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Original Research Article

Deep Neck Space Infection: A Clinical Study and Review of Literature

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Abstract: A study of 101 cases of deep neck space infection in period of two and half years. In DNSI included Ludwig's angina, Para pharyngeal abscess, retropharyngeal abscess, Peritonsllar abscess, Cervical necrotizing fasciitis and parotid abscess. Common etiology is dental pathology in most of cases. Tender swelling with fluctuation was main sign in most of cases but in CNF discolouration of skin overlying the swelling and fluctuation. Most of culture was sterile. 92% were managed by medical and surgical treatment. In surgical treatment include incision and drainage, tracheostomy, surgical debridement and reconstruction. Antibiotic therapy included cephalosporin, amino glycoside and metronidazole in most of cases. CNF was associated with DM, immunocompromised, steroid therapy taking patients, severe anaemia, pulmonary tuberculosis and old age and it was very severe condition. It requires skilled treatment with control of past disease.
Keywords: DNSI, CNF, Peritonsllar abscess

INTRODUCTION:

An intimate knowledge of the management of infections of the deep spaces of the neck is essential to the daily practice of ENT Surgeon. Decisions must be made in a timely fashion through the acute course of the disease. Interventions must be performed with the appropriate surgical and airway skill. The surgeon must decide on medical and surgical management, that includes antibiotic selection ,how to employ supportive rescusitative care such as fluids and nutrition and when to operate. To make these decisions the surgeon must understand the anatomy of the region, the etiology of infection, appropriate diagnostic workup, and medical and surgical management.

Deep neck space infection (DNSI) occurs in potential spaces between the folds of deep cervical fascia. These infections continue to be seen despite the wide use of antibiotics. Although frequency of deep neck space infections may have declined, these infections are nevertheless associated with significant morbidity, mortality and sometimes life threatening, even in the era of antibiotics [23]. Failure to recognize DNSI early may be due to altered clinical picture resulting from the use of inappropriate antibiotics and changing bacteriological pattern [1].Further presentations may be atypical in immunocompromised patients, diabetic mellitus, tuberculosis, tuberculosis& IV drug abusers, who are prone to infections with uncommon organisms. The anatomical proximity of the cervical fascial spaces to common sites of infections in the head and neck make them vulnerable during upper respiratory infections tooth infections before antibiotics, originated in pharynx and tonsil. Since the advent of antibiotics the oropharyngeal infections are no longer a significant etiological factor [2], dental infection and regional trauma are now more common cause.

The common clinical features include swelling in neck, pain tenderness, fever, dysphagia, respiratory distress and signs of toxemia. Sometimes neck space infection may even lead to mediastinitis, [3] internal jugular vein thrombosis and brain abscess[4].

The patients are to be closely monitored for impending airway obstruction and septicaemia. The management includes effective antimicrobial therapy and timely surgical intervention. 23].Though the incidence of DNSI has been reported to be decreasing , many papers [3,4,5,6, 7,23,41,] have been published in the recent past . These reports mention the changing trends in bacteriology, diagnostic facility and management, which have some controversies. In view of above reports we have undertaken this study to evaluate the incidence, clinical features, diagnostic aids and management at this institution.

Aims & objectives:

1. To study the incidence and clinical features of Deep neck space infections.
2. To evaluate the modern diagnostic modalities in deep neck space infections.
3. To evaluate the etiology and possible causative organism in Deep neck space infections.
4. To study the management of deep neck space infections and complications encountered

Surgical Anatomy:

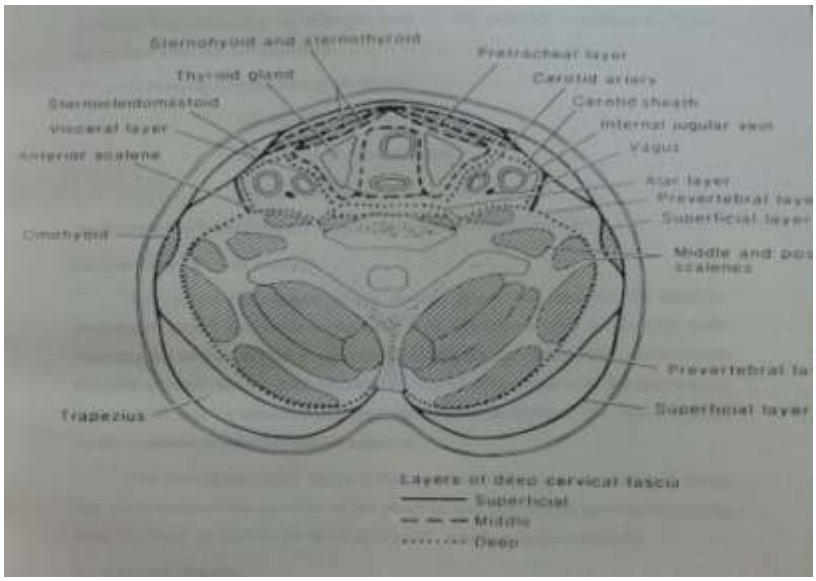


Fig-1: cervical fascia

Facial layers:

An understanding of the anatomy of the cervical fascia is critical in understanding the location of a deep neck infection, in predicting the extent of infection, and in choosing an approach for surgical drainage. The cervical fascia is the fibrous connective tissue that envelops and divides the structures of the neck and creates potential spaces (Fig.1). The cervical fascia is divided into superficial and deep layers. The superficial fascia is immediately deep to the dermis and it ensheathes the platysma as well as the muscles of facial expression, the superficial musculoaponuerotic system (SMAS). It extends from the cranium down to the thorax and axilla. The deep layer is divided into superficial, middle, and deep layers.

The superficial layer of the deep cervical fascia (SLDCF) is an essential structure in understanding deep space infections of the neck. The SLDCF generally forms the outer margin of odontogenic deep space neck infections (DSNI). The tenacity of this fascia prevents the egress of pus toward the skin until neck infections are quite late. The result is that because of the barrier of the SLDCF, infections will expand to the point of descending toward the mediastinum, ascending to the lateral pharynx and masticator spaces, or will expand to the point of causing airway obstruction. Understanding the SLDCF is essential to understanding the pathway of infection.The SLDCF begins posteriorly at the nuchal ridge and spreads laterally and anteriorly, splitting to envelop the trapezius and sternocleidomastoid (SCM). It attaches to the hyoid bone anteriorly.

It envelops both the parotid and submandibular glands. It fuses with the fascia, covering the anterior bellies of the digastric and mylohyoid forming the inferior margin of the submandibular space. At the mandible, the fascia splits and the internal layer covers the medial surface of the pterygoid muscles up to the skull base. The external layer covers the masseter muscle and inserts into the zygomatic arch. Inferiorly, it inserts into the clavicles, sternum, and acromion of the scapula.

The middle layer of the deep cervical fascia (MLDCF) is also known as the pretracheal fascia. It often forms the base of deep space infections of the neck, thus creating a barrier to the extension of infection into the pulmonary, tracheobronchial tree, esophagus, and prevertebral space. It is separated into muscular and the visceral divisions.

The muscular division surrounds the sternothyroid, sternohyoid, and thyrohyoid muscles. The muscular division does not offer important pathways for infection because the attachment is quite rigid, and no potential space is typically present except as it presents abutting the prevertebral fascia. Inferiorly this division also inserts into the clavicle and the sternum. Superiorly it inserts into the hyoid and thyroid

cartilages. Posteriorly it fuses with the alar division of the deep layer of the deep cervical fascial at the level of T2 and forms the anterior wall of the retropharyngeal space.

The visceral layer of the MLDCF envelops the thyroid, trachea, and esophagus. It extends inferiorly into the upper mediastinum and joins the fibrous pericardium. The middle layer also encloses the pharyngeal constrictors and the buccinator muscles. The visceral layer of the MLDCF is the pathway to mediastinitis in the deep space head and neck infection, forming the anterior barrier that must be traversed by advancing infection. To descend, the infection will also disrupt the alar division of the DLDCF, described below.

The deep layer of the deep cervical fascia (DLDCF) separates into a posterior prevertebral division and an anterior alar division. The prevertebral division is adherent to the anterior aspect of the vertebral bodies from the base of theskull down the spine. It extends posteriorly around the spine and the muscles of the deep neck, the vertebral muscles, muscles of the posterior triangle, and the scalene muscles. It envelops the brachial plexus and subclavian vessels, extending laterally into the axillary sheath. The alar division is located between the visceral division of the middle layer and the prevertebral division of the deep layer. The deep layer corresponds to the posterior boundary of the retropharyngeal space, extending down to the level of T2, where it fuses with the visceral fascia. Thus the DLDCF is important in providing the posterior boundary for extension of infection to the mediastinum.

The DLDCF is rarely perforated by infection, but when this occurs, it can result in cervical spine osteomyelitis or epidural abscess following head and neck infection.

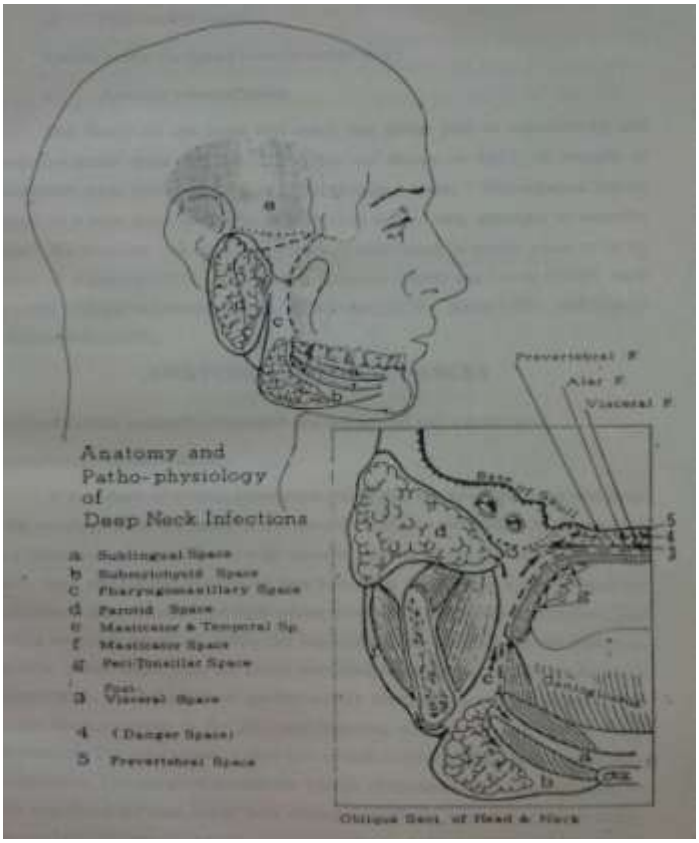


Fig. 2: Fascial Planes

Spaces:

The spaces created by these fascial planes are potential spaces that are useful to consider in understanding the pathway of infection (Fig. 2). They include the lateral pharyngeal, retropharyngeal, submandibular, and pretracheal.

The floor of the mouth and mandible, the superficial layer of deep cervical fascia, and the lateral pharyngeal space bind the submandibular space. This space is divided by the mylohyoid muscle into sublingual and submandibular portions that are continuous posteriorly around the free margin of the muscle. The sublingual portion contains the submandibular duct, lingual nerve, and hypoglossal

nerve, whereas the submandibular portion contains the anterior belly of the digastric. The lateral pharyngeal space is an inverted, cone-shaped potential space that extends from the skull base to the hyoid. The medial border is the buccopharyngeal fascia; the lateral border is the pterygoid muscles and mandible.

Overlying the buccopharyngeal fascia is the superior pharyngeal constrictor muscle, which separates the peritonsillar ‘‘space’’ from the lateral pharyngeal space. The lateral pharyngeal space communicates anteriorly with the submandibular space and posteriorly with the retropharyngeal space. The styloid process and its attached structures divide the lateral pharyngeal space into two compartments; the anterior and posterior. The anterior compartment contains fat and connective tissue, whereas the posterior compartment contains cranial nerves IX, X, XII, the cervical sympathetic chain, the internal jugular vein, and the carotid artery. The retropharyngeal space lies between the middle and deep layers of cervical fascia, and extends from the skull base to the bifurcation of the trachea. There is a midline raphe that is formed by the attachment of the superior constrictor muscle to the alar layer of the deep cervical fascia. This midline raphe separates two chains of lymph nodes that lie within the space. The pretracheal space is located below the hyoid bone and extends inferiorly to the level of the fourth thoracic vertebrae along the arch of the aorta. The pretracheal space has the MLDCF as its anterior border, and is bounded posteriorly by the esophagus.

The infections in these spaces can be direct extensions from other spaces of the head and neck, or from the primary site. Extensions of infections can follow the fascial planes into the mediastinum or the axilla. Of special mention are the so-called ‘‘danger space’’ and the carotid sheath. The danger apace is the area between the alar and prevertebral fascia that extends from the skull base to the diaphragm. The carotid sheath forms a potential space that allows for infection to descend into the mediastinum, whereas infection that rests between the MLDCF and the DLDCFin the retropharyngeal region will create a retropharyngeal abscess that will end at about the tracheoesophageal junction.

METHODOLOY AND RESULTS:

A study of 101 cases of DNSI comprising of Ludwig’s angina, parapharyngeal abscess, cervical necrotizing fasciitis, parotid abscess& retropharyngeal abscess etc, which were presented in the department of otorhinolaryngology and head and neck surgery, NIMS medical college, Jaipur during a period from Jan 2011 to June 2013(Two and half year study)All 101 cases underwent a detailed history, clinical examination, relevant investigations & medical and surgical treatment .DNSI in our study the patients were divided in following group on the basis of sign, symptoms and radiological findings:

1. Ludwig’s angina
2. Peritonsillar abscess
3. Para pharyngeal abscess
4. Cervical necrotizing fasciitis
5. Parotid abscess
6. Retropharyngeal abscess

Table-1: The frequency of various type of DNSI

S.No.	Types of DNSI	No. of cases	Percentage
1	Ludwig’s angina	47	46.53
2	Peritonsillar abscess	28	27.72
3	Para pharyngeal abscess	8	7.92
4	Cervical necrotizing fasciitis	11	10.89
5	Parotid abscess	6	5.94
6	Retropharyngeal abscess	1	0.99
	Total cases	**101**	**100%**

Among this the most common space infection was Ludwig’s angina & the least common was retropharyngeal abscess. Male : female ratio was 3:2, incidence of female was higher in 21-40 year of age group .According to the religion the maximum number of patients were hindus 89(88.11%)& 12 cases (11.89%) were Muslims. Major etiology responsible for DNSI was odontogenic (50.5% cases) followed by upper respiratory tract infections (33.66% cases) and idiopathic in (15.84% cases). Dental pathology (51cases) includes 47 cases of dental caries & rest 4 periodontitis. Among this the most common odotogenic focus was mandibular 2nd molar in 44 cases(86.27%) out of 51 cases .Rt side and left sided lower molar involvement ratio was 3: 2

Table-2: Distribution according to etiology in different types of DNSI

S.No.	Etiology	DNSI =101	L.A N=47	P.A. N=28	CNF N=11	PPA N=8	Parotid.A N=6	RPA N=1
1	Odontogenic	51	40	0	9	2	0	0
2	URTI	34	5	25	0	0	3	1
3	Idiopathic	16	2	3	2	6	3	0

Odontogenic etiology was the main reason in Ludwig's angina (85.2% cases) and CNF (81.81%), whereas upper respiratory tract infection was a main etiology in peritonsillar abscess(89.25% cases) and retropharyngeal abscess (100%) . parapharyngeal abscess cases (75%) were reported with idiopathic etiology.

It was observed that maximum number of patients gave a history of pain (100%), fever (100%), swelling (96.03%) and odynophagia (91.08%). Toothache was complained mainly in Ludwig's angina (85.2% cases) & CNF (81.81% cases). Trismus was complained in parotid abscess (66.6%), CNF (63.63%) and parapharyngeal abscess (62.5%) cases.

In our study it was observed that tender swelling was the most common sign. While fluctuation was present in 62.37% cases. Observed oropharyngeal abnormality, dental pathology and laryngopharyngeal abnormality is 74.25%, 50.50% and 16.83% cases respectively.

Indirect laryngoscopy was possible only in 26 cases (25.74%). In remaining 75 cases (74.25%) IDL could not be done because of marked trismus, bulge in floor of mouth and peritonsillar area. In difficult IDL cases , telescopic examination was tried which was successfully carried out in 65 cases (64.36% of total cases).telescopic examination was not done in remaining 10 cases due to bulge in posterior third tongue, epiglottis edema , poor general condition & non cooperative patients. Telescopic examination was done through nasopharynx or oropharynx by approach through oral cavity or nostril respectively.

Most common finding in aero digestive tract were bulge in floor of mouth (44.55%). Supraglottic edema was found in 10 cases (9.90%) out of them 4 cases were associated with stridor.

Table-3: physical examination in different type of DNSI

S.No	Signs	L.A. N=47	PTA N=28	CNF N=11	PPA N=8	PA N=6	RPA N=1
1	Tender swelling	47	25	11	8	6	0
2	Fluctuation/Crepetation	44	0	10	6	3	0
3	Bulge in FOM	45	0	0	0	0	0
4	Peritonsillar bulge	0	28	0	0	0	0
5	Dental pathology	40	0	9	2	0	0
6	Laryngopharyngeal abnormality	6	0	4	6	0	1
7	Hyperemia & skin edema	0	0	11	0	0	0
8	Discoloration of overlying skin	0	0	9	0	0	0

Acronyms: L.A= Ludwig's angina, PTA = Peritonsillar abscess, CNF=Cervical necrotizing fasciitis,PPA=Para pharyngeal abscess, PA=Parotid abscess, RPA = Retropharyngeal abscess
FOM= Floor of mouth

In our study, anemia (Hb less than 10gm %) was found in 77.22% cases of DNSI. Polymorphonuclear lymphocytosis was found in 87.12% cases of DNSI, in which 7.92% cases were having counts more than 20,000 per cumm.

Albuminuria was detected in 71.28% cases of DNSI with 100% incidence in CNF cases. 1 patients of CNF with diabetic mellitus showed presence of urine sugar +4 on admissions.X-ray soft tissue neck lateral view, AP view was carried out as routine investigations in all cases to find the specific space involvement. Dental X-ray was carried out in 50.50% cases; CT scan was done in 13.86% cases.

Most common findings in X-ray soft tissue neck lateral view was edema of suprahyoid region(50.50%) in Ludwig's angina and retropharyngeal edema with gas shadow was consistent finding of all cases of CNF. CT scan neck & thorax is

carried out in 14 cases which included 6 cases of CNF, 5 cases of PPA & 3 cases of Ludwig's angina with suspected mediastinal extension.

Culture and staining reports revealed that AFB staining was negative in all cases. Gram's staining bacilli 8% cases. Aerobic culture was positive in 22% cases. Remaining 78% of cases may have had either positive and negative anaerobic or no bacteria. In aerobic culture the most common bacteria was staphylococcus aureus in 14% cases and in remaining cases streptococcus pyogen 4% cases, klebsiella in 2% and pseudomonas in 2% were cultured.

Only 7 cases were completely cured by medical management without any surgical intervention. 82.17% required incision and drainage while 10.89% cases required incision drainage & wound debridement. Tracheostomy was carried out in 8.91% cases and reconstructive surgery in 8.91% cases. Reconstructive surgery was carried out 9 cases of CNF by split thickness skin grafting(8 cases) and forehead full thickness rotation flap with split skin graft(1 case) . Forehead full thickness rotation graft was used in 1 case because this case was having or ocutaneous fistula and exposed parotid duct. Remaining skin defect was covered with split skin graft. Created skin defect was covered with split skin graft.

In our study, 11 cases (10.89%) had associated with comorbidity. Most common was the old age (3.96%). One case had active pulmonary tuberculosis. 1 case was having history of old MI; he died during hospitalization for CNF after re-attack of MI.

We encountered little complication in our study. For example Transverse superior mediastinotomy with negative suction drainage was done in 3 cases for drainage of mediastinal abscess which extended from case of Ludwig's angina & remaining two cases of mediastinitis of CNF were cured by antibiotic therapy. Pneumonia & empyema were cured by antibiotic therapy. Septicaemia was managed by addition of broad spectrum antibiotic, blood transfusion and iv fluids. Acute renal failure caused electrolyte imbalance was corrected and managed by antibiotic therapy. Mortality rate of DNSI IS 0.99% (1/101 case) and in relation to CNF IS 9.09% (1/11 case).

Table 4: Follow up (50 cases) up to 6 month to 2 year

S NO	Type of complication	DNSI N=50	Ludwig 's angina	Peritonsillar abscess	CNF	Para pharyngeal abscess	Parotid abscess	Retropharyngeal abscess
1	Contracture of neck	2	0	0	2	0	0	0
2	Restricted mouth opening	5	0	0	5	0	0	0
3	Recurrence of DNSI	3	0	2	1	0	0	0
	Total	10 (20%)	0	2 (4%)	8 (16%)	0	0	0

During follow up period 2 patients had mild neck contracture, 5 patients had restricted mouth opening and 3 patients developed reattack of deep neck space infections.

Photograph after six months of split skin grafting Showing mild skin contracture [PHOTO 1]

Photograph after two years of split skin grafting in a case of CNF [PHOTO 2]

Photograph showing discolouration and Dehiscence of skin [PHOTO 3]

Photograph after one month of split skin Graft [PHOTO 4]

An advance case of Ludwig"s angina involving submandibular Region extending to post aural regions. Corrugated rubber drain in situ from submental to post aural region. [PHOTO 5]

Photograph showing submental and left submandibular Incisaion with in situ Corrugated rubber drain (Ludwig"s angina) [PHOTO 6]

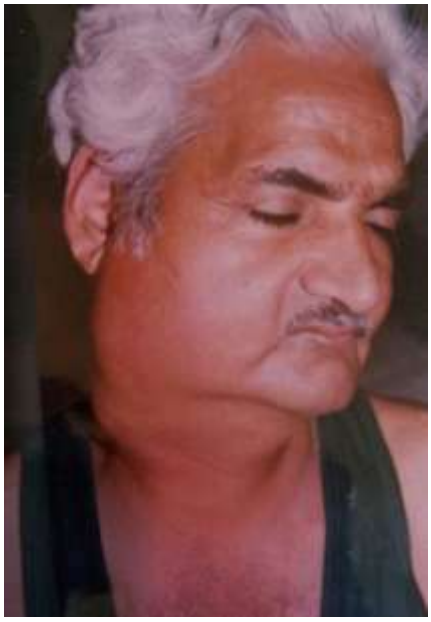
Photograph showing healthy ulcer over cheek and upper neck with orocutaneous fistula and In situ (a case of CNF associate with tuberculosis) [PHOTO 7]

Phograph of same patient showing forehead Full thickness rotation graft After two month of forhead full thickness graft [PHOTO 8&9]

Photograph showing extensive discolouration of skin with tissue necrosis (a diabetic patient) [PHOTO 10]

Photograph showing split skin grafting over chest [PHOTO 11]

Photograph showing healing and granulation and Photograph showing after 7 days of split skin graft [PHOTO 12&13]



Photograph showing swelling over angle of mandible and upper part of neck with redness of skin –a case of parapharyngeal abscess [PHOTO 14]

Trecheostomised patient of CNF [PHOTO 15]

CT Scan neck at the level of hyoid bone showing multiple air pockets and tissue edema with distortion of fascial planes [PHOTO 16]

CT Scan lower neck showing extensive soft tissue edemaand small abscess anterior to trachea on left side [PHOTO 17]

CT Scan neck showing air pockets in soft tissue with edema and compressing the larynx [PHOTO 18]

CT Scan lower neck showing air collection in soft tissue with edema anterior to trachea(mediastinitis) [PHOTO 19]

X-ray soft tissue neck lateral view showing soft tissue swelling with air bubbles and edema of epiglotis [PHOTO 20]

DISCUSSION:

Our study is based on 101 patients of deep neck space infections (DNSI) admitted in department of otorhinolaryngology and head and neck surgery , NIMS medical college , Jaipur during a period from Jan 2011 to June 2013.. The incidence of deep neck space infections in relation to indoor patients of ENT department has been observed 3.51%. This incidence is very high as compared to other similar English literatures as shown in the following table-5:

Table-5: Literatures on deep neck space infections (DNSI) studies

S.No	Author's name	Diagnosis	No. of patients	Study period
1	Tom & Rice [5]	DNSI	51	March 1981 to Feb 1987
2	Sethi& Stanley [23]	DNSI	64	Jan 1983 to April 1992
3	Patterson *et al.*[4]	Ludwig's angina	20	Jan 1963 to July 1980
4	Tovi *et al.* [3]	CNF	15	1979 to 1989
5	Kantu & Har *et al.;* [7]	CNF	8	Jan 1985 to June 1995
6	Verghese *et al.;*[18]	Peritonsillar abscess	32	Jan 1995 to Oct 1999
7	Our study	DNSI	101	Jan 2011 to June 2013

In our study Ludwig's angina constituted 46.53% cases, other authors reported the lower incidence of Ludwig's angina as compared to our study. Higher incidence in the present study may be because of poor dental hygiene, inadequate or improper treatment of carious tooth, illiteracy & ignorance of the possible complications of dental pathology and inadequate medical facility especially in the rural areas.

Higher incidence of CNF in present study is because of comorbidity factors like old age, anaemia, poor nutrition, rheumatoid arthritis with steroid drug therapy and poor dental hygiene. Lower incidence of retropharyngeal abcess in present study (0.99%) as compare to above mention study. As trauma by impacted foreign body especially fish bone are the main etiology factor for retropharyngeal abscess, none of patient in present study is used to take fish bone as a diet.

Table-6: incidence of involvement of space/categories as repoted by various authors

Name of authors	Total no of cases	Ludwig's angina	Peritonsillar abscess	CNF	Para Ph. abscess	Parotid abcess	Retro pharyngeal abscess	Others
Tom & Rice [5]	51	13 (26%)	-	-	9 (18%)	1 (2%)	5 (10%)	38
Sethi& Stanley [23]	64	19 (29.6%)	0	6 (9.36%)	10 (15.62%)	0	29 (45.24%)	0
El – Sayed & Dousary [33]	19	5 (25%)	0	0	4 (20%)	0	3 (15%)	7 (35%)
Kim *et. al* [6]	44	18	0	0	18	0	0	29
Sakaguchi *et al* [41]	91	7 (7.5%)	72 (80%)	-	8 (9%)	0	1 (1%)	3 (4%)
Present study	101	47 (46.53%)	28 (27.72%)	11 (10.89%)	8 (7.92%)	6 (5.94%)	1 (0.99%)	-

In present study patients ages ranged from 3 years to 77 years (mean age 29.9 year) ,maximum number of deep neck space infections cases nearly 60% are observed between 21-40 years of age. Tom & Rice [5] also had similar observations (ages ranged 5 month to 60 years and mean age 29.6 years). However Sethi & Stanley [23] reported higher mean age (45.5 years, age ranged from 3 year to 87 years) as compare to present study. This may be due to occurance of dental pathology at an early age & lower average life expectancy in patients of study group. In present study as regard the sex incidence the male – female ratio has been observed to be 3:2. Tom & Rice [5] and Sethi & Stanley [23] have reported this ratio as 1.8:1 and 1.2:1 respectively. These figures are near comparable present study.

In present study 88.11% patients were Hindu and rest was Muslims. This is comparable to Hindu and Muslims population composition of this region. Hence the presence of deep neck space infections is similar to both of religion considering this composition.

Nearly seventy nine percent patients were belonging to rural area. Even considering the rural urban population composition (70:30) in this area, the incidence of DNSI is slightly higher in rural area. This may be because of poor medical facility, ignorance about complications of dental origin, illiteracy & poverty in these patients.

In this study dental pathology has been observed as most common cause (50.50%) of DNSI. Sethi and Stanley [23] have also observed dental pathology as a significant causative factor (31%) in patients of DNSI. However majority of patients (39%) belongs to idiopathic group. As regard the dental pathology in 51 cases of present study group 47 had

dental caries and rest 4 periodontitis. Tom & Rice [5] had observed intravenous drug abuse as the main etiology factor.

In ludwig'angina, Dental etiology was main causative factor in 85% cases. Patterson *et al.*[4] and Sethi & Stanley [23] has also observed dental etiology in Ludwig's angina patients as 85% and 90% respectively. Dental etiology for Ludwig's angina has been established for more than a century.

In CNF (81.81%) cases has dental etiology. Similarly Kantu &Har-el[7] has also reported dental etiology for CNF in 75% cases. However Sethi & Stanley [23] and Tovi *et al.;*[3] had observed dental etiology in 17% and 20% respectively. It is worth to note that nearly 40% cases of DNSI which also included 6 cases of CNF had idiopathic etiology in Sethi & Stanley series[23]. Tovi *et al.;* [3] has observed CNF as a complication of surgery and trauma in head and neck region.

In parapharyngeal abscess 75% cases has unknown etiology despite of detailed history, physical and radiological examination. Sethi & Stanley [23] also had similar observation. (80%). It is possible that initial foci of infection in these patients may have been in oropharynx, and may resolve by the time of presentation. It has observed that parapharyngeal abcess may develop secondary to naso pharyngitis, sinusitis, mastoiditis and infected tooth. They further added the most of time, the true etiology firmly may not establish. As regard the parotid abscess in 3 cases, the possible case was URI and in remaining 3 cases no cause established.

In present series the most common presenting symptoms of DNSI encounter were pain (100%) fever (100%) swelling (96.03%) and odynophagia (91.08%). Tom & Rice[5] and Sethi & Stanly [23] also had similar observations. Neck swelling was a constant feature in cases of Lidwig's angina, parapharyngeal abscess and CNF. Sethi & Stanley [23] also mentioned neck swelling as a significant feature in these conditions.

Toothache was present in 50.50% cases of deep neck space infections. Tom& Rice [5] and Sethi & Stanley [23] reported toothache in lesser number of cases .This may be because of cases composition of different category of deep neck space infections in their series. Similarly trismus was also reported by Tom & Rice [5] (14%) and Sethi & Stanley [23] (34%) in lesser number of cases as compare to present study (50.49%). This may be because of present study reported at advanced stage of disease.

The summary and conclusion of present study were as follows:

- The incidence on deep neck space infections was 3.51% in relation of patients admitted in ENT ward during a period in 2 years
- The different category of deep neck space infections were observed as Ludwig's angina (46.53%) ,peritonsillar abscess(27.7%), cervical necrotizing fasciitis (10.9%), parapharyngeal abscess(7.9%), parotid abscess(5.9%), and retropharyngeal abscess(.99%).
- The maximum number of cases (approximated 60%) were seen in third and fourth decade of life , having mean age 29.9 years.
- The male female ratio in patients of DNSI was 3:2.
- Eighty percent patients were Hindu.
- Seventy nine percent patients belonged to rural area
- In patients on DNSI the odontogenic etiology was seen in 50.50% cases followed by upper respiratory tract infections 33.66% .Dental caries was the most common pathology encountered in odontogenic group. As regard the different category of deep neck space infections the most common etiological actor encountered was odontogenic in Lidwig's angina (85%), and cervical necrotizing fasciitis (82%) and upper respiratory tract in peritonsillar abscess (89%).
- The most common symptoms were pai, fever, swelling, odynophagia, dysphagia, dyspnea. Toothache and trismus. Toothache was the significant presenting symptoms in patients having odontogenic etiology.
- Physical examination revealed tender swelling, dental pathology, oropharyngeal and laryngo pharyngeal abnormality etc. bulge in floor of mouth was the most significant (95.7%) in cases of Ludwig's angina. In cases of cervical necrotizing fasciitis skin discolouration, crepitation and skin dehiscence were important findings.
- In most cases (75%) routine indirect laryngoscopy was not possible so have used 70 degree telescope for examination of upper airways.
- Seventy seven percent cases were anaemic. 79.2% cases were having leucocyte count more than 10,000. Albuminuria was also seen in 71% cases.
- X ray soft tissue neck lateral view was observed as a very helpful diagnostic tool in delineating to air passage. Retropharyngeal widening with gas shadow was seen in approximately 11% cases.X ray chest helped in knowing the extension of deep neck space infections in mediastinum and also gave

information about other lung conditions like mediastinitis/medistinal abscess, empyema, and lung abscess etc. dental x ray revealed periapical radiolucency in most of the cases of odontogenic etiology. C.T. scan was very helpful in cases of mediastinitis/mediastinal abscess, cervical necrotizing fasciitis and parapharyngeal abscess.

- In present study sixty percent cases showed mixed flora on gram's staining, indicating the polymicrobial etiology in deep neck space infections. Majority of culture sample (78%) were sterile. The patients of positive culture revealed staphylococcus aureus as the most common organism.
- The comorbidity condition observed were old age, anemia, pulmonary tuberculosis, steroid therapy, diabetes mellitus and old MI etc.
- Considering the polymicrobial organisms and dental pathology as the chief etiological factors, aggressive antibiotic therapy used in this study included 3rd generation Cephalosporine, Amino glycoside and Metronidazole.
- Regular assessment and maintenance of airway was given the top priority in management and tracheostomy was done in 8.9% cases.
- In 93.06% cases suitable surgical procedure including incision &drainage, incision& debridement and intra oral drainage etc. carried out. In 35.64% cases dental extraction was also done to remove the etiological factor.
- Complication encounter included mediastinitis/mediastinal abscess, pneumonia, septicemia and acute renal failure etc. three cases of mediastinal abscess were drained by transcervical superior mediastinotomy route.
- Nine out of 11 cases of cervical necrotizing fasciitis developed soft tissue skin dehiscence in anterior part of neck, chest and face. In 8 cases split skin graft and in one case forehead full thickness rotation graft were done.
- One case of cervical necrotizing fasciitis in present study develops reattack of MI and expired. In present series overall mortality rate was 0.99%.
- During follow up period 2 patients had mild neck contracture, 5 patients had restricted mouth opening and 3 patients developed reattack of deep neck space infections.

CONCLUSION:

Deep neck space infection (Ludwig's angina, cervical necrotizing fasciitis, peritonsillar abscess, parapharyngeal abscess, parotid abscess and retropharyngeal abscess) is a surgical emergency and frequently encountered in this region. As dental pathology is the main etiological factor, we advocated that the adequate facilities must be established at primary level to treat dental conditions and to improve dental hygiene so as to prevent and minimize this serious entity. Maintenance of adequate airway, aggressive multi drug antibiotic therapy, timely surgical drainage and suitable management of complications may help in reducing the morbidity and mortality of this life threatening entity.

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