Severe parapharyngeal abscess that developed significant complications: management during the COVID-19 pandemic

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SUMMARY

A 50-year-old Caucasian man presented to the emergency department during the early stages of the COVID-19 pandemic with a rapidly progressive facial swelling, fever, malaise and myalgia. The patient had recently travelled to a COVID-19-prevalent European country and was therefore treated as COVID-19 suspect. The day before, the patient sustained a burn to his left forearm after falling unconscious next to a radiator. A CT neck and thorax showed a parapharyngeal abscess, which was surgically drained, and the patient was discharged following an intensive care admission. He then developed mediastinitis 3 weeks post-discharge which required readmission and transfer to a cardiothoracic unit for surgical drainage. This report discusses the evolution of a deep neck space infection into a mediastinitis, a rare and life-threatening complication, despite early surgical drainage. This report also highlights the difficulties faced with managing patients during the COVID-19 pandemic.

BACKGROUND

Head and neck space infections may be superficial or deep. The latter includes parapharyngeal space abscesses, which form 11% of deep neck space infections; these are difficult to diagnose early and have a high risk of complications.[1] Most parapharyngeal space abscesses are of dental or tonsillar origin. The parapharyngeal space is bound anteromedially by the superior constrictor muscle, and once breached an infection can result in a parapharyngeal space abscess which could disseminate into the retropharyngeal space, carotid sheath and mediastinum.[2] Other complications include sepsis, airway obstruction, internal jugular vein thrombosis, carotid artery aneurysm and pericarditis. Complications of parapharyngeal abscesses are increasingly rare due to the introduction of antibiotics and early diagnosis with improvement in imaging.[3] Management is difficult and early surgical intervention is advised to prevent the spread of infection and such complications.

We present a case of a parapharyngeal abscess and the significant complications that developed during the COVID-19 pandemic. The presented case highlights some of the issues faced surrounding patients and healthcare workers during the COVID-19 pandemic. The overwhelming pressure on an already stretched National Health Service (NHS) with the anticipation of potential rises in COVID-19-related hospital admissions means that healthcare professionals need to act decisively and change their approach to some common procedures. This means avoiding hospital admissions where possible, accelerating discharge where appropriate and avoiding non-essential surgery to expand the NHS's capacity to cope with this pandemic. There is much debate surrounding aerosol-generating procedures such as tracheostomies.

Patients suspected of COVID-19 are placed into COVID-19 cohort areas, exposing them to COVID-19 when they may actually be negative for the disease. Therein lies the dilemma of what to do with a patient who has tested negative for COVID-19 but still has a high clinical suspicion of being COVID-19-positive.

CASE PRESENTATION

A 50-year-old Caucasian man presented during the COVID-19 pandemic to the emergency department (ED) of a general hospital in the UK with a rapidly progressive cervicofacial swelling. He did not have other red flag signs or did not report symptoms such as drooling or dysphagia. Of particular importance was his recent travel to France (around 2.5 weeks prior to presentation) which resulted in him subsequently deciding to self-isolate, as he normally worked with vulnerable people. Two weeks after returning from France he began to develop symptoms of fever, malaise and myalgia. The day before the patient presented to the ED he had a fall which resulted in loss of consciousness and a full thickness burn from a radiator on his left forearm (<5% body surface area).

Due to his fever, significant recent travel history and presence of some of the recognised COVID-19 symptoms, he was treated as a COVID-19 suspect and was transferred to the COVID-19 ED. The patient had no significant medical history other than a chronic cough and a penicillin allergy (rash). He was an ex-smoker who had quit over 20 years ago.

The ED doctors' initial impression was that this was a case of Ludwig's angina, for which they carried out a non-contrast CT head and spine, and the patient was referred to the oral and maxillofacial surgery (OMFS) team at a local general hospital. They suspected that the recent fall was the likely aetiological cause as the patient did not have any other symptoms such as dental pain or sore throat.

On examination by the OMFS team, he was found to have a mild diffuse left buccal facial swelling and erythema extending to the submental

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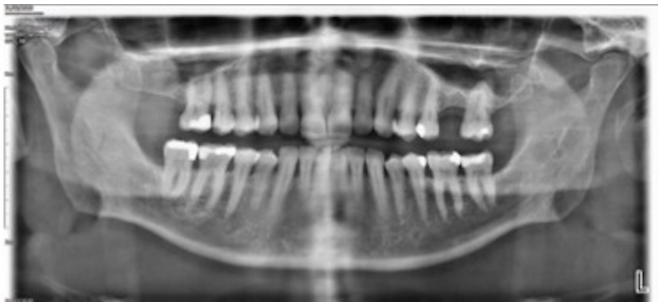

Figure 1 Orthopantomograph on day 1 of first admission showing no abnormalities with dentition.

area. He had significant tenderness on his right neck, but there were no palpable fluctuant collections on the neck. He had a floor of mouth swelling which was soft. There were no abnormalities detected on examination of his dentition. Visual examination of the oropharynx was unremarkable. A diagnosis of Ludwig's angina was ruled out following this examination due to the mainly unilateral presentation, lack of submandibular involvement and lack of neck swelling. His temperature was 38.1°C, respiratory rate was 22 and heart rate was 121, with a National Early Warning Score (NEWS) 2 of 5 and a Glasgow Coma Score of 15. He was diagnosed with sepsis and initially needed septic management.

INVESTIGATIONS

Blood tests confirmed the clinical suspicion of an acute inflammatory condition. Full blood count showed a normal haemoglobin level of 169 g/L, a slightly raised white cell count of 11.5×10^9/L, a reduced lymphocyte count of 0.7×10^9/L, a raised neutrophil count of 9.4×10^9/L and a normal platelet count of 193×10^9/L. Urea and electrolytes were normal, and the C reactive protein (CRP) was raised at 271 mg/L.

An orthopantomogram (OPG) (figure 1) was taken which was unremarkable, ruling out an odontogenic source. An urgent CT head including the facial bones (figure 2) and CT cervical spine requested by the ED doctors showed a left parapharyngeal abscess.

A chest X-ray (figure 3) showed a small focal area of consolidation in the left lower lung, which was presumed to be infective.

DIFFERENTIAL DIAGNOSIS

A diagnosis of a left parapharyngeal abscess was made based on the CT findings and the clinical history and examination.

Causes of deep neck space infections include odontogenic origins, suppurative lymphadenitis, upper respiratory infections, sialolithiasis, parotitis, otogenic causes, trauma, foreign body ingestion, HIV, non-insulin-dependent diabetes mellitus and tuberculosis.[1] Important aetiological causes to consider in this case could be pharyngitis, tonsillar abscess, recent trauma, burn on the left forearm, secondary infections, potential microorganisms cultured from any positive blood culture results and suspected COVID-19 virus.

Dental pathology is well recognised as one of the leading causes of deep neck space infection. The lack of dental pain, the clinical examination which revealed no evidence of dental pathology and the unremarkable OPG ruled out this potential diagnosis. We therefore had to suspect less common aetiologies that may have contributed to the patient's presentation. Pharyngitis was suspected due to the patient's fever and cough; however, this was excluded due to lack of the following: sore throat, hoarse voice, tonsillar exudate and key risk factors such as young age. Tonsillar abscess was suspected due to the patient's fever and swelling; however, this was excluded after an unremarkable examination of the oropharynx and lack of features suggestive of a tonsillar abscess on the patient's CT.

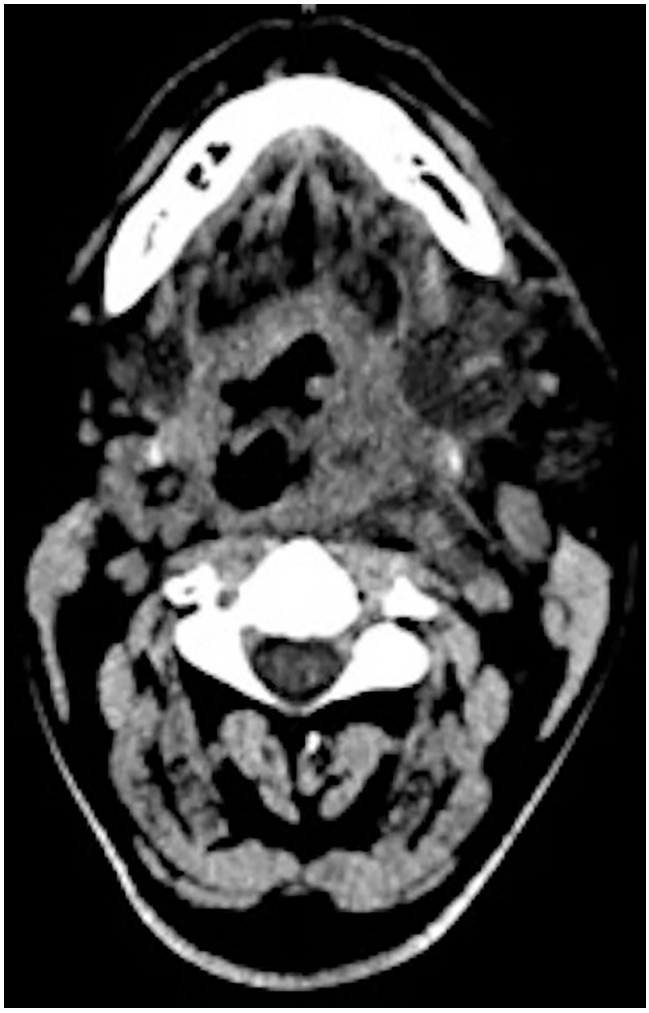

Figure 2 Axial view of non-contrast CT head on day 1 of admission showing a 9 cm in length likely left parapharyngeal abscess (extensive oedema and inflammatory change) causing distortion and displacement of the pharynx to the right side, centred at the level of the hyoid bone.

Due to the patient's fall the previous day which resulted in a collision with a radiator, recent trauma needed to be excluded as a cause of the parapharyngeal abscess. From the clinical examination and history taking there were no signs of any soft tissue or hard tissue facial injuries. Examination of the burn site on his left forearm showed no sign of infection and therefore secondary infection was deemed unlikely.

The patient was a COVID-19 suspect due to the current global pandemic, his significant travel history, fever and other non-specific COVID-19 symptoms. A chest X-ray on admission showed a focal area of consolidation which assisted in diagnosing community-acquired pneumonia. A diagnosis of a full thickness skin burn on the patient's left forearm, which was <5% of the body surface area, was also made.

TREATMENT

The patient's primary management comprised treatment for his sepsis. He was initially given intravenous clarithromycin (500 mg

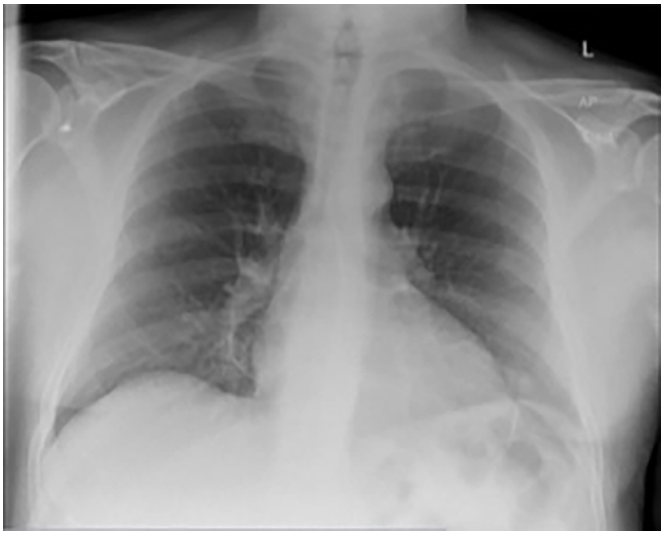

Figure 3 Chest X-ray on day 1 of admission showing a small focal patch of consolidation seen on the left lower zone adjacent to the cardiac silhouette, which was probably infective in nature.

two times per day) and metronidazole (500 mg three times a day) while awaiting blood culture results due to being allergic to penicillin. He was also given intravenous fluids, analgesia (1 g intravenous/oral paracetamol four times a day) and intravenous dexamethasone (6.6 mg four times a day), and remained nil by mouth. The oral and maxillofacial surgeons decided that the patient did not require urgent surgery on the night of admission as he was not an airway risk and his observations normalised with this initial management.

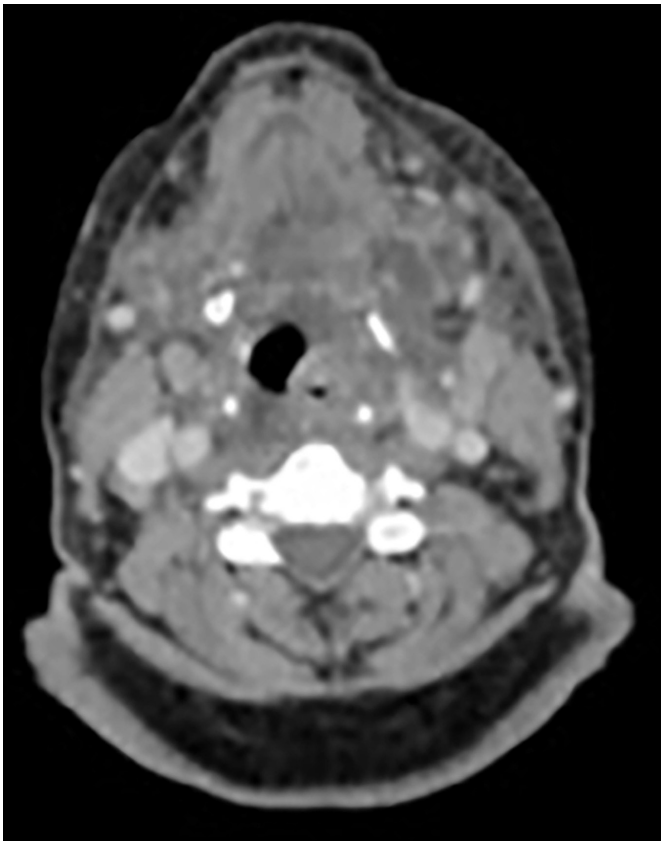

Figure 4 Axial view of CT neck with contrast on day 2 of the first admission. The appearance is suggestive of Ludwig's angina. Phlegmonous cellulitis involving almost all spaces on the left side of the neck. Extension of the process is noted into the mediastinum. Minor displacement and narrowing of the supraglottic larynx and pharynx. No large collections are seen.

As the CT taken at the ED before transfer was non-contrast, a CT neck and thorax with contrast (figure 4) was requested prior to surgery the following morning. This confirmed a collection in the left parapharyngeal space and a bibasalar atelectasis, affecting the left side more so than the right.

The patient then required surgical exploration under general anaesthesia. An awake fibreoptic intubation was carried out successfully. Extraoral and intraoral incisions were made to allow exploration of the tissue spaces. The submandibular, submental, submasseteric, buccal and parapharyngeal spaces were explored with blunt dissection, releasing copious amounts of pus. One extraoral and two intraoral drains were placed. When extubated, the patient was unable to maintain his oxygen saturations due to significant laryngeal oedema. He was therefore reintubated and admitted to the intensive care unit for 3 days.

Meanwhile the blood culture and pus swab results revealed growth of *Streptococcus constellatus*, resulting in a change of antibiotics to intravenous 2 g ceftriaxone two times per day and intravenous 500 mg metronidazole three times a day, as per advice from the microbiology team. Two doses of intravenous clarithromycin were given before this was changed to intravenous ceftriaxone. Intravenous ceftriaxone was therefore used for the remainder of the patient's inpatient stay, while intravenous metronidazole was continued throughout. Intravenous dexamethasone was given from admission to discharge.

Two COVID-19 testing swabs were taken prior to surgery (first nose and throat and second endotracheal); the first came back negative and the second was rejected as it was classed as a duplicate sample. The patient still remained a COVID-19 suspect and remained in the COVID-19 section of the hospital; this was due to the high level of clinical suspicion and the risk of false negatives associated with COVID-19 swab testing.

OUTCOME AND FOLLOW-UP

The patient was successfully extubated 2 days later and was stepped down to the ward after 2 nights on the intensive care unit. He was discharged from the COVID-19 surgical ward the following day (day 6) with a 7-day course of oral clindamycin (450 mg four times a day), as per microbiology advice. The patient did not have a nasogastric tube during this stay.

In accordance with national guidance during the COVID-19 pandemic, a telephone appointment was arranged to review the patient, who appeared to be recovering well.

Three weeks following discharge the patient contacted the OMFS department with a short history of blood-stained saliva, which was likely from the intraoral drain site. The patient was reassured and advised to recontact the department if he developed any other signs or symptoms. The following day he experienced a change in his voice and some soreness in the lower anterior neck. He also reported that he was starting to experience mild respiratory difficulties. The patient was advised to attend the OMFS unit urgently.

On examination the patient had no obvious facial nor intraoral swelling, and the floor of the mouth and tongue appeared normal. The patient also noted that the voice changes and respiratory difficulties he initially described were no longer present. He had mild swelling in the suprasternal area of his neck, but the examination was otherwise unremarkable. His temperature

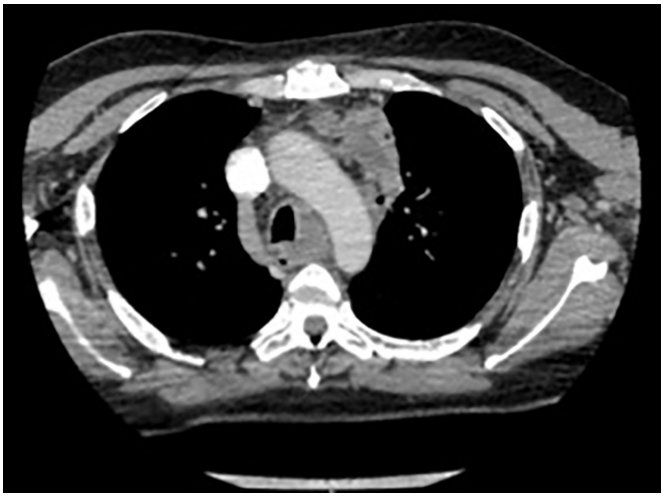

Figure 5 Axial view of CT neck with contrast on day 2 of readmission showing appearance in keeping with mediastinitis and both cervical and mediastinal collections with surgical emphysema throughout the cervical tissues, presumably all secondary to coughing.

was 39.1°C and his heart rate was 108, with a NEWS2 score of 3. This improved throughout the day with minimal treatment.

Blood tests revealed a raised white cell count of 16.9×10^9/L, a raised neutrophil count of 12.8×10^9/L and a raised CRP of 155 mg/L. He was started on intravenous ceftriaxone and metronidazole (the same antibiotics, with the same dose and regimen as his previous admission, as per microbiology advice) and intravenous dexamethasone 6.6 mg four times a day, while waiting for blood culture results. Repeat COVID-19 testing was needed due to fever and high clinical suspicion for COVID-19 due to a chronic cough; this was done via a nose and throat swab. The intravenous antibiotics were given throughout his stay, while the dexamethasone was stopped on day 3 of readmission.

Figure 6 Coronal view of CT thorax on day 5 of readmission showing loculated, irregular, peripherally enhancing collections in the left pararetrotracheal and prevascular regions, with the latter showing few air foci representing abscesses. Atelectatic changes are noted in the lungs. Bilateral pleural effusions are also noted.

Figure 7 Axial view of CT thorax on day 5 of readmission showing loculated, irregular, peripherally enhancing collections in the left pararetrotracheal and prevascular regions, with the latter showing few air foci representing abscesses. Atelectatic changes are noted in the lungs. Bilateral pleural effusions are also noted.

The following morning a CT neck with contrast (figure 5) was carried out which showed mediastinitis with both cervical and mediastinal collections and surgical emphysema throughout the cervical tissues. The cervical collection was confined to the level of the thyroid, measuring 5.3×1.7×4.3 cm, while the collection within the anterior mediastinum measured approximately 6.6×2.8 cm, and the collection to the left of the neck in the posterior mediastinum measured approximately 1.6×3.3 cm in cross-sectional diameter. The cardiothoracic surgeons were contacted regarding the mediastinitis; they advised that surgical exploration and drainage were not currently indicated taking into consideration the current COVID-19 pandemic and the relatively small collections.

The patient's observations remained stable, his temperature came down, and he had no chest pain, respiratory difficulties or dysphagia.

The third COVID-19 swab returned negative and the blood cultures revealed no growth. A CT thorax with contrast was taken on day 4 of the patient's readmission to check for resolution of the mediastinal collections. The CT thorax (figures 6 and 7) showed left para-retrotracheal and prevascular abscesses which measured 8.8 cm and 7.2 cm in length, respectively. On further discussion with the cardiothoracic surgeons, and in view of the increase in size of the collections, it was advised that the patient be transferred for surgical management of mediastinitis on day 7. The patient remained asymptomatic throughout the period of his readmission to his transfer; he was eating and drinking well and had no difficulty with speech or swallowing. On day 9 of his readmission, the patient underwent surgical drainage of the chest concurrent with drainage of the neck by the cardiothoracic and ear, nose and throat (ENT) teams, respectively. The patient was discharged 10 days after this operation and a 5-week course of oral metronidazole (400 mg three times a day) and intravenous ceftriaxone (2 g once daily, as outpatient parenteral antimicrobial therapy) was prescribed. The patient made full recovery.

DISCUSSION

COVID-19 first emerged in China in December 2019, caused by an infection with a novel coronavirus, SARS-CoV-2. This has

spread globally and the WHO has declared it a global pandemic. As of 6 November 2020 there have been 49 463 678 cases confirmed globally, including 1 245 714 deaths.[4]

Similar published cases of mediastinitis with an oropharyngeal infective origin have recognised the importance of timely treatment with a combination of effective surgical drainage and adequate antibiotic therapy.[5–8]

Appropriate antibiotic therapy was guided by the results of the patient's pus swabs and blood cultures. Deep neck space infections are typically polymicrobial and involve β-haemolytic *Streptococcus*, *Staphylococcus aureus* and *Neisseria* species.[2] Common anaerobes include *Fusobacterium*, *Bacteroides* and *Peptostreptococcus*.[2] Typically penicillin, aminoglycosides and metronidazole cover Gram-positive, Gram-negative and anaerobic micro-organisms, respectively, in spreading deep neck space infections.[9] Ceftriaxone was used in place of penicillin to manage the deep neck space infection empirically due to an allergy to penicillin. The patient was administered metronidazole and ceftriaxone in view of the efficacy of third-generation cephalosporins, such as ceftriaxone, in managing deep neck space infections in place of penicillin.[9] Heavy growth of the *S. constellatus* species helped guide the use of the said antibiotics on the advice of microbiologists.

S. constellatus belongs to an aggressive group of pathogens called the *Streptococcus milleri* group. These are known to cause abscesses across the body; however, this is rare in the head and neck.[10] Their aggressive nature may explain recollection in the neck and subsequent need for readmission to hospital. This, coupled with the patient's persistent cough and likely cause of surgical emphysema, resulted in mediastinitis.

Mediastinitis is a rare but life-threatening complication which typically afflicts the immunosuppressed[2] and has a mortality of 40%.[9] As mentioned, its management usually requires both surgical drainage and antibiotic therapy.[9] COVID-19 and the consequent restriction of surgery to only the most essential procedures played a role in the initial avoidance of surgical drainage. In light of this, the cardiothoracic decision to monitor the patient's response to intravenous antibiotic therapy was justified by citing the small size of the mediastinal collections and the clinical stability of the patient on readmission. On day 9 of readmission, however, the patient underwent surgical drainage of the chest as antibiotic therapy alone proved insufficient—as evidenced by the increase in size of the mediastinal collections between the CT scans.

In addition to the initial avoidance of cardiothoracic surgery, there are stark differences in how this patient was managed during the COVID-19 pandemic when compared with how he may have been managed pre-COVID. Different personal protective equipment was worn (as per national and Trust guidance) to manage this patient, particularly for aerosol-generating procedures.

In more normal circumstances, this patient would have had a formal examination of his oropharynx with an endoscope when he initially presented. However, this is a known high-risk procedure with the potential for aerosol generation.[11] Due to the high clinical suspicion of COVID-19 infection, a decision was made that the risks of scoping the patient outweighed the benefits. The ENT team were consulted and were happy with the OMFS management plan. Care was also taken during the visual examination of the oropharynx to avoid provoking gag reflex. Post-surgery, this patient could not tolerate extubation due to laryngeal oedema and the consequent failure to maintain oxygen saturations. Although laryngeal oedema has been highlighted as a potential feature of patients with COVID-19, in this case it may have actually been attributable to the adjacent abscess and subsequent neck exploration.[12] If reintubation had failed, the patient would have needed a tracheostomy. Tracheostomies are an example of an aerosol-generating procedure, and in patients with COVID-19 they are linked to a significant risk of transmission.[13 14]

Owing to the COVID-19 pandemic, this patient was discharged following initial hospital admission and followed up via telephone rather than face-to-face. The patient was readmitted 3 weeks following discharge. This may have been avoided had the patient been followed up face-to-face, where repeated blood tests and clinical examination may have diagnosed incompletely treated or recurring infection and prevented later complications.

During the COVID-19 pandemic, there was an increased pressure from bed managers to shorten patient stays to free up beds for a potential COVID-19 inpatient surge. This meant that this patient was discharged after only 1 day on the ward following discharge from intensive care and followed up via telephone. His initial white cell count on first admission was 11.5×10^9/L and CRP was 271 mg/L; this decreased to a white cell count of 7×10^9/L and an increased CRP of 557 mg/L on day 1 postoperatively. This patient was discharged with a CRP of 50 mg/L; however, the white cell count had increased to 16×10^9/L on discharge. This patient's vital signs remained stable despite the isolated raised white cell count and therefore the patient was deemed fit for discharge. While it was not clinically deemed unsafe at the time to discharge this patient, less pressure from bed managers may have allowed the patient to stay longer until the white cell count reduced and blood results had normalised. This in turn may have prevented the need for readmission and the complication of mediastinitis. Therefore, pre-pandemic, in addition to having a face-to-face follow-up, this patient may have stayed in the hospital longer on first admission.

This patient was swabbed on both first and second admission. During this patient's prolonged hospital stay, he was not reswabbed and therefore the clinical suspicion of COVID-19 remained. Perhaps reswabbing this patient during his readmission would have helped reduce the suspicion of COVID-19. However, this patient was managed relatively early during the pandemic and at this time it was not recognised practice to swab inpatients weekly for COVID-19.

Chest X-rays and CT scans are useful in aiding diagnosis of novel coronavirus pneumonia, with characteristic features on CT scans including multiple ground-glass opacities in both lungs.[15] CT scans also facilitate in localising and determining both the extent of collections and the spread of infection in deep neck space infections. The patient's initial chest X-rays on admission showed focal consolidation within the left lower lobe, which was deemed likely infective in nature by the radiological report. Chest X-rays on both admission and readmission could not exclude COVID-19. As such, clinicians erred on the side of caution and remained suspicious of COVID-19.

With regard to the parapharyngeal abscess, the results from clinical examination, imaging, COVID-19 swabs and a swab of the burn site seemed to exclude COVID-19, the burn, recent trauma and other common causes of deep neck space infections as the source of the patient's abscess. The exact aetiology therefore remains unknown.

Finally, it is also important to note the impact of COVID-19 on the emergency care of patients. The Resuscitation Council's Recommended Summary Plan for Emergency Care and Treatment (ReSPECT) process, introduced in 2017, gives clinicians and patients a framework to help discuss and support decision making in the case of a future emergency.[16] More explicitly, the

process creates personalised recommendations for a person's clinical care and treatment in such an emergency where they would be unable to make or express choices; it discusses the level of care a patient would be willing to receive should they become critically ill, including decisions about whether to attempt cardiopulmonary resuscitation. The recommendations are made from conversations with patients, their families and healthcare professionals and they are documented on the accompanying form.[12] In the context of the current pandemic, it is important to have conversations with admitted patients with COVID-19 early when they are well and able to communicate what care and treatment they would/would not want to receive in an emergency situation. Such discussions and decisions are particularly important due to the nature of COVID-19 and the possibility of requiring mechanical ventilation and intensive care.

In summary, the pressures to try and reduce the transmission of COVID-19 and adapt to new methods of working (for example, remote consultations) can sometimes be overwhelming. Nonetheless, we need to balance the risks of transmission versus the benefits of thorough clinical examination and appropriate treatment in order to determine what is in the patient's best interests during this pandemic. The ReSPECT process has had its importance further emphasised by this pandemic, and in most hospitals the accompanying form is being completed for patients who may require this advance planning in order to guide our treatment decisions.

Learning points

- The COVID-19 pandemic can cause patients to avoid attending emergency departments, resulting in delayed clinical presentations and more complications associated with deep neck space infections.
- Prompt recognition and treatment of deep neck space infections is essential during the COVID-19 pandemic to avoid the development of complications and the need for surgical airway management and other aerosol-generating procedures.
- We must weigh up the benefits of early hospital discharge to increase bed capacity and reduce COVID-19 transmission with the risk of not fully treating infections that may result in complications and the need for further surgery or readmission during the COVID-19 pandemic.
- Multidisciplinary management with our microbiology, anaesthetic, intensivist and surgical colleagues is essential as patients suspected of COVID-19 are being managed differently by all specialties; communication is key in order to determine what is in the patient's best interests.
- It is essential that ceiling of care forms are completed at a very early stage when a patient is admitted so that it may serve as guidance when deciding what treatments are appropriate for patients during the COVID-19 pandemic.

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