DEEP SPACE INFECTIONS OF NECK

S. Kaluskar, P. Bajaj, P. Bane

Abstract: A retrospective study was performed on fourteen cases of deep cervical space infections in the neck admitted for diagnosis and treatment to the ENT Department, during a period of seven years from 1989-1997. Of the fourteen, four patients had Ludwig's angina and of the fourteen, one had a very serious complication resulting in death. Early diagnosis and adequate treatment were of paramount importance. The role of tracheostomy and management of airway in deep cervical space infections of the neck is discussed together with bacteriology, antibiotic treatment and surgical management.

Keywords: Deep Space Infections of Neck, Ludwig's Angina, Tracheostomy

INTRODUCTION:

In the Head and Neck area, the most frequent location for formation of infections is the peritonsillar area and the second most frequent location is the submandibular-submental space¹. In the latter space, the infections are usually of odontogenic origin. Retropharyngeal and parapharyngeal space infections occur less frequently and are more common in younger children. The sources of infection to the neck may arise from infections of the nose, paranasal sinuses, nasopharynx, pharynx, middle ear, salivary glands and teeth and tonsils. As this study will show, in the majority of instances the source cannot be identified nor is even the responsible organism cultured. The potential of the swelling of soft tissues in the head and neck to cause increasing airway obstruction necessitates prompt and adequate treatment.

This concept has been recognised since antiquity as even Hippocrates has drawn attention to it². In 1836, Wilhelm Fredrick Von Ludwig described a disease process of infection which was almost always fatal (Burke J, 1939)³. In this series, four patients presented with Ludwig's angina according to the clinical criteria laid down for this condition. Ludwig's angina is defined as a potentially lethal, rapidly spreading cellulitis, involving the sublingual and submandibular spaces accompanied with tender swelling in the floor of the mouth and elevation and posterior displacement of the tongue, brawny, suprahyoid induration. In a true Ludwig's angina the sublingual and submandibular spaces are bilaterally involved. As in this infection, the cellulitis spreads in continuity along fascial and muscle planes, rapid involvement of interconnecting tissue spaces such as the lateral pharyngeal space may occur. Before the 1940's, the mortality rate for Ludwig's angina was around 54 per cent, but today in several series reported it has fallen to 4 per cent. In deep cervical space infections, early aggressive intravenous antibiotic therapy is combined with surgical decompression and drainage where appropriate. The presence of increasing swelling in the neck can lead to compression of the airway and as there may be associated trismus, elevation of the tongue, oedema of the glottis, anaesthetic hazards are also formidable. In the past, tracheostomy was more often performed than today. With aggressive use of intravenous antibiotics and surgical decompression combined with alternative methods of airway management, the immediate role of tracheostomy in these cases is questionable. This paper will discuss methods of treatment and airway management.

MATERIALS AND METHOD

The ENT records for a seven year period January 1989 to September 1997 were examined and the records of all patients who had a diagnosis of deep cervical space infection were analysed. Fourteen patients were identified and form the present series. The clinical characteristics recorded include age, race, sex, aetiology, presence of trismus, organisms cultured, and anaesthetic difficulties and surgical management.

RESULTS

The fourteen patients consisted of seven men and seven women, with an average of thirty-six years and an age range of fourteen to eighty-seven years. All were of Caucasian origin. In four cases the source of infection was from the teeth and in all other cases there was no identifiable cause. Ten patients received Metronidazole, six patients soluble Penicillin, two patients Ampicillin, four patients Cephalosporin, one patient Ampicillin and Flucloxacillin combination. All patients were started on intravenous antibiotics on admission and temperature and white cell count were measured.

Careful monitoring was done regarding airway. In cases where the swelling was fluctuant, surgical drainage was performed. In other cases when swelling increased despite antibiotic therapy, surgical drainage was established. In cases where there was adequate evidence of compression of the airway and rapidly increasing oedema, tracheostomy was performed and surgical drainage established of the involved spaces. In all except one patient, recovery was complete after two weeks. In one patient who died, the death was due to an uncommon complication of diffuse intravascular coagulation which led to septicaemia and eventually end-stage renal failure. The latter patient was eighty-seven years of age. In this series there were no immunocompromised patients and only one diabetic. The average temperature recorded on admission was 37.8 centigrade and the average white cell count on admission was 12,800.

DISCUSSION

In our series, only four patients had identifiable odontogenic cause. Of the remaining ten, they had no identifiable cause in the head and neck area. Of the four cases of Ludwig's angina, only

one had odontogenic cause. In 1979, Hought et al⁴ found in their extensive review of seventy five cases of Ludwig's angina, seventy percent were due to odontogenic cause. However, one could not draw any meaningful comparison in this series as only four had Ludwig's angina as per definition. In most cases of Ludwig's angina, the commonly involved teeth are mandibular molars because the apices are related to the mylohyoid muscle attachment. Once the infection has passed beneath the mylohyoid muscle attachment, infection spreads easily into the submandibular⁵ and sublingual spaces. In the lower incisor region, if the infection has perforated the lingual plate, the sublingual space infection can spread over the posterior margin of the mylohyoid muscle and involve the submandibular and submental spaces. In this series, only one case of Ludwig's angina had an attributable odontogenic cause. The teeth concerned were lower incisors. In this series, it is interesting to note that only in five patients were organisms cultured from the pus sent for culture and sensitivity. Of the five, streptococci and staphylococci were seen in four patients and in one *Klebsiella* (Table 1). In most head and neck infections, streptococci and staphylococci are the most predominant organisms followed by anaerobes. Occasionally coliforms are seen. Prior to culture and sensitivity, antibiotic coverage is directed toward those bacteria most likely to be present. Penicillins or cephalosporins are the drugs of choice in combination with Metronidazole. The antibiotic regime may have to be modified after the culture and sensitivity is available.

In the last few years, there have also been increasing reports of atypical mycobacterium *avii murium*. Thus it is still very important to submit the specimen also for examination for mycobacteria. In our series, soluble Penicillin and Metronidazole was the antibiotic of choice as the majority of reports to date indicate that streptococci are the predominant organisms involved in deep space infections of the neck where the organisms have been successfully cultured. However, it is now sufficiently clear that in a majority of deep cervical space infections in the head neck area, the anaerobic organisms play a major causative role. In the head and neck area, the aerobic organisms act synergistically with the anaerobic organisms and the anaerobes⁶ include *Bacteroides malaninogenicus*, peptococci, peptostreptococci. Clinically one would be strongly suspicious of anaerobic organisms where there is tissue necrosis with associated foul odour and gas formation. The most effective antibiotic in the treatment of anaerobic infections to date is Metronidazole. In this series there were no cases where Gentamicin was used.

In the series reported by Hought et al in 1989, thirty-two percent of patients responded to aggressive antibiotic therapy without surgical intervention. In all cases in this series, intravenous antibiotics were commenced on admission and where there was localised fluctuant swelling surgical drainage was established. In other cases here swelling continued to increase, surgical drainage was established. In cases where airway showed compromise, tracheostomy was performed and no cases were managed by intubation only.

In our series, surgical drainage was established in all cases where appropriate under general anaesthesia. In our series, all patients

were successfully intubated without having to resort to use of fiberoptic laryngoscopy⁷. In all cases the anaesthetic was administered by experienced consultant Anaesthetists. In our series, although seven patients had trismus on presentation, the anaesthetists were successful in intubation in all except one which required tracheostomy. In Ludwig's angina⁸ and deep cervical space infections of the neck, the trismus is secondary to muscle spasm and pain. If the technique of initial deep inhalation anaesthesia is followed, the spasm is relieved and pain is inhibited and, therefore, the mouth can be opened wider thus allowing better visualisation of the vocal cords. Blind nasal intubation may be indicated in some cases and is best carried out if indicated by an experienced anaesthetist. In patients where there is involvement of the lateral pharyngeal and retropharyngeal space, during blind intubation attempts, due to inadvertent force, pus may be extruded and thus escape into the lungs. Further, there may also be damage caused to the pharynx and larynx. In such difficult circumstances it is best to resort to the use of fiberoptic guided intubation. In all cases where airway was compressed and tracheostomy indicated, the initial procedure is to carry out the tracheostomy and to establish safely a good airway. Cricothyroidotomy has been proposed as an alternative as it has been reported in some series following tracheostomy, the complications of tracheal stenosis in about twenty percent of cases.

It is mandatory that the surgeon be scrubbed and ready to perform a tracheostomy if induction and intubation was unsuccessful. In the last few years there have been increasing reports of cases where during induction, airway obstruction occurred, to manage by insertion of nasopharyngeal airway. If, however, intubation was not possible, tracheostomy must be carried out. In patients with severe glottic oedema, pharyngeal oedema, swollen neck, grossly elevated tongue and severe trismus, elective tracheostomy must be done under local anaesthesia as was the case in one patient in this series. Allen et al in 1985⁹ recommended tracheostomy or crico-thyroidotomy in the management of airway in patients with increasing neck swelling with associated deep cervical space infections or in Ludwig's angina.

Although in this series the youngest age was fourteen years, deep cervical space infection in the paediatric population is not an uncommon occurrence. In the paediatric population too, very often there is no identifiable cause. In cases where the attributable causes can be identified include complication of acute tonsillitis, odontogenic causes, infection of the nose and paranasal sinuses, middle ear and nasopharynx and pharynx and inflammatory causes of salivary glands particularly the submandibular salivary gland. The surgical treatment of choice for involvement of unilateral submandibular space is established of adequate drainage of the space and in cases of Ludwig's angina, bilateral drainage should be established. In cases where the submental space is involved, the drainage should include the submental space and extension into the sublingual space where appropriate.

In adults, retropharyngeal space infection is rare. In this series, only one patient had involvement of retropharyngeal space. It is more common in infants or younger children¹⁰. It is believed that this observation is due to the fact that retropharyngeal lymph

nodes are well developed in early life and drain the nose, paranasal sinuses, nasopharynx, pharynx and middle ear and later this lymphoid tissue atrophy. Complications which result from untreated retropharyngeal space infections include mediastinal spread, acute respiratory distress and involvement of internal jugular vein and carotid artery. In this series, one of the patients had pus extending along the carotid sheath and thrombosed internal jugular vein. The best method of draining a retropharyngeal space is via an intraoral approach. Pharyngeal space infection should be suspected when there is bulging of the lateral pharyngeal wall with medial displacement of the tonsil and trismus. Incision and drainage is established via an external approach, carrying out the dissection medial to the sternomastoid muscle and superior to the hyoid bone.

In one of the patients, an eighty year old lady, an unusual fatal complication of diffuse intravascular coagulation developed which terminated in fatal septicaemia eventually leading to end stage renal failure. In management of deep cervical space infections¹¹, early diagnosis and adequate treatment is of great importance in preventing life threatening complications.

In the diagnosis and management, the most useful x-rays are AP and lateral view of the neck and soft tissue view of the neck, although in an acute emergency where the airway is completely endangered, an immediate tracheostomy may have to be performed under local anaesthesia. CT scan is very useful especially in early diagnosis and management of retropharyngeal and parapharyngeal space infections.

Table 1: Patient Characteristics

Case No.	Diagnosis	Age	Sex	Race	Trismus	Aetiology	Organisms Isolated
1	Ludwig's angina	9	F	C	Yes		
2	Ludwig's angina	14	M	C	Yes		
3	Left Parotid, Parapharyngeal, Sub-mandibular space, Lateral Pharyngeal wall	80	F	C	No		
4	Ludwig's angina	36	M	C	No		
5	Right Parotid	54	F	C	No	None	
6	Ludwig's angina	40	F	C	Yes		
7	Ludwig's angina	87	M	C	Yes		
8	Right Sub-mandibular space Parapharyngeal space	17	M	C	No		
9		17	M	C	Yes		
10	Left Parotid	19	F	C	No		
11	Ludwig's angina	31	F	C	Yes		
12	Left Sub-mandibular space	22	M	C	Yes		
13	Submental Swelling	77	M	C	No		Klebsiella
14	Right Sub-mandibular space	19	M	C	No		

Table 2 : Management

Case No	Intra-venous Antibiotics	Drainage under General Anaesthesia	Induction Difficulties	Spaces Drained	Tracheostomy
1	Penicillin Metronidazole	Yes	No	Submental	No
2	Cephalosporin Metronidazole	Yes	No		No
3	Cephalosporin Metronidazole	Yes	No	Submental	No
4	Ampicillin Metronidazole	Yes	No	Bilateral Sub-mandibular	No
5	Penicillin Metronidazole	Yes	No	Parotid	No
6	Flucloxacillin Metronidazole	Yes	No	Bilateral Sub-mandibular	No
7	Penicillin Metronidazole	Yes	No	Bilateral Sub-mandibular	No
8	Penicillin Metronidazole	Yes	No	Right Sub-mandibular	No
9	Ampicillin Metronidazole	Yes	No	Submental	No
10	Cephalosporin	Yes	No	Parotid	No
11	Ampicillin Doxycillin	Yes	No	Right Sub-mandibular	No
12	Penicillin	Yes	No	Left Sub-mandibular	No
13	Penicillin	Yes	No	Bilateral Sub-mandibular (Disseminated Intravascular Coagulation, Septicaemia)	Yes
14	Cephalosporin Metronidazole	Yes	No	Right Sub-mandibular	No

REFERENCES

- 1 Litman, R. et al. A Retrospective Study of Peritonsillary Abscesses. *Ear Nose and Throat Journal*. 1987, 66:21-24.
- 2 Muckleston H S. Angina Ludovici and Kindred Infections: An Historical and Clinical Study. *Ann Otol Rhinol Laryngol*. 1942, 35:467.
- 3 Burke, J. Angina Ludovici: A Translation together with a Biography of Wilhelm F. Von Ludwig *Bul Hist Med*. 711151939.
- 4 Hought R T, Fitzgerald B G, Latta J E, et al. Ludwig's angina – A Report of Two cases and Review of The Literature from 1945 till January 1979. *J Oral Surg*. 1980, 38:849.
- 5 Blinder D et al. Idiopathic Submandibular abscesses in Children. *Int J. Oral Maxillofac Surgery*. 1976, 15:292-295.
- 6 Quayle A A. *Bacteroides* Infections in Oral Surgery. *J Oral Surg*. 1974, 32:91.
- 7 Schwartz H C, Baner RA, Davis, N J et al. Ludwig's Angina: Use of a Fiberoptic Laryngoscope to avoid Tracheostomy. *J Oral Surg*. 1974, 32:608.
- 8 Finch, R G, Snider, G F, Sprinkle P M. Ludwig's Angina *JAMA*. 1980, 243:1171.
- 9 D Allen, T E Loughnan, R A Ord. A Re-evaluation of the role of tracheostomy in Ludwig's Angina. *J Oral Maxillofac Surg*. 1985, 43:436.
- 10 Yeoh, L. et al. Retropharyngeal Abscesses in a children's Hospital. *J.Otolaryngology*. 1985, 99:555.
- 11 Johnston, J and tucker, H. Recognising and Treating Deep Neck Infection. *J. Post Graduate Medicine*. 1976, 59:95–100.

Address for correspondence:

Dr S Kaluskar
ENT Office,
Tyrone County Hospital,
Hospital Road,
Omagh BT79 0AP, United Kingdom
e-mail: pbane@hotmail.co.uk