that Kashmir valley being hilly and economic backward, the infrastructure in form of roads, transportation facilities and peripheral healthcare facilities are very poor and patients succumb before reporting to the hospitals.

The investigative part of the study has also not been ignored, as some patients underwent tracheoscopy/bronchoscopy besides the routine radiology of cervical spine, chest, skull etc. and a few patients underwent CT Scan study of chest and neck though most of the patients were directly shifted to operation theatre after initial airway control and resuscitation. Tracheal

repair was accomplished after thorough debridement of the wound, without undue tension using interrupted, slowly absorbable sutures i.e., Vicryl (polyglactin) . Tracheostomy has been used in many series^{9,19,22,25}, but we never followed this rule and believe that the decision regarding tracheostomy should be made on the basis of individual patient's requirements. Only two patients were tracheostomised in our series. After repair we aimed and recommend early extubation of the patient so that the suture line over trachea is not stressed.

The patients need to be kept under follow up and need to be assessed regularly to detect features of tracheal stenosis .This complication was encountered by us in 14% . However in none of our patients did wound disruption occur. We attribute these results to proper mobilization of trachea and application of flexion suture between chin & anterior sternal skin and use of specific antibiotics.

In our series firearm injuries are the leading case of penetrating tracheal injuries as is true of many other studies. But we have injuries caused due to bear maul – the common mode of injuries in people living in remote hilly terrain with least access to health care facilities. In fact one of such patients managed to report to us after the lapse of 48 hours. Though the management in them is not different from other cases, but the infection rate in them is quite high due primarily to delayed initiation of required treatment.

Survival rate in our series is 89% in spite of delayed presentation, hemodynamic instability in 27.8%, and high rate of infection. This points towards the fact that the earliest intervention by expert medical teams, in spite of all odds can prevent what would otherwise be sure mortalities.

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