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A study of deep space infections of neck

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ABSTRACT

Background: The objective of the study was to analyse the signs and symptoms, etiology, site and outcome of deep space infections of neck.
Methods: This was retrospective study and included 50 patients admitted with deep neck space infections to Government Mc Gann teaching hospital SIMS, Shimoga, Karnataka, India between January 2009 – January 2015.
Results: The extreme age group, high virulence of organism, underlying clinical conditions, low socioeconomic groups are vulnerable for above infections. Mortality in 3 cases was due to mediastinitis and extended space infection.
Conclusions: Deep neck space infection is still a challenging disease in otorhinolaryngology. Early surgical drainage remains the main method of treating deep neck abscesses and conservative medical treatment are effective in selective cases that have minimal cellulitis.

Keywords: Deep neck spaces infection, Morbidity, Life risk, Incision & drainage, Culture of pus, Antibiotic therapy

INTRODUCTION

Deep neck space infections involve fascial planes and spaces of the head and neck. These infections are relatively common and can result significant morbidity and potential mortality.[1,2] This concept has been recognized since antiquity as even Hippocrates have drawn attention to it. In 1836, Wilhelm Fredrick Von Ludwig described a disease process of infection which was almost always fatal. Traditionally, surgical incision and drainage with antibiotics as per culture and sensitivity reports has been the mainstay of treatment. However, incision and exploration occasionally risks the patient to potential injury to neurovascular bundle and a cosmetically undesirable scar.[15] Before knowing the details one should have thorough anatomical knowledge of the deep neck spaces of head and neck as discussed below.[3,4]

Cervical fascia

Fascial planes divide the neck into potential spaces. The two main fascial divisions of the neck are the superficial cervical fascia and deep cervical fascia. Deep cervical fascia is again divided in to an investing layer, pretracheal fascia and prevertebral fascia. The superficial fascia is just beneath the dermis and covers platysma and muscles of the expression.

Deep fascia

Investing (superficial) layer

Superiorly attached to the nuchal bone, over the mastoid process along the entire length of base of mandible. Inferiorly along trapezius and sternocleidomastoid, it is attached to the acromion, clavicle & manubrium sterni, fusing with their periosteum.

Pretracheal fascia

Superiorly attached to the hyoid bone, inferiorly continues into the superior mediastinum along the great vessels and merges with fibrous pericardium. Laterally it merges with the investing layer of deep fascia and carotid sheath.

Prevertebral fascia

It covers the anterior vertebral muscles and extends laterally on scaleneus anterior, scaleneus medius and levator scapulae forming a fascial floor for the posterior triangle of the neck. The prevertebral fascia is particularly prominent in front of the vertebral column, where there may be two distinct layers of fascia. The space created by splitting of the anterior pre vertebral fascia, the danger space is a part of the pre vertebral space. Superiorly it is attached to the base of skull. Inferiorly it descends in front of the longus colli into the superior mediastinum, where it blends with the anterior longitudinal ligament and buccopharyngeal fascia by a loose areolar zone. Anteriorly the prevertebral fascia is separated from the pharynx and its covering the retropharyngeal space.

Neck spaces

Para pharyngeal space

Also called lateral pharyngeal or pharyngomaxillary space, it is an inverted pyramid with its superior base at the skull base and inferior apex at the junction of the posterior belly of digastric and greater cornu of hyoid bone. The pterygomandibular raphae and medial pterygoid muscles bound the space anteriorly, while the vertebral fascia bounds it posterirly.

Submandibular and sublingual spaces

These spaces functionally comprise a single space. The mucosa of the floor of the mouth forms superior boundary of the submandibular space, and the digastric muscle and hyoid bone form the inferior. Anteriorly the mylohyoid space, with the posterior belly of digastric bound the submandibular space, with the posterior belly of digastric and stylomandibular ligament serving as its posterior borders. The mylohyoid muscle divides the submandibular space into a superior sublingual compartment & inferior submaxillary compartment.[5]

Retropharyngeal space

It extends from the skull base to mediastinum at the tracheal bifurcation and is a potential space between the middle and deep layers of deep cervical fascia. The space lies anterior to the alar fascia and posterior to the buccopharyngeal fascia of the middle layer, which lines the posterior pharynx and esophagus.

Danger space

It is so named because of the potential for rapid inferior spread of infection to the posterior mediastinum through its loose areolar tissue, extends from skull base to the diaphragm. This potential space lies between the retropharyngeal and pre vertebral spaces. The alar layer forms its anterior border; the pre vertebral layer forms its posterior border. Laterally transverse processes of the vertebrae enclose the danger space.

Masticator space

The superficial layers of deep cervical fascia define this space upon splitting at the inferior border of the mandible to cover the medial pterygoid and masseter muscles. The fascia continues superiorly to cover the inferior tendon of temporalis muscle and incorporate with superior temporalis fascia. It contains the mandible and muscles of mastication, third portion of trigeminal nerve, internal maxillary artery and much of the buccal pad of fat.

Peritonsillar space

It contains of loose connective tissue between the capsule of the palatine tonsil and superior constrictor muscle. The anterior and posterior tonsillar pillars contribute its anterior and posterior borders respectively.

Pre-vertebral space

This space is enclosed by pre vertebral fascia, vertebral bodies and transverse processes and it extends from the clivus of the skull base to the coccyx. It is a compact potential space that contains dense areolar tissue and lies posterior to the danger space.

Parotid space

The superficial layer of deep cervical fascia forms the parotid space as it splits to enclose the parotid gland. However the fascia which does not enclose the superomedial aspect of the gland permits communication with the prestyloid compartment of parapharyngeal space.

Carotid space

The carotid or the visceral vascular space is the potential space within the carotid sheath containing the carotid artery, internal jugular vein, vagus nerve and sympathetic plexus.

Anterior visceral space

The visceral division of the middle layer of deep cervical fascia encloses the anterior visceral space or the pretracheal space, which lies immediately anterior to the trachea. It extends from the thyroid cartilage to the superior mediastinum. It contains the pharynx, larynx, trachea, esophagus and thyroid gland.

METHODS

Patients who attended to department of ENT Government, Mc Gann teaching hospital SIMS, Shimoga with signs and symptoms as shown in Table 1 were

included in the study. Clear cut cases of peritonsilar abscesses, deep neck space infections confined to dentoalveolar space and abscess due to fractures were excluded from the study.

It is a retrospective type of study from January 2009 to January 2015 which includes 50 patients. Institutional ethical committee clearance is obtained for the study.

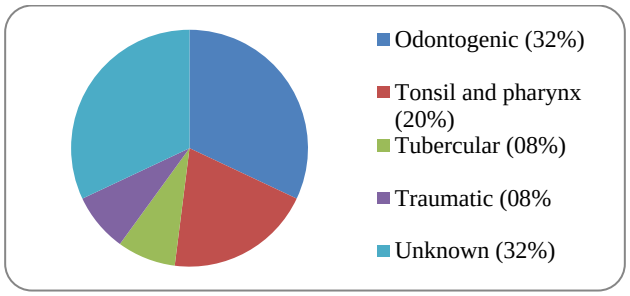

Figure 1: Etiology of neck space abscesses.

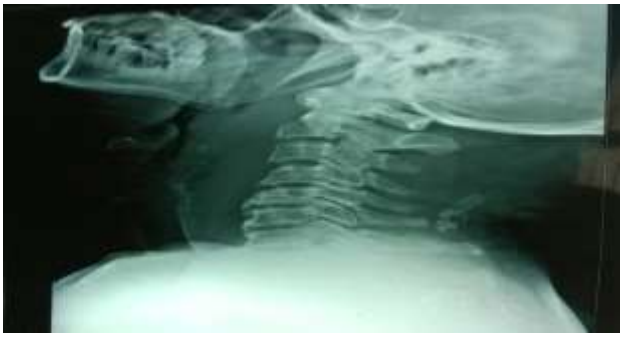

Figure 2: X-ray retropharyngeal abscess.

Figure 3: Extended neck space abscess.

Figure 4: Parotid abscess.

Figure 5: Neck abscess with facial paralysis.

Table 1: Signs and symptoms.

Signs and symptoms	No. of patients	%
Pain and swelling in the neck	50	100
Fever	50	100
Dysphagia and odynophagia	46	92
Toothache and extraction if any	16	32
Trismus	8	16
Double tongue sign and mouth floor swelling	8	16
Loss of skin tissue due to necrosis	2	4
Stridor	2	4
Toxemia and systemic presentation	3	6

RESULTS

A total of 50 patients participated in the study of which 27 were women and 23 were men. Their ages ranged from 2 years to 84 years. Among them 25 patients were less than 10 years and above 70 years as shown in Figure 6 and 7. Majority of them were poor and low socioeconomic group.[10,11] The involved spaces were diagnosed by clinical and radiological methods such as CT scan and USG whenever required. Involvement of submandibular space (Ludwig's angina) and parapharyngeal space abscess was 16 patients (32%) in each and the remaining results are as shown in Table 2.

Table 2: Site of involvement in deep neck space.

Space	Number	Percentage
Submandibular space	16	32
Parapharyngeal space	16	32
Retropharyngeal space	6	12
Parotid space	5	10
Mediastinum space	2	4
Branchial cyst abscess	2	4
Extended spaces infection (2 or more spaces concurrently involved)	3	6%

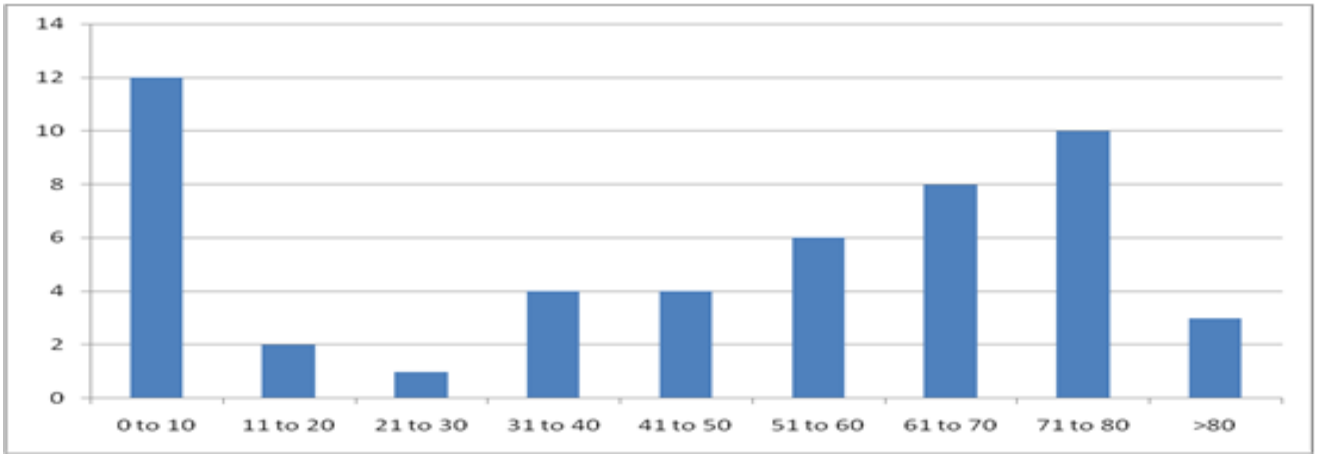

Figure 6: Distribution according to age.

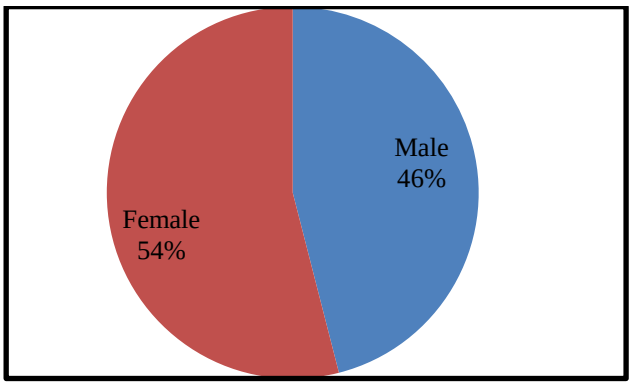

Figure 7: Distribution according to sex.

The common cause for deep neck space infection in our study was due to odontogenic origin was identified in 16 cases (32%) and tonsilopharyngeal focus in 10 cases (20%), unknown causes in 16 cases (32%) as shown in Figure 2. However, we diagnosed 4 cases of tubercular etiology involving 3 retropharnygeal spaces and other was with parapharyngeal space. 4 cases of traumatic abscess were noted, and one patient had impacted chicken bone developed tension pneumothorax later on managed by bilateral intracostel drainage by general surgeon colleague. Other cases were due to spread of infection secondary to unhygienic beard shaving. 16 patients were diagnosed having underlying systemic diseases. Among them 12 patients with uncontrolled diabetes mellitus type-II, 3 patients with HIV-I & II reactive and 2 patient with HBsAg positive.[12,13] 2 patients had respiratory compromise which improved following treatment and 1 patient required tracheostomy and airway management.

The pus collection was sent to bacteriological study, of which 26 of them didn't show any yield and 24 patients showed the growth. We encountered few complicated patient, among them 2 patients had skin loss due to necrosis of overlying skin and 1 case of dental sinus. 3 patients with toxemia died between 1-10 days of admission due to varied reasons as shown in Table-3.

Table 3: Mortality details due to varied reasons.

No.	Age (years) /sex	Extended space involvement	DM type-II	Protein energy malnutrition
1	62 years/M	+	+	-
2	68 years/M	+	+	-
3	77 years/F	+	+	+

DISCUSSION

Deep neck space infections call for early diagnosis and prompt management. Pus in the neck calls for the surgeon's best judgment, his best skill and often for all his courage- Mosher (1929). In the preantibiotic era majority of deep neck space infections resulted from pharyngeal and tonsillar infection. In the post antibiotic era an increasing incidence is observed from odontogenic origin.

The other causes include upper respiratory tract infection, sialadenitis, Bezold's abscess, trauma, foreign body impaction (fish bone, chicken bone, etc), tuberculosis and rarely, congenital lesions like branchial cyst. Many a times the cause of infection remains obscure perhaps because the infectious foci had been resolved at the time of presentation.[6]

In the present study we had 16 cases (32%), in whom the causes were not detected. Infection due to dental cause was observed in 16 cases (32%). This is in similarity with Parhiscar et al.[7] The submandibular and parapharyngeal space involvement was observed in 32 patients (64%). Retropharyngeal space abscess in 6 cases (12%), parotid space in 5 cases (10%) and 3 patient (6%) with multiple spaces abscesses (extended space infection) were noted. Patients with these conditions are more vulnerable to undergo complications like septicemia, descending necrotizing mediastinitis (Lincoln's highway" Mosher-1929), jugular vein thrombosis, venous septic emboli, carotid artery rupture, disseminated intravascular coagulation and adult respiratory distress syndrome.[8,14]

CT scan, X-ray chest PA view, X-ray neck (retropharyngeal abscess) and blood tests to evaluate diabetes, uremia, chronic liver and renal failure and malignancies were carried out whenever required.[7,9] In recent years, CT is the most widely used imaging procedure. Intravenous contrast may help to identify an abscess as a "rim enhancing lesion" with a low density center. Cellulitis is defined as soft tissue swelling with obliteration of regional fat planes and it is been reported to have sensitivity of 91% and specificity of 60% for detection of head and neck abscess.

Aggressive intravenous antibiotic administration is the cornerstone of therapy. Anaerobic cover with metronidazole should be provided followed by hydration correction, analgesics and antipyretics. 5 cases (10%) of parotid abscesses were successfully managed.

Surginal drainage is indicated as early as possible. Various neck incision have been described for different abscesses thus preventing the need for tracheostomy and airway management.[15] The incision should be wide to access the abscess cavity with good control of adjacent neurovascular structures. Blunt dissection should be done to avoid injury to pharyngeal wall. Regular toileting of the wound and dressing should be done.

Mortality rate was high around 54% before second world war, however reduced to 4% nowadays due to advanced technology, antibiotic and protocol management.[16] In the present study, it was observed that the mortality rate was 6%.

The pus usually yielded mixed microbiological flora including *Streptococci*, *Staphylococci*, *Peptostreptococci*, *Bacteroids oralis*. 52% did not grow any culture results may be due to liberal use of high dose of antibiotics before surgical drainage of the abscess.

CONCLUSION

Deep neck space infection is still a challenging disease in otorhinolaryngology. Odontogenic and tonsillar causes are the most common. Submandibular and parapharyngeal spaces are most frequently involved. Patients with diabetes mellitus, elderly age group, immunological derangement, highly virulent organisms are the precipitating factors. Early surgical drainage remains the main method of treating deep neck abscesses and conservative medical treatment are effective in selective cases that have minimal cellulitis. In the extended space abscess, retropharyngeal space abscess and Ludwig's angina, we should consider for airway management as well. Mortality is known in spite of best treatment due to varied reasons, hence informed consent may be obtained to overcome the litigations. The authors suggests the future researchers to carry out similar studies with a large number of samples for long duration with improvised approach towards culture and sensitivity, current battery of diagnostic tools, adequate usage of ventilator and emergency medicine services which may help in improvising the approach and results towards mankind.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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