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Deep neck space infections: a UK centre, two-year, retrospective review of 53 cases

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Abstract

Objective. This retrospective study comprehensively assesses clinical characteristics, management, outcomes, and complications of deep neck space infections in adults at a UK ear, nose and throat tertiary centre.

Methods. Adult deep neck space infection patients from April 2019 to March 2021 were retrospectively reviewed using health records and picture archiving and communication system data. Demographics, presentation, microbiology, treatment, complications, and outcomes were analysed.

Results. Fifty-three patients (mean age: 53.8 years, M:F ratio 1.5:1) were studied. Deep neck space infections were polymicrobial in 29.4 per cent, with *Streptococcus milleri* group (64.7 per cent) occurring most frequently. Complications occurred in 20.8 per cent, including mediastinitis (13.2 per cent) and Lemierre's syndrome (7.5 per cent). Mortality was 5.7 per cent. Treatment included intensive care admission (32.1 per cent), tracheostomy (15.1 per cent), medical management alone (39.6 per cent), bedside peritonsillar abscess drainage (18.9 per cent), transcervical drainage (28.3 per cent), transoral drainage (13.2 per cent), and hot tonsillectomy (5.7 per cent). Patient age correlated with length of stay.

Conclusion. The study highlights deep neck space infection complexity, emphasising tailored management, effective antibiotics, and frequency and severity of complications. Comprehensive understanding of deep neck space infections can improve care and outcomes.

Main Article

Alexander Charlton takes responsibility for the integrity of the content of the paper

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Introduction

Deep neck space infection is a serious clinical entity that carries significant morbidity and mortality to patients and a significant cost burden for the National Health Service (NHS). It most commonly stems from odontogenic and oropharyngeal infections that spread to deep neck potential spaces and fascial planes. Given the nature and the location of the pathological process, deep neck space infection remains a particularly challenging condition to manage. Many patients require prolonged hospital stay, intensive care unit (ICU) admission, surgical drainage of abscesses and airway management.

The diagnosis of deep neck space infection is suspected clinically with most patients presenting with a sore throat, neck pain, neck stiffness and fever. However, it is usually corroborated by diagnostic imaging. Importantly, not all units have diagnostic imaging at their disposal 24 hours/day, 7 days/week and might have reduced coverage by the relevant speciality.

This brings us to the next point that this condition frequently necessitates care in high-acuity or high-level-monitoring environments and often includes crossover from several specialities due to the location of pathology, the necessity for airway securement and potential complications. Specialities that could be involved range from otolaryngology, maxillofacial surgery, intensive care, thoracic surgery, microbiology, respiratory and interventional radiology. This illustrates the complexity encountered in managing deep neck space infections. The most common complications are mediastinitis, Lemierre's syndrome, pneumonia and/or pulmonary empyema, and airway obstruction. These complications can be life threatening and mortality from deep neck space infections has been reported between 1.6 per cent to 7.6 per cent.[1,2]

In the last 20–25 years, it appears that the incidence of deep neck space infections has been rising in England and Wales.[3] It has also been reported that this is potentially linked to reduced tonsillectomy rates since adopting the Scottish Intercollegiate Guidelines Network recommendations for tonsillectomy.[4] Coronavirus disease 2019 (Covid-19) has also affected the incidence rise with reduced availability of primary care and dentistry services during the lockdown. The pandemic also led to reduced antibiotic availability in the community and delayed presentations in patients with upper aerodigestive tract infections.[5]

Most deep neck space infections are polymicrobial with *Staphylococcus aureus* and *Streptococcus pyogenes* being the most common aerobic species, and *Peptostreptococcus* and *Prevotella* the most common anaerobic species.[6] However, more recently *Streptococcus viridans*, *Klebsiella pneumoniae* and *Bacteroides* have emerged as more

prominent in the microbiological milieu.[7] The microbial flora is also dependent on patients' comorbidities (i.e. intravenous drug users are more prone to developing methicillin-resistant *Staphylococcus aureus* infections whilst *Klebsiella pneumoniae* is the most common pathogen isolated in diabetics).[2,9]

Treating the causative pathogen with appropriate antimicrobial agents is only one aspect of deep neck space infection management. As stated previously, given the location of the pathological process adjacent to the airway and the potential compromise to which it is exposed, hence securing the airway is another key factor in treating patients with deep neck space infection. This can be done by endotracheal intubation or by tracheostomy procedure. The former mandates ICU stay while the latter enables the patient to be stepped down to a ward level of care, which was a particularly pertinent point during the Covid-19 pandemic when ICU bed availability was scarce. This adds another layer to the management complexity.

The key question is whether the patient needs to be taken to theatre for incision and drainage under general anaesthetic, and potentially simultaneous airway securing (intubation or tracheostomy) or not. Some cases can be managed conservatively depending on the clinical picture, patient's comorbidities, and prognosis, as well as on the settings because not all units will have a trained surgeon available to perform incision and drainage or the ICU availability to accommodate an intubated patient. There is also a role for radiologists in the management of deep neck space infection cases by way of the radiological guided aspiration of abscesses, as recent reports suggest that this constitutes a less invasive but more effective approach.[9] However, this type of service is even less readily available.

Material and methods

This study was a retrospective review of all adults presenting to the ENT service at a tertiary centre in the UK with a deep neck space infection from 1 April 2019 to 31 March 2021. Interrogation of in-patient handover lists was utilised to identify potential cases which were then confirmed or refuted by review of digital health records and picture archiving and communication systems. Inclusion criteria were deep neck space inflammation or abscess on imaging, age 16 years or older, and under the care of the ENT service. Exclusions included patients with simple peritonsillar abscess in the absence of deep neck space involvement, and patients less than 16 years of age or under the care of a team other than ENT.

All data came from digital health record and picture archiving and communication systems and were analysed using Microsoft Excel. Variables and outcomes measured included patient demographics, patient management, outcomes and/or complications, and disease factors including bacterial culture results. Specific variables and outcome measures are summarised in Tables 1–6. Frequencies and percentages were utilised to represent categorical variables. Mean and standard deviation were utilised to represent continuous variables.

Results

Fifty-three eligible participants were identified with a mean age of 53.8 years and male to female ratio of 1.5:1. Demographic data are summarised in Table 1.

Participants had a mean duration of symptoms of 4.66 days prior to presentation to our ENT service, with 22.6 per cent having recently attended hospital in the preceding days for related symptoms, and 41.5 per cent having received antibiotics prior to their hospital presentation. Mean length of hospital stay was 10.5 days. Hospital attendance and episode data are displayed in Table 2.

Table 1. Demographic data of participants; SD = standard deviation; IQR = interquartile range

Characteristic	*n* = 53
Age (years)	
– Mean (± SD)	53.8 (16.5)
– Median (IQR)	54.3 (24.3)
– Range	17–86
Gender	*n* (%)
– Male	32 (60.4%)
– Female	21 (39.6%)

Thirty participants (56.6 per cent) had a deep neck space abscess, compared to 43.4 per cent with deep neck space inflammation alone. Mean abscess volume from cross-sectional imaging measurement was 22 cm^3. Table 2 summarises infection characteristics.

Complications of deep neck space infection were identified in 20.8 per cent of participants, with mediastinitis (13.2 per cent) and Lemierre's syndrome (7.5 per cent) being the most common. All identified deep neck space infection complications are presented in Table 3.

We identified three mortalities (5.7 per cent), 32.1 per cent rate of ICU admission, and 15.1 per cent tracheostomy rate. Most patients were managed with medical management alone (39.6 per cent), with 18.9 per cent receiving bedside peritonsillar abscess drainage, 28.3 per cent undergoing transcervical drainage, 13.2 per cent undergoing transoral drainage, and 5.7 per cent undergoing hot tonsillectomy. Table 2 summarises management and outcome data.

Positive bacterial cultures were isolated from 17 participants, with 5 (29.4 per cent) being polymicrobial, and *Streptococcus milleri* group being the most common organism (64.7 per cent, 11/17). Table 4 displays incidence, management, complication rate and length of stay according to causative micro-organism.

In keeping with local prescribing guidance, co-amoxiclav alone was the most frequently utilised antibiotic regime. The ranges of different empirical antibiotic regimes used, and their frequencies, are displayed in Table 5.

The parapharyngeal space was most frequently involved (abscess in 32.1 per cent, inflammation in 28.3 per cent), followed by the retropharyngeal space (abscess in 13.2 per cent, inflammation in 22.6 per cent). Table 6 displays incidence, management, and mortality according to subsite/type of infection. These data are broken down and displayed in Figures 1–4, which represent the rates of mortality and management approaches for all patients with deep neck space infection (Figure 1), frequency of deep neck space infection by type (inflammation vs. abscess) and site (Figure 2), management and mortality according to deep neck space involved for patients with deep neck space inflammation only (Figure 3), and the management and mortality according to deep neck space involved for patients with deep neck space abscesses (Figure 4).

No correlation was identified between duration of symptoms prior to hospital attendance and length of hospital stay (Figure 5), but a strong positive correlation was found between

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Table 2. Hospital attendance, infection characteristics, hospital episode, and management data; SD = standard deviation; IQR = interquartile range

Characteristics	
Duration of symptoms prior to presentation (days)	
– Mean (± SD)	4.66 (4.48)
– Median (IQR)	3.5 (3)
– Range	1–25
Hospital attendance in preceding days for symptoms related to deep neck space infection (re-attendance)?	
– Yes, *n* (%)	12 (22.6%)
– No, *n* (%)	41 (77.4%)
Antibiotic administration prior to presentation	
– Yes, *n* (%)	22 (41.5%)
– No, *n* (%)	31 (58.5%)
Deep neck space abscess *vs* inflammation only	
– Abscess	30 (56.6%)
– Inflammation only	23 (43.4%)
Abscess volume (cm^3)	
– Mean (± SD)	22.0 (25.9)
– Median (IQR)	8.5 (28.4)
– Range	1.19–99
Complications of deep neck space infection	
– Yes	11 (20.8%)
– No	42 (79.2%)
Mortality	
– Yes	3 (5.7%)
– No	50 (94.3%)
Length of hospital admission (days)	
– Mean (± SD)	10.5 (18.7)
– Median (IQR)	5 (6)
– Range	1–120
Intensive care admission	
– Yes	17 (32.1%)
– No	36 (67.9%)
Duration of ICU stay (days)	
– Mean (± SD)	4.65 (7.59)
– Median (IQR)	3 (3)
– Range	0–33
Tracheostomy	
– Yes	8 (15.1%)
– No	45 (84.9%)
Management	
– Medical management alone	21 (39.6%)
– Bedside peritonsillar abscess drainage	10 (18.9%)
– Transcervical drainage	15 (28.3%)
– Transoral drainage	7 (13.2%)
– Hot tonsillectomy	3 (5.7%)

increasing age and length of hospital stay, with a Pearson correlation coefficient of 0.32 and p value of 0.021 at a 95 per cent confidence interval (Figure 6).

Table 3. Numbers and percentages of identified complications of deep neck space infection

Complications of deep neck space infection	*n* (%)
Mediastinitis	7 (13.2%)
Lemierre's syndrome	4 (7.5%)
Pleural empyema	2 (3.8%)
Gastrostomy requirement	2 (3.8%)
Pneumothorax	1 (1.9%)
Stroke	1 (1.9%)
Neutropenic sepsis	1 (1.9%)
Sigmoid sinus thrombosis	1 (1.9%)
Mandible erosion	1 (1.9%)
Pneumomediastinum and extensive surgical emphysema	1 (1.9%)
Complete airway obstruction necessitating emergency cricothyroidotomy	1 (1.9%)
Hypoxic brain injury	1 (1.9%)

Discussion

Our study reviewed 53 patients who were admitted to our tertiary centre with deep neck space infection inflammation or abscesses identified on imaging over the course of two years. There are several important variables to consider when managing deep neck space infection, and evaluating these will help otolaryngologists understand this life-threatening condition.

Deep neck space infection can affect all ages; however, our cohort's mean age was 53.8 years old, which is slightly older than documented studies in the UK.[10] Our cohort showed a male predominance with a male to female ratio of 1.52:1, which is consistent with previous studies. Velhonoja *et al.* reported that males with deep neck space infection had poor dental status compared to females (75.2 per cent *vs* 25.5 per cent).[10–13]

Most reported deep neck space infections are polymicrobial. Cultures can guide antibiotic therapy and determine more aggressive and/or necrotising infections that require more aggressive surgical treatment. In our study, 17 patients had positive microbiology findings, however, only 5 (29.4 per cent) had polymicrobial growth. The *Streptococcus milleri* group was by far the most common of the organisms cultured (64.7 per cent, $n = 11$) followed by *Prevotella* species (17.6 per cent, $n = 3$) and *Fusobacterium necrophorum* (17.6 per cent, $n = 3$) (Table 4). Recent studies have shown differences in the most common causative organisms such as *Prevotella* species in Finland[13] and *Streptococcus pyogenes* in Saudi Arabia.[14] These inconsistencies highlight the importance of local antibiotics prescribing guidance based on local patterns of infection.

The only patient who had grown *Actinomyces* was admitted the longest (120 days) with ICU admission, both trans-cervical and trans-oral drainage, hot tonsillectomy, tracheostomy, and several severe complications. Whether the patient's complicated admission was attributed to *Actinomyces* alone is uncertain, as infection was polymicrobial, including *Prevotella* species and *Streptococcus constelatus*. Compared to our whole cohort, patients who grew *Streptococcus milleri* group were more likely to have ICU admission (63.6 per cent *vs* 32.1 per cent, $p = 0.084$) and require trans-cervical drainage (28.2 per cent *vs* 72.7 per cent, $p = 0.012$). Studies have shown *Streptococcus milleri* group to be an aggressive, rapidly

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Table 4. Incidence, management, complication rate and length of stay according to causative micro-organism. *Includes *streptococcus milleri* where subtype not specified as well as those specified as *streptococcus anginosus* and *streptococcus constellatus*. **1 case excluded due to length of stay of 120 days which would skew results

Causative micro-organism	Number of identified cases	Length of stay (mean days)	Intensive care admission *n* (%)	Trans-cervical drainage *n* (%)	Trans-oral drainage in theatre *n* (%)	Hot tonsillectomy *n* (%)	Tracheostomy *n* (%)	Complication(s) from deep neck space infection *n* (%)
Streptococcus pyogenes	1	4	1 (100%)	1 (100%)	0	0	0	0
*Streptococcus milleri**	11	14**	7 (63.6%)	8 (72.7%)	4 (36.4%)	1 (9.1%)	4 (36.4%)	3 (27.3%)
– *Streptococcus constellatus*	6	6.2**	4 (66.7%)	4 (66.7%)	3 (50%)	1 (16.7%)	2 (33.3%)	1 (16.7%)
– *Streptococcus anginosus*	2	10.5	1 (50%)	1 (50%)	1 (50%)	0	1 (50%)	0
Haemophilus influenzae	1	4	1 (100%)	0	1 (100%)	0	0	0
Prevotella species	3	10.5**	2 (66.7%)	2 (66.7%)	2 (66.7%)	1 (33.3%)	2 (66.7%)	1 (33.3%)
Fusobacterium necrophorum	3	9.7	1 (33.3%)	3 (100%)	0	0	2 (66.7%)	0
Fusobacterium nucleatum	2	7.5	0	2 (100%)	0	0	1 (50%)	1 (50%)
Actinomyces	1	120	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)
Anaerobes	1	13	1 (100%)	1 (100%)	0	0	1 (100%)	0

Table 5. Ranges, numbers and frequencies of different empirical antibiotic regimes used

Empirical antibiotic regime	*n* (%)
Co-amoxiclav alone	21 (39.6%)
Benzylpenicillin + Metronidazole	10 (18.9%)
Ceftriaxone + Metronidazole	5 (9.4%)
Cefuroxime + Metronidazole	4 (7.5%)
Ceftriaxone alone	3 (5.7%)
Tazocin alone	2 (3.8%)
Co-amoxiclav + Metronidazole	2 (3.8%)
Cefuroxime + Clindamycin	1 (1.9%)
Ceftriaxone + Clindamycin	1 (1.9%)
Clindamycin alone	1 (1.9%)
Meropenem + Amoxicillin	1 (1.9%)
Gentamicin + Meropenem + Tazocin	1 (1.9%)
Cotrimoxazole + Metronidazole	1 (1.9%)

progressive pathogen causing abscesses at various sites in the body, including outside the head and neck.[15]

Due to widespread antibiotic use in early clinical manifestation of deep neck space infection, it is not surprising that a considerable proportion (39.6 per cent, $n = 21$) of our patients were treated with medical management alone. Intravenous co-amoxiclav alone was used for most patients (39.6 per cent), which followed our institution's guideline and corroborates the known consensus use of broad-spectrum antibiotics to treat deep neck space infection.[8,16] Deep neck space infections can be treated with intravenous (IV) antibiotics successfully. However, patients who display airway compromise, large abscess collection, or sepsis non-responsive to antibiotic therapy may require surgical drainage and/or airway management. Of the 21 patients who were treated with medical management alone, three patients (14.3 per cent) were intubated and two of these patients (9.5 per cent) subsequently died due to severe complications and undrainable collections.

Overall, 11 of 53 patients (20.8 per cent) experienced complications, of which mediastinitis was the most common (13.2 per cent, $n = 7$) followed by Lemierre's syndrome (7.5 per cent, $n = 4$). Nineteen patients (35.8 per cent) required airway management, either tracheostomy or intubation. One patient had an emergency cricothyroidotomy due to impending airway compromise, which later was converted to a tracheostomy.

There were three deaths (5.6 per cent) in our cohort. One patient was on chemotherapy for acute myeloid leukaemia and unfortunately developed neutropenic sepsis after initial improvement with antibiotics alone. It is recognised that a rapidly progressive course of deep neck space infection with a fatal outcome may be seen in patients who are immunocompromised with diabetes, chemotherapy, or human immunodeficiency virus infection.[17]

The second patient that died had an extensive abscess collection dissecting most cervical planes with bilateral emphysema. This patient presented seven days from the start of symptoms but did not have a drainable collection. The mean duration of symptoms prior to presentation in our cohort was 4.66 days with a range of 1–25 days (Table 2). The delay in presentation may have led to this fatal outcome. In contrast, the patient who presented at 25 days had no complications and was treated with IV antibiotics alone. This

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Table 6. Numbers and percentages of incidences, management, and mortality according to subsite of infection; GA = general anaesthetic

Site/type of infection	*n* (%)	Tracheostomy	Transcervical drainage	Transoral drainage under GA	Bedside quinsy drainage	Hot tonsillectomy	Mortality
Total	53	8 (15.1%)	15 (28.3%)	7 (13.2%)	10 (18.9%)	3 (5.7%)	3 (5.7%)
Peritonsillar abscess (not considered deep neck space in isolation)	21 (39.6%)	3 (14.3%)	4 (19.0%)	6 (28.6%)	9 (42.9%)	3 (14.3%)	0
Deep neck space inflammation only	23 (43.4%)	1 (4.3%)	1 (4.3%)	4 (17.4%)	6 (26.1%)	1 (4.3%)	0
– Parapharyngeal	15 (28.3%)	1 (6.7%)	1 (6.7%)	3 (20.0%)	6 (40.0%)	1 (6.7%)	0
– Retropharyngeal	12 (22.6%)	0	0	3 (25.0%)	0	1 (8.3%)	0
– Masticator	4 (7.5%)	1 (25%)	0	2 (50.0%)	2 (50%)	0	0
– Submandibular	3 (5.7%)	0	1 (33.3%)	0	2 (66.7%)	0	0
– Paraglottic	0	0	0	0	0	0	0
– Pre-epiglottic	1 (1.9%)	0	0	0	0	0	0
– Pre-vertebral space	2 (3.8%)	0	0	0	1 (50%)	0	0
Deep neck space abscess (excludes peritonsillar abscess)	30 (56.6%)	7 (23.3%)	14 (46.7%)	3 (10.0%)	4 (13.3%)	2 (6.7%)	3 (10%)
– Parapharyngeal	17 (32.1%)	7 (41.2%)	9 (52.9%)	1 (5.9%)	3 (17.6%)	2 (11.8%)	3 (17.6%)
– Retropharyngeal	7 (13.2%)	3 (42.9%)	4 (57.1%)	2 (28.6%)	0	1 (14.3%)	1 (14.3%)
– Masticator	1 (1.9%)	0	1 (100%)	0	0	0	1 (100%)
– Submandibular	5 (9.4%)	2 (40.0%)	4 (80.0%)	0	0	0	0
– Paraglottic	3 (5.7%)	0	1 (33.3%)	1 (33.3%)	0	0	0
– Pre-epiglottic	2 (3.8%)	0	0	1 (50%)	0	0	0
– Parotid	4 (7.5%)	0	2 (50%)	0	2 (50%)	0	1 (25%)
– Peri-vertebral	1 (1.9%)	0	1 (100%)	0	0	0	0

emphasises the variability seen amongst patients with deep neck space infection.

There were no new diagnoses of malignancy, however the third mortality was a 77-year-old male with left parotid tail abscess extending into masticator and parapharyngeal spaces, which was secondary to metastatic parotid squamous cell carcinoma. Deep neck space infection as the initial presentation of head and neck cancer is uncommon but may arise due to a necrotic metastatic lymph node and extensive blood supply to the head and neck.[18]

The co-existence of infection and malignancy can be clinically challenging as the malignancy is being superimposed by the abscess or infection, which can lead to delay in diagnosis. Our study showed an average age of patients with deep neck space infection of 53.8 years, therefore a patient who is 20 years over the median age should lead clinicians to consider

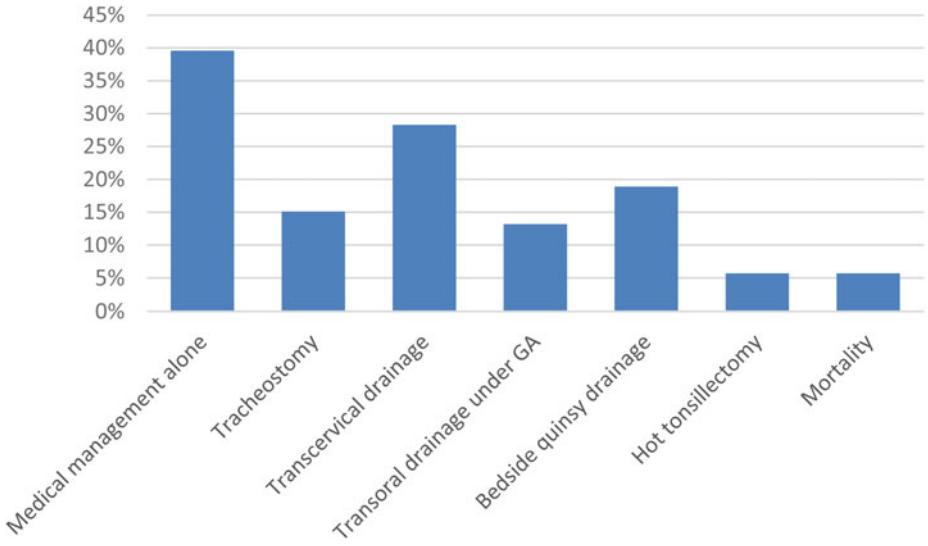

Figure 1. Management approaches and mortality for all patients with deep neck space infection.

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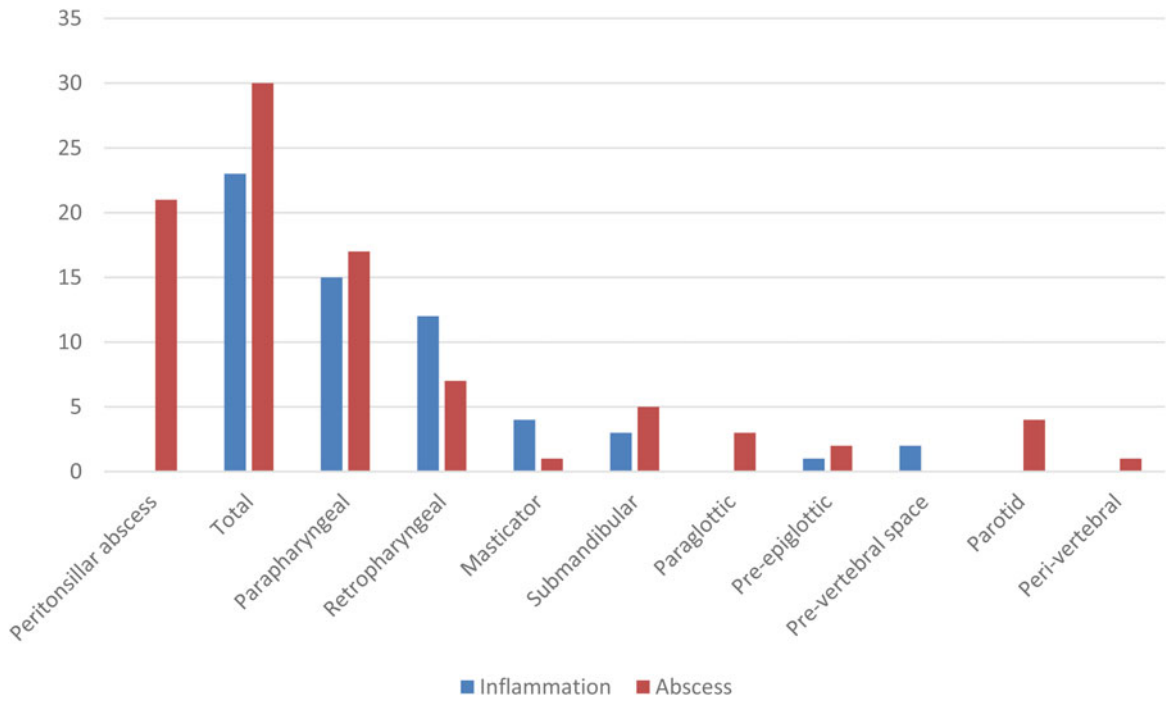

Figure 2. Frequency (number) of deep neck space infections by type (inflammation *vs* abscess) and site.

malignancy in that cohort. Furthermore, patients who are at elevated risk of head and neck malignancy (elderly, smokers, etc.) presenting with deep neck space infection should have samples sent for histopathological evaluation for early detection and treatment of the malignancy.[19]

The most common site of deep neck space infection in our study was the parapharyngeal space: inflammation and abscess 43.4 per cent ($n = 23$) and 32.1 per cent ($n = 17$), respectively. Retropharyngeal was the second commonest site of deep neck space infection, and we had one case of Ludwig angina. When discussing deep neck space infection, Ludwig angina is typically the most common presentation reported in studies,[11,20] however, because Ludwig angina is associated with dental infections, it is managed by the oral and maxillofacial surgery department in our tertiary centre.

Limitations and future work

We appreciate that a case series such as ours is vulnerable to selection bias of particular patients and cannot be extrapolated to the wider population. However, our review is comparable to current medical literature which enables clinicians to review any potential shifting patterns of deep neck space infection.

Thirty of 53 patients did not have any cultures grown, which may be due to the prompt commencement of antibiotics prior to blood cultures and intra-operative sampling.

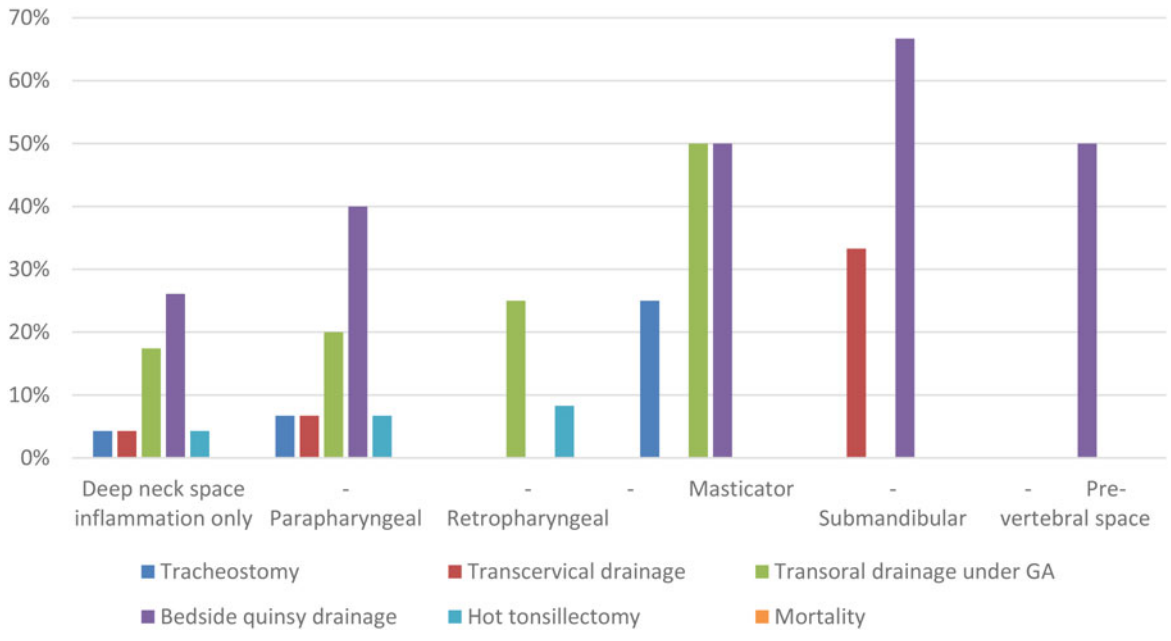

Figure 3. Percentages of management and mortality according to deep neck space involved for patients with deep neck space **inflammation only**. GA = general anaesthesia.

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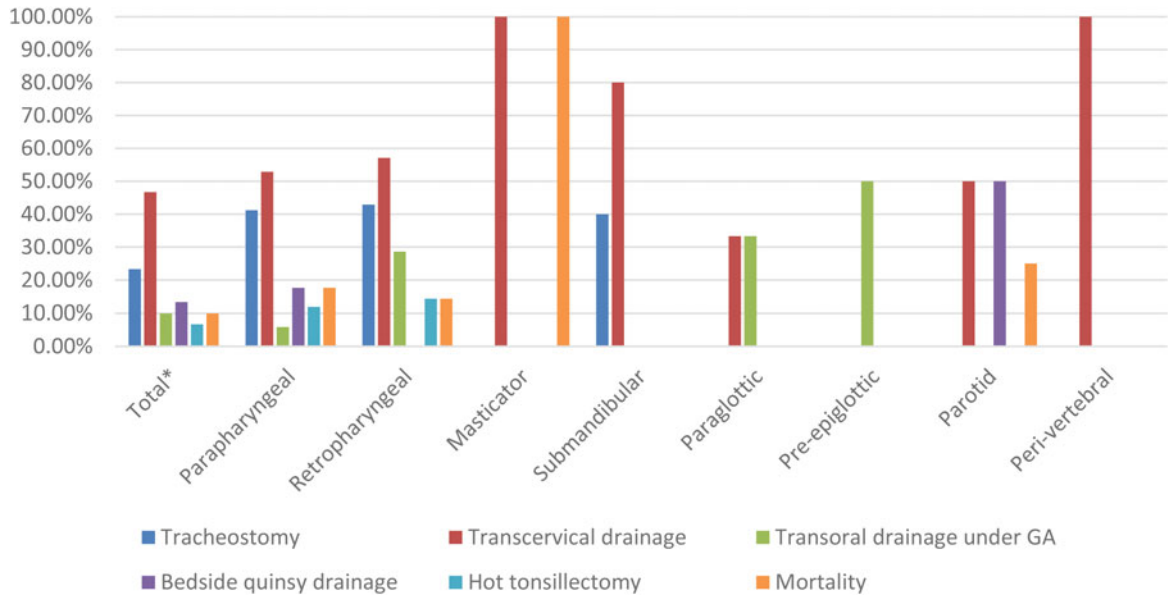

Figure 4. Management and mortality percentages according to deep neck space involved for patients with deep neck space **abscesses**.

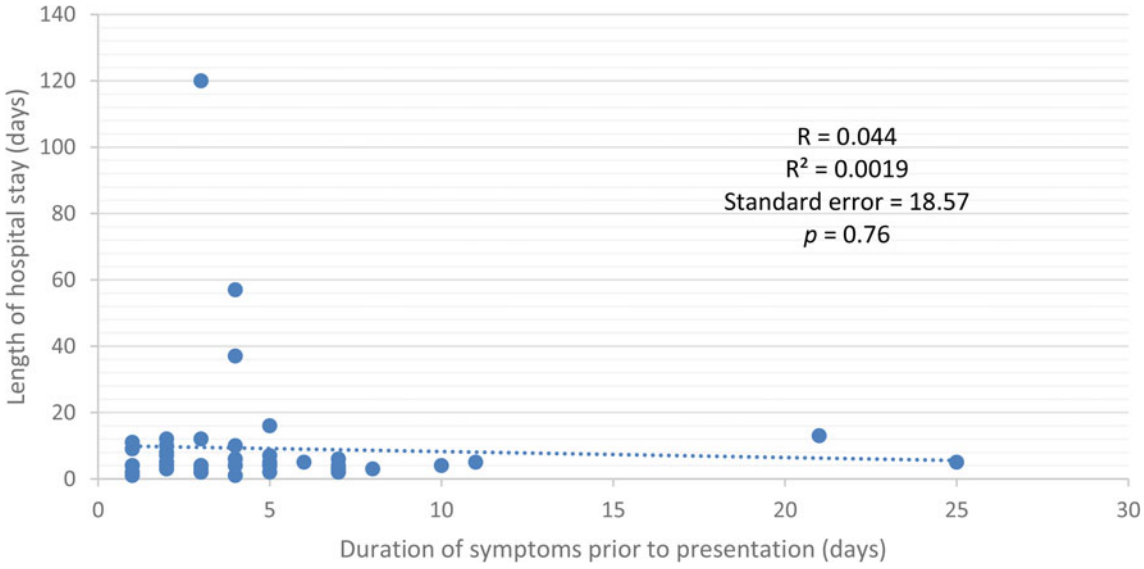

Figure 5. Duration of symptoms prior to hospital attendance (presentation) plotted against length of hospital stay.

Having those results may have given us alternative outcomes and antibiotic regimes for specific patients. Furthermore, our study did not include the patients' co-morbidities and ethnicity, which would give us additional data for analysis.

- Complications remain common in deep neck space infections, and attending clinicians must be alert to these, particularly mediastinitis and Lemierre's syndrome
- Medical therapy alone with systemic antimicrobials is an appropriate treatment for a substantial proportion of patients with deep neck space infection
- A range of surgical options may be appropriate for managing deep neck space infection; these should be tailored to the patient condition, surgeon skillset and interpretation of cross-sectional imaging
- The *Streptococcus milleri* group is commonly implicated in deep neck space infection in our cohort, but local antibiotic guidelines reflecting local bacteriology trends are essential to effective management
- The parapharyngeal space appears to be the most frequent site of deep neck space infection in adult, UK otolaryngology cohort of patients

In the interest of future work, combing the oral and maxillofacial surgeons' deep neck space infection patients including their Ludwig angina patients will give us a larger number for comparison. Finally, with the increase of deep neck space infection cases in the UK,[3,4] and our data illustrating a hospital stay of 10.5 days on average due to substantial number of patients requiring more radical management (41.5 per cent, $n = 22$), evaluating the cost effects to our hospital would be beneficial.

Conclusion

Deep neck space infections remain challenging in terms of decision-making, especially in light of their heterogeneity. This study adds the recognition that these infections can involve a variety of neck spaces, and can be treated in a variety of manners, which all seem to have a role. This highlights the

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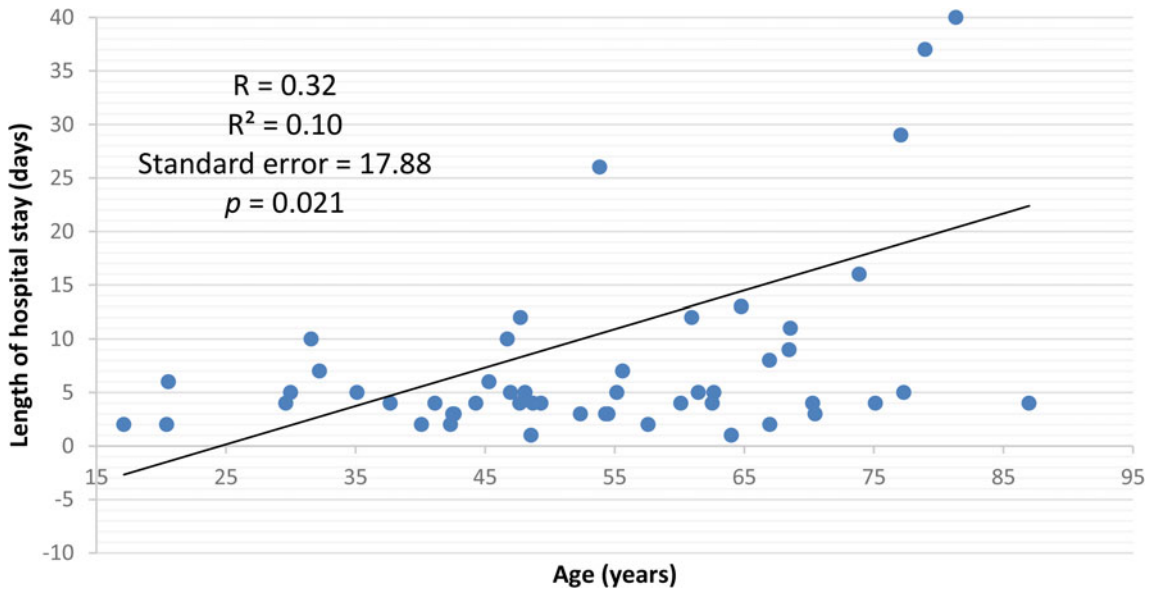

Figure 6. Patient age versus length of hospital stay.

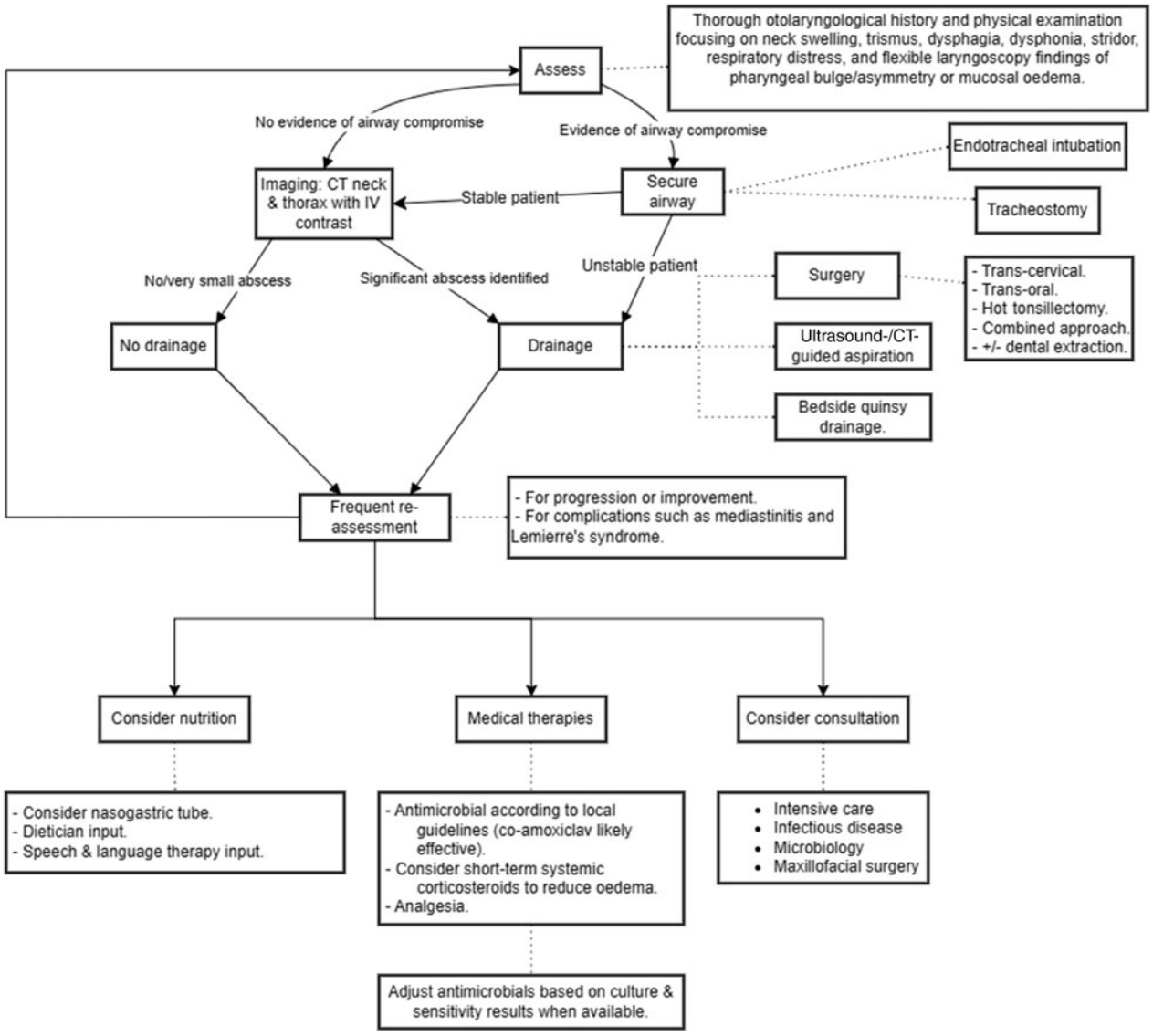

Figure 7. Proposed management algorithm for patients with deep neck space infections

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requirement for bespoke management that depends on the summation of clinical information and review of cross-sectional imaging. It is important for clinicians to be alert to complications from deep neck space infections, particularly Lemierre's syndrome and mediastinitis, as these are common. Local antibiotic guidance based on bacteriological findings are also crucial to provide optimal antimicrobial therapy, which can frequently avert the need for surgery. To aid understanding and knowledge of managing these complex and often challenging patients, the authors have proposed a management algorithm (Figure 7).

Competing interests. None declared.

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