Original Research Article

A study on etiology, clinical manifeststions and management of deep neck space infections

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Abstract

Background: Deep neck space infections (DNSI) are serious diseases that involve several spaces in the neck. These are commonly seen in low socioeconomic group with poor oral hygiene, and nutritional disorders. These are bacterial infections originating from the upper aerodigestive tract. The incidence of this disease was relatively high before the advent of antibiotics. Treatment of DNSI includes antibiotic therapy, airway management and surgical intervention. **Aims**: To determine the various etiological, associated risk factors and clinical manifestations in Deep Neck Space Infections. **Materials and methods:** It is a Retrospective study done in 80 Patients diagnosed as Deep Neck Space Infection clinically and radiologically and Undergoing treatment for the same Patients diagnosed with Deep Neck Space Infection clinically and radiologically. **Results:** In this study 50 cases were male and 30 cases were female with a male to female ratio being 1.66 : 1. .The commonest age group was 21— 30 years (32.5%). The commonest site was Ludwigs angina with 19 cases followed by submandibular space infections with 17 cases with swelling has main presenting complaint. In this study 50 cases had dental caries as etiology ; around 18 cases was associated with anaemia. Ultrasound and CECT neck was used as vital imaging techniques. With maximum 25 days and minimum 8 days hospital stay. 61 cases underwent surgical (Incision and Drainage) , 19 cases with medical management. pus culture showed 23 cases with Streptococcus pyogenes followed by 8 cases with Pseudomonas. All cases responded to ceftriaxone and metronidazole combinations with 14 cases with Piperacillin and metronidazole. There were 2 deaths due to impending renal failure. **Conclusions:** Incision and Drainage is the mainstay of surgical treatment with wide exposure and use of betadine solution impregnated wick at the wound site daily. Patient education regarding oral and dental hygiene has to be stressed and Control of diabetes , proper nutrition to prevent deep neck space infections.

Keywords: Deep neck space infections, Incision and Drainage, ceftriaxonE

Introduction

Fascia is a dense connective tissue and neck is draped with layers of fascia with potential spaces between them referred as neck spaces. Deep Neck Space Infections (DNSI) implies infection in the potential spaces either with abscess formation or with cellulitis . Deep neck space infections pose various challenges to the treating surgeon. These infections may rapidly spread in hours and can cause fatal respiratory obstruction and complications. Various spaces may intercommunicate facilitating the spread of the infections. Complex head and neck anatomy often makes their management challenging. It was a serious and life threatening event in the pre antibiotic era. With the availability of current modern imaging techniques, early surgical interventions and use of newer antibiotics the mortality in the present times is reduced. Most head and neck infections are endogenous and a mixed flora of aerobes and anaerobes are often encountered Broad spectrum antibiotics are advocated for treating infections. Hence our aim is to determine the various etiological associated risk factors, clinical manifestations and management in Deep Neck Space Infections.

Materials and methods

It is a Retrospective study done in 80 Patients diagnosed as Deep Neck Space Infection clinically and radiologically and Undergoing treatment for the same in the department of ENT at Mahatma Gandhi Memorial Hospital / Kakatiya Medical College, Warangal. Patients diagnosed with Deep Neck Space Infection clinically and radiologically.

Inclusion Criteria

Patients of all age groups associated comorbidities like diabetes, tuberculosis , HIV infected, those on steroid or chemoradiotherapy;

Exclusion Criteria

Patients not giving consent for surgical intervention when needed in case of stage of abscess; According to the inclusion and exclusion criteria a total of 80 patients were selected in the study. Data was collected on the following variables - Age, sex, duration of stay, symptoms, clinical features, etiology, systemic diseases, addictions, deep neck spaces involved, microbiological agent involved, management, investigations, complications and outcome. All patients who were admitted with deep neck space infection in the department were followed. Their detailed history was taken. Blood , radiological investigations associated complications identified. The first line empirical antibiotics used were noted. Samples of pus that were taken for culture and sensitivity noted. The type of organism involved and the antibiotic sensitivity were followed up ; Details of surgical and medical interventions done studied. The progress of the patient and response to the treatment during the hospital stay evaluated. Management of complications were noted.

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Results

Table-1: Age distribution in present study

Age interval in years	Number of cases	Percentages
0-10	3	3
11-20	15	18.7
21-30	26	32.5
31-40	15	18.7
41-50	5	6.2
51-60	8	10
61-70	4	5
71-80	4	5
>81	-	-

In total 80 cases male are 50(62.4%) and female- 30(37.5%) with ration of m : f ratio- 1.66: 1 thus male had sex predominance in this study. The highest incidence of deep neck space infections were noted in the age group of 21-30 years accounting to 26 cases - 32.5%

Table-2: Site distribution in present study

Spaces /Site	Number of cases	Percentages
Ludwigs (submandibualar space+ sublingual space + submental space)	19	23.7%
submandibular	17	21.2%
Parotid	11	13.7%
peritonsillar	10	12.5%
Canine	7	8.7%
submental	6	7.5%
Buccal	6	7.5%
retropharyngeal	3	3.7%
parapharyngeal	1	1.2%

Ludwigs angina found to be the highest with 19 cases , followed by submandibular space alone, other spaces involved were parotid, peritonsillar , canine, submental buccal, retropharyngeal, parapharyngeal.

Table-3: Clinical Findings in cases

Clinical features	Frequency	Percentage(%)
swelling	75	93.7
Pain	74	92.5
Dysphagia	44	55
fever	33	41.2
Trismus	21	26.2
Discharge from swelling	10	12.5
odynophagia	10	12.5
Hoarseness of voice	1	1.25
Stridor	-	-
Etiology		
Dental Caries	50	62.5
Tonsillitis	20	25
Aerodigestive Trauma	10	12.5
Associated comorbidities		
Anaemia	18	22.5
Diabetes	7	8.75
Tuberculosis	5	6.25
HIV	2	2.5
Chronic kidney disease	2	2.5

Swelling was the most common symptom followed by pain, dysphagia, fever ,trismus, discharge from swelling ,odynophagia. Out of 80 cases – 50 (62.5%) cases had dental infection as etiological agent others –tonsillitis, trauma to lesser extent. Associated comorbidities were – 34 cases (42.5%)out of 80. Out of 80 - 60cases (75%)associated with smoking and alcohol as addictive habits;

Investigations

out of 80 cases 56.2 % - low haemoglobin, 21.8 % - high blood sugar, 14.7% - sputum for AFB positive, 5.8% - retro positive 5.8%- raised renal function test and impaired electrolytes; USG and CT /CECT neck was used as a vital imaging techniques, Hospital stay in present study is Minimum – 8 days Maximum - 25 days

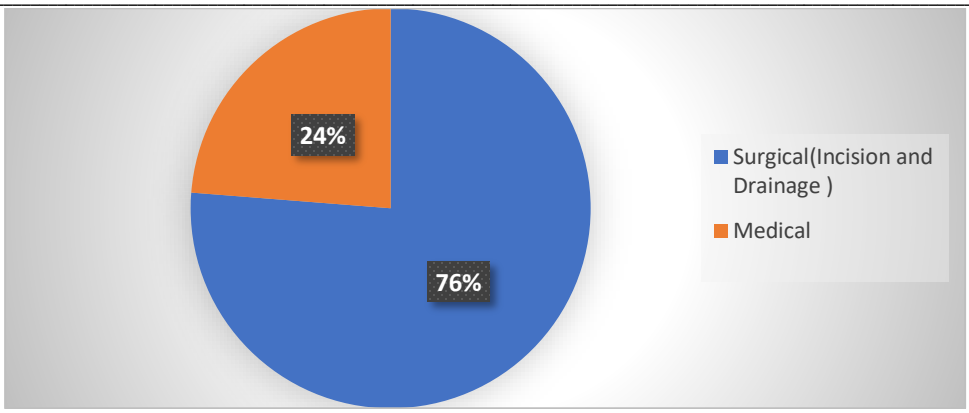

Fig 1: Management of cases in present study

Incision and Drainage of the specific deep neck space was Done .Around 61 cases underwent surgical management

Table-4: Culture and sensitivity of pus in present study

Organism	Number of cases	Percentage
Sterile	23	37.7
Streptococcus pyogenes	23	37.7
Pseudomonas	8	13.1
Bacteroides fragilis	7	11.4

Culture and sensitivity of pus were sent Streptococcus was the most common organism isolated Followed by Pseudomonas, Bacteroides fragilis.

Table -5: Antibiotic and sensitivity of cases in study

Antibiotics	Streptococcus	Bacteroides fragilis	Pseudomonas
ceftriaxone	82.4%	40	50%
metronidazole	72.4%	50%	50%
piperacillin	55%	65%	50%
ampicillin	45%	40%	-
ciprofloxacin	48%	35%	50%
amikacin	40%	43%	-

Majority responded to ceftriaxone and metronidazole .piperacillin in 14 cases

About 6 (33.3%)cases underwent blood transfusion. 7 cases were treated for diabetes, 5 cases started on Anti – tubercular drugs, 2 cases with anti – retroviral drugs, Oral hygiene – encouraged.

Out of 80 cases 78 recovered with treatment and 2(2.5%) deaths due to impending renal failure.

Left Parotid Abscess

Acute Necrotizing Fasciitis

Fig 2: Cases in present study

Discussion

Deep neck space infections are dreadful infections and are still a potentially life threatening condition with considerable mortality even in this era of modern medicine. This is due to delayed presentation of the patient to a tertiary centre and frequent association with fatal complications as a result of close proximity to aerodigestive tract and major vasculature of neck. These are commonly seen in low socioeconomic group with poor oral hygiene and nutritional disorders. There is a rise in the recent past due to reemerging diseases like AIDS and Tuberculosis. With an insight into prevention of these dreadful infections, patient education, oral and dental hygiene has to be strengthened. Management of these infections needs best understanding of neck fascia and anatomy of neck spaces. In this study of 80 cases of Deep neck space infections, 50 males(62.4%) and 30 females(37.5%), the ratio of male to female being 1. 66 : 1 which is slightly higher compared to Paolo and Carlo[1] (Italy) and Sichel and Dano (Israel)[2] studies. According to this study, sex comparison showed a definite male predominance. Huang et al (0.69)[3], Sethi and Stanley (0.83)[4]. These studies also showed a male preponderance. male : female ratio. This study showed male: female ratio as 1.66 : 1. Other studies showed (male:female ratio), Puttamadaiah study[5] as 1 : 1.38, female, Chavada, Payal S. et al. Study[6]- 1.4:1,male, Arun O Study[7] 1 : 1.2, female and Khokle P et al study[8] 2.4 : 1, male which it showed ratio and predominance.

In our study the age distribution ranged from 21yrs to 30years, this is comparable to the study by Paolo and Carlo[1] where the age distribution is 40years to 60 years. According to this study the prevalence of deep neck space infection was high in third decade age group. In comparison to studies by Chen et al (43.2yrs)[9], Wang et al (41.8yrs)[10], Huang et al (49.5yrs)[3], Sethi and Stanley (45.5yrs)[2]. In this study age is 21 – 30 years is 32.5%- third decade. Other studies age distribution was Puttamadaiah study[5] 30-40 years, Chavada, Payal S. et al[6] study 21- 40 years Arun O Study[7] 40-50 years and Khokle P et al study[8] - 30- 50 years

This study showed Ludwigs Angina (32%) as the commonest type of DNSI, which is in similarity with Paolo and Carlo[1] study unlike other studies like Sichel and Dano[2] study Israel, Lyudmila and Boyanova of Bulgaria which showed Peritonsillar infections as the commonest and this was the 5 th commonest infection in our study.

According to the radiological and clinical findings 19 (23.7%)patients had involvement of the ludwigs angina ,in 17 patients (21.2%), followed by the parotid space in 11 patients (13.7%) and the peritonsillar space in 7 patients (8.7%). This differed in comparison with various studies as Puttamadaiah study[5], ludwigs angina Chavada, Payal S. et al study[6] ludwigs angina . Arun O Study[7] peritonsillar abscess Khokle P et al study[8] submandibular abscess

According to Paolo and Carlo study, odontogenic was the most common causes of DNSI and 27% were without any etiological reason. According to Huang et al impacted foreign body cause was the common etiology. odontogenic cause was the third most common etiology. In this study in 30 cases cause could not be found and labelled as idiopathic .

Rest of the 50 cases had a etiological factor as odontogenic infections, predominantly predisposing to Ludwigs and Submandibular space infections. Followed by tonsillitis and trauma. Other studies showed Puttamadaiah study[5], Chavada, Payal S. et al. Study[6], Arun O Study[7] showed dental caries as etiology.

Common presenting complaint was swelling, pain , dysphagia ,fever , trismus, discharge from swelling and odynophagia. Presenting complaints varied according to the space involved in different studies. In this study – swelling , fever and trismus was most common

symptoms ,since ludwigs Angina was common deep neck space infections ;
other studies as Puttamadaiah study[5] swelling , fever and trismus, Chavada, Payal S. et al. Study[6] swelling, fever and trismus, Arun O study[7] - sorethroat , dysphagia, odynophagia , fever . Khokle P et al study[8] swelling , fever and trismus. In Paolo and Carlo[1] study ,hoarseness of voice was the symptom and patient had stridor in 5 cases. In this study no cases of hoarseness of voice or stridor seen.
According to study conducted by Huang et al [3] diabetes mellitus was reported as the most common risk factor to be associated with deep neck infections. Among the 15 cases , 12 were diabetic , The incidence of complications was more with diabetics compared to non diabetics. In Paolo and Carlo study[1] diabetes as comorbidity. In this study anemia accounted for 18 cases (52.9%) Diabetes 7cases (20.5%) , Tuberculosis 5 cases (14.7%) HIV 2 cases(5.8%) , Chronic kidney disease 2 cases(5.8%) Other studies as Puttamadaiah study[5] , Chavada, Payal S. et al. Study[6] , Arun O study[7] , Khokle P et al study[8] showed diabetes.
According to Paolo and Carlo[1] study, 26 patients (53%) had addictions ,23 patients had no addictions. Most of them were smokers. In this study 60 cases (75%) associated with smoking and alcohol as addictive habits. Other studies as Puttamadaiah study[1]-50(50%), Chavada, Payal S. et al[6]. 44 (43.5%)Arun O study[7] 22(55%) , Khokle P et al[8] study 10(58.8%) cases had addictive habits
In this study out of 80 cases 18 cases (56.2%) had low haemoglobin , 7 cases (21.8%) had high blood sugars compared to Paolo and carlo study[1] which showed 15 cases , 5 cases (14.7%) had sputum positive for acid fast bacilli , 2 cases(5.8%) was HIV positive, 2 cases – (5.8%) had deranged renal function test.
Detailed proper history and clinical evaluation stood as the mainstay of diagnosis in the study. The radiological investigations specially x-rays, lateral view and AP view of soft tissue of neck helped to show encroachment of airway to take a decision for securing airway and presence of air bubbles guided us to know that there was anaerobic infection necessitating I/V antibiotics covering anaerobes. According to the paolo and carlo[1] radiological investigations done were X ray of soft tissue neck was taken in all cases (100%)
USG of neck was taken for 38 patients (77.6 %). Due to the easy availability in the casualty and relatively inexpensive compared to CT scan, the number of USG scans outnumbered CT scans. but MRI scan is more expensive and requires prolonged scanning time, hence In Paolo and Carlo study MRI scan was not done for any of cases.
In this study X ray lateral view neck was done in 73 cases, Ultrasound is used in identifying deep seated abscess was done 63 cases. in CECT SCAN was done in 20 cases, MRI was done in 5 cases Other studies as Puttamadaiah study[5] , Chavada, Payal S. et al[6]. xray ,ultrasound and CT was done Arun O study[7], Khokle P et al[8]- MRI was also used in 2 cases. In Paulo and carlo study[1], The mean duration of hospital stay was 11.92 days which was similar with other studies. In this study 14.3 % had to stay in hospital for more than 20 days. Because most of them developed complications and required surgical interventions. In this study – hospital stay was Minimum - 8 days , Maximum - 25 days. In Paolo and carlo[1] study surgery was the mainstay of treatment. Medical management was the main stay of treatment in Arun O[7] study. In this study ,Surgical treatment with prompt incision and drainage along with antibiotics showed best results in 61 cases .
In this study , at first following treatment given as Empirical oral antibiotics started at first; Parenteral prophylactic antibiotics, preferably broad spectrum antibiotics with coverage for anaerobic bacteria. Maintenance of airway, nutritional support and maintenance of hydration status in the form of administering intravenous fluids, Analgesics and antipyretics, Maintenance of oral hygiene and Monitoring of vitals as spikes of temperature indicates episodes of septicemia.
According to Paolo and Carlo[1] studies the management of deep neck space infections involves prompt surgical drainage via an external approach. Medical management with broad-spectrum IV antibiotics, high-dose IV or oral corticosteroids was the treatment protocol according to Plaza et al study. In this study surgical treatment was main stay of treatment modality Intraoral and external approach was done depending on space involved Other studies as Puttamadaiah study[5], Chavada, Payal S. et al[6]. Khokle P et al[8] surgery was mainstay of treatment . In Arun O study[7] medical modality was mainstay of treatment
In this study Empiric antibiotic therapy was started before the pus culture report was available. It covered most gram-positive, anaerobic and -lactamase producing bacteriae. Then it was modified according to the culture and sensitivity reports. The most common empirical parenteral antibiotics was ceftriaxone addition to metronidazole. Majority of the patients did not need a change in antibiotic after culture and sensitivity. Other supportive medical management included were about 6 cases underwent blood transfusion, 7 cases were treated for uncontrolled diabetes 5 cases for Anti – Tubercular drugs, 2 cases with anti – retroviral drugs and Oral hygiene were encouraged .
According to the Paolo and Carlo[1] study ,by radiological and clinical findings, 34 patients had single deep neck space involvement (69.4%) and 15 patients had multiple space involvement (30.6%). Hypopharyngoscopy and drainage of abscess was done in 42 patients and external route drainage was done in 18 patients. One patient had severe respiratory obstruction due to the abscess and had to undergo tracheostomy. In patients with CECT suggestive of abscess formation early surgical intervention is necessary. Surgical intervention is also essential in airway compromise, sepsis and inadequate response to antibiotics within 48 hours
In this study 61 underwent surgical treatment . Prompt incision of the space involved was done. Pus collected was sent to culture and antibiotic sensitivity . Daily dressing with betadine done and surgical site healed spontaneously. Organisms identified In Paolo and Carlo[1] study Streptococcus (viridians and pyogenes) was the frequently isolated organism in 10 out of 23 cases (22%) followed by Staphylococcus aureus in 8 cases (17%). Sayed Y et al study showed streptococcus Lee Y Q et al showed Klebsiella .
In this study -23 samples were sterile 23 samples were Streptococcus pyogenes isolated 8 samples were pseudomonas 7 samples were Bacteroides fragilis.
In other studies, organisms isolated were Puttamadaiah study[5], Chavada, Payal S. et al[6]. Arun O study[7] streptococcus and in Khokle P et al[8] Klebsiella.
In this study Antibiotic sensitivity showed most of the organisms responded well for ceftriaxone and metronidazole .study done at Bulgaria showed resistance to metronidazole (2.5%). In this study around 14 cases showed resistance to ceftriaxone those 14 patients responded well to Piperacillin In other studies ,patient responded to following antibiotics Puttamadaiah study[5], Chavada, Payal S. et al[6]., Arun O study[7] streptococcus and in Khokle P et al[8] – amikacin.The mortality increases with increased incidence of complications. According to Paolo and carlo study[1] the important complications of deep neck space infections were airway obstruction, sepsis, mediastinitis, pleural effusion, IJV thrombosis, pericarditis, pneumonia, carotid artery rupture, hepatic failure, shock and DIC. In this study 2 known cases of chronic kidney disease accounted for mortality; No tracheostomy was done in this study cases. Other studies as Puttamadaiah study[5] no mortality, Chavada, Payal S. et al [6]. 2 deaths due to respiratory failure , Khokle P et al[8] - 1 mediastinitis, Arun O study[7] 4 deaths due to respiratory failure.

Conclusion

Due to advent of antibiotics , deep neck space infections were in decreasing trend but due to no primary prevention ,patient ignorance and negligence, irrational use of antibiotics its trend is raising again. The common age group found to be affected is 21-30 years (32.5%). These infections had male sex predominance M: F-1.66: 1. Out of all deep neck space infections ,Ludwigs angina was common infections - 23. 7%. Most of the deep neck space infections were dental infections. Comorbidities like diabetes, TB, anemia , HIV Increased the hospital stay upto 25 days . History and clinical

examination are of great importance in diagnosis supported by imaging techniques. Medical treatment is also important in deep neck space infections (23.7%) rational use of antibiotics is vital. Incision and Drainage is the mainstay of surgical treatment with wide exposure and use of betadine solution impregnated wick at the wound site daily . Patient education regarding oral and dental hygiene has to be stressed. Control of diabetes , proper nutrition to prevent deep neck space infections. Completing course of Anti – tubercular drugs and Anti – retroviral drugs. Complications like airway compromise should be managed by Intubation or tracheostomy.

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