“ANALYSIS OF ANTERIOR NECK INJURIES AND THEIR INTERVENTION”

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In partial fulfilment of the Regulations

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M.S. (OTO-RHINO-LARYNGOLOGY & HEAD AND NECK SURGERY)

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Registration No.: 221914303

DEPARTMENT OF E.N.T &HEAD AND NECK SURGERY

TIRUNELVELI MEDICAL COLLEGE

TIRUNELVELI

MAY 2022

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PROTOCOL TITLE: ANALYSIS OF ANTERIOR NECK INJURIES AND THEIR INTERVENTION.
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Dear Dr. HARITHA GOVIND.A.P, The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during The IEC meeting held on 07.01.2020.

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1. TIREC Application Form ☐
2. Study Protocol ☐
3. Department Research Committee Approval ☐
4. Patient Information Document and Consent Form in English and Vernacular Language ☐
5. Investigator's Brochure ☐
6. Proposed Methods for Patient Accrual Proposed ☐
7. Curriculum Vitae of the Principal Investigator ☐
8. Insurance /Compensation Policy ☐
9. Investigator's Agreement with Sponsor ☐
10. Investigator's Undertaking ☐
11. DCGI/DGFT approval ☐
12. Clinical Trial Agreement (CTA) ☐
13. Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA) ☐
14. Clinical Trials Registry-India (CTRI) Registration ☐

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1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3weeks before for renewal / extension of the validity
4. An annual status report should be submitted.
5. The TIREC will monitor the study
6. At The time of PI's retirement/leaving the institute, the study responsibility should be transferred to a person cleared by HOD
7. The PI should report to TIREC within 7 days of the occurrence of the SAE. If the SAE is Death, the Bioethics Cell should Receive the SAE reporting form within 24 hours of the occurrence.
8. In the events of any protocol amendments, TIREC must be informed and the amendments should be highlighted in clear Terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. The PI must comment how proposed amendment will affect the ongoing trial. Alteration in the budgetary status, staff requirement should be clearly indicated and the revised budget form should be submitted.
   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented.
   d. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IEC, only then can they be implemented.
   e. Approval for amendment changes must be obtained prior to implementation of changes.
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ABBREVIATIONS

IJV – Internal Jugular Vein

EJV – External Jugular Vein

AJV – Anterior Jugular Vein

CCA – Common Carotid Artery

ICA – Internal Carotid Artery

ECA – External Carotid Artery

AE – Aryepiglottic Fold

TM – Tympanic Membrane

IDL – Indirect Laryngoscopic Examination

AP – Anteroposterior

SCM – Sternocleidomastoid Muscle

RCT – Randomized Control Trial

PDT – Percutaneous Dilatational Tracheostomy

ICU – Intensive Care Unit

RTA – Road Traffic Accident

CTVS – Cardiothoracic and Vascular Surgery

POD – Postoperative Day

ATLS - Advanced Trauma Life Support

INTRODUCTION

Laryngotracheal injuries are extremely uncommon, but they can be fatal. They are of major clinical significance because, if not treated timely and effectively, this will result in acute complications such as shock, sepsis, death, or, if the patient survives, the creation of fistula or voice dysfunction.

Laryngotracheal structures area plays pivotal role in breathing, swallowing, and speaking. Traumatic damage to its complicated architecture can induce considerable acute dysfunction, posing a life-threatening situation. To reduce the risk of perioperative problems and long-term morbidity like dysphagia and dysphonia, proper assessment and appropriate surgical care are required.

Neck trauma constitutes <1% of all trauma cases. But accounts for >75% of immediate mortality. Meticulous assessment and timely accurate surgical management are essential to reduce acute sequelae and improve post traumatic outcome.

This is an observational study in a tertiary care centre hospital, Tamilnadu, India. In which the various patterns, modes, clinical presentations, survival rate and management status is studied for a study period of two years (2019 to 2020).

AIM OF THE STUDY

To describe the causes, categorize the severity of injury and outcome of management of neck trauma based on time and depth of injury.

REVIEW OF LITERATURE

Neck trauma constitutes <2% of all trauma cases worldwide. But the morbidity and mortality caused by neck trauma is much more serious. Apart from the worldwide census in India the neck injuries are very common with similar statistics status. Neck injuries can happen by any mode. It can be accidental, suicidal or homicidal. Out of all these injuries penetrating injuries are notorious to cause mortality.

1. ENT Department, NSCB Medical College, Jabalpur, Madhya Pradesh, India, conducted a retrospective study from 2014 to 2016. In total, 17 patients were there in the trial. All documents pertaining to the patient's symptoms at the time of presentation, the type and mechanism of injury, and the severity of the injury were examined. The management plan was assessed, and any post-operative problems were carefully recorded. 14 of the 17 patients were men, and all of them came from a low socioeconomic background. The most common age group for neck trauma was between the ages of 22 and 40. Seven of the incidents were homicidal, five were suicide, and four were the result of an accident, the majority cases arrived at the hospital within 2–6 hours except for 3 cases which took longer than 8hours.
2. Penetrating Neck Wounds- Mandatory Versus Selective Exploration done by The Department of Surgery, Harlem Hospital Centre,

Columbia University, College of Physicians and Surgeons, New York. Records of all patients with penetrating wounds to the neck were reviewed and analysed. Chest and neck X-ray films carried out in all patients who were in stable condition. All Patients with clinical evidences suggestive of a serious injury were subjected to neck exploration, the study suggests that with experienced staff, frequency of operations for penetrating neck wounds without structural injuries can be minimized by selective neck exploration.

3. About two thirds of all depressed patients contemplate suicide and 10 to 15 percent commit suicide[1"] – Major depression and bipolar disorder; Kaplan and Sadock synopsis of psychiatry.
4. Tracheostomy: Epidemiology, Indications, Timing, Technique, and Outcomes by Nora H Cheung MD and Lena M Napolitano MD
5. Suicide Risk and Mental Disorders by Louise Brådvik Faculty of Medicine, Department of Clinical Sciences Lund, Lund University, Lund SE 221 00, Sweden;Nlouise@bradvik.se
6. Neck Trauma: Ent Prospects; article in Indian journal of otorhinolaryngology by Kavita Sachdeva and Aparaajitha Upadhyay.
7. Safety in selective surgical exploration in penetrating neck trauma by Frederico Teixeira, Carlos Augusto Metidieri Menegozzo conducted as a retrospective analysis at the Emergency Department of the Hospital das Clínicas of the University of Sao Paulo was performed by a chart

review of their trauma registry, identifying 161 penetrating neck trauma victims. Major signs and symptoms of vascular or aerodigestive injuries should prompt emergent surgical exploration without second thought. This study also supported selective management based on physical evaluation and diagnostic studies. Suggest more of a selective approach which decreases the incidence of non-therapeutic cervicotomies and their complications.

8. In a study conducted by Prokakis et al. Journal of Cardiothoracic Surgery 2014, on Airway trauma - a review on epidemiology, mechanisms of injury, diagnosis and treatment.

9. A 10year study of penetrating head and neck injury by assault in the North East of England by Ben J. Steel1. Andrew Swansbury, Louis T. Wheeler, retrospective study involving all patients presenting to A&E with H&N penetrating injuries between 1 January 2010 and 31 December 2019.

10. Penetrating neck injuries study by B.Vishwanatha, A.Sagayaraj, Shalini G. Huddar, Prashanth kumar, R. K. Datta.study happened in karnataka From 1999 to 2005, forty-two cases of penetrating neck injuries which were treated in their hospital were included in this study. Thirty-one (73.8%) injuries were due to homicide, six cases (14.2%) were due to suicide attempt and five (11.9%) were accidental injuries. Six patients had injuries in zone I, thirty-four patients of their study had injuries in

zone II and only two patients had injuries in zone III. All patients presented with wound in the neck. Early treatment of laryngeal injury within first 24 hours is to hope for the best results for air way and voice.

11. Another study on Value of clinical examination in the assessment of penetrating neck injuries by Andrés Isaza-Restrepo1,2, Julián Andrés Quintero-Contreras3, Jorge Escobar-DiazGranados1 and Ángela María Ruiz-Sternberg1 conducted in the Hospital Occidente Kennedy's (HOK) emergency department from August 2009 until and including June 2010 it was a retrospective study to compare the diagnostic accuracy of clinical findings (symptoms and soft signs on admission of the patient) with the definitive findings according to the gold standard test for each particular situation. Selected group was between 14 and 65 years. Patients underwent an interview and a complete physical examination, and form was filled out by the surgeon on duty, the majority were male, the mean age was 29.22years. most frequent neck injuries were caused by stab wounds and mainly affected the zone II of the neck. Vascular soft signs noted 118 (57%) patients, 87 (42%) patients presented minimal bleeding, followed by 54 (26%) who presented non-expansive haematomas. only one patient had an abnormal fibrobronchoscopy, underwent surgery. Study indicates that physical examination is a reliable, simpler, economical, accurate, and widely applicable diagnostic tool.

12. Anatomy of a Suicide: A Case Report by conducted by Department of General Surgery, Hospital Center Valais Romand – Hospital Sion, Sion, Switzerland and Department of Thoracic Surgery, Hospital Center Valais Romand – Hospital Sion, Sion, Switzerland. A 52-year-old female was admitted after a self-inflicted, right para tracheal stab wound sustained pneumothorax. Right pneumothorax was treated with a chest drain and a right exploratory cervicotomy done. Hemodynamically unstable patients with platysma, vascular or aerodigestive lesions require surgery. Laryngotracheal injuries need panendoscopy and bronchoscopy prior to surgical exploration. Pharyngo-esophageal injuries are treated conservatively. Multidetector helical CT with angiography (MDCT-A) significantly reduces negative exploratory surgery suggests 'no zone' approach as more beneficial.

13. Penetrating neck injuries a review of 192 cases by Department of Surgery, Faculty of Medicine, Isfahan university of Medical Sciences, I fahan, R Iran. Most injuries were due to stab wound, and the majority of patients were young. Recommending early neck exploration in unstable cases and deep wound than platysma.

14. Correlation between the level of the external wound and the internal injury in penetrating neck injury does not favour an initial zonal management approach by A. S. Madsen1, J. L. Bruce, G. V. Oosthuizen1, W. Bekker1, study by Department of Surgery, University

of KwaZulu-Natal, Nelson R. Mandela School of Medicine, Pietermaritzburg, KwaZulu-Natal, and Department of Surgery, University of the Witwatersrand suggested patients with zone II wounds were approximately half as likely to have other injuries as those with wounds in other zone. Patients with multiple external zonal involvement were 8·5 times more likely to have injuries than those with wounds in another zone.

MATERIALS AND METHODS

Setting:

Emergency OPD and the department of ENT, Tirunelveli medical college hospital, Tirunelveli.

Design of the study:

Prospective Descriptive study

Period of the study:

2019 to 2021

Sample size:

All patients who presented to emergency department with neck traumas during study period were included in this study.

Inclusion criteria:

All patients presented to emergency department with neck trauma

Exclusion criteria:

Nil

STUDY METHOD:

After obtaining institutional and ethical committee clearance all patients presenting to emergency department with neck injuries were examined. If the general condition of the patient was stable, detailed history and examination is carried out first and then managed accordingly, if patient is unstable, treatment was started first and later on history documented. ENT examination of the patients presented to emergency department of our hospital with neck trauma between 2019 to 2021 were examination of oral cavity, oropharynx, laryngopharynx examination and detailed neck examination. Patient demographics such as age, sex, mode of injury, site of injury, time taken to reach the tertiary care centre, clinical presentations were documented initially. Patient will be undergoing detailed clinical, endoscopic, radiological (if needed) examination and investigations. After obtaining consent patient is shifted to emergency operation theatre for airway management and exploration if needed. Post operatively patients were observed in ENT wards, tracheostomy decannulation was tried during the treatment period in the ward itself. Psychiatry opinion and counselling were given to all patients before discharge. These patients were followed up clinically on OPD basis for the assessment of complications and quality of life.

DISCRIPTIVE NECK ANATOMY

Neck is a tube-like structure that runs from top of the head to the trunk. Anteriorly, from the lower border of the mandible to the top surface of the manubrium, superior nuchal line on occipital bone to IV disc between the C_7 to T_1 posteriorly.

COMPARTMENTS OF THE NECK

1. Visceral compartment – It is anteriorly located and it contains visceral, digestive and endocrine glands.
2. Vertebral compartment – It is posteriorly located and it contains the cervical vertebrae, spinal cord, cranial nerves, and muscles.
3. Vascular compartment - Contains CCA, ICA, IJV and the vagus nerve on each side of the neck.

TRIANGLES OF NECK

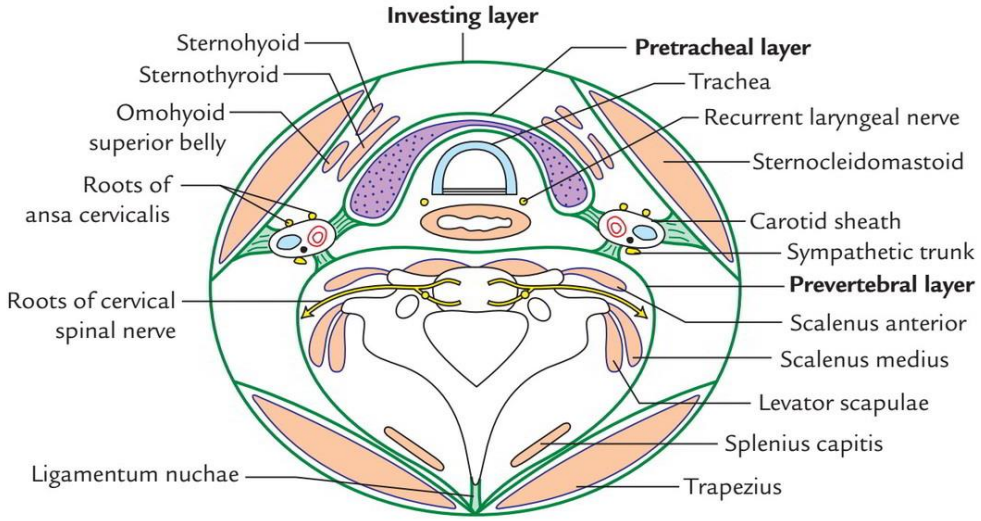
Anterior Triangle – It is bounded by anterior border of sternocleidomastoid, inferior border of mandible and midline of the neck.

Posterior Triangle – It is bounded by posterior border of sternocleidomastoid, anterior border of trapezius and middle $1/3^{rd}$ of clavicle.

CERVICAL FASCIA

It has 2 layers. superficial fascia and deep cervical fascia. Superficial layer attached to the mandible and continues as thoracic fascia. The deep fascia contains 3 layers – superficial investing layer, middle layer and deep layer

The investing layer encircles the neck muscles, salivary glands, trachea and oesophagus, and it attaches superiorly to the superior nuchal line, superior occipital protuberance, posteriorly attaches to the C_7 vertebra and ligamentum nuchae, laterally attached to the mastoid process and zygomatic arch and inferiorly attached to the scapula spine, acromion process, clavicle and manubrium sterni. It encloses suprasternal space of burns and supraclavicular space. Carotid sheath formed by 3 layers of deep cervical fascia.



Prevertebral fascia

It is a part of deep layer of deep cervical fascia and it surrounds vertebral column and its muscles, and it attached superiorly to the base of skull, occipital

bone, jugular foramen and carotid canal, posteriorly attached to the ligamentum nuchae and laterally to the mastoid process and anteriorly attached to the transverse process of the C_1 to C_7.

Pretracheal fascia

It encircles the trachea, oesophagus and thyroid gland, it starts from the hyoid bone and continues as thoracic fascia. **Ligament of Berry** – Thickened portion of pretracheal fascia that encases the thyroid gland and attached to the trachea. **Buccopharyngeal fascia** - It encircles the pharynx and separated from the alar fascia by retropharyngeal space. **Alar fascia** separated from the prevertebral fascia by dangerous space of neck.

FASCIAL COMPARTMENTS OF THE NECK

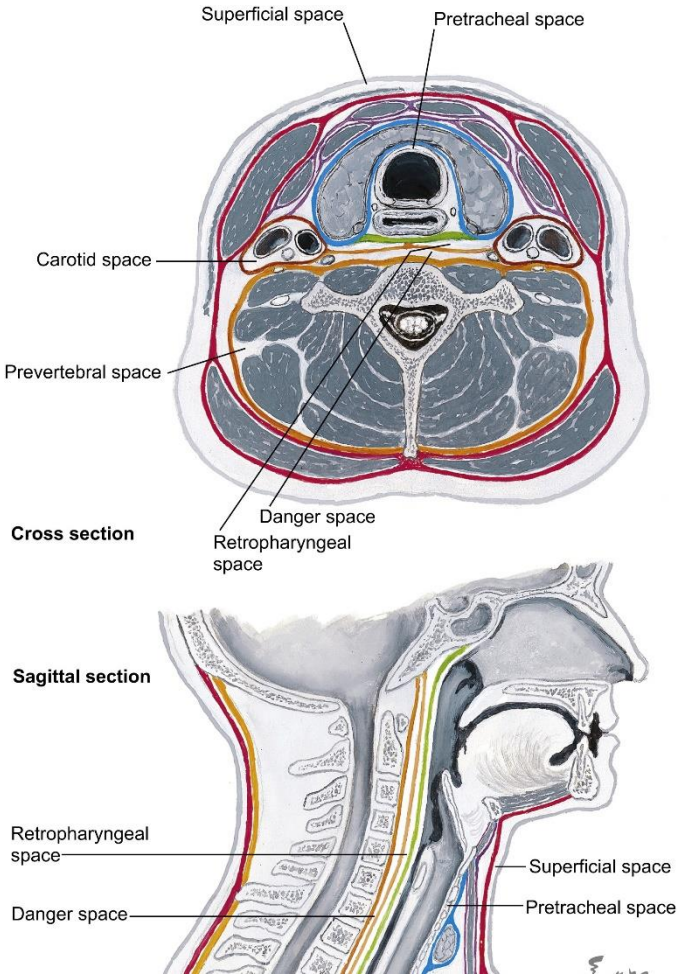
The cervical fascia divides the neck into 4 compartments by investing layer of deep cervical fascia, prevertebral fascia, pretracheal fascia (visceral compartment) and neurovascular compartment.

SPACES OF THE NECK

Cervical fascial reflection divides the neck spaces into multiple spaces in relation to the hyoid bone.

1. Spaces present with the entire length of neck - Superficial and deep neck spaces. Deep neck spaces constitute the retropharyngeal space, danger space, and prevertebral space

2. Suprahyoid neck spaces include: Submental, submandibular space, sublingual space, peritonsillar space, parotid space, parapharyngeal space and the masticator space.
3. Infrahyoid neck spaces include: Pretracheal space, retropharyngeal space, dangerous space of Grodinsky and Holyoke and prevertebral space.

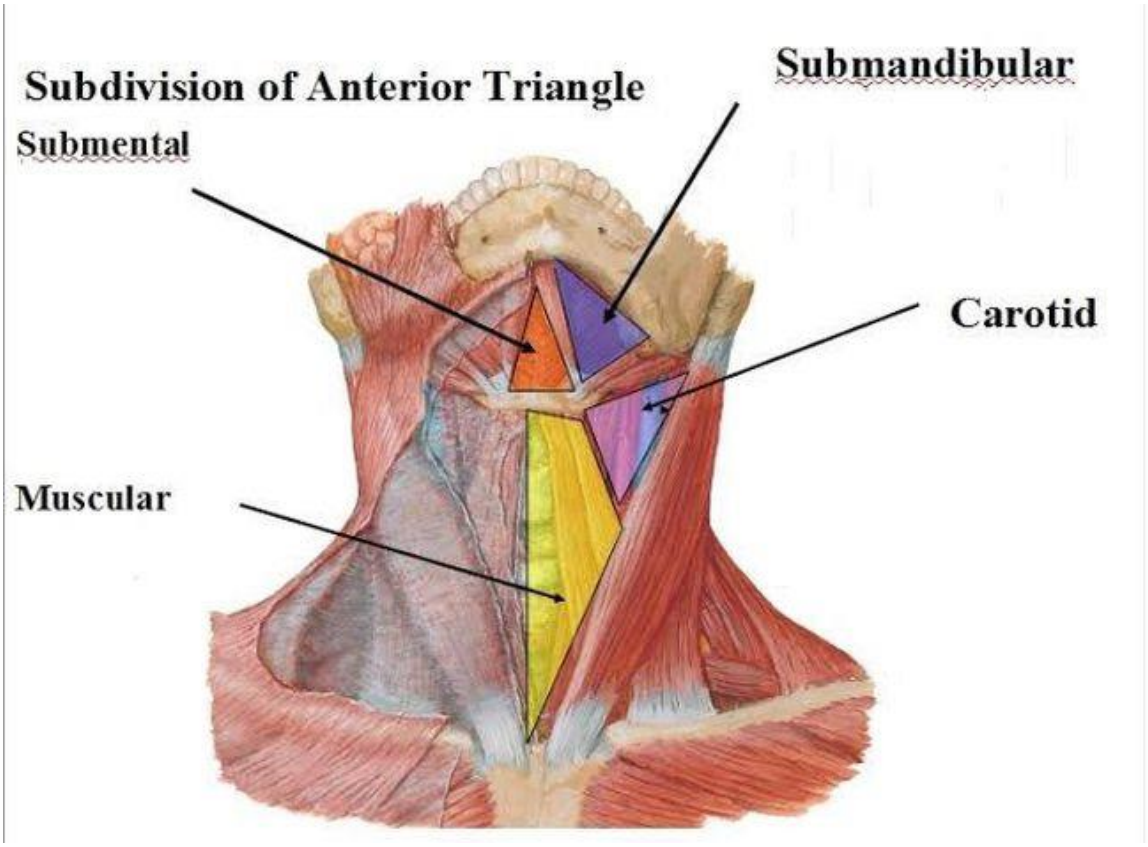


Retropharyngeal space

It is situated between the buccopharyngeal fascia and alar fascia. It extends from the base of the skull to the posterior mediastinum.

Danger Space of Grodinsky and Holyoke (Space 4)

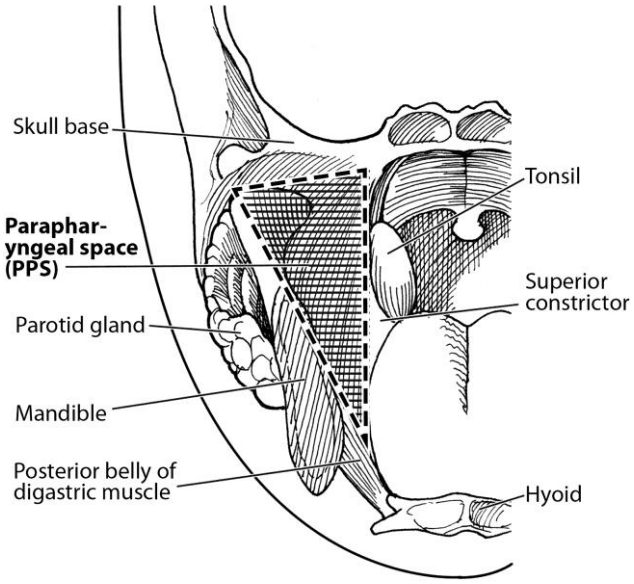
it is situated between alar fascia and prevertebral fascia. It extends from the skull base to the diaphragm.



Parapharyngeal Space

It is an inverted pyramid shaped potential space bounded superiorly by the skull base, inferiorly by the hyoid bone, laterally by pharyngeal wall, angle of mandible with medial pterygoid muscle, medially by pharyngeal wall. It is divided into pre styloid or anterior compartment and post styloid or posterior compartment by styloid process and its attached muscles and ligaments.

Prestyloid (Masticator space) contains fat and parotid gland. Post styloid (carotid space) contains ICA, internal jugular vein, sympathetic trunk , IX-XII cranial nerves and lymph nodes.



VENOUS DRAINAGE

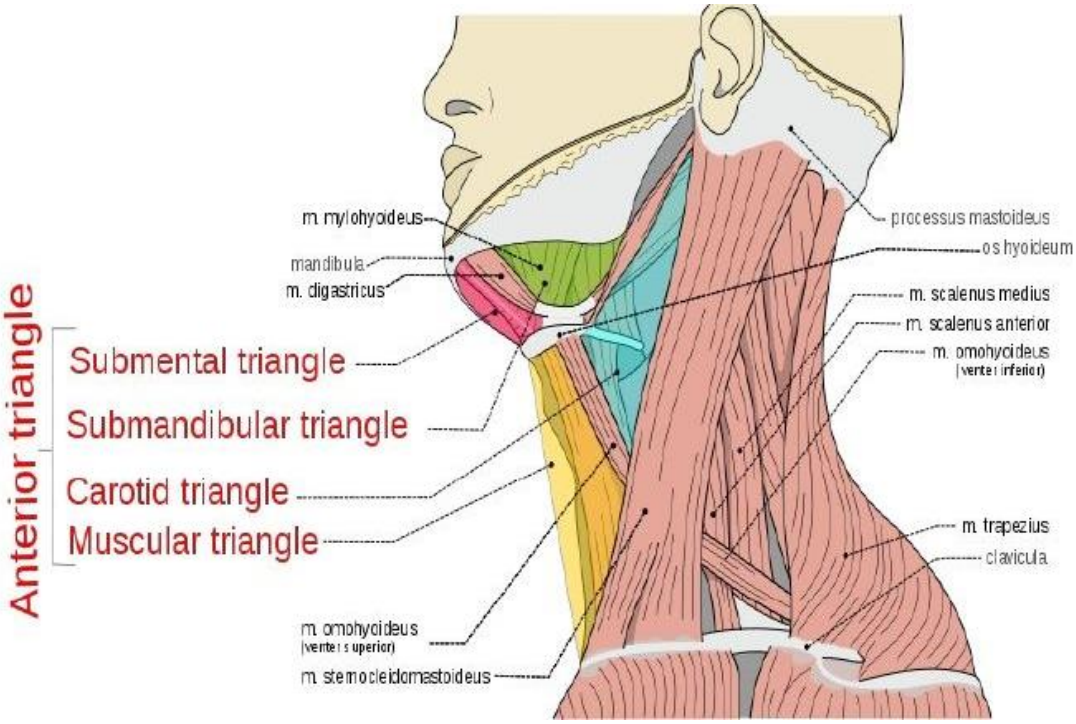
Primary superficial venous channels formed by EJV & anterior jugular veins (AJV). At the angle of mandible, posterior auricular vein join with the posterior division of the retromandibular vein to form the EJV. Anterior division of retromandibular vein joins with facial vein to form common facial vein, a tributary of IJV.EJV drains into the subclavian vein. AJV is a paired venous channel and draining anterior aspect of neck.

TRIANGLES OF NECK

Anterior Triangle

It is bounded laterally by anterior border of sternocleidomastoid, superiorly by inferior border of mandible and medially by midline of the neck. It is divided into submental, submandibular, muscular and carotid triangles.

1. Submandibular triangle – Bounded superiorly by inferior border of mandible, anteroinferiorly by anterior belly of digastric muscle and posteroinferiorly by posterior belly of digastric muscle.
2. Submental triangle – It is bounded inferiorly by hyoid bone, laterally by anterior belly of digastric muscle and medially by midline.
3. Muscular triangle – It is bounded superiorly by the hyoid, superior belly of omohyoid muscle, laterally by the anterior border of sternocleidomastoid muscle and medially by midline.
4. Carotid triangle – It is bounded superiorly by stylohyoid muscle and posterior belly of digastric, anteroinferiorly by superior belly of omohyoid muscle and posteriorly by anterior border of sternocleidomastoid muscle.



ANTERIOR TRIANGLE NECK MUSCLES

Suprahyoid Muscles – Elevate the hyoid bone during swallowing

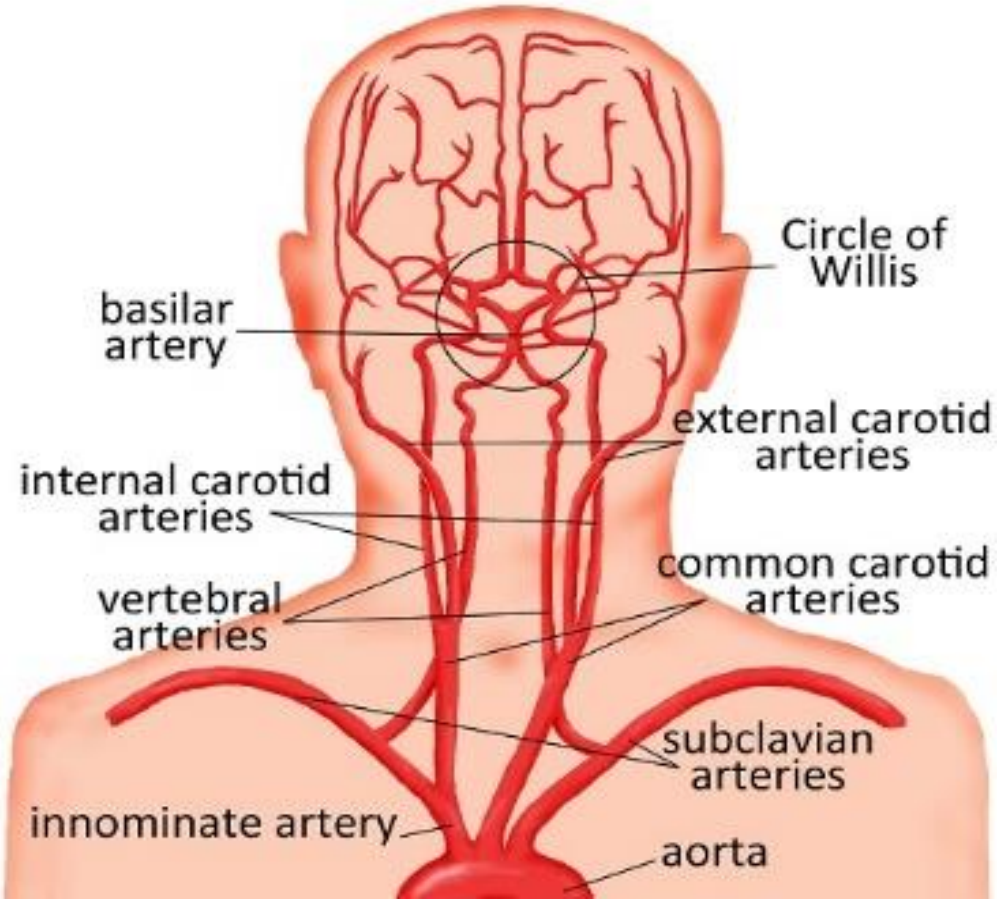
1. Stylohyoid
2. Digastric
3. Mylohyoid
4. Geniohyoid

Infrahyoid Muscles (Strap muscles) – Depresses hyoid bone after swallowing

1. Omohyoid
2. Sternohyoid
3. Thyrohyoid
4. Sternothyroid

BLOOD SUPPLY

1. Common carotid artery and its branches
2. Internal jugular vein and its tributaries



Carotid System

Right common carotid artery from the brachiocephalic trunk. Left CCA is a direct branch of arch of aorta. Both arteries present in the neck lateral to trachea and oesophagus. In the upper border of thyroid cartilage, CCA divides into its terminal branches – ICA & ECA. ICA enters into the cranial cavity through the

carotid canal without giving any branches in the neck. ECA gives 7 branches in the neck.

1. Superior thyroid artery – First branch
2. Ascending pharyngeal artery – Smallest artery
3. Lingual artery
4. Facial artery – 3rd anterior branch, supplies all structures in face
5. Occipital artery – Posterior branch
6. Posterior auricular artery – Posterior branch
7. Maxillary artery – Largest of the CCA's two terminal branches

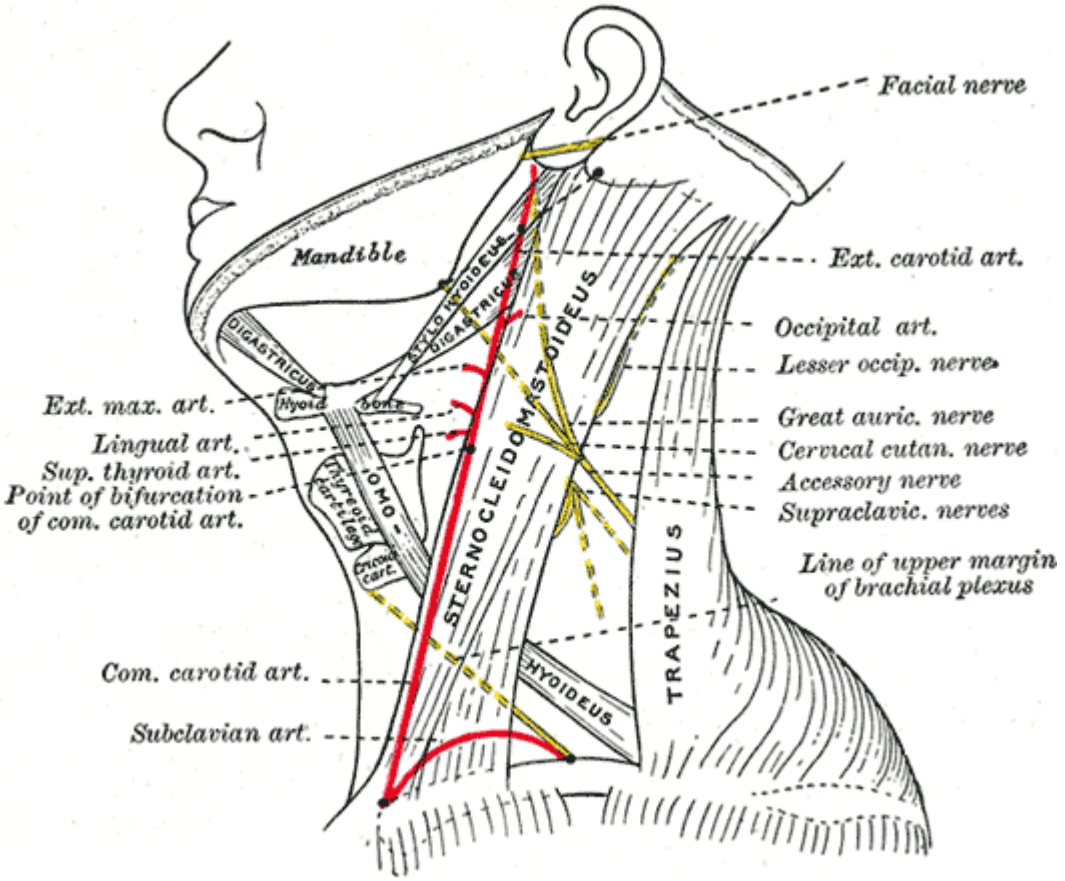
Venous Drainage

1. IJV – It is the extension of sigmoid sinus; in the neck it is situated posterior to the ICA and courses lateral to the CCA.
2. Brachiocephalic Trunk – It is formed by union of IJV with subclavian vein at the level of clavicle.

Nerve Supply

1. Facial nerve – It enter into the neck via the stylomastoid foramen and innervates posterior belly of digastric, stylohyoid and platysma.
2. Glossopharyngeal nerve – It enters the neck via the jugular foramen and innervates stylopharyngeous muscle, carotid sinus and pharynx

3. Vagus nerve – It enters the neck via the jugular foramen and lies between the IJV & CCA and ICA in the carotid sheath. It supplies carotid body and pharynx. It gives two branches in the neck - superior laryngeal nerve and recurrent laryngeal nerve.
4. Accessory nerve – It enters the neck via the jugular foramen and innervates trapezius.



5. Hypoglossal nerve – It enters the neck via hypoglossal canal, lies medial to IJV and ICA and supply muscles of tongue.
6. Transverse cervical nerve – It is a branch of cervical plexus (C_1&C_2) and it provides cutaneous innervation of the neck.

7. Ansa cervicalis – It is formed by descendens hypoglossi (C_1) and cervical nerves C_2 and C_3. It innervates “strap muscles” of the neck.

OESOPHAGUS – It extends from C_6 to T10, 25cm length and enter into the thorax via thoracic inlet. It lies posterior to the trachea and anterior to the vertebral column.

TRACHEA – It extends from C_6 to T5, continues superiorly as larynx and ends at carina, lies anterior to oesophagus.

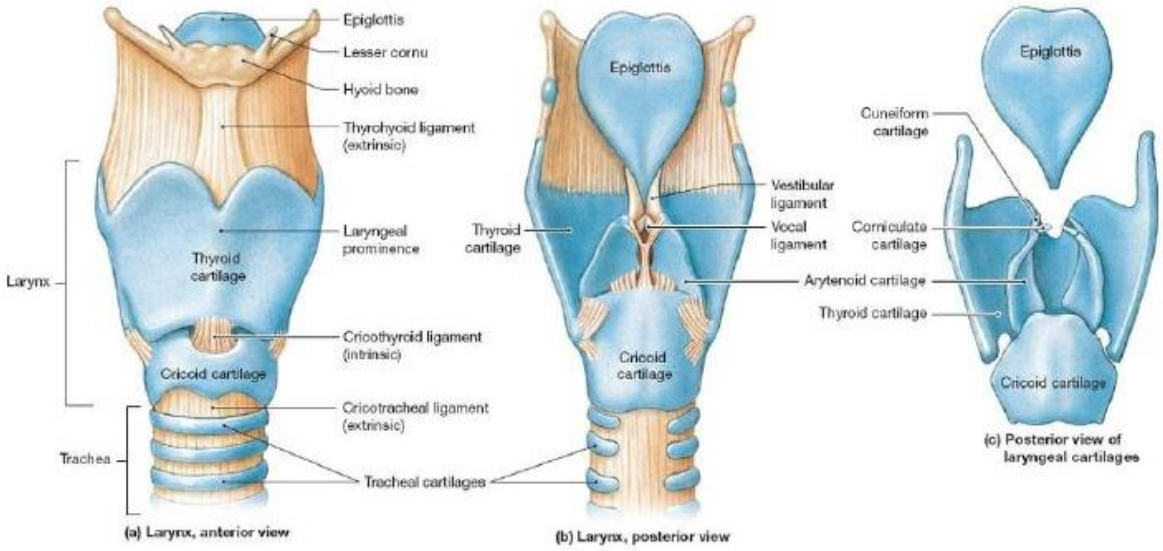
RECURRENT LARYNGEAL NERVES

It arises from vagus nerve at the level of Nodus ganglion.it wind around subclavian artery on the right side & the arch of aorta on the left side. it travels in the trachea-oesophageal groove. It enters the larynx by passing deep to lower margin of inferior constrictor muscle. It supplies the mucosa of the larynx below the level of vocal cords. **Galen’s anastomosis** – submucosal plexus present in the medial wall of the pyriform sinus, it is formed by ascending branch of the RLN and descending branch of internal laryngeal nerve.

External laryngeal nerve

It is a branch of vagus nerve, it enters the neck with superior laryngeal vessels by piercing through the thyrohyoid membrane.It gives external laryngeal nerve supplying the cricothyroid muscle and internal laryngeal nerve innervating the mucosa of the larynx above the level of vocal cords.

FRAMEWORK OF LARYNX



Hyoid bone

It is the only bone present in the larynx. It is divided into body, lesser and greater horns. It has anterior and posterior surfaces, superior and inferior borders. It is attached to the thyroid cartilage by Thyrohyoid membrane. Epiglottis attached to the hyoid bone by hyoepiglottic ligament.It gives attachments to the digastric, mylohyoid, stylohyoid, geniohyoid and hyoglossus muscles.It is attached to the mandible and skull base by stylohyoid ligament.

Thyroid cartilage

It is the largest unpaired hyaline cartilage present in the laryngeal framework. It has two laminae, superior and inferior cornua, thyroid notch – where two alae meet at centre, outer and inner surfaces. Vocal cord attached to the inner surface of the thyroid cartilage 8 mm below the thyroid notch by anterior

commissure tendon. The outer surface has oblique line of thyroid cartilage, gives attachment to thyrohyoid and inferior constrictor muscles. Ossification of thyroid cartilage starts at the age of 25years and completed at the age of 65years. Inferior cornua has articular facet for cricoid cartilage. Superior cornua gives attachment to the thyrohyoid ligament. Superior part of thyroid cartilage attached to the hyoid bone by thyrohyoid membrane and attached to cricoid cartilage by cricothyroid membrane.

Cricoid Cartilage

It is the only cartilage that encircles the larynx completely, signet ring shaped. It is narrow anteriorly and broad posteriorly. It has lamina posteriorly, flat and quadrilateral in shape, it has articular facet for arytenoid cartilage. Narrow anterior arch. Ossification starts at the age of 35 years and completed by 65 years.

Epiglottis

It is a leaf shaped unpaired cartilage, the free border directed upwards and posteriorly. Anterior surface is free in its upper part, lower part related to pre-epiglottic space. Posterior surface has several small pit like structure. It is a fibroelastic cartilage.

Arytenoid Cartilage

It is a pyramidal shaped paired hyaline cartilage. It has base articulating with cricoid cartilage, apex articulating with corniculate cartilage and gives attachment to the AE fold. It has three surfaces (medial, posterior and anterolateral) and two processes (vocal process and muscular process)

Corniculate Cartilage (Cartilage of Santorini)

It is a paired cartilage and articulates with arytenoid

Cuneiform (Cartilage of Wrisberg)

It is a pair of rod shape cartilage, just in front of corniculate cartilage.

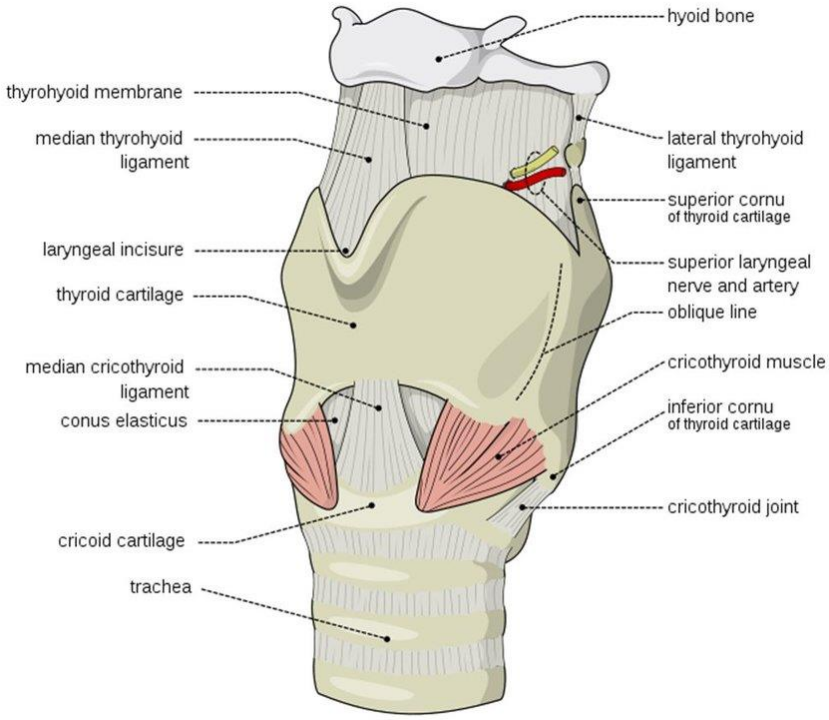
Ligaments

1. Thyrohyoid ligament - Median and lateral thyrohyoid ligaments
2. Cricothyroid ligament - Medial and lateral cricothyroid ligaments

Membranes

1. Thyrohyoid membrane – It is attached between the hyoid and thyroid cartilage, the median and lateral portion of the membrane thickened to form median and lateral thyrohyoid ligaments. Superior laryngeal neurovascular structures traverses through this.

2. Conus elasticus (Cricovocal membrane) – It is attached between upper border of cricoid to vocal ligament and arytenoid cartilage, upper portion forms the vocal cord
3. Quadrancular membrane – It arises from lateral epiglottic border to the arytenoid cartilage, thickened superior portion forms the AE fold and inferior border forms the vestibular fold.



Muscles of Larynx

1. Intrinsic muscles
    a) Muscles that change shape and size of laryngeal inlet - aryepiglottic and oblique arytenoid
    b) Muscle helps to move vocal cords
        i. Abductors: Posterior cricoarytenoid

ii. Adductors: Lateral cricoarytenoids, lateral and inter arytenoid and cricothyroid

iii. Tensors: Thyroarytenoids (Vocalis), Cricothyroid (External tensor)

2. Extrinsic muscles

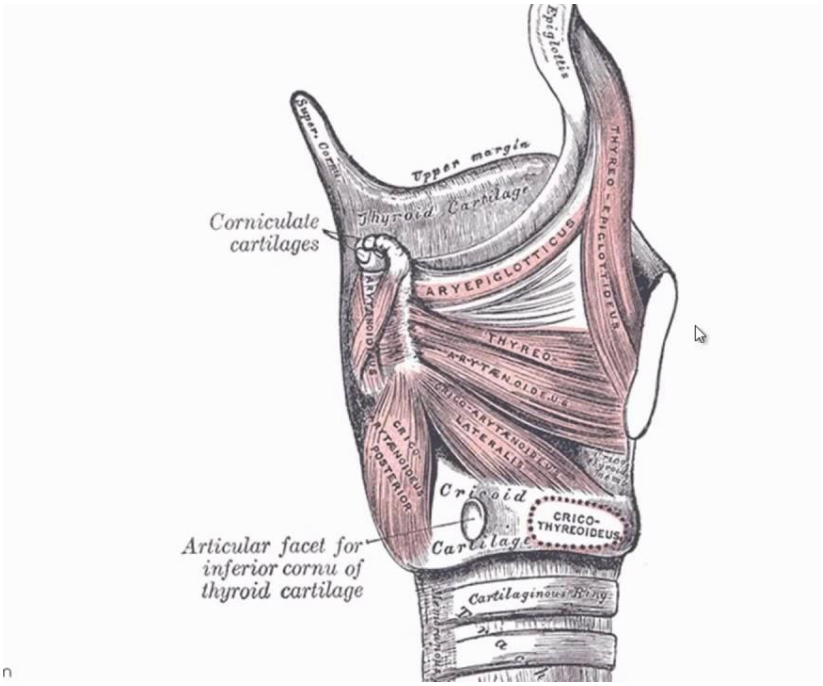
a) Strap muscles

i. Elevators: Mylohyoid, stylohyoid, thyrohyoid and digastric

ii. Depressors: Sternothyroid, sternohyoid and omohyoid

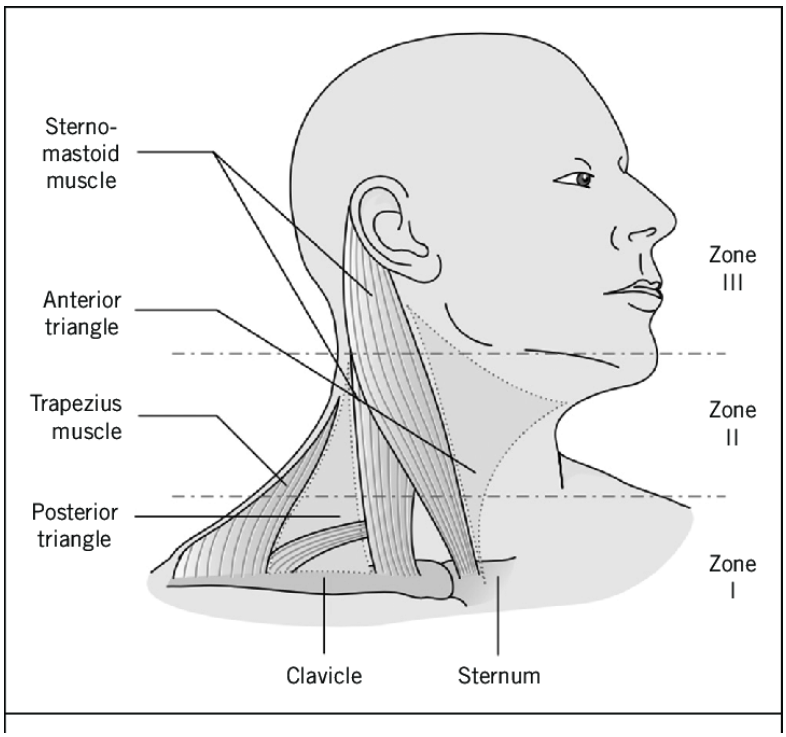
iii. Tensor of vocal cord: Cricothyroid

b) Pharyngeal muscles - Inferior constrictor



CLASSIFICATION OF ANATOMICAL ZONES OF NECK

Neck is divided into 3 anatomical zones by Monson in 1969, which includes zone 1 extending from clavicle to cricoid, zone II from cricoid to angle of mandible and zone III from angle of mandible to skullbase.



LARYNGEAL TRAUMA

Neurological trauma or intracranial trauma being the most frequent cause for death in trauma, second position is by the obstructive damage to the airway. According to previous concepts only open laryngotracheal traumas was only considered first. Our emergency services throughout the country is equipped to handle the trauma of head and neck by means of endotracheal intubation and tracheostomy. Closed injuries are notorious to cause severe functional damage especially if inadequately treated.

Open Injuries

Our life is vulnerable to any kind of violence from mankind. It can be assault, self-inflicted wound. Road traffic accidents can also cause open neck injuries. Commonly violence to head and neck causes devastating clinical conditions that leads to death. Most common cause is a stab wound that can cause deep injury to the inter cartilaginous membranes and cause deflected onto the endolarynx that is thyrohyoid membrane and cricothyroid membrane. In military situation, missile injuries and missile wounds are more common and that cause more extensive tissue loss and a higher morbidity. Associated other structure injuries like great vessels of neck occur in stab injuries and cervical spine injury in missile trauma.

Clinical Features

Beside obvious neck trauma other two main clinical symptoms that bring patient to hospital are haemorrhage and dyspnoea. Dyspnoea may due to impaction of cartilage or soft tissue into airway, increasing mediastinal emphysema or haemorrhage into laryngotracheal tree. Surgeon should be expertise enough to handle severe vascular trauma in case of severe haemorrhage.

Classification of Laryngotracheal Trauma

A. Open injuries

B. Closed injuries

a. External trauma – Motor vehicle accidents and sports injuries

b. Endotracheal intubation

C. Burns and scalds

D. Radiation

E. Miscellaneous Injuries

a. Foreign body

b. Nasogastric tube

Treatment for Open Injuries

Always open wound treated with exploration and examination under GA and wound repair is to be done. Emergency intubation and resuscitation required in dyspnoea and heavy haemorrhage. Basic principle of the repair is control of haemorrhage and restoration of adequate airway, this is usually achieved by intubating the patient through this wound or separate tracheostoma. Intubating through the wound avoid the hurry in creating another tracheostome. After giving GA, the foreign bodies are to be removed first. Inspect the neighbouring vessels and adequate debridement is to be performed. After this process the defect is repaired. An elective tracheostomy is then performed. Antibiotics and tetanus toxoid also to be administered.

Treatment for Closed Injuries

It is caused commonly by road traffic accidents. But may also occur during sports activities like karate and basketball. What happens in these activities is that the participants are mainly adolescent to adult age group with a very pliable thyroid cartilage. Most common injury being fracture hyoid bone.

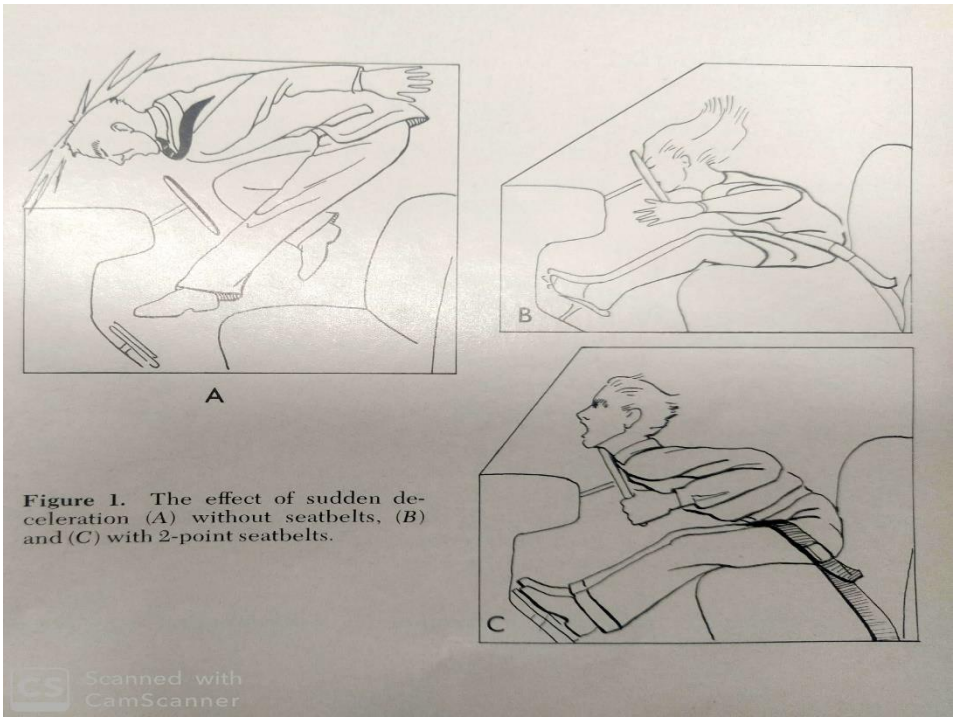


Figure 1. The effect of sudden deceleration (*A*) without seatbelts, (*B*) and (*C*) with 2-point seatbelts.

In motor vehicle accidents, most influencing factor is wearing a seatbelt or not. The type of seatbelt, length of front compartment and the height of the person wearing also becoming the deciding factor in severity of RTA related neck injuries.

If a person not wearing seatbelt, in case of sudden decelerations would be thrown forward, striking the dashboard, steering wheel, or windshield with resultant injury to head, thorax or neck. In case two-point seatbelts worn, that

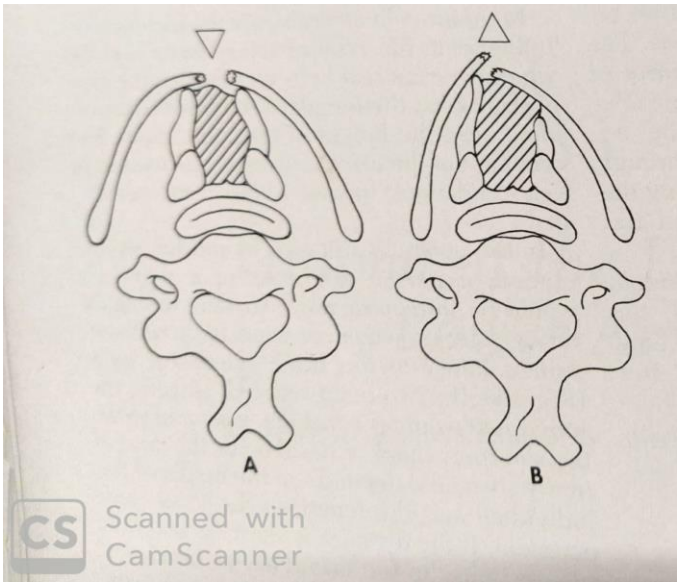
person pivot at the waist and strike the steering wheel or dashboard, as said above his total height and length of front compartment of vehicle also matters. If the distance is short, patient will have a maxillofacial injury. If the length is much more, neck becomes hyperextended, exposing the vulnerable laryngotracheal complex to the protruding structures. Laryngeal skeleton will be crushed between these structures and the cervical spine. So, in summary, one can use shoulder belts to avoid these kinds of injury.

TYPES OF INJURIES

Fractured Thyroid Cartilage

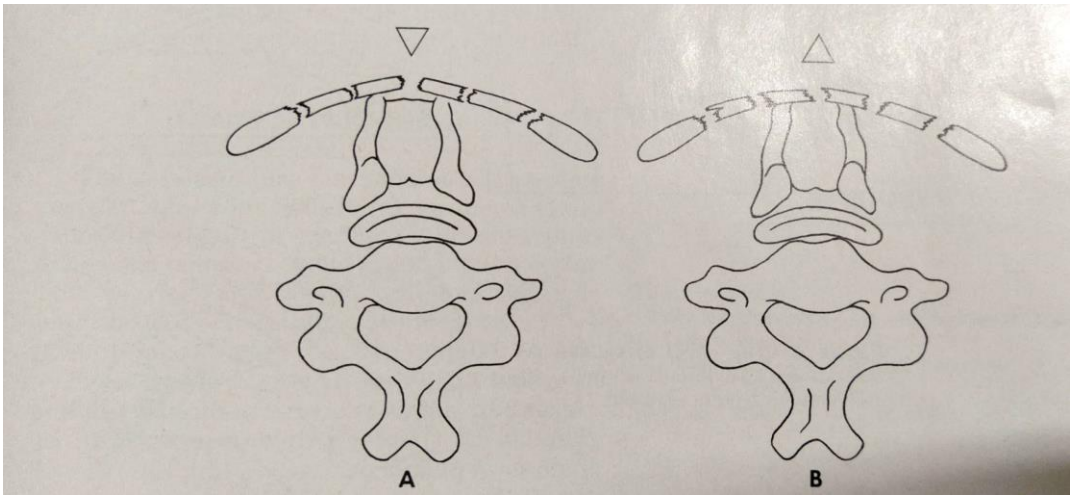
i. If uncalcified

When the cartilage is uncalcified, it is forced against the cervical spine and after an episode of compression it springs back once the compression force got removed. This cause a linear fracture line down the thyroid prominence with internal derangement. This compression and release forces also cause dislocation and falling of epiglottis into the lumen. The vocal cords are avulsed from their attachment or vocal processes or the arytenoids may also get dislocated.



ii. If calcified

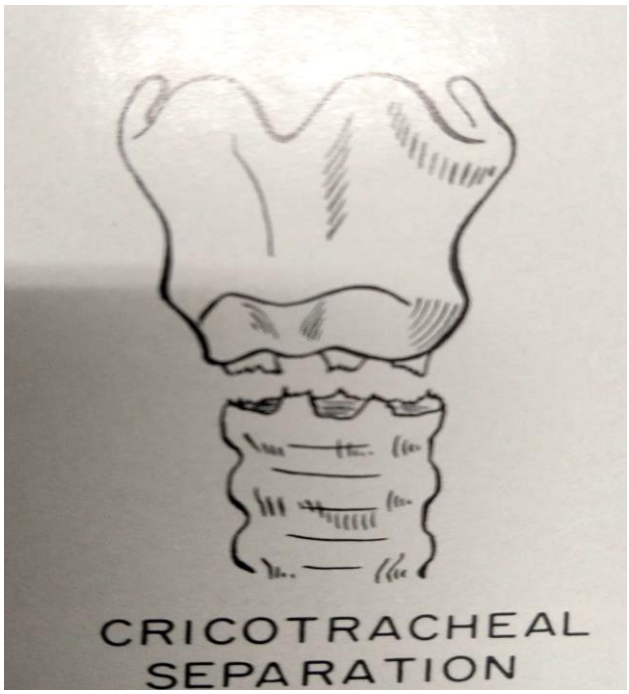
Calcified cartilage on compression shatters when neck flattened. Later-on laryngeal anteroposterior diameter shortens and subsequent internal derangement.



Fractured Cricoid Cartilage

The isolated cricoid fracture is rare. It occurs associated with fractured thyroid cartilage. This is encountered when an injured larynx explored for

fractures. Since the recurrent laryngeal nerve is very close to this, its injury is likely to occur.

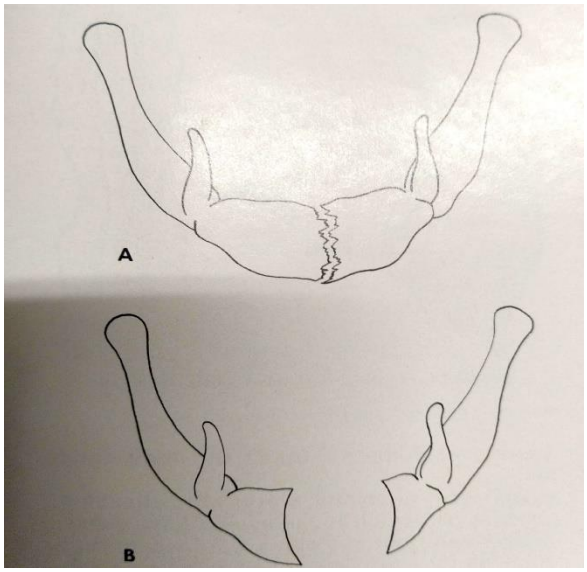


Tracheal Avulsion

Tracheal avulsion occurs when there a tear happens at cricotracheal membrane. Patient will present with severe respiratory obstruction. Most of the patients may die at the place of injury. Tracheal avulsion is more frequent than tracheal fracture.

Fracture Hyoid

This occurs in young individual. Sports injuries are the main reasons for it. Patients complaints of severe painful dysphagia. This occurs due to fracture segment causing bony crepitus at fracture site. Respiratory distress seldom occurs.



Oesophageal Injury

Injury to the hypopharynx and oesophagus should think of in cases of blunt injury neck, due to air trap, patient is presented with progressively increasing surgical emphysema. It is diagnosed very later in usual scenario. Someone suspecting oesophageal injury at the presentation can take a contrast study to rule out this.

DIAGNOSIS

Timely diagnosis and immediate management are very crucial in successful management of neck trauma associated with laryngotracheal framework involvement. Scenarios have been changed nowadays as otorhinolaryngologists seen the cases at emergency ward and finding out the air leak, as this aids in timely management. In all aspects, late diagnosis still happens in a large no. of cases among this. Many reasons can be thought of. Consultant's minds are preoccupied by other life-threatening injuries mainly in an unconscious patient. Laryngeal injury is come to scene only in cases of difficulties in weaning patient from intubation on a later date. Proper training of casualty medical officers or other non-otolaryngologist doctors in suspecting and treating airway injuries. This will change the prognosis of neck injuries. Vascular injuries are the most common cervical injuries and happens in 40% patients in penetrating neck trauma[6]

Symptoms

Laryngeal injuries are diagnosed commonly on later dates following trauma. It will be asymptomatic initially. Emergency officers will give false hope to the patient's relatives before finding out this kind of lethal injuries.

1.Voice change - Depending on degree of vocal fold involvement, hoarseness, dysphonia with breathy voice and air wastage can happen. Associated tracheal avulsion below it can add on to comorbidity by causing air pressure from below, and that cause weak voice.

2. Pain - It occurs in fracture hyoid commonly. Pain aggravated by coughing and swallowing.

3. Dyspnoea - It occurs due to respiratory obstruction due to oedema, haematoma and surgical emphysema.

4. Dysphagia - It is diagnosed only if patient is having neck bruises or neck lacerations.

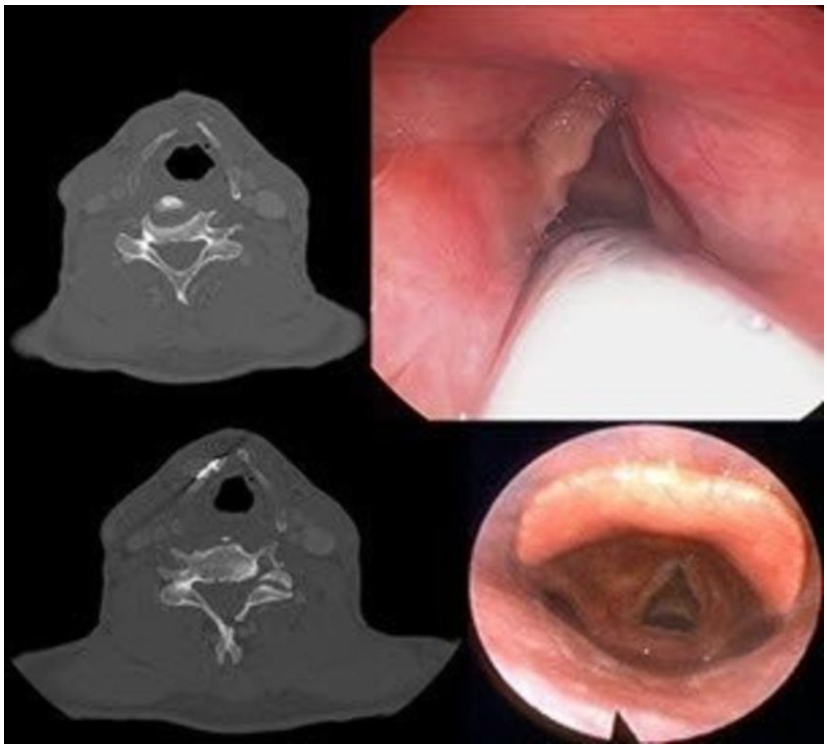
5. Neck wound

Signs

Blunt lethal neck traumas are difficult to pick up. Laryngotracheal injury may be there beneath the normal looking anterior neck. One should specifically look for external laryngeal contour, loss of thyroid protuberance and flattening of anterior neck. Associated clinical signs include neck oedematous, palpating

fracture line, abnormal bony crepitus. Surgical emphysema will be persistently increasing and aggravates on coughing.

IDL - Difficult to do in the initial stages, but all must try to do IDL as this will give an idea regarding the internal derangement. Haematoma of supraglottis or evidence of internal derangement should be looked for. Proper assessment is not possible by this also.



SPECIAL INVESTIGATIONS

Endolaryngeal imaging is a necessary to assess severity of injury in emergency wards if facilities are available. Anteroposterior and lateral view of X-ray neck can help you with assessing airway patency, tracheal shift, position of epiglottis,

surgical emphysema. Fracture of ossified cartilage and status of cervical spine can also see with this. Laryngogram is a very useful investigation which is diagnostic and it is very difficult to perform in acute condition of the patient. X-ray chest and oesophagogram can be done in view of internal injury.

MANAGEMENT

Depends on the severity of the injury.

Mild cases;

Patients with mild symptoms and minimally oedematous larynx needed at least 24hours hospitalization and observation with absolute bedrest, steroids and antibiotics if needed. If there is significant airway compensation, a tracheostomy can be performed if necessary.

Severe cases;

In severe cases, a tracheostomy, direct laryngoscopy and surgical exploration of neck are considered.

Indications for surgical exploration

a. Upper airway obstruction

b. Laryngeal skeleton fracture

c. Progressive surgical emphysema

d. Endolaryngeal derangement

e. Haemorrhage

f. If there is a doubt regarding the extent of the injury

Ruling out the cervical spine injury is must before exploration. Some injuries like free floating displaced epiglottis should not be missed during endoscopy or direct laryngoscopy. Surgeon should be having a habit of expecting more than one subsite injury during exploration, that is along with endolaryngeal injury, patient may be having hypopharyngeal injury.

Management of fracture of thyroid cartilage with internal soft tissue injury**,** Surgical exploration to be done with cervical collar incision. This will be enough for exposing thyroid, hyoid, thyroid alae and cricoid. Laryngofissure performed and internal derangement assessed. The internal suturing like suturing of epiglottis or vocal cords are performed. Special care to be taken while repairing the mucosal injury. If there is alar fracture do wiring if needed. And one should insert a keel in between vocal cords if there is anterior commissure injury to prevent anterior webbing of vocal cords after the procedure. Keel is left in place for 6 to 8weeks.

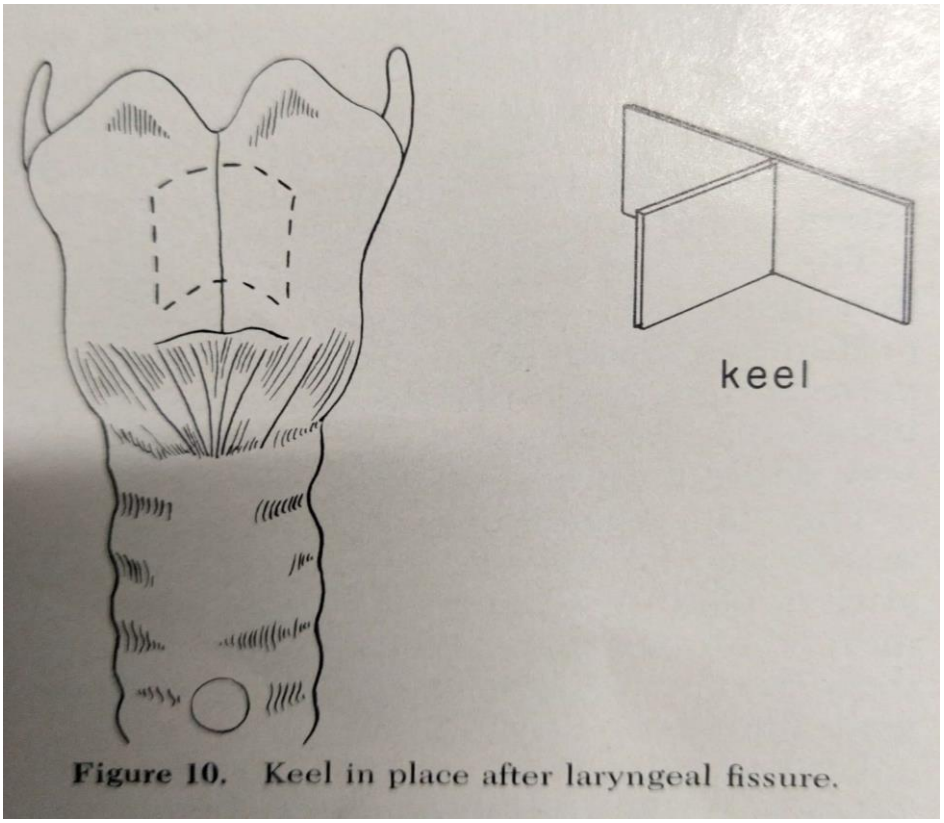


Figure 10. Keel in place after laryngeal fissure.

Management of shattered thyroid cartilage with internal derangement

There must be multiple stellate fractures in this case. External perichondrium may appear intact with multiple fracture segments shattered inside the larynx. Very small fragments can remove and it is much easier to excise them. Debridement must be minimal enough. Larger fragments may need wiring. A laryngofissure is made and internal derangement is repaired with adequate mucosal approximation. Sometimes mucosal defects cannot be approximated and, in such cases, suturing it with skin or use dermal or buccal mucosal grafts. Internal moulded laryngeal stents are available of nonreactive materials nowadays. Stents are placed in situ for 3month period and maintained with a transfixion wiring. Stents can be solid or hollow. Hollow stent makes the patient

speak with a high chance of aspiration. Solid stents (E.g. Montgomery stent) are better than hollow, but too long stent can cause painful dysphagia as it may protrude very high above glottis.

Management of Fracture of Cricoid Cartilage

Isolated cricoid cartilage fracture is rare. One common association is the fracture of thyroid cartilage and damage to recurrent laryngeal nerve and vocal cord palsy. If fracture segments are unstable, wiring is required as in thyroid cartilage management. Stents are placed and maintained in situ for 3month period. The management of injuries with recurrent laryngeal nerve injury is a controversial topic. Anastomosis can be tried if the cut ends are easily visible. Surgical exploration is not advisable in cases of severe haemorrhage and surrounding haematoma, as the nerve endings are not seen or it can further damage and injure an intact stretched nerve.

Management of Tracheal Avulsion

Cricotracheal membrane breach is the most frequent type of tracheal injury. It is almost always associated with recurrent laryngeal nerve injury. Tracheal suturing of defect should be submucosal especially if one is using nonabsorbable suture materials. Stent is not needed in this.

Fracture of Hyoid Bone

Management is easy. Excise the bone on either side of the fractured area. This will prevent bony crepitus.

NECK EXPLORATION

Aggressive management policy of neck injuries involving platysma penetration lead to a significant decrease in morbidity and mortality over a period of time. A term called “Aggressive conservatism” used for the aggressive consideration of repeated examination of clinical signs, available investigative features and frequent re-evaluation of clinical status of the patient. This shows considerable evidence of outweighing of morbidity of negative exploration when compared to delayed treatment injuries.

When we are evaluating a trauma patient, for the convenience neck is divided into 3 zones and anterior and posterior triangles as shown in the image. According to anatomical orientation zone I and zone III injuries requires investigation for further assessment and to plan appropriate surgical approaches. Zone II structures are readily accessible so they are explored on clinical grounds. Site of an external wound does not give much idea to the actually involved region.

First priority is for the airway and ventilatory capability for both blunt and penetration injuries. Active haemorrhage is managed by digital pressure and compression dressings. If uncontrollable bleed, don’t blindly clamp tissues, this

is done after formal exploration. In cases of adequate $SPO_{2,}$ volume resuscitation should be done.

PREOPERATIVE INVESTIGATIONS

Radiological

1.Neck X-ray AP and lateral view

Surgical emphysema, airway compression, injury to the hyoid, tracheal deviation, cervical spine injury, paravertebral bleeding or oedema and the position of missile fragments can be studied.

2.Chest X-ray PA and lateral view

3.Upper gastrointestinal contrast studies

- Imaging has no much significant role in trauma, oesophageal injury is suspected in zone 1 & 2 injuries
- Gastrograffin is used for contrast study
- Barium leak may cause inhalation/additional problem

Angiography

Angiographic studies are not needed much in penetrating injuries of zone 2 .one can easily explore that area. But in cases of blunt traumas angiography becomes necessary especially in progressive neck swelling cases. Development of intravascular thrombosis after an intimal tear is an area of importance because

at the time of exploration thrombosis may not be formed. If we are suspecting any zone 1 injury or injury near to zone3 in a patient who is hemodynamically stable, angiography becomes the important investigation as in these areas as the repair of injured vessels needed expert assessment due to the anatomical concerns and for the proper selection of surgical approach. Expanding haematoma of mediastinum and in stridor cases, exploration becomes necessity

Endoscopy;

Not a necessary procedure in trauma. Usually the exploration cases, we can assess the vocal cord mobility at the time of intubation, or at the end of surgery for exclusion purpose.

Indications for exploration;

A. suspected vascular injury
B. suspected visceral injury

Surgery

- Done under GA
- Should be in a formal and systematic manner
- Position: Supine with neck extension at atlantooccipital joint.
- Incision: Mastoid process to suprasternal notch along anterior border of SCM
- Lateral extension can be made accordingly

- Mediastinal exploration is done with median sternotomy incision
- Expose IJV, carotid sheath is exposed
- Trachea, thyroid and carotid are exposed anteromedial to retracted IJV
- Carefully preserve sympathetic chain, lies on vertebral bodies
- Anteromedial to IJV, oesophagus will be there
- In cases of detailed exploration, lateral extension can be made and sternal head of SCM is removed
- If there is difficulty in seeing oesophagus, wide bore ryles tube can be inserted for better identification
- By blunt dissection supraclavicular fat pad cleared and brachial plexus exposed. Scalenus anterior muscle is divided for exposing Subclavian artery second part.
- Clavicle may get divided at midline, periosteum stripped and subclavian vein and distal subclavian arteries exposed. Great vessels of mediastinum are assessed with midline sternotomy.
- The partial removal of clavicle can cause in postoperative decreased shoulder girdle power
- Avoid injury to accessory nerve – It enters deep part of SCM muscle 3-4 cm below this point
- Pharyngeal wall being the medial most structure in the surgical field.

Postoperative care

- Wound is closed in layers.
- Removal of drains – 24 to 48hours after drain stops

Complications

1. Haemorrhage

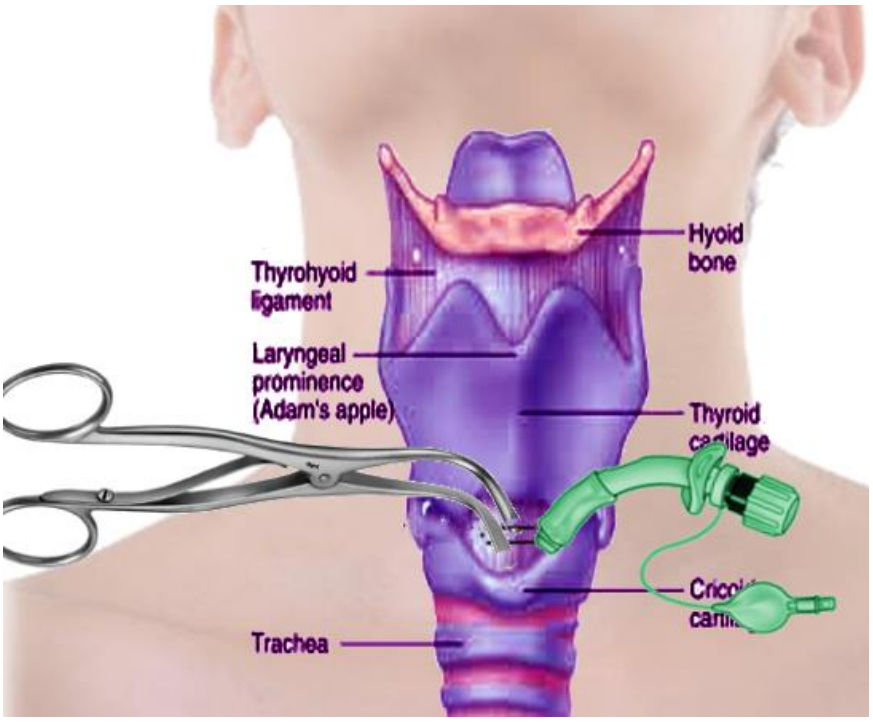
2.Airway obstruction

3.Air embolism

4.Fistula formation

5.Abscess

CRICOTHYROIDOSTOMY



- Procedure to get immediate access to trachea
- Thyroid cartilage fixed with thumb and index
- Skin and subcutaneous tissue incised horizontally
- Cricothyroid membrane lies in this subcutaneous plane

TRACHEOSTOMY

- Standard tracheostomy is a better option in trauma than cricothyroidostomy
- Anaesthesia – local anaesthesia in emergency situations, Lignocaine2% with adrenaline 1 in 1lakh concentration in Jacksons triangle and General anaesthesia in elective condition
- Horizontal incision made midway between cricoid cartilage and suprasternal notch
- Skin, platysma and deep cervical fascia incised
- Incision comes above second tracheal cartilage
- Incision deepened and strap muscles are just retracted
- Opening widened with scissors
- Cricothyroidostomy should replace by tracheostomy within 48 hours
- Thyroid isthmus is retracted upwards
- Identify the 3rd and fourth ring of Exposed tracheal ring
- The site of tracheostoma will vary according to mode and depth of neck trauma
- Few drops of lignocaine instilled in trachea
- Sometimes the tracheostomy tube is maintained in the traumatic ring itself
- The stoma is temporary only

- Once the patient is recovered from the trauma, sphigotting and decannulation can be done

INDICATIONS FOR TRACHEOSTOMY

- Intubation for a long time
- Ventilator weaning is made easier with the use of a ventilator.
- Improvements in pulmonary hygiene (ie, managing secretions) Any of the following can cause upper airway blockage.
- Stridor, a lack of oxygen, and retraction
- A history of obstructive sleep apnoea with arterial desaturation Vocal cord paralysis on both sides
- An inability to intubate is a medical condition in which a person is an add-on to severe head and neck surgery or trauma treatment as protection of the airway (neurologic diseases, traumatic brain injury)[8]

COMPLICATIONS AFTER TRACHEOSTOMY

1.IMMEDIATE

- Structural damage to trachea
- Aspiration
- Haemorrhage
- Procedure failure
- Hypoxemia
- Hypercarbia

- Death
- Air embolism
- Loss of airway

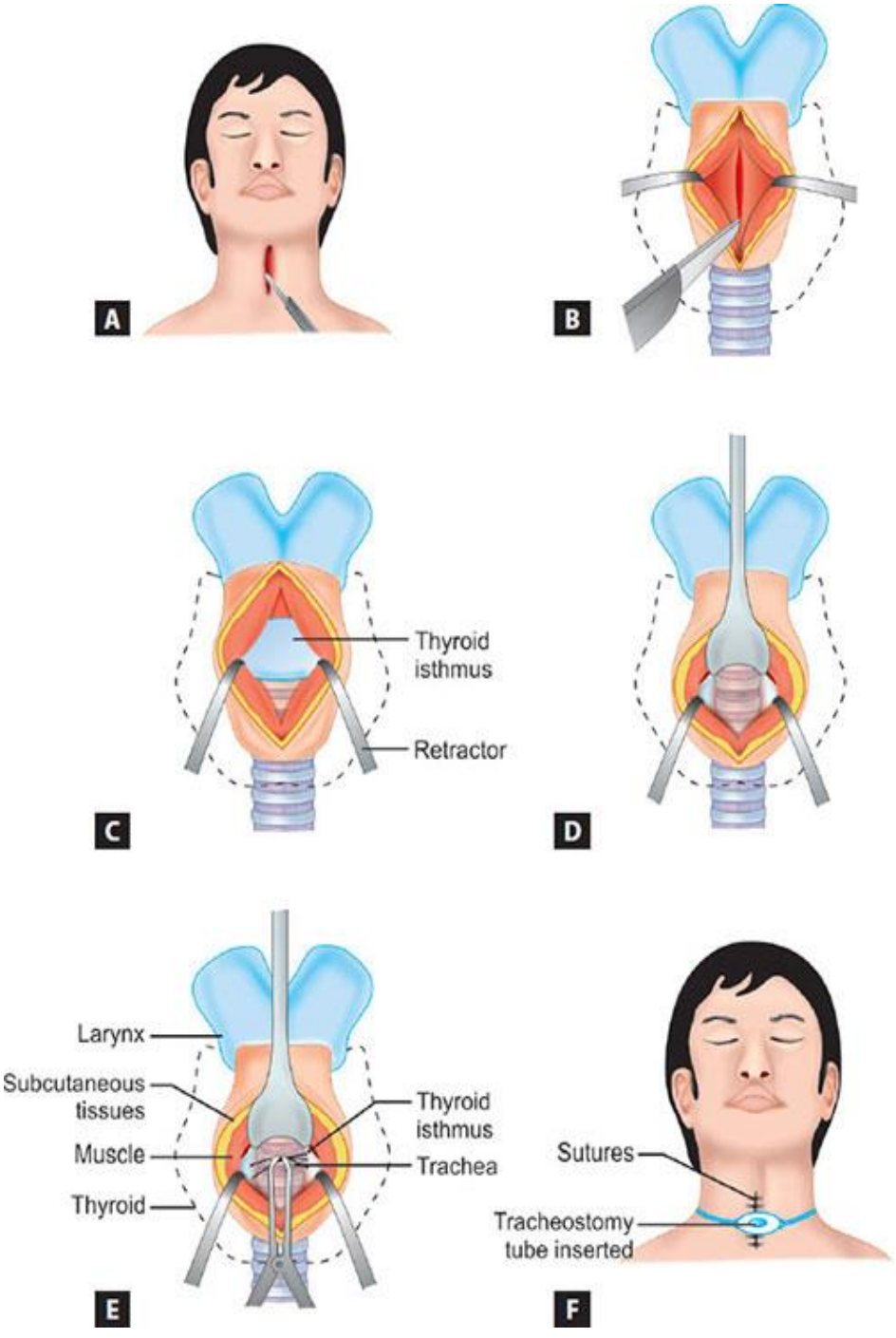
2.EARLY

- Subcutaneous emphysema
- Pneumothorax
- Pneumomediastinum
- Tube displacement
- Decannulation
- Dysphagia
- Haemorrhage
- Stomal infection
- Stomal ulceration

3.LATE

- Aspiration
- Accidental decannulation
- Tracheal stenosis
- Tracheomalacia
- Granulation
- Pneumonia
- Dysphagia & Tracheocutaneous fistula

PERCUTANEOUS TRACHEOSTOMY VERSUS OPEN TRACHEOSTOMY



Percutaneous dilatational tracheostomy (PDT) has been indicated as the technique of choice in most adult ICU patients who require elective tracheostomy and have no contraindications to percutaneous tracheostomy. PDT performed in the ICU was linked to a lower risk of wound infection in a systematic review and meta-analysis of 17 RCTs involving 1,212 individuals. When compared to open surgical tracheostomy, the hospital stay was shorter and costs were lower. Percutaneous tracheostomy is as safe as surgical tracheostomy and is associated with reduced procedure time and cost, according to the preponderance of data. percutaneous

tracheostomy was associated with a higher rate of

decannulation/obstruction (OR 2.79, 95% CI 1.29–6.03) [2]

DECANNULATION PROCEDURE AFTER TRACHEOSTOMY

Decannulation is the procedure by which a patient is weaned from the tracheostomy.it is a staged procedure usually takes 1 to 2days. Different protocol is there for both adults and paediatric patients.

Prerequisites for adults before decannulation for any case;

- To establish the patient's readiness for tracheostomy tube decannulation, answer the following questions:
- Have the reasons for tracheostomy placement changed or improved significantly?

- Is the patient able to tolerate a decannulation cap on an uncuffed tracheostomy tube of adequate size without stridor?
- Is airway patency at the level of the glottis and immediate subglottis confirmed by fibreoptic laryngoscopy?
- Is the patient's level of consciousness and laryngopharyngeal function sufficient to prevent aspiration of the lower airway?
- Is the patient able to cough effectively with the tracheostomy tube capped?
- Have you undergone all operations that require general endotracheal anaesthesia?
- If you answered yes to all of the questions, proceed with the decannulation procedure as follows: The tracheostomy tube should be removed.
- Clean up the area.
- Apply a dry gauze dressing to the wound.
- When the patient is talking or coughing, instruct them to apply pressure to the dressing with their fingers.
- Change the dressing every day and as needed if the site is moist with secretions until the site heals.

Decannulation in adults;

If the patient is sick, he may be in the plastic tube, it has to be changed to metal one. And the patient must be stable enough to decannulate. Spigotting is the procedure by which we will cap the tracheostomy tube opening with a needle cap and the patient is observed day time. Then night spigotting and observation is done inside the ward. only if the patient is tolerating spigotting for two days, strapping is done. If the wound is not healing by secondary intention, suturing is done. Graft and flap methods are used sometimes if wound healing is not well.

Decannulation in paediatric age group;

It is not an easy procedure as in adults. They may be more dependant with the tube than in adults. Periodically downsizing method is used in children. Day by day the tube size is gradually decreased, if child could tolerate this decannulation is done completely.

DEPRESSION AND SUICIDAL TENDANCY

Depression and mania are the two basic symptoms of mood disorders. Among this depression disorder patient shows more suicidal tendancies. About two thirds of all depressed patients contemplate suicide and 10 to 15 percent commit suicide[1]. Patient may be feeling hopeless or worthless. Sometimes they report it as emotional pain and unable to cry as a symptom. Recently hospitalized

patients for a suicidal attempt has more chance to end up in a successful suicide than depression patients with never hospitalized.

Other symptoms include,

- Exhibit withdrawal from family, friends and activities
- Reduced energy, Difficulty in finishing works at workplace, school, Decreased appetite, Weight loss, less motivation to take up a new activity, Insomnia, Multiple awakenings during sleep, Sexual problems, Alcohol abuse, Somatic complaints (e.g. constipation and headache), Inability to concentrate, Thinking problem and Anxiety

  Anxiety have a strong association of about 90%. There is study conducted in Australia royal menta health society, in which Out of 1051 participants, 364 reported life-time depression. Of these, 48% reported life-time suicidal ideation and 16% reported a life-time suicide attempt[3]

Depression in children;

Very difficult diagnose in children. Child may exhibit symptoms like schoolphobia and excessive clinging to parents. Adolescent symptoms include sexual promiscuity, Poor academic performance, running away, substance abuse and truancy.

Depression in older people;

Depression disorder is more common in older population than in adults.it is mostly underdiagnosed and underrated. Their depressive episodes may be having correlation with social isolation, loss of spouse, concurrent physical illnesses etc.

DSM 5 criteria for major depressive disorder

5 or more of following symptoms for 2week period and shows a change from previous situations. At least one of the symptoms are depressed mood and loss of interest

1.Depressed mood

2.Markedly diminished pleasure/interest

3.Significant weight loss when not dieting or weight gain more than 5% in month

4.Insomnia/hypersomnia

5.Psychomotor agitation/retardation day by day

6.Fatigue/loss of energy

7.Feeling of worthlessness or excessive or inappropriate guilt

8.Diminished ability to think/concentrate

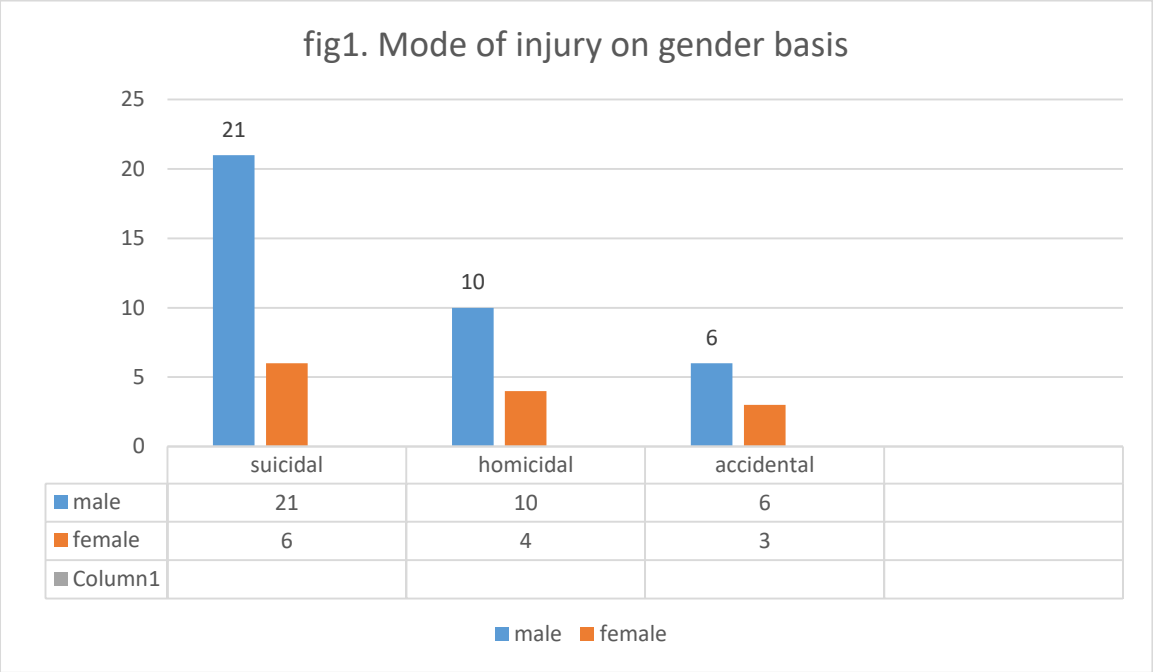
9.Recurrent thoughts of death, recurrent suicidal ideation

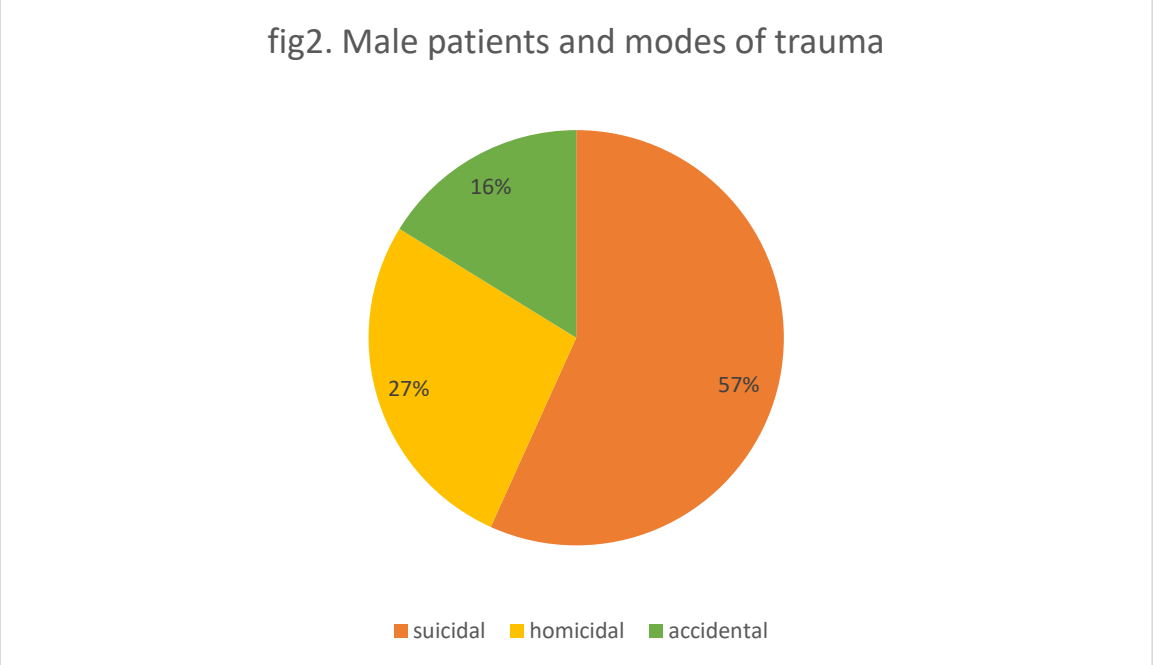
STAGING:

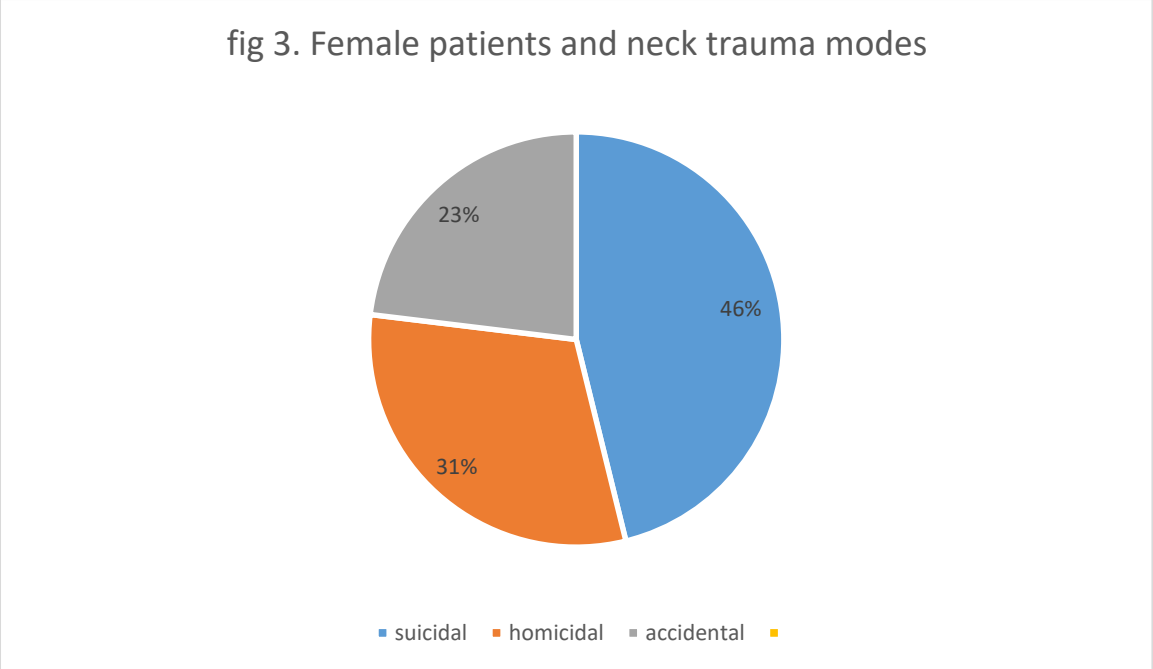
- Mild
- Moderate
- Severe
- With psychotic features
- In partial remission
- In full remission
- Unspecified

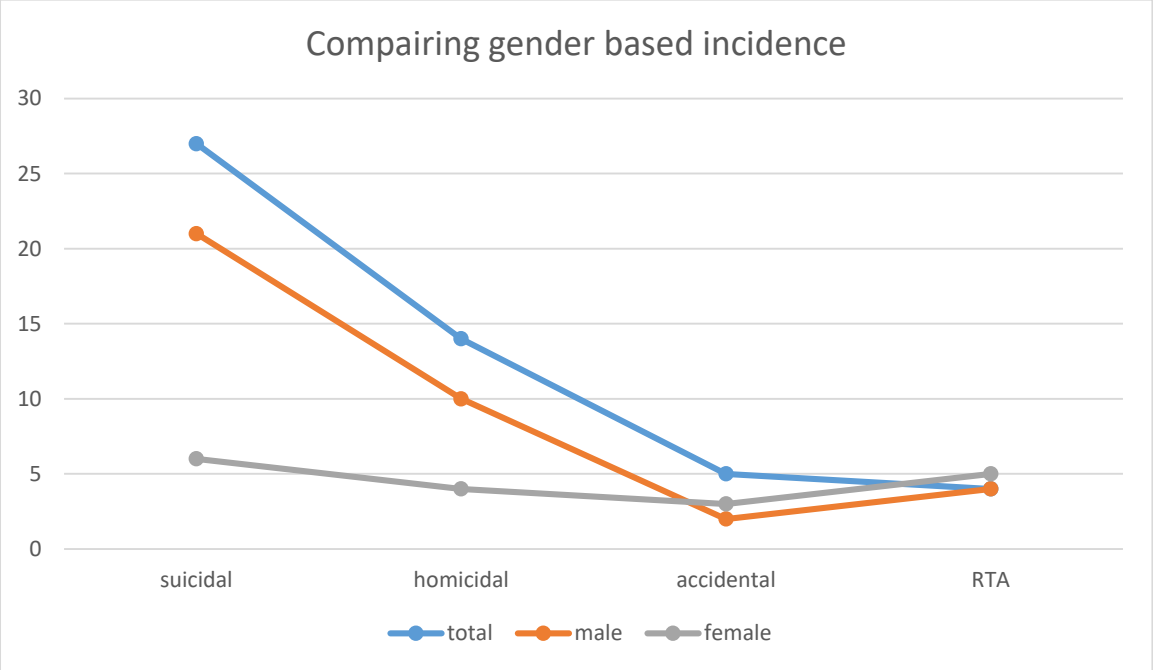
ANALYSIS & RESULTS

1. Incidence



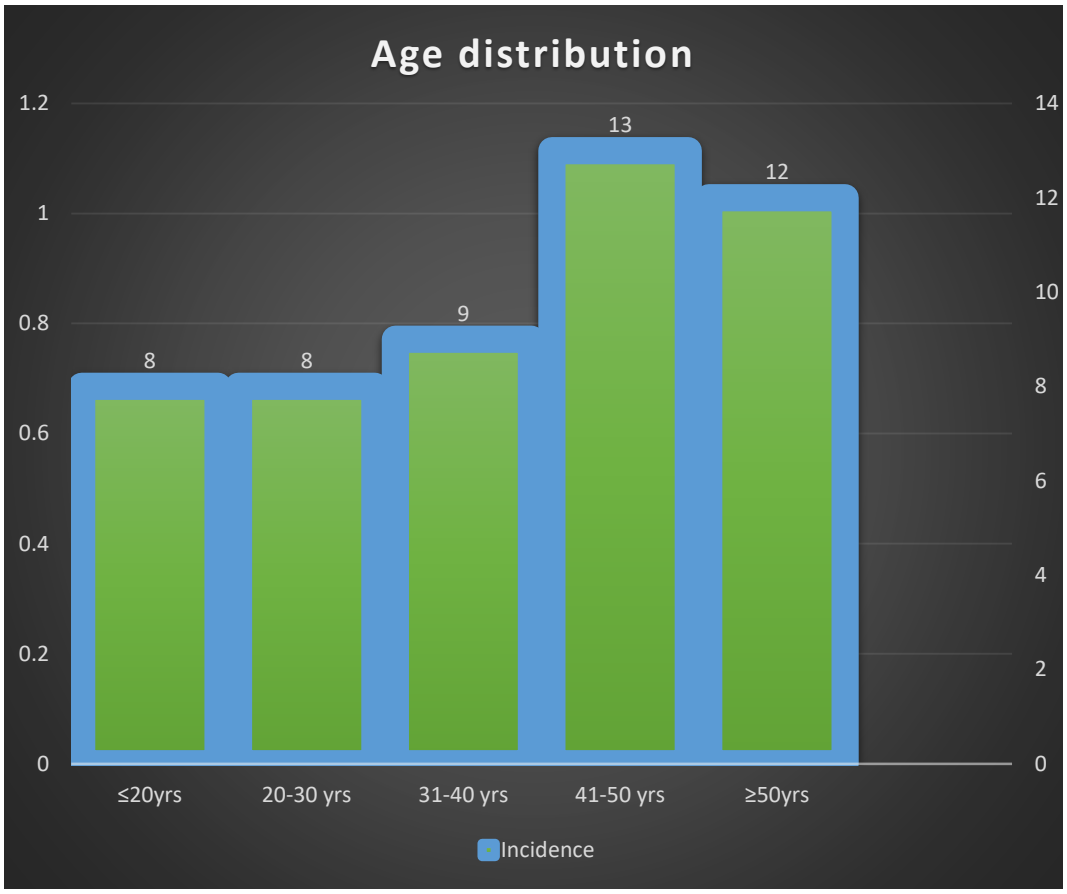






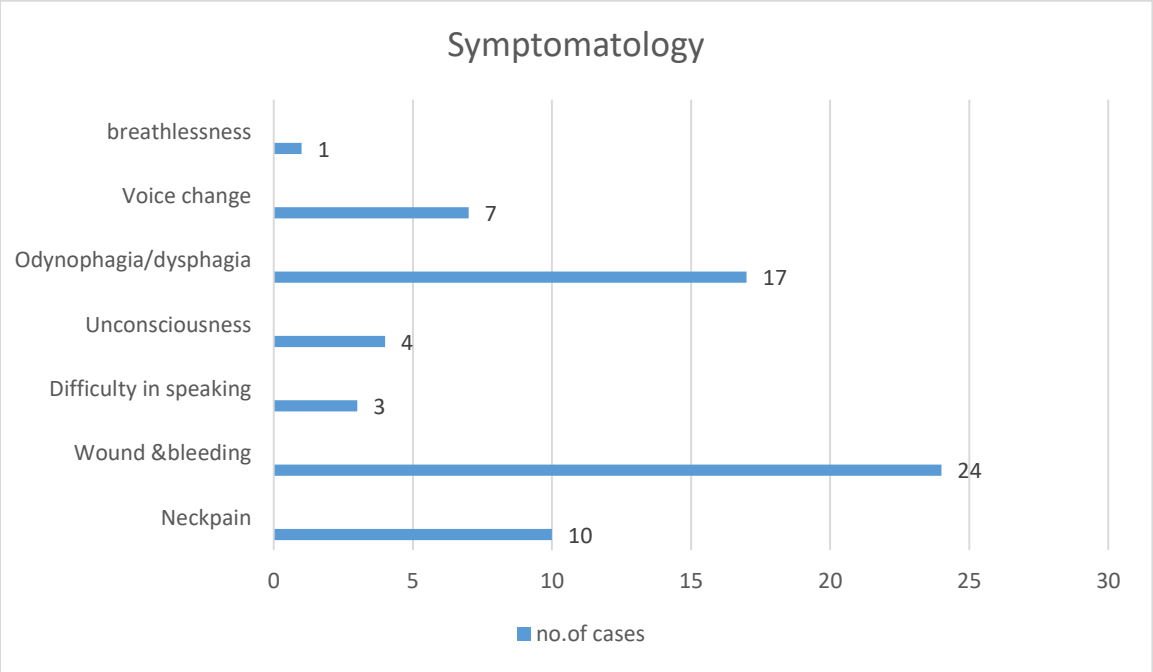
Out of 50 patients included in this study, 37 were male patients (74%) and 13 patients were female (26%) and that indicates a male preponderance in neck trauma cases. Among male patients, the common mode of injury in the descending order of frequency: 21 cases were suicidal neck injuries (57%), 10 were homicidal injury (27%) and 6 were accidental neck injury (16.2%). Among

the 13 female patients, 6 cases due to suicidal injury (46%), 4 cases were homicidal injuries (31%) and 3 cases were due to accidental trauma (23%) were reported during the study period.



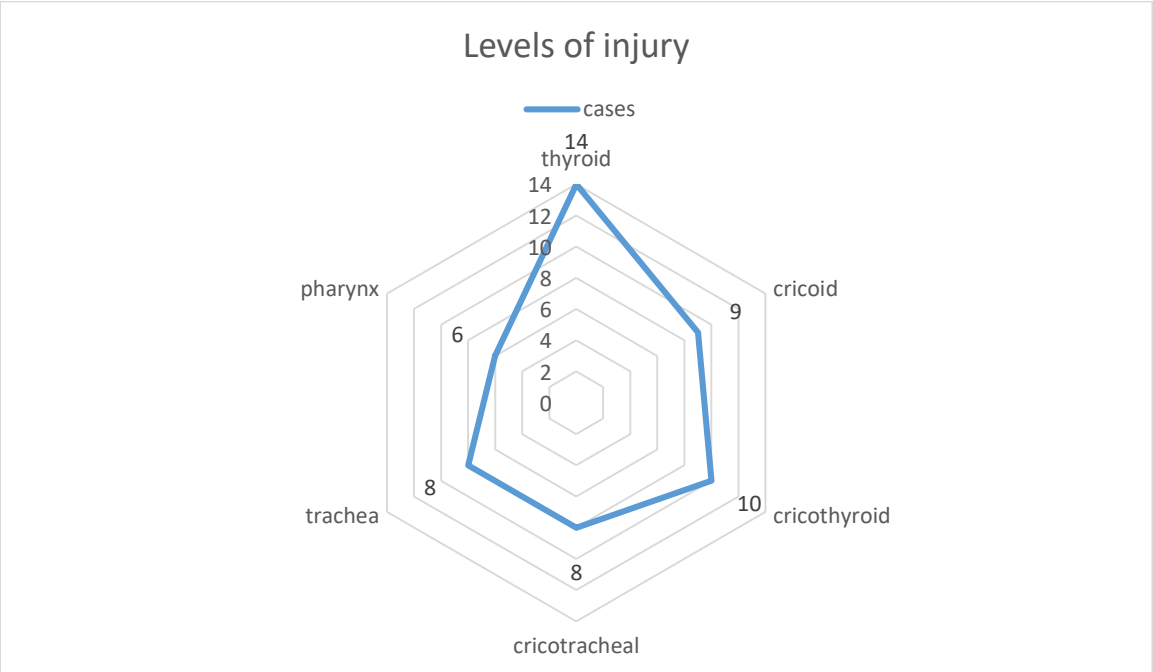
Most common age group presenting with neck trauma was above 40years (50%), with highest incidence in the age group of 40 to 50years (26%). Incidence of neck injuries up to 30years was 32% and incidence of neck trauma in between 31 to 40years was 18%.

2.Symptomatology



On assessment of symptomatology, most common symptom at the time of presentation was bleeding from the wound site (48%), followed by difficulty in swallowing (34%). Least frequent presenting symptom was breathlessness. 4 cases (8%) were brought by relatives in an unconscious state to the emergency department, suggested involvement of other systems and more severe injury.

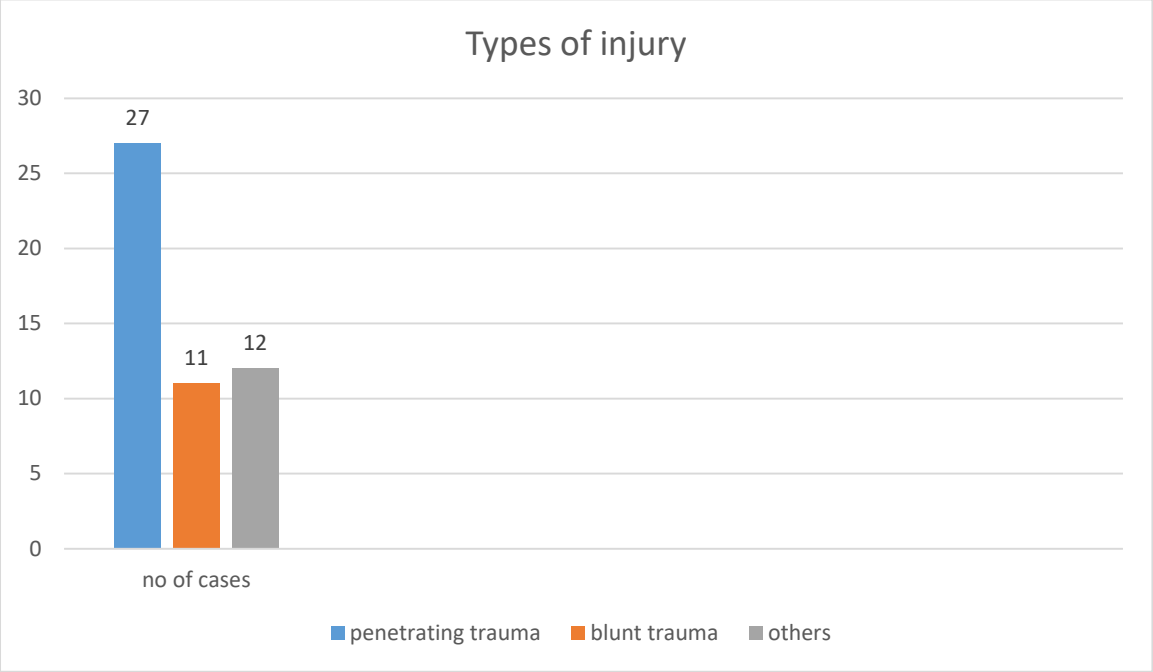
3.Levels of Injury

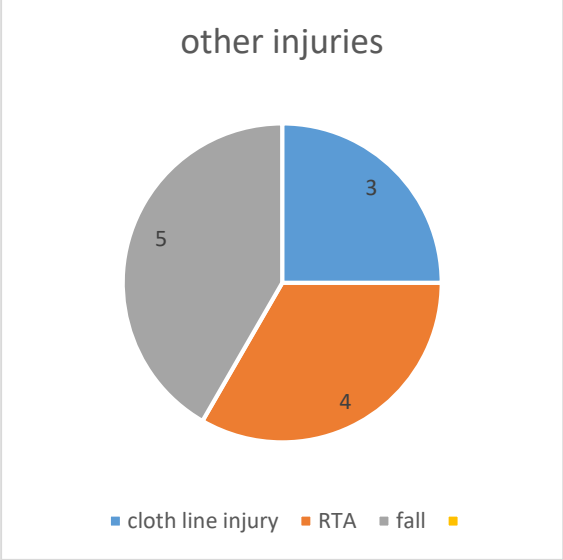


In our study group, most of the injuries were found to be at the level of thyroid cartilage (28%) and 9 cases had injury at the level of Cricoid cartilage (18%). Same incidence were found at Cricotracheal and tracheal level (16%) Pharyngeal involvement was noted in 12% of the cases.

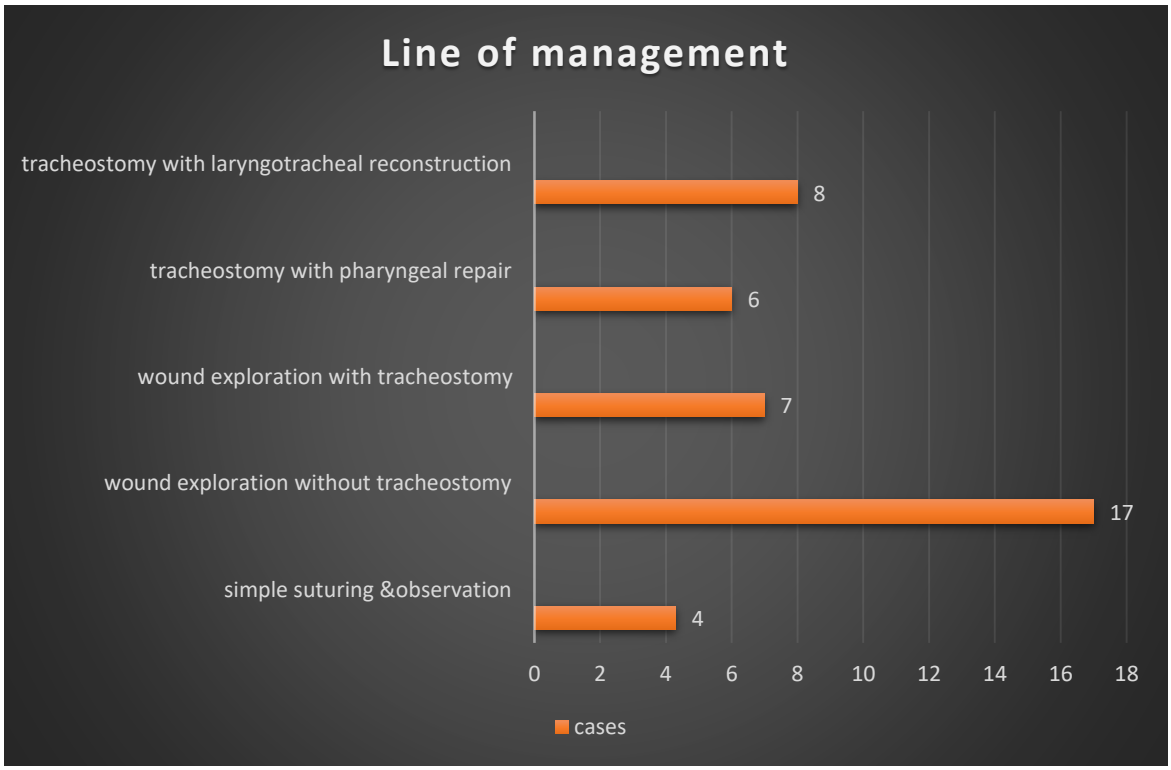
4.Types of Injury

Considering the type of injury among 50 patients, 27 cases were penetrating trauma (50%) and 5 cases were accidental fall (10%). 4 cases were due to RTA (8%). 3 cases were due to cloth line injury (6%).



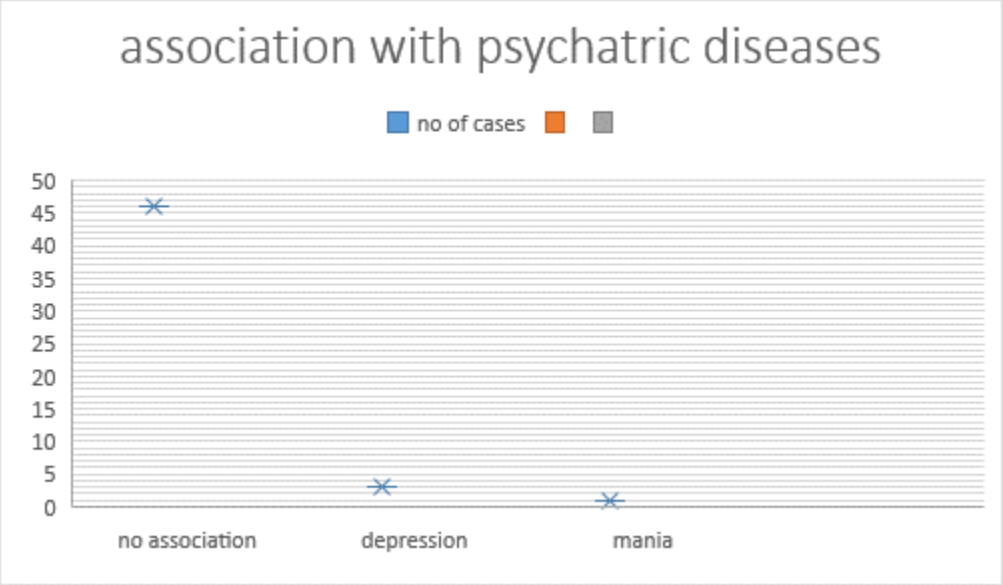


5. Line of Management



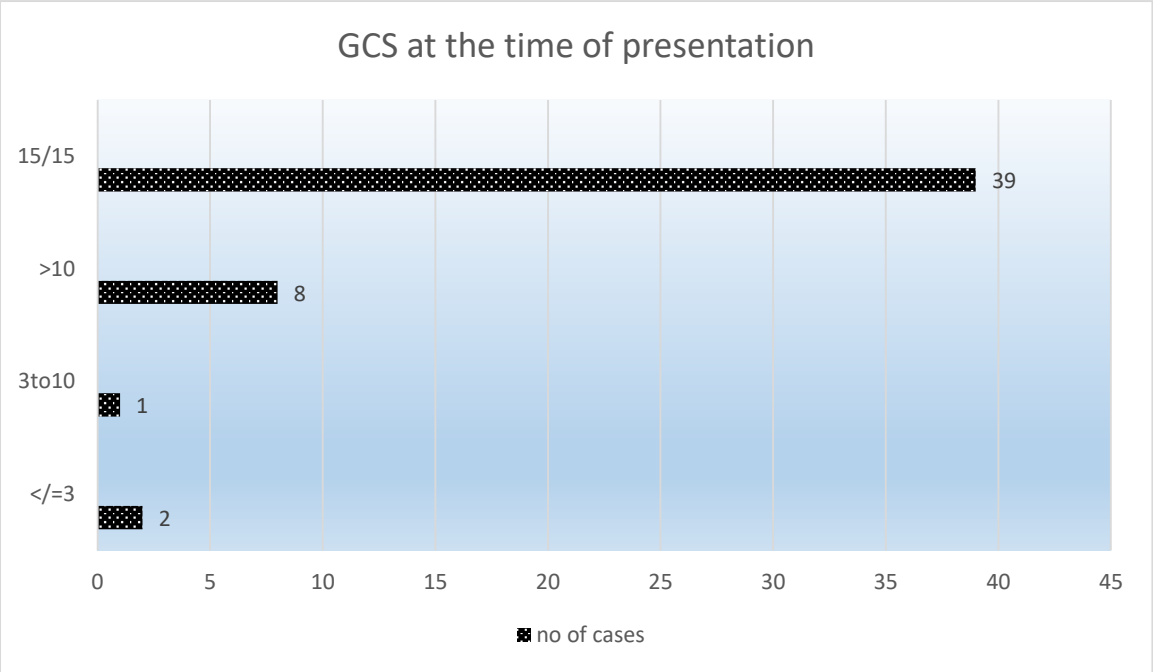
Depending on the nature and extent of injury, management plan was decided. On analysing the line of management given in our hospital, 17 cases (34%) were required surgical exploration of the wound and primary closure. 7 cases (14%) were treated by primary laryngotracheal repair with elective tracheostomy. 4 cases (8%) were superficial injuries and required only simple suturing of the wound. Pharyngeal injury was noted in 12% of the cases, which required pharyngeal reconstruction.

6.Association with Psychiatric Illness



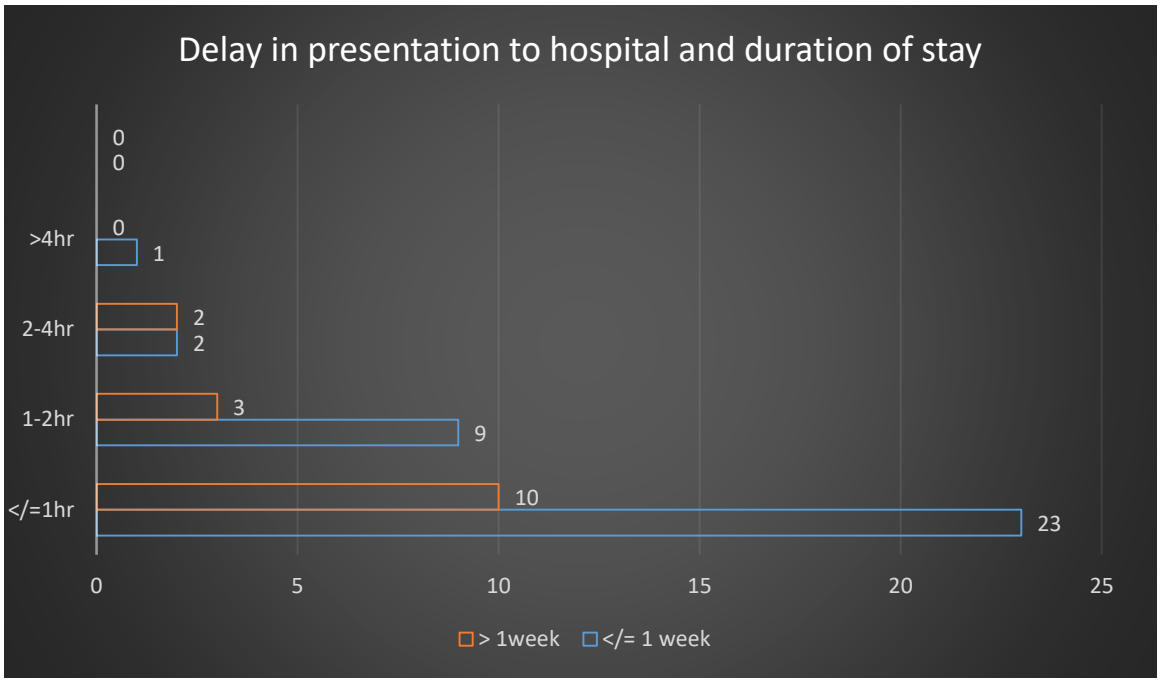
On analysing the psychiatric disease association among neck trauma cases, who were included in this study, 92% cases had no psychiatric association. 8% cases associated with psychiatric illness. Among these, 67% of cases were most commonly associated with depression, Maniac episodes were associated with 33% of cases.

7.GCS at the Time of Presentation



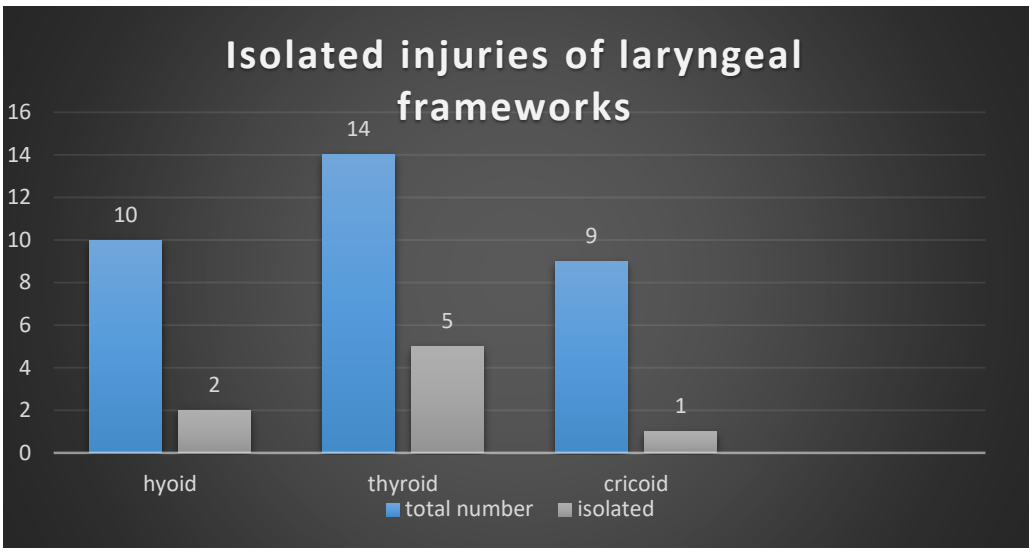
In our study, out of 50 patients, 39 patients (78%) were conscious and communicating properly at the time of presentation. 2 cases (4%) were brought in an unconscious state suggested other system involvement or severe injury. 9 cases (18%) were brought in a confused state, correlating well with the temporary concussion and encephalopathy caused by hanging.

8.Time of Presentation



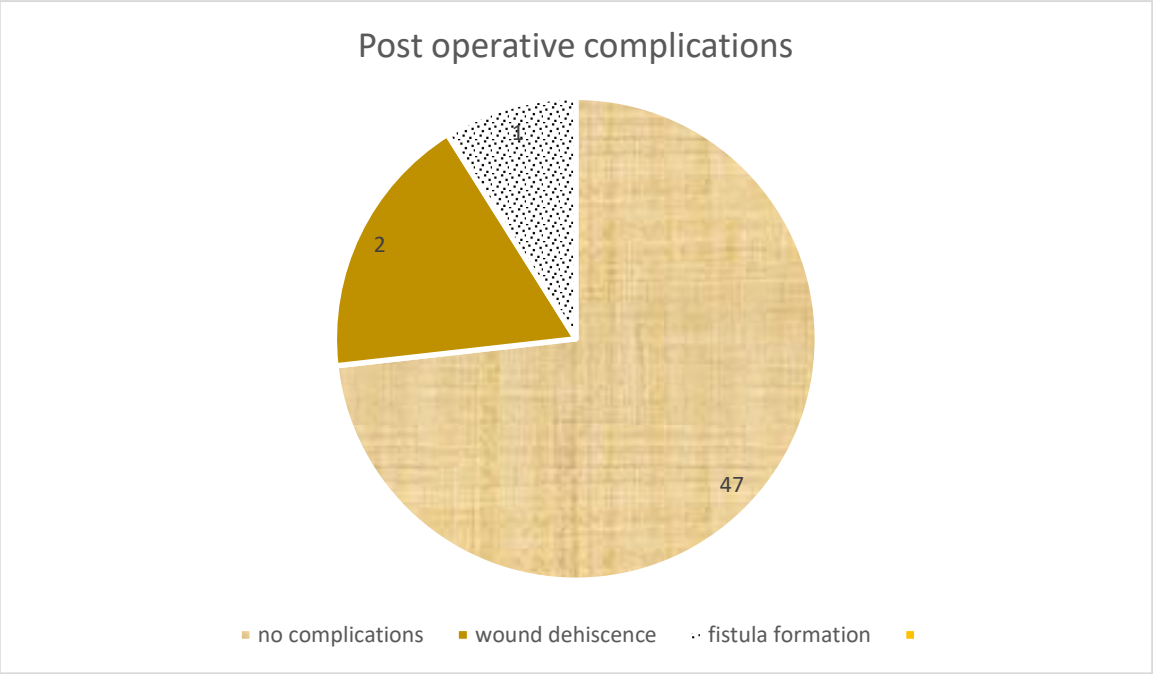
In our study, 33 cases (66%) approached directly at the tertiary care centre and reached within one hour of trauma, out of which 23 cases (70%) required hospital admission for less than 1week only and 10 cases (30%) required hospital admission for more than 1week. The number of cases reported within 1 to 2hours of trauma were12, among these 9 cases (75%) were required hospital admission for less than a week duration, 3 cases (25%) required hospital admission for more than 1week duration. 4 cases (8%) were presented with a delay of 2 to 4hours and 50% of cases required hospital admission for more than 1week duration. 1 patient (2%) reported to the hospital with a delay of >4hours.

9.Laryngeal Framework Injury



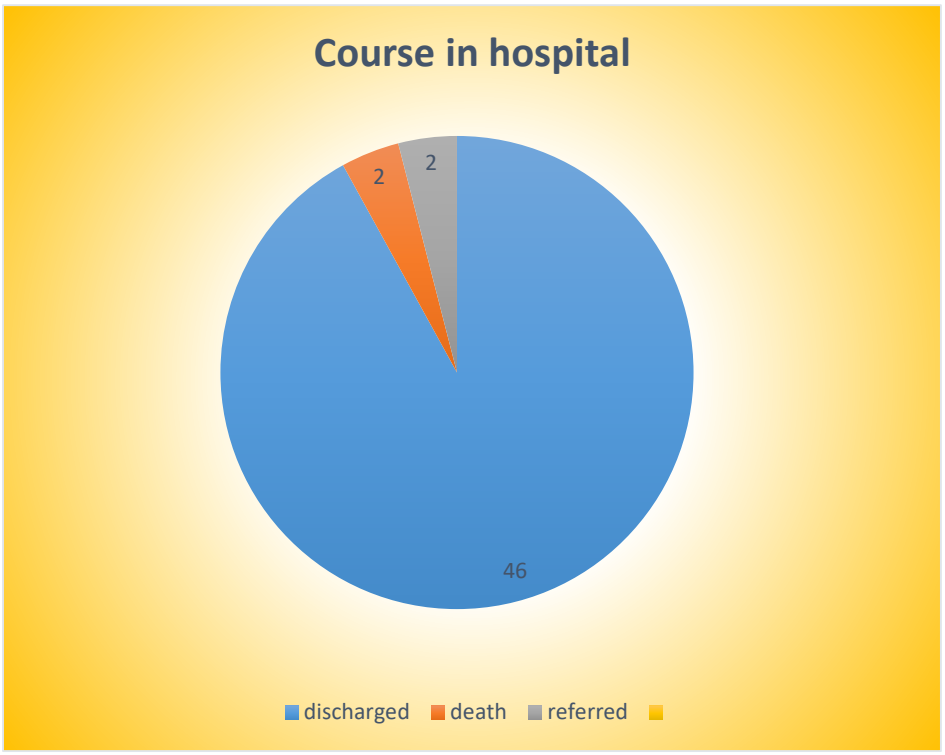
In this study, most common cartilage injured was the thyroid cartilage with an incidence of 14 cases (42%). 9 patients had cricoid cartilage injury, which was the least injured laryngeal cartilage with 27% incidence. 10 patients had hyoid bone injury (2%). Out of 33 laryngotracheal framework involved cases, isolated thyroid cartilage involvement was noted in 5 patients (15%) and only 2 cases had isolated hyoid bone fractures (4%), only 1 case had isolated cricoid injury (2%) and combined injury was noted in 25 cases (79%).

11.Post-operative Complications



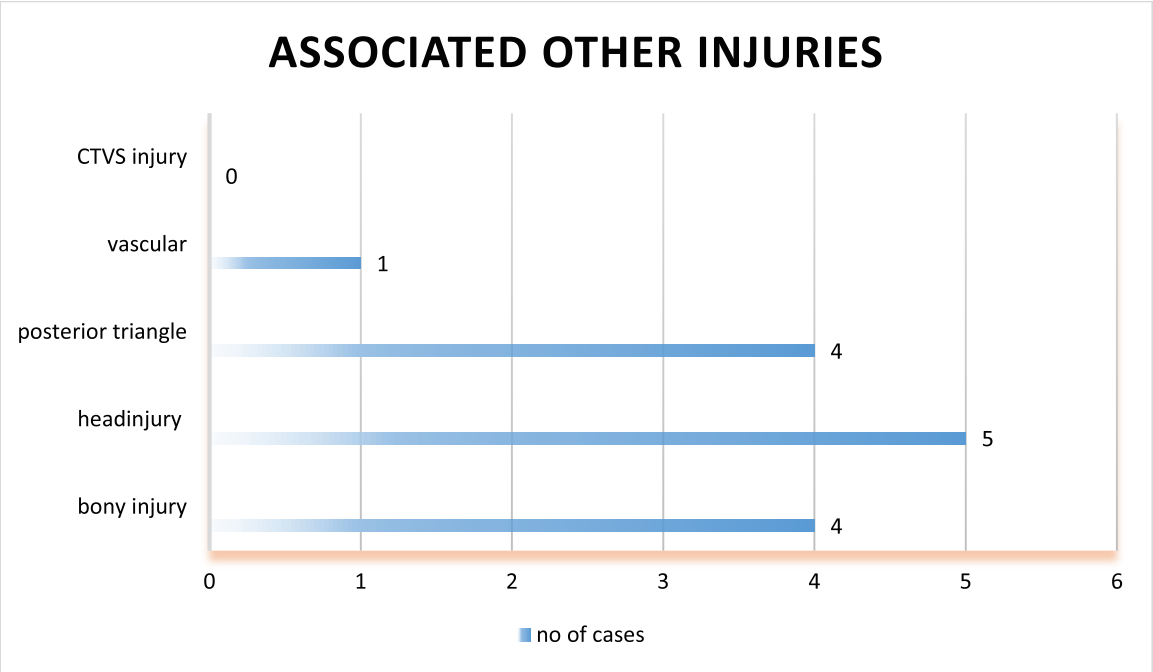
In this study of 50 patients, 47 patients (94%) discharged without any complications. 2 patients (4%) had wound dehiscence and 1 patient had fistula formation. No other complications were reported in our hospital.

12.Outcome



In our study, out of 50 cases, 46 patients (92%) were asymptomatic and discharged without any complications. 2 cases (4%) were died and 2 cases (4%) had referred to higher centre due to nonavailability of vascular surgeons in our centre at that particular time period.

13.Associated Injuries



In this study of 50 cases, Associated injuries were noted in 14 cases (28%). Among which, 5 cases (35%) was associated with head injury. 4 cases (28%) had Posterior triangle injury, another 4 cases (28%) had long bone injury and 1 patient (7%) had vascular injury. No CTVS association noted in this study.

DISCUSSION

This study was conducted in department of otorhinolaryngology and emergency OPD during a time period of 2year (2019 to 2021). It's a descriptive observational study involving 50 cases with different modes of neck injuries.

In our study, 37 out of 50 cases of neck trauma were found to be male patients with an incidence of 74% and this was correlated well with the study conducted in ENT department, NSCB medical college, Madhya Pradesh, India, a retrospective study from 2014 to 2016.

Among Males incidence of suicidal neck injury were almost double than homicidal injuries with an incidence of 57%. This was in contrast to study by Modi and Pandy[4] who observed that in India, suicidal wounds of the throat are rare.

Among female population, 46% having suicidal tendency with most adopted mode of injury their neck was by hanging.

Out of 50 patients irrespective of gender,14 cases were homicidal injury, 27 were suicidal, 5 had accidental cause and 4 due to road traffic accidents.

Most commonly affected age group in our study were found to be more than 40years of age with an incidence of 50%. A similar retrospective study conducted in North East of England by Ben J. Steel1 · Andrew Swansbury1 · Louis T. Wheeler [7] which also showed the average age was 31.5years.

Most of the patients were from rural areas and belonged to lower socioeconomic status, concluded that patients belonging to these particular age group (more than 40years) are the ones with risk taking behaviour, active participation and frequent involvement in interpersonal violence. Substance abuse noted in 60% of the injured males. These all are the social factors play a major role in misbehaviour leading to disputes and violence leading to neck trauma.

Most common presenting symptom was bleeding from the wound site followed by difficulty in swallowing. Least frequent presenting symptom was breathlessness. 8% cases were brought to the hospital in an unconscious state, suggested involvement of other systems and more severe injury.

In our study group, most common site of injury was at the level of thyroid cartilage followed by Cricoid cartilage, tracheal injury, Pharynx and hyoid bone. Similar findings are observed in a retrospective study of 2year duration conducted in NSCB hospital, Madhyapradesh[7].

Most common mode of neck injury observed in our study was penetrating neck trauma followed by blunt neck injury, accidental fall, RTA and then hanging. A study on Penetrating neck injuries by B.Vishwanatha, A.Sagayaraj, Shalini G. Huddar, Prashanth kumar, R. K. Datta, study happened in Karnataka From 1999 to 2005 showed similar finding of commoner incidence of penetrating neck injuries than other mode of injuries[8].

No significant psychiatric association was observed in majority of neck trauma cases included in our study. 8% cases associated with psychiatric illness. Most commonly associated with depression followed by maniac episodes. A chapter on Major depression and bipolar disorder; Kaplan and Sadock synopsis of psychiatry[9], textbook of psychiatry support our study for psychiatric illness association.

In our study, majority of patients were conscious and communicating properly at the time of presentation. 4% of cases were brought in an unconscious state suggested other system involvement or severe injury. 18% of the hanging patients were brought in a confused state due to temporary concussion and encephalopathy.

In our study, majority of the patients reached at tertiary care centre within one hour of trauma, among these 70% of the patients required hospital admission for less than 1week and 30% required hospital admission for more than 1week. If the patient is brought to the tertiary care hospital within the golden period (1hour) the hospital stay is less and postoperative morbidity is less. Delay in presentation for more than 2hours leads to prolonged hospital stay and more postoperative morbidity.

The management of neck injuries depends on the nature, extent of injury and general condition of the patient. In our study most of the patients managed with surgical exploration of the wound and primary closure, some cases required

elective tracheostomy prior to primary laryngotracheal repair. Patients with superficial injuries were managed by simple suturing of the wound. Blunt injuries neck and more superficial injuries most commonly managed by conservative method.

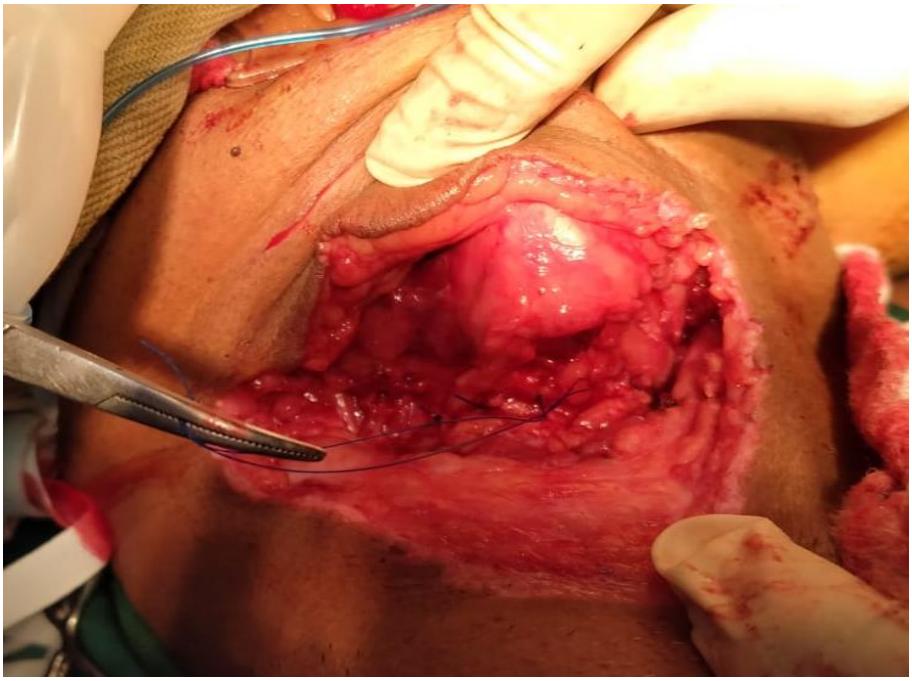
In a study on ‘Safety in selective surgical exploration in penetrating neck trauma” by Frederico Teixeira, Carlos Augusto Metidieri Menegozzo* conducted as A retrospective analysis at the Emergency Department of the Hospital das Clínicas of the University of Sao Paulo suggests major signs and symptoms of vascular or aerodigestive injuries should prompt emergent surgical exploration without second thought[9].

Majority of the patients discharged without any complications post operatively. Patients undergone primary laryngotracheal repair with elective tracheostomy, the tracheostomy was decannulated after uneventful laryngotracheal repair. In our study of 50 patients, only 1 patient had fistula formation and 4% of patients had wound dehiscence following primary neck exploration. No other complications were reported in our hospital.

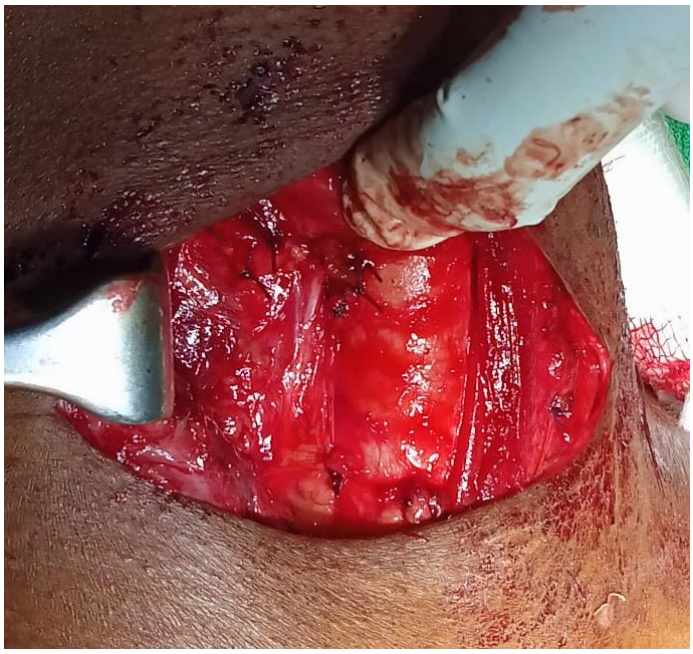
LEVELS OF INJURIES & THEIR MANAGEMENT

1.Involving skin, subcutaneous tissue and strap muscles

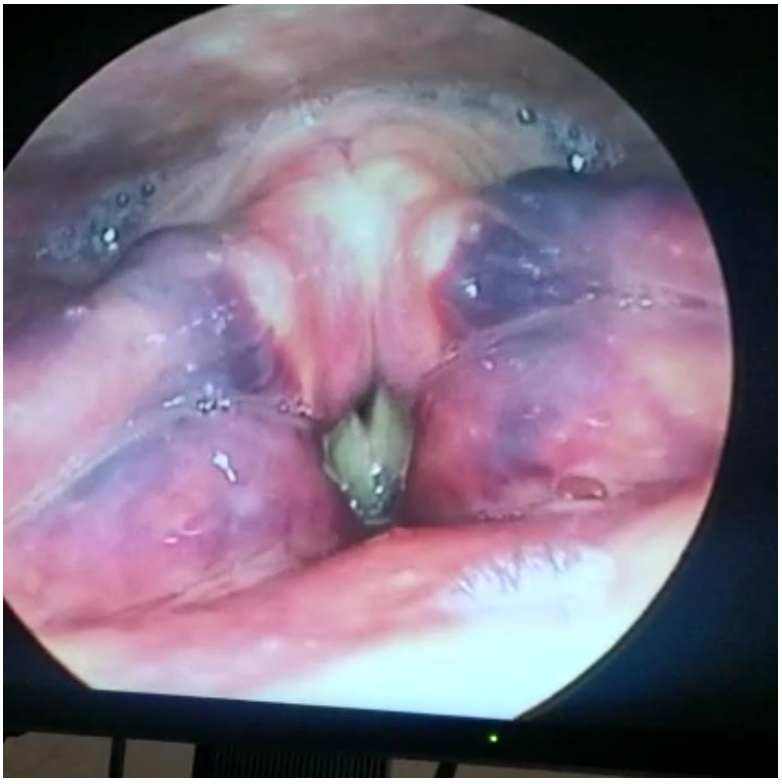
2.Involving injury at the level of cricothyroid membrane with cartilage injury



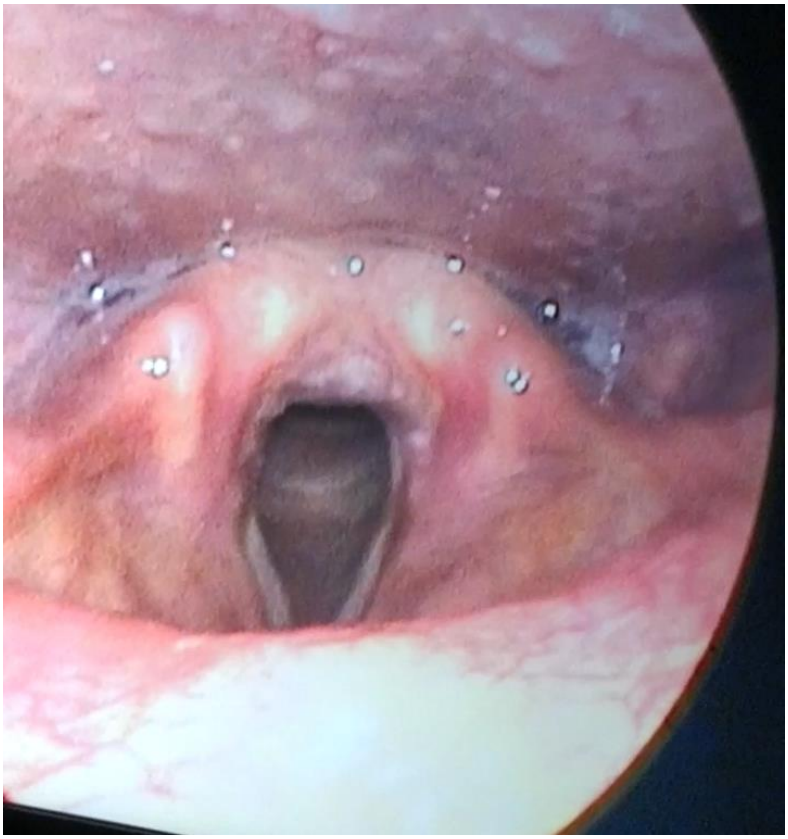
3.Tracheal level



4.Contusion of supraglottic structures on day 1

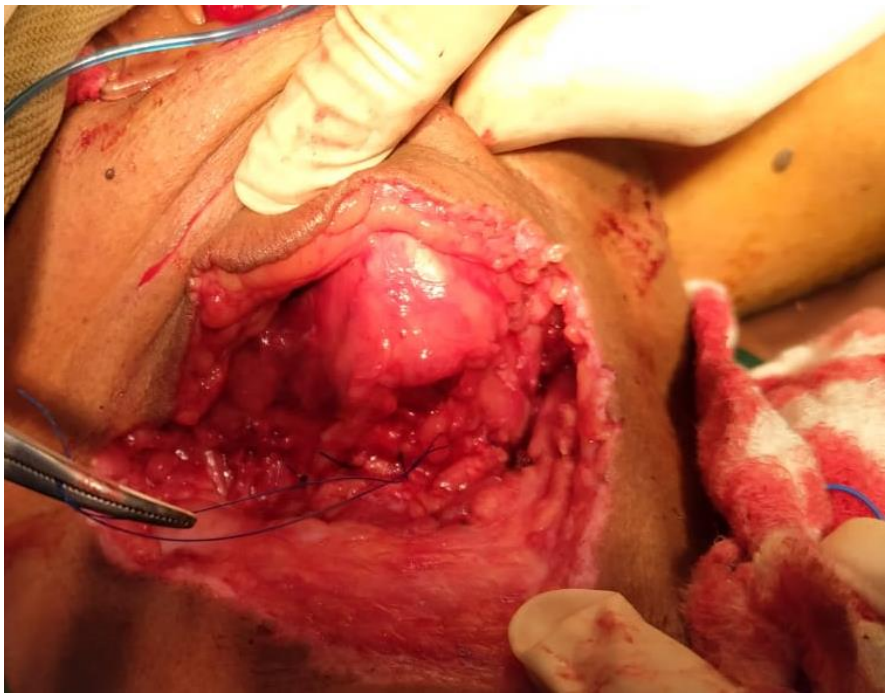


5.Supraglottic laryngoscopic picture of same patient on POD 10



6.Injury at cricotracheal level with pharyngeal involvement

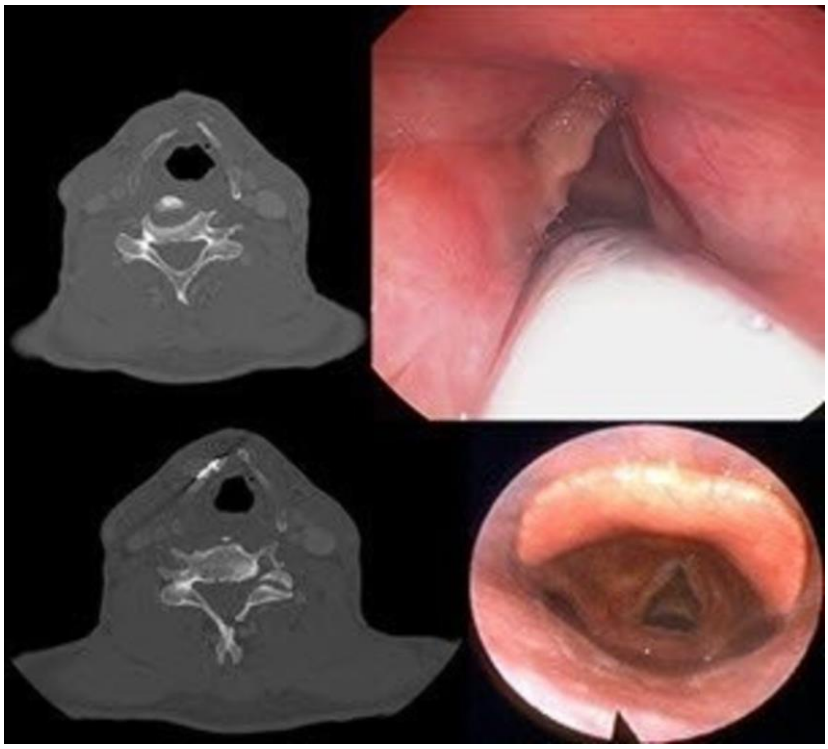
7.Surgical exploration and reconstruction of laryngotracheopharynx



8.Tracheostomy with neck exploration

9.Injury at the level of thyrohyoid membrane with hyoid bone fracture in a suicidal cut injury

10.Radiological correlation with VLS picture in cartilage fracture



CONCLUSION

Neck trauma with laryngeal framework injury is a rare yet life-threatening surgical emergency.

Initial management of these patients established according to the ATLS criteria.

In our study the incidence of neck injury is most common in middle aged men with risk taking behaviours like substance abuse and taking part in social disputes.

Among the neck trauma, penetrating injuries are more common due to suicidal attempts, the most common type of injury is combined laryngotracheal framework injury. In isolated cartilaginous injuries thyroid cartilage is more commonly involved.

Neck trauma cases due suicidal cut wounds are commonly associated with psychiatric illness. So, this will suggest all cases of neck trauma promptly evaluated and treated for psychiatric diseases.

Arriving at the tertiary referral centre within the golden period of neck injury (First one hour) and getting timely surgical intervention is vital for better surgical outcome and prevention of future complications like fistula formation and subglottic stenosis.

The treatment of a cut throat necessitates a multidisciplinary approach, headed by ENT and head and neck surgeon with vascular assistance to avoid unnecessary delay in prompt treatment and preventing the complications.

BIBLIOGRAPHY

1. About two thirds of all depressed patients contemplate suicide and 10 to 15 percent commit suicide[1"] – major depression and bipolar disorder;Kaplan and sadock synopsis of psychiatry
2. Tracheostomy: Epidemiology, Indications, Timing,Technique, and Outcomes by Nora H Cheung MD and Lena M Napolitano MD
3. Suicide Risk and Mental Disorder Louise Brådvik Faculty of Medicine, Department of Clinical Sciences Lund, Lund University, Lund SE 221 00, Sweden;Nlouise@bradvik.se
4. Neck Trauma: ENT Prospects; article in Indian journal of otorhinolaryngology by Kavita sachdeva and Aparaajitha upadhyay
5. Diagnosis, Management and Treatment of Neck Trauma, Patrizio Petrone,Leyre Velaz-Pardo, Amir Gendy, Laura Velcu, Collin E.M. Brathwaite, D'Andrea K. Joseph, Department of Surgery, NYU Winthrop Hospital, NYU Long Island School of Medicine, Mineola, New York, USA
6. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-Neck Trauma by Titilola Alao[1]; Muhammad Waseem[2]
7. Eur J Trauma Emerg Surg. 2018; 44(Suppl 1): 3–271. Published online 2018 Apr 13.Level 3 guideline on the treatment of patients with severe/multiple injuries, AWMF Register-Nr. 012/019

8. Epidemiological Survey of Head and Neck Injuries and Trauma in the United States Rosh K. V. Sethi, BS, Elliott D. Kozin, MD, Daniel J. Lee, MD, FACS, Mark G. Shrime, MD, MPH, FACS and Stacey T. Gray, MD, FACS
9. J West Afr coll surg.2017 july- sept;7(3):1-23 ;CC Nwawolo and CN asoegwu
10. Akhthar S ,Awan s .laryngotracheal trauma:its management and sequelae. J Pak Med assoc.2008;58:241-3
11. Atkins BZ ,Abbate S,Fisher SR,Vaslef SN. Current management of laryngotracheal trauma:case report and literature review, J TRAUMA 2004;56;185-90
12. Santosh uttarkar pandurangarao, Prasanth basavaraj and Lavanya karnam JCDR publications on primary management and outcome open laryngotracheal trauma
13. George v,Herzog M ,Seid IR.Head and neck trauma an interdisciplinary approach.ist edn.thieme;2006.diagnosing injuries of larynx and trachea.web 20 mar 2015.
14. Nowicki JL, Stew B, Ooi E. Penetrating neck injuries: a guide to evaluation and management. Ann R Coll Surg Engl. 2018;100:6–11. 2. Sethi RK, Kozin ED, Fagenholz PJ, Lee DJ, Shrime MG, Gray

15. ST. Epidemiological survey of head and neck injuries andtrauma in the United States. Otolaryngol Head Neck Surg.

16. Watson WL, Silverstone SM. Ligature of the common carotid artery in cancer of the head and neck. Ann Surg. 1939;109(1):1–27.

17. Makins GH. Gunshot Injuries to the Blood Vessels. Bristol,England: John Wright and Sons, Ltd; 1919 (Disponible en formato E-Book: https://play.google.com/store/books/details?id=V2oSAAAAYAAJ&rdid=book-V2oSAAAAYAAJ&rdot=1)

18. Lawrence KB, Shefts LM, McDaniel JR. Wounds of the common carotid arteries, report of seventeen cases from World War II. Am J Surg. 1948;76(1):29–37.

19. Thal ER, Meyer DM. Penetrating neck trauma. Curr Probl Surg. 1992;29(1):1–56.

20. Feliciano DV. Penetrating cervical trauma. Current concepts in penetrating trauma. World J Surg. 015;39:1363–72.

21. De Re´gloix SB, Baumont L, Daniel Y, Maurin O, Crambert A, Pons Y. Comparison of penetrating neck injury management in combat versus civilian trauma: a review of 55 Cases. Mil Med. 2016;181(8):935–

22. Ibraheem K, Khan M, Rhee P, Azim A, O'Keeffe E, Tang A, et al. ''No zone'' approach in penetrating neck trauma reduces unnecessary computed tomography angiography and negative explorations. J Surg Res. 2018;201:113–20.

23. Prichayudh S, Choadrachata-anun J, Sriussadaporn S, Parkart R, Sriussadaporn S, Kritayakirana K, et al. Selective management of penetrating neck injuries using ‘‘no zone’’approach. Injury. 2015;46:1720–5.

24. Jain RK, Charkraborty P, Joshi P, Pradhan S, Kumari R.Penetrating neck injuries: from ER to OR. Indian JOtolaryngol Head Neck Surg. 2018. http://dx.doi.org/10.1007/s12070-018-1307-6.

25. Sachdeva K, Upadhyay A. Neck trauma: ENT prospects. Indian J Orolaryngol Head Neck Surg. 2017;69(1):52–7.http://dx.doi.org/10.1007/s12070-016-1048-3.

26. Madsen AS, Laing GL, Bruce JL, Clarke DL. A comparative audit of gunshot wounds and stab wounds to the neck in a SouthAfrica metropolitan trauma service. Ann R Coll Surg Engl.2016;98:488–95. http://dx.doi.org/10.1308/rcsann.2016.0181.Teixeira F, Menegozzo CAM, Netto SDC, Poggeti RS, SilvaFSC, Birolini D, et al. World J Em Surg. 2016;11:32.

27. Schroll R, Fontenot T, Lipcsey M, Heaney JB, Marr A, Meade P, et al. Role of computed tomografphy angiography in the management of Zone II penetrating neck trauma in patients with clinical hard signs. J Trauma Acute Care Surg. 2015;79(6):943–50.

28. Siau RTK, Moore A, Ahmed T, Lee MSW, Tostevin P.

Management of penetrating neck injuries at a London trauma centre. Eur Arch Otorhinolaryngol. 2013;270:2123–8. http://dx.doi.org/10.1007/ s00405-012-2324-9.

29. Wepner J. Improved mortality from penetrating neck andmaxillofacial trauma using Foley catheter balloon tamponade in combat. J Trauma Acute Care Surg. 2013;75(2):220–4. http://dx.doi.org/10.1097/ TA.0b0 13e3182930fd8.

30. Harris R, Olding C, Lacey C, Bentley R, Schulte KM, Lewis D, et al. Changing incidence and management of penetrating neck injuries in the South East London trauma centre. Ann R Coll Surg Engl. 2012;94:240–4.

31. Soliman A, Ahmad S, Roy D. The role of aerodigestive tract endoscopy in penetrating neck trauma. Laryngoscope. 2014;124:1–9. http://dx.doi.org/10.1002/lary.23611.

32. Van Waes OJ, KCAL Cheriex, Navsaria PH, van Riet PA, Nicol AJ, Vermeuen J. Management of penetrating neck injuries. Br J Surg. 2012;99(1):149–54.

33. Brennan J, Lopez M, Gibbons MD, Hayes D, Faulkner J, Dorlac WC, et al. Penetrating neck trauma in Operation Iraqi Freedom. Otolaryngol Head Neck Surg. 2010;144(2):180–5. http://dx.doi.org/10.1177/ 0194599810391628.

34. Ahmed A. Selective observational management of penetrating neck injury in Northern Nigeria. S Afr J Surg.2009;47(3):80–5.

35. Osborn TM, Bell B, Qaisi W, Long WL. Computed tomographic aniography as an aid to clinical decision making in the selective management of penetratinginjuries to the neck: a reduction in the need for operativeexploration. J Trauma. 2008;64:1466–71.

36. Thoma M, Navsaria PH, Edu S, Nicol AJ. Analysis of 203 patients with penetrating neck injuries. World J Surg. 2008;32:2716–23.

37. Bell RB, Osborn T, Dierks EJ, Potter BE, Long WB. Management of Penetrating neck injuries: a new paradigm for civilian trauma. J Oral Maxillofac Surg. 2007;65:691–705.

38. Fox CJ, Gillespie DL, Weber MA, Cox MW, Hawksworgh JS, Cryer CM, et al. Delayed evaluation of combat-relatedpenetrating neck trauma. J Vasc Surg. 2006;44:886–93. Inaba K, Murena F, McKenney M, Rivas L, de Moya M,Bahouth H, et al. J Trauma. 2006;61:144–9. http://dx.doi.org/10.1097/01.ta.0000222711.01410.bc.

39. Navsaria P, Thoma M, Nicol A. Foley catheter balloon tamponade for life-theratening hemorrhage in penetrating neck trauma. World J Surg. 2006;30:1265–8. http://dx.doi.org/10.1007/s00268-005-0538-3.

40. Pakarinen TK, Leppaniemi A, Sihvo E, Hiltunen K-M, Salo J.Management of cervical stab wounds in low volume trauma centres: systematic physical examination and low threshold for adjunctive studies, or surgical exploration.Injury. 2006;37:440–7.

41. Woo K, Magner DP, Wilson MT, Margulies DR. CT angiography in penetrating neck trauma reduces the need for operative neck exploration. Am Surg. 2005;71(9):754–8.

42. Weitzel N, Kendall J, Pons P. Blind nasotracheal intubation for patients with penetrating neck trauma. J Trauma. 2004;56(5):1097–101. http://dx.doi.org/10.1097/ 01.TA.0000071294.21893.A4.

43. Nason RW, Assuras GN, Gray PR, Lipschitz J, Burns CM. Penetrating neck injuries: analysis of experience from a Canadian trauma centre. J Can Chirurgie. 2001;44(2):122–6.

44. Sekharan J, Dennis JW, Veldenz HC, Miranda F, Fykberg ER. Continued experience with physical examination alone for evaluation and management of penetrating zone 2 neck injuries: results of 145 cases. J Vasc Surg. 2000;32:483–9.

45. Biffl WL, Moore EE, Rehse DH, Offner JP, Franciose RJ, Burch JM. Selective management of penetrating neck trauma based on cervical level of injury. Am J Surg. 1997;174:678–82.

46. Irish JC, Hekkenberg R, Gullane PJ, Brown DH, Rotstein LE, Neligan P. Penetrating and blunt neck trauma: 10-year review of a Canadian experience. Can J Surg. 1997;40(1):33–8.

47. Montalvo BM, LeBlang SD, Nun˜ ez DB, Ginzburg E, Klose J, Becerra JL, et al. Color Doppler sonography in penetrating injuries of the Neck. Am J Neuroradiol.

1996;17:943–51.

48. Sofianos C, Degiannis E, VandenAadweg MS, Levy RD, Naidu M, Saadia R. Selective surgical management of zoneII gunshot injuries of the neck: a prospective study. Surgery. 1996;120:785–8.

49. Demetriades D, Theodorou D, Cornwell E, Weaver F, Yellin A, Velmahos G, et al. Penetrating injuries of the neck in patients in stable condition. Arch Surg. 1995;130:971–5.

50. Demetriades D, Charalambides D, Lakhoo M. Physical examination and selective conservative management in patients with penetrating injuries of the neck. Br J Surg. 1993;80:1534–6.

51. Luntz M, Nusem S, Kronenberg J. Management of penetrating wounds of the neck. Eur Arch Otorhinolaryngol. 1993;250:369–74.

52. Mansour MA, Moore EE, Moore FA, Whitehill TA. Validating the selective management of penetrating neck wounds. Am J Surg. 1991;162:517–21.

53. Rivers SP, Patel Y, Delany H, Veith FJ. Limited role of arteriography in penetrating neck trauma. J Vasc Surg. 1988;8:112–6.

54. Meyer JP, Barret JA, Schuler JJ, Flanigan P. Mandatory vs selective exploration for penetrating neck trauma. Arch Surg. 1987;122:592–7.

55. Jurkovich GJ, Zingarelli W, Wallace J, Curreri PW. Penetrating neck trauma: diagnostic studies in the asymptomatic patient. J Trauma. 1985;25(9):819–22.

56. Ordog GJ, Albin D, Wasserberger J, Schlater T,Balasubramaniam S. 110 Bullet wounds to the neck. J Trauma. 1985;25(3):238–46.

57. Sclafani S, Panetta T, Goldstein A, Phillips T, Hotson G, Loh J, et al. The management of arterial injuries caused by penetration of zone III of the neck. J Trauma. 1985;25(9):871–81.

58. Golueke PJ, Godstein AS, Sclafani S, Mitchell W, Shaftan G. Routine versus selective exploration of penetrating neck injuries: a randomized prospective study. J Trauma. 1984;24(12):1010–4.

59. Narrod JA, Moore EE. Initial management of penetrating neck wounds–a selective approach. J Emerg Med. 1984;2:17–22.

60. Narrod JA, Moore EE. Selective management of penetrating neck injuries. Arch Surg. 1984;119:574–8.

61. Prakashchandra M, Bhatti FK, Gaudino J, Ivatury R, Agarwal N, Nallathambi MN, et al. Penetrating injuries of the neck: criteria for exploration. J Trauma. 1983;23(1):47–9.

62. Kasbekar AV, Combellack EJ, Derbyshire SG, Swift AC. Penetrating neck trauma and the need for surgical exploration: six year experience within a regional trauma centre. J Laryngol Otol. 2017;131:8–12. http://dx.doi.org/ 10.1017/S0022215116009506.

63. Bodanapally UK, Shanmuganathan K, Dreizin D, Stein D, Reddy AK, Mirvis SE, et al. Penetrating aerodigestive injuries in the neck: a proposed

CT-aided modified selective management algorithm. Eur Radiol. 2016;26:2409– http://dx.doi.org/10.1007/s00330-015-4050-3.

64. Cobzeanu MD, Palade D, Manea C. Epidemiological features and management of complex neck trauma from a ENT surgeon‘s perspective. Chirurgia. 2013;108:360–4.

65. Walsh MS. The management of penetrating injuries of the anterior triangle of the neck. Injury. 1994;25:393–5.

66. Goldberg PA, Knottenbelt JD, VanDerSpuy JW. Penetrating neck wounds: is evidence of chest injury an indication for exploration? Injury. 1991;22(1):7–8.

67. Ngakane H, Muckart DJJ, Luvuno FM. Penetrating visceral injuries of the neck: results of a conservative management policy. Br J Surg. 1990;77:908–10.

PROFORMA

CASE STUDY OF ANTERIOR NECK INJURIES

Case no:

Name:

Age/sex:

IP Number:

Address:

Referred/direct:

Date of admission:

Date of discharge:

Date &time of injury:

Time of presentation to hospital:

Mode of injury:

GCS at presentation:

Clinical features:

General examination:

Systemic examination:

VLS findings:

Neck wound examination:

1. Dimension:
2. Hyoid
3. Thyroid

4. Cricoid
5. Thyrohyoid membrane
6. Air leak
7. Strap muscles
8. Pharyngeal injury
9. Trachea
10. Neurological injury
11. Vascular injury
12. Posterior triangle

Ear and Nose Examination:

Imaging technique used:

Imaging findings:

1. Tracheocartilaginous
2. Bony
3. Neurovascular

Other injuries:

1. Head injury
2. CTVS
3. Longbone

Management details:

1. Exploration & suturing
2. Tracheostomy
3. Laryngotracheal reconstruction
4. Assistance of neurovascular and plastic surgery

Duration of hospital stay:

Discharge/death/referred:

Substance influence:

Psychiatric diseases:

Post op decannulation:

Post op complication:

Post op voice:

Investigations :

CBC

Hb			
TC			
DC			
Platelets			
BT/CT			

RFT

UREA		
SUGAR		
CREATININE		

ELECTROLYTES

Na+		
K+		

LIVER function test

Total biliruibin			
Indirect bilirubin			
Direct bilirubin			

SGOT			
SGPT			
ALP			
Albumin			
Globulin			

ECG

HIV/HBsAg/HCV

Urine routine

Chest Xray

Others

HIGH RISK CONSENT FOR TRACHEOSTOMY AND NECK WOUND EXPLORATION AND CLOSURE

எனது கழுத்தில் மர்ம நபர் ஒருவர் அரிவாளால் வெட்டிவிட்டு சென்றுவிட்டான். என்னை மருத்துவமனைக்கு அழைத்து வந்தனர். என்னை பரிசோதித்த மருத்துவர்கள் தொண்டை பகுதியில் வெட்டுபட்டு தைராய்டு குறுத்தெலும்பிற்கு மேலாக முழுவதும் Open ஆக உள்ளது எனவும் இதனால் இரத்தப்போக்கு கிருமிதொற்று, தொண்டையில் வீக்கம், மூச்சுத்திணறல் ஏற்பட்டு உயிரிழப்பு ஏற்படும் அபாயம் உள்ளது என்பதையும் மருத்துவர்கள் மூலம் தெரிந்து கொள்வேன். எனவே மயக்க மருந்து கொடுத்து மூச்சுக்குழாயில் துளையிட்டு அறுவைசிகிச்சை (Tracheostomy) செய்து குழாயினை பொறுத்திவிட்டு பின்பு வெட்டப்பட்ட பகுதியில் அறுவைசிகிச்சை செய்து சரிசெய்ய வேண்டும் என்றும் கூறினார்கள். மேலும் அறுவை சிகிச்சையின்போது இரத்தக்கசிவு, கிருமித்தொற்று, மூச்சுத்திணறல், செயற்கை சுவாசம் தேவைப்படுதல், உயிரிழப்பு போன்ற பின்விளைவுகள் ஏற்படலாம், குழாய் பொறுத்தியபின் குரலிழப்பு ஏற்படலாம் என்பதையும் மருத்துவர் மூலம் அறிந்து கொண்டேன். இதற்கு மருத்துவர்களை (அ) பிற ஊழியர்களை பொறுப்பாக மாட்டார்கள். இச்சிகிச்சைக்கு முழு சுய நினைவுடன் சம்மதம் தெரிவித்துக்கொள்கிறேன்.

ராமச்சந்திரன்

sl no	name	age/sex	mode	time of injury	time of presentation	GCS at presentation	clinical features	VLS	neck wound purticulars											
									dimension	hyoid	thyroid	cricoid	thyrohyoid membrane cut	air leak	strap muscle cut	pharyngeal injury	trachea	neurological injury	vascular injury	posterior triangle
1	kannanraja	23/m	self inflicted	8pm	9 30 pm	15	pain,bleeding	0	7*6*2cm	0	0	0	0	0	1	0	0	0	0	0
2	jayaramachandran	60/m	suicidal	12 05am	1:00 AM	15	breathy voice,air leak, laceration,odynophagia	0	14*20*3cm	0	0	0	1	1	1	1	0	0	0	0
3	raj	72/m	suicidal	7pm	7 30 pm	15	difficulty in speaking, laceration,breathy voice	1 contusion-supraglottis vocal cords - mobile	8*2*1cm	1	1	1	1	1	1	1	1	0	0	0
4	brahmmalakshmi	35/f	hanging	5 30am	6 35am	13	ligature mark	0	multiple abrasions	0	0	0	0	0	0	0	0	0	0	0
5	murugan	28/m	assault	6pm	9 30pm	15	neckpain, odynophagia	0	4*2*0.5cm	0	0	0	0	0	1	0	0	0	0	1
6	sudheva	14/m	suicidal	5pm	5 30pm	15	shoulder pain, neckpain, difficulty in mouth opening	0	contusion	0	0	0	0	0	0	0	0	0	0	0
7	sugeesh	18/m	RTA	7pm	8pm	3	multiple wounds	0	8*2*2cm	0	0	0	0	0	1	0	0	1	0	0
8	badrakali	8/f	assault	8pm	8 30pm	14	difficulty in swallowing, breathy voice, laceration	0	10*5*2cm	1	1	1	1	1	1	0	1	0	0	0
9	vellayathan	48/m	suicidal	7am	8am	15	laceration, painful swallow	0	8*5*2cm	0	1	0	0	0	1	0	0	0	0	0
10	murugan	23/m	assault	10PM	12PM	15	wound,neckpain	medialization of right vocal fold , contusion	5*4*2	1	1	1	1	1	1	1	1	0	0	0
11	muppidathy	45/m	suicidal	1AM	2:00 AM	15	wound , difficulty in speaking	0	8*6*2cm	1	1	0	1	1	1	1	1	0	0	0
12	belson	20/m	assault	12AM	1 20AM	15	WOUND	0	4*1*1	0	0	0	0	0	0	0	0	0	0	0

sl no	name	age/sex	mode	time of injury	time of presentation	GCS at presentation	clinical features	VLS	neck wound purticulars											
13	kannama	40/f	fall	6PM	6 15	15	NECKPAIN	0	2*2*1	0	0	0	0	0	1	0	0	0	0	0
14	rajkumar	50/m	assault	5PM	5 30	15	wound	0	4*1*1	0	0	0	0	0	0	0	0	0	0	0
15	anbalagan	33/m	suicidal	4AM	4 40	15	dysphagia,neckwound	0	5*5*2	0	0	0	0	0	1	0	0	0	0	0
16	maala	39/f	assault	1PM	2PM	15	laceration, painful swallow	0	6*3*1	0	0	0	0	0	0	0	0	0	0	0
17	nambi	75/m	suicidal	4AM	5AM	14	wound, neckpain	0	10*4*4	0	0	1	1	1	1	1	1	0	0	0
18	arumugaselvi	14/f	assault	8PM	9PM	15	difficulty in speaking, laceration,breathy voice	contusion - supraglottis, medialized left AE fold	15*7*4	1	1	1	1	1	1	0	1	1	1	1
19	krishnaveni	30/f	suicidal	2AM	4AM	15	NECKWOUND	0	6*3*1	0	0	0	0	0	1	0	0	0	0	0
20	joseph	36/m	suicidal	6AM	7 30	15	laceration, painful swallow	0	4*3*1	0	1	0	0	0	1	0	0	0	0	0
21	aravind	31/m	SUICIDAL	11PM	2AM	10	WOUND	0	10*5*1CM	1	1	0	1	1	1	0	0	0	0	0
22	arumugan	43/m	suicidal	2 30AM	3 20AM	15	NECKPAIN,WOUND,DYSPHAGIA	0	multiple abrasions	0	0	0	0	0	0	0	0	0	0	0
23	seethai	46/f	accidentaltrauma	3 40PM	4 30	15	difficulty in swallowing and speaking	0	8*8*3	1	1	1	1	0	0	0	0	0	0	1
24	suresh	19/m	suicidal	6 50AM	7 20	14	NECKPAIN	0	2*1*1	0	1	0	0	0	0	0	0	0	0	0
25	kanniyappan	29/m	assault	8PM	8 20	15	wound	0	3*1*1 and abrasions	0	0	0	0	0	0	0	0	0	0	0
26	manigandan	30/m	suicidal	9PM	9 30	15	NECKPAIN,WOUND,DYSPHAGIA	0	3*2*1	0	0	0	0	0	0	0	0	0	0	0
27	alagumuthu	45/m	suicidal	10PM	12 30	15	NECKPAIN, WOUND	0	6*4*2	0	1	0	0	1	1	0	0	0	0	0
28	ravi	57/m	suicidal	12am	12 30am	14	wound,neckpain,difficulty in swallowing	0	10*5*3	1	1	1	1	1	1	0	0	0	0	0

sl no	name	age/sex	mode	time of injury	time of presentation	GCS at presentation	clinical features	VLS	neck wound purticulars											
29	aalipathu	54/f	ACCIDENTAL TRAUMA	4PM	4 20	15	wound	0	contusion, neck swelling	0	0	0	0	0	0	0	0	0	0	0
30	veeraselvi	27/f	suicidal	2am	7am	15	bleeding from wound	0	multiple abrasions	0	0	0	0	0	0	0	0	0	0	0
31	logeswari	33/f	hanging	8pm	10pm	13	difficulty in swallowing and speaking	0	ligature mark 12*3cm	1	0	0	0	0	0	0	0	0	0	0
32	meena	24/f	suicidal	6am	6 30am	15	wounds	0	4*3*2cm	0	0	0	0	0	0	0	0	0	0	0
33	raja	41/m	assault	10pm	10 40pm	15	laceration, painful swallow	0	6*4*4cm	0	0	0	0	0	1	0	0	0	0	0
34	guru	56/m	assault	3pm	4pm	15	speaking problem,neck pain	0	7*8*3cm	0	1	1	1	1	1	1	1	0	0	0
35	iyyappan	49/m	suicidal	4am	6am	15	neckpain	0	multiple hesitation cuts	0	0	0	0	0	0	0	0	0	0	0
36	perumalsamy	68/m	assault	9pm	9 30pm	15	WOUND,PAIN	0	2*2*1	0	0	0	0	0	0	0	0	0	0	0
37	somu	50/m	assault	6pm	6 45pm	15	WOUND,PAIN	0	3*2*1	0	0	0	0	0	0	0	0	0	0	0
38	palani	59/m	RTA	3pm	6pm	3	neckwound, unresponsiveness	contusion and oedema false cords	10*4*3cm	0	1	1	1	1	1	0	0	1	0	1
39	sankaran	68/m	suicidal	12am	1 20AM	15	laceration, painful swallow	0	5*4*1	0	0	0	0	1	0	0	1	0	0	0
40	mareeswaran	43/m	fall	11am	11 30am	15	wound	0	1*2*1	0	0	0	0	0	0	0	0	0	0	0
41	ramar	70/m	suicidal	10pm	11pm	15	difficulty in speaking, laceration,breathy voice	0	4*3*1	0	0	0	1	1	0	0	0	0	0	0
42	karthik	17/m	suicidal	3am	3 30am	15	multiple wounds	0	abrasions	0	0	0	0	0	0	0	0	0	0	0
43	nisha	12/f	assault	8 30pm	8 50pm	15	laceration, painful swallow	0	8*5*2CM	1	0	0	0	0	1	0	0	0	0	0
44	ponkumar	45/m	rta	5 40am	6 10am	15	wound	0	4*2*1	0	0	0	0	0	1	0	0	0	0	0

sl no	name	age/sex	mode	time of injury	time of presentation	GCS at presentation	clinical features	VLS	neck wound purticulars											
45	selva	38/m	trauma	5:00 PM	5 40pm	15	wound,pain	0	multiple cut wounds	0	0	0	0	0	1	0	0	0	0	0
46	jeya	40/f	hanging	6am	6 30am	12	contusion, LOC	0	ligature mark 12*3cm	0	0	0	0	0	0	0	0	0	0	0
47	ravindran	44/m	suicidal	7am	8am	15	difficulty in swallowing	0	ABRASIONS	0	0	0	0	0	0	0	0	0	0	0
48	sathyadas	56/m	assault	9pm	9 30pm	15	pain, wound	0	5*4*4cm	0	1	0	1	1	0	0	0	0	0	0
49	balaji	49/m	RTA	12pm	12 45pm	13	contusion, LOC	0	neck oedema	0	0	0	0	0	0	0	0	0	0	0
50	umakanthan	65/m	suicidal	2 30am	3 40am	15	multiple wounds	0	largest 2*1*1	0	0	0	0	0	0	0	0	0	0	0

imaging	imaging findings			other injuries			management details				duration of hospital stay	discharged/death/referred	substance influence	psychiatric disease	decannulation postop	postop complication	post op voice
	tracheocartilaginous	bony	neurovascular	headinjury	CTVS	longbones	exploration&suturing	tracheostomy	laryngotracheal reconstruction	assistance of neurovascular and plastic surgery							
CT	0	0	0	0	0	0	1	0	0	0	7DAY	1	0	0	0	0	0
CT	0	1	0	0	0	1	1	1	0	NA	1DAY	3	0	1(mania)	1	0	0
CT	1	1	0	0	0	0	1	1	1	0	14DAYS	1	1	0	1	0	0
0	0	0	0	0	0	0	0	0	0	0	8DAYS	1	0	1(depression)	0	0	0
CT	0	1	0	0	0	1	1	0	0	0	5DAYS	1	1	0	0	gaping of wound	0
XRAY	0	0	0	0	0	0	1	0	0	0	1DAY	1	0	0	0	0	0
CT	0	0	1	1	0	0	1	0	0	0	1DAY	2	1	0	0	NA	NA
CT	1	1	0	0	0	0	1	1	1	0	20DAYS	1	0	0	1	0	0
CT	0	0	0	0	0	0	1	0	0	0	8DAYS	1	0	0	0	0	0
ct	1	1	0	0	0	0	1	1	1	0	14days	1	1	0	1	Pharyngocutaneous fistula	0
ct	1	1	0	0	0	0	1	1	1	0	23days	1	0	0	1	0	0
NA	0	0	0	0	0	0	1	0	0	0	1DAY	1	1	0	0	0	0

imaging	imaging findings			other injuries			management details				duration of hospital stay	discharged/death/referred	substance influence	psychiatric disease	decannulation postop	postop complication	post op voice
NA	0	0	0	0	0	0	1	0	0	0	1DAY	1	0	0	0	0	0
NA	0	0	0	0	0	0	1	0	0	0	3day	1	1	0	0	0	0
CT	0	0	0	0	0	0	1	0	0	0	2DAY	1	1	0	0	0	0
NA	0	0	0	0	0	0	1	0	0	0	1DAY	1	0	0	0	0	0
CT	1	0	0	0	0	0	1	1	0	0	15DAYS	1	1	0	1	wound gaping	0
CT	1	1	1	0	0	1	1	1	1	1	30DAYS	1	0	0	1	0	0
CT	0	0	0	0	0	0	1	0	0	0	1DAY	1	0	0	0	0	0
CT	1	0	0	0	0	0	1	0	0	0	3DAYS	1	1	0	1	0	0
CT	1	1	0	0	0	0	1	1	1	0	14DAYS	1	0	1(depression)	1	0	0
0NA	0	0	0	0	0	0	0	0	0	0	1DAY	1	1	0	0	0	0
CT	1	0	0	0	0	0	1	0	0	0	6days	1	0	0	0	0	0
CT	1	0	0	0	0	0	1	0	0	0	3DAYS	1	0	0	0	0	0
CT	0	0	0	0	0	0	1	0	0	0	2days	1	1	0	0	0	0
na	0	0	0	0	0	0	1	0	0	0	3day	1	1	0	0	0	0
CT	1	0	0	0	0	0	1	1	0	0	8DAYS	1	1	1(depression)	1	0	0
CT	1	1	0	0	0	0	1	1	1	0	24DAYS	1	0	0	1	0	0

imaging	imaging findings			other injuries			management details				duration of hospital stay	discharged/death/referred	substance influence	psychiatric disease	decannulation postop	postop complication	post op voice
CT angiogram	0	0	0	0	0	0	0	0	0	0	3days	1	0	0	0	0	0
NA	0	0	0	0	0	0	0	0	0	0	2days	1	0	0	0	0	0
ct	0	1	0	1	0	0	0	0	0	0	7days	1	0	0	0	0	0
CT	0	0	0	0	0	0	1	0	0	0	4days	1	0	0	0	0	0
CT	0	0	0	0	0	0	1	0	0	0	5DAYS	1	0	0	0	0	0
CT	1	0	0	0	0	0	1	1	1	0	10DAYS	1	1	0	1	0	0
CT	0	0	0	0	0	0	0	0	0	0	2DAYS	0	0	0	0	0	0
CT	0	0	1	1	0	0	0	0	0	0	20DAYS	1	1	0	0	0	0
NA	0	0	0	0	0	0	1	0	0	0	6DAYS		1	0	0	0	0
CT	1	1	1	1	0	0	1	1	0	0	1DAY	2	1	0	0	NA	NA
ct	0	0	0	0	0	0	1	1	0	0	8days	1	0	0	1	0	0
na	0	0	0	0	0	0	0	0	0	0	1day	1	0	0	0	0	0
CT, XRAY	0	0	0	0	0	0	1	1	0	0	7DAY	1	1	1(sev depression)	1	0	0
na	0	0	0	0	0	0	0	0	0	0	1day	1	0	0	0	0	0
ct	0	1	0	0	0	0	1	0	0	0	5days	1	0	0	0	0	0
ct,xray	0	0	0	0	0	1	1	0	0	0	2days	3	1	0	0	0	NA

imaging	imaging findings			other injuries			management details				duration of hospital stay	discharged/death/referred	substance influence	psychiatric disease	decannulation postop	postop complication	post op voice
ct	0	0	0	0	0	0	1	0	0	0	2day	1	1	0	0	0	0
ct brain	0	0	1	1	0	0	0	0	0	0	4days	1	0	0	0	0	0
CT	0	0	0	0	0	0	0	0	0	0	2DAY	1	1	0	0	0	0
ct	0	0	0	0	0	0	1	1	0	0	9days	1	0	0	1	0	0
usg neck	0	0	0	0	0	0	0	0	0	0	6days	1	1	0	0	0	0
na	0	0	0	0	0	0	0	0	0	0	3day	1	0	0	0	0	0
																	0