Diversified and Unusual Presentations of Neck Space Infections: Still a Big Concern for Physicians

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Abstract The aim of this clinical study was to find similarities; dissimilarities of neck space infections along with challenges faced by treating physician for their diversified clinical presentations and complications. Patients with neck space infections were compared for the purpose. The classic manifestations of these infections, such as high fever, systemic toxicity, and local signs were not present in all cases leading to dilemma in physician's decision making. They progress towards fatality very fast. Prompt recognition, diagnosis and management of such cases and complications are of paramount importance to reduce morbidity and mortality. In addition to broad spectrum antibiotic therapy along airway protection, surgical drainage is necessary in nearly all cases. Neck space infections still continue to be a well prevalent health problem in poor socioeconomic group in developing countries having significant morbidity as well as mortality.

Keywords Neck space infections · Descending necrotizing mediastinitis · Ludwig's angina · Cranio-cervical necrotizing fasciitis · Tracheostomy · Sepsis

Introduction

Neck spaces are communicating, continuous and lie proximal to each other and with other vital structures of body like airway, major neck vasculature, and mediastinum, pleural and pericardial cavity. This unique and complex anatomical status poses a challenge in clinical practice. Deep neck space infections are mostly polymicrobial [1] and commonly arise from a septic focus of the mandibular molars, tonsils, parotid gland, cervical lymph nodes, middle ear etc. Their onset and progression to fatality is rapid. Many clinicians are unfamiliar with these conditions as these conditions have become less common in postantibiotic era. The classic manifestations of these infections, such as high fever, systemic toxicity, and local signs may be absent due to widespread use of antibiotics and/or profound immunosuppression [1]. Their tendency to cause oedema, distortion and obstruction of airway pose a great challenge for treating physicians and anesthesiologists and can even be lethal [2, 3]. These cases are also very much known for multiple other life threatening complications like sepsis, septic shock, descending necrotizing mediastinitis, cranio cervical necrotizing fasciitis etc. Thus, clinicians must be aware of such infections and should not underestimate their potential extent or severity. Early recognition of potential cases, discussion with patient party, appropriate referral, aggressive antibiotic and timely surgical intervention are very much important to reduce morbidity and mortality of such cases.

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Case 1

Presenting History

A 10 year old boy presented to the emergency department with complaints of fever, pain and swelling of face and neck, inability to open mouth with drooling of saliva for last 7 days, inability to swallow for last 3 days along with progressive difficulty in breathing especially in supine position. Mother also gave history of caries lower teeth with pain on and off.

Clinical Findings

He was febrile (39.4 °C) with toxic look, dehydrated, dyspnoeic and uncomfortable to take breath in supine position with pulse rate of 146 beats/minute, respiratory rate of 36 breaths/minute. Base line saturation was 92 % in room air and he was in a state of shock. Bilateral cheek (left > right) and neck was swollen. Oral examination revealed foul breathing odour and trismus (mouth opening 1 finger) with pushed up tongue.

Management

Urgent X-ray soft tissue neck and chest (Fig. 1) suggested Ludwig's angina, retropharyngeal abscess with pus extending to mediastinum. Emergency Incision and Drainage (I&D) of submandibular space, retropharyngeal space and anterior neck were done under General Anaesthesia (GA) with ongoing resuscitation for shock. Postoperatively patient was not extubated and was shifted to Intensive Care Unit

(ICU) and weaned and extubated on 7th postoperative day (POD). Empiric broad spectrum antibiotics were started. Culture showed *Streptococcus beta hemolyticus*, *klebsilla* and *E. Coli*. Antibiotic was changed as per sensitivity report. Patient developed progressive empyema in left side and pericardial effusion which had increased progressively. Chest tube drainage (Fig. 2) and echocardiography guided pericardiostomy using 12 F pig tail catheter was done. Latter on open pericardiostomy was done under GA for unresolving effusion. He improved subsequently and was shifted to ward on 28th day (Fig. 3) and discharged to home on 32nd day.

Case 2

Presenting History

A 60 year old diabetic lady presented with progressively increasing painful swelling in the face and neck for 7 days with painful limitation of mouth opening. There was no history of fever. She gave history of caries tooth which was painful on and off. The last episode of pain started 2 days ago extending to face and neck along swelling.

Clinical Findings

She was alert, oriented, afebrile and hemodynamically stable with no signs of respiratory distress. Right side of the face, eyelid and scalp were swollen, tender and nonfluctuating on the day of presentation. Trismus and foul smelling breath was present. Right tonsil was found to be pushed medially.

Fig. 1 Soft tissue swelling in submandibular space (Ludwig's angina), cervical prevertebral area (retropharyngeal space) and in anterior neck (pretracheal area)

Fig. 2 Wide mediastinum and drain in pericardial space and left pleural space

Fig. 3 Patient after near recovery. Arrow with blue solid filling showing faint scar mark of I&D and arrow with red filling showing sternotomy dressing

Management

Provisional diagnosis of facial cellulitis with (?) abscess/ Ludwig's angina was made and started on broad spectrum antibiotics. CT face and neck was done on day 1 which showed soft tissue thickening in the masticator space with increase in the thickness of scalp with no features of airway compromise. On 5th hospitalized day fluctuation was noted over the right cheek, submandibular space and ultrasound guided pus was aspirated from masseter space and send for microbiological studies but no microorganism isolated. No AFB, bacteria, fungus found from next day sample also and patient remained afebrile throughout. Swelling extended with impending respiratory distress. Repeat CECT showed abscess in right masticator space with air shadow in superficial temporal space and frontal area (Figs. 4, 5). Tracheostomy was done along I&D of 300 ml pus on 9th day (Fig. 6). Antibiotic was escalated in view of increasing TLC count with toxic granules and band form >10 % and possible gas forming organism. Patient responded to daily drainage, dressing and antibiotic (Fig. 4) and was discharged on 42nd day.

Case 3

Presenting History

A 25 year old lady presented with progressive painful swelling in the right cheek for 5 days associated with pain and difficulty in opening mouth for 2 days. She had history

Fig. 4 Swelling and air shadow in right posterior and supra auricular region and frontal region

Fig. 5 CECT showing air shadow in right masticator space, superficial temporal space and frontal area

of carious 1st molar tooth of the same side and was having toothache from last week for which dentist advised extraction but did not comply.

Clinical Findings

She was alert, oriented, afebrile with heart rate of 102/min. A diffuse tender erythematous swelling was noted over the right cheek and submandibular region. Oral examination revealed oedematous floor which was doughy in feeling.

Fig. 6 Showing I&D areas after near recovery

The tongue was pushed up and lateral. Trismus was also present with foul smelling breath and caries molar tooth.

Management

She was started on broad spectrum antibiotic. Over the next 2 days swelling extended to right eyelid without signs of improvement. CECT confirmed the diagnosis of abscess (Fig. 7). I&D was done and pus culture showed beta haemolytic *streptococcus* and *Klebsiella pneumoniae*. Antibiotic was changed with common sensitive one as per culture and sensitivity report. Patient recovered well and was discharged on 12th day.

Fig. 7 Soft tissue swelling in right cheek (masticator space) with slight air shadow

Case 4

Presenting History

A 7 year old girl was brought by parents with complaints of progressive painful swelling of the right side of the face (Fig. 8) for last 7 days, pain and difficulty in opening mouth for last 5 days along with continuous fever. Fever was not associated with chills and rigor. The girl had caries teeth in the same side of lower jaw and was having continuous pain from last 10 days but no dental consultation had been done.

Clinical Findings

She was alert, oriented and febrile. Tachycardia and tachypnoea were present. Diffuse tender erythematous swelling was noted over the right cheek extending to the submandibular region. Oral examination revealed doughy swelling of the floor of the mouth pushing tongue up and towards left side along with trismus, foul smelling breath. Multiple caries teeth were noted in the lower jaw of the same side. Fluctuation test of the swelling was positive.

Management

She was started on broad spectrum antibiotic empirically. CECT showed masticator and submandibular space abscess. I&D was done under General Anesthesia. Culture of

Fig. 8 Swelling of the right cheek

the pus isolated *Streptococcus viridians* which was sensitive to the empirically started antibiotics. Patient responded to twice daily dressings, irrigation and antibiotics and was discharged on 25th hospital day.

Case 5

Presenting History

A 37 year old male presented with complaints of progressive swelling in left side of neck associated with difficulty in swallowing and opening mouth for 3 days. He also complained of difficulty in breathing for last 2 days which was increasing gradually. He had multiple dental caries in the left lower jaw for which he never consulted dentist.

Clinical Findings

He was alert, afebrile, hemodynamically stable and in respiratory distress. A diffuse swelling was noted in the left side of the cheek. Overlying skin was shiny and erythematous. The swelling was tender and fluctuant over dependent area. Oral examination revealed a tender, doughy swelling of submental and submandibular region. Tongue was pushed upwards and laterally. Trismus and foul smelling breaths were present along with multiple caries teeth in the left lower jaw.

Management

Immediate broad spectrum antibiotics were started empirically and emergency tracheostomy was done under local anesthesia. CECT confirmed Ludwig's angina (Fig. 9). I&D was done under GA and pus was sent for culture but culture came as negative. No fungal component on staining and culture was found. Patient recovered over next 14 days and was discharged.

Case 6

Presenting History

An 11 year old girl presented with continuous throat pain and fever for last 2 days. Fever was not associated with chills and rigor. She also complained of difficulty in swallowing which was more for solid food along with swelling over right upper part of neck for 1 day. She had history of recurrent tonsillitis, 2–4 attacks/year. No histories of carious teeth were found.

Fig. 9 Contrast CT showing swelling, air shadow in submandibular space and obliterated oropharynx. Tracheostomy tube is in situ

Clinical Findings

She was febrile and tachycardic with no features of respiratory distress. A tender swelling was noted over right upper part of neck mainly over angle of the jaw along with tender palpable lymph nodes. Trismus and torticollis were also noted. Right tonsil was markedly enlarged and congested. There was no pus formation in the tonsillar cleft while soft palate and uvula were grossly oedematous. Floor of the mouth and teeth were normal.

Management

X-ray soft tissue neck showed features of retropharyngeal abscess in the stage of cellulites. CECT neck showed right peritonsillar abscess with multiple enlarged nodes on right side of neck (Fig. 10). Conservative treatment was started with broad spectrum antibiotics and Betadine gargle. Swelling and odynophagia subsided drastically within 24 h. I&D was not done despite having torticollis as patient responded to antibiotics within 24 h and was discharged on 7th day.

Discussion

Neck spaces are formed by different fasciae and are potential spaces for infection. They pose a unique anatomical status due to its continuity and proximity with each other. Invasion by microorganism produces cellulites or abscess which spreads by continuity along these paths of least

Fig. 10 Contrast CT showing swelling of soft palate, tonsillar bed swelling, torticollis type feature with increased prevertebral soft tissue swelling

resistance, rather than by lymphatic channels [4]. They are also in close proximity and continuity with other vital structure of body like airway, major neck vasculature, and mediastinum, pleural and pericardial cavity. Therefore infections of such spaces are a major threat to the life of the patient and a big challenge for the treating team.

Submandibular and masticator spaces were the most common spaces involved in cases of odontogenic origin while parapharyngeal and retropharyngeal spaces were involved in tonsillar origin case. One patient had extensive disease involving pericardial, pleural and mediastinal space as well. Sepsis was present in all cases but only one case presented with severe septic shock requiring ICU treatment. Pneumonia also was found only in one case. No vascular complication was noted in any cases.

Descending necrotising mediastinitis (DNM) is a rare and very severe infection most commonly originating from peritonsillar, dental or odontogenic abscesses [5]. Despite modern therapy, the mortality rate still remains high ranging between 12.5 and 37.5 % [6].

Pericardial effusion [7] and pleural effusions [8] are far more uncommon complications reported while pericardial effusion leading to life threatening tamponade effect is probably exceptionally rare. Interventional or surgical drainage is very much essential for saving the life.

Cranio-cervical necrotizing fasciitis (CCNF) is aggressive, rare and fatal [9]. CCNF associated with deep neck infection is far more uncommon. An analysis of 185 patients with deep neck infections by Huang et al. [8] and 50 patients by Rana et al. [10] have not shown any case of CCNF though Huang et al. has shown skin defect in 1.1 % patients whose cause is not so clear. One case of CCNF with Ludwig's angina is reported by Chueng et al. [11]

where fasciitis was confined to neck region only (provided CT scan and figure in their article). In the present patient nape of the neck and scalp were the predominant abscess areas. Moreover present patient did not show signs and symptoms like fever, tachycardia, tachypnoea and shock which itself lead to clinical dilemma.

Five out of 6 cases (83 %) were of odontogenic origin. Four out of 6 cases (66.7 %) had culture positive infection among them 3 cases were polymicrobial infections with *Streptococcus* being the predominant organism. Two patients' (33.33 %) pus culture came negative repeatedly. No history of prior antibiotics was found in any of the cases. This may be because we performed only aerobic bacterial culture and fungal culture and probably anaerobic culture could have been able to identify organism/s.

The distorted airway anatomy, tissue immobility and limited access to the mouth make orotracheal intubation with laryngoscopy difficult. Securing such an airway is still challenging and dangerous [12]. Death from loss of an airway still occurs in patients with advanced deep neck infections [12] and it happens mostly because of acute loss of the airway during interventions to control it [13]. Three out of 6 patient (50 %) needed airway control and 2 (both adult) out of 3 (67 %) had to undergo tracheostomy under local anesthesia. One patient (children) with neck swelling (pus) as well was managed with orotracheal intubation which was done by the senior most anesthesiologist keeping all rescue devices in hand. One patient had airway obstruction only with submandibular and submental swelling pushing tongue up and posterior even without retropharyngeal swelling.

Rana et al. [10] have shown that 80 % of neck space infection patients belong to lower socioeconomic class. Five out of 6 (83.33 %) of our patients were from poor socioeconomic background which implies that neck space infections are disease of poor socioeconomic class and they presented relatively late in hospital and landed up with more complications and extensive disease.

Neck space infection can occur in any age group. 50 % of our patients were in adult age group. Four out of 6 cases were female. Presentation varies widely (Table 1). Fluctuation may not be present/appreciable in all abscesses. Surgical intervention was required in 5 out of 6 cases (83 %) and repeated drainage and surgery was required in 3 out 5 cases (60 %).

Neck space infection is a major morbidity and may even lead to mortality if not managed appropriately and timely. Multi disciplinary approach is required many a time. Our patients had hospitalization ranging from 7 to 42 days with median hospital period of 19.5 days. Yet, all of the patients responded well to the same management bundle of airway protection, broad spectrum antibiotic, surgical drainage and supportive care.

Table 1 Summary table showing age, sex, symptoms and signs, anatomical spaces involved, complications, aetiology and microbiological parameters of the cases

Parameters	Present (no. of cases)	Absent (no. of cases)
Sex		
Male	2	
Female	4	
Age		
6 month to 6 years	0	
6–18 years	3	
More than 18 years	3	
Socioeconomic status (poor)	5	1
Aetiology		
Dental problem	5	
Tonsillitis	1	
Classic signs		
Fever	4	2
Trismus	6	0
Toxic look	3	3
Local signs	6	0
Dysphagia	5	1
Difficulty in breathing	3	3
Culture	5	1
Bacteriology (culture positive)	4	2 ^a
Streptococcus beta hemolyticus	2	
Streptococcus viridians	1	
Klebsiella pneumonia	2	
<i>E. coli</i>	1	
Polymicrobial	3	
Fungus	0	
Systemic disease/ immunocompromised	1	5
Complications		
Sepsis	6	0
Airway compromise	3	3
Mediastinitis/DNM	1	5
Shock	1	5
Pneumonia	1	5
Empyema thoracic	1	5
Pericardial effusion	1	5
CCNF	1	5
Vascular complications	0	6
Tracheostomy/intubation	3	3
Spaces involved		
Masticator space	5	1
Sub mandibular	4	2
Sub mental	3	3
Peri tonsilar	2	4
Parapharyngeal	2	4
Retropharyngeal	2	4

Table 1 continued

Parameters	Present (no. of cases)	Absent (no. of cases)
Mediastinal	1	5
Pleural	1	5
Pericardial	1	5

^a Negative after aerobic culture

Conclusion

It is very much clear that neck space infections are still prevalent in developing countries like India and more prevalent in poor socioeconomic class. Clinical presentation and courses are widely variable and even after advancement of health sector technologies, management of such patients is still a big challenge for physicians. Delayed presentation to hospital and poor availability and accessibility of proper health care is a contributing factor for complications and related morbidity and mortality. Primary health care physicians/practitioners/dentist can make a major contribution in reducing such events by starting broad spectrum antibiotics and referring the patient to appropriate hospital as early as possible. Proper oral and dental care and education should be also emphasized as preventive measure at community level.

Conflict of interest None.

Consent from patient Both verbal as well as written consent taken from the patient and patient party.

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