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# Necrotising fasciitis of the posterior neck crossing the midline: A case report

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## ABSTRACT

**INTRODUCTION AND IMPORTANCE:** Craniofacial necrotising fasciitis is a complex condition, with high mortality given its propensity to descend via the deep neck spaces into the chest and mediastinum. Management requires optimal antimicrobial therapy with associated aggressive surgical debridement. **PRESENTATION OF CASE:** A 64-year-old man presented to ENT with a posterior neck swelling. Despite incision and drainage of the swelling following a trial of antimicrobial therapy, it increased in size, with areas of overlying necrosis demonstrated. Based on radiological and clinical findings, a diagnosis of necrotising fasciitis was made. He was taken to theatre for debridement. Intra-operatively, carotid sheath suppuration was noted, after tissue retraction resulted in copious bleeding from the anterior wound bed, requiring vigorous resuscitation and clamping of underlying structures to achieve haemostasis. Senior ENT and vascular surgery involvement was quickly sought to achieve haemostasis, however bleeding from the wound bed was difficult to control. This was due to the significant watershed area at the posterior neck which would not have been amenable to selective vessel ligation. After multiple cardiac arrests, a team decision was taken to discontinue resuscitation.

**CLINICAL DISCUSSION:** Operating in this area of anatomical complexity required input from a number of different specialty teams. Although input from infectious diseases, microbiology, plastic surgery and tissue viability was commendable, there was room for optimising this further. Early patient referral to a tertiary centre where on-site input was available from maxillofacial surgery and plastic surgery would have been beneficial; a set-up commonly seen in regional trauma networks.

**CONCLUSION:** This case demonstrates the intricacies surrounding a rare occurrence of necrotising fasciitis of the neck crossing the midline. Multi-disciplinary team involvement is imperative and should be encouraged at an early stage.

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## 1. Introduction

Necrotising fasciitis is a subcutaneous infection of the soft tissue, which extends to deep fascia and spreads across fascial planes. Presence in the head and neck is rare; usually a consequence of deep neck space infection from dental or oropharyngeal sepsis. As this life-threatening infection spreads, overlying skin becomes necrotic. Due to the ability of the infection to traverse the deep fascia of the head and neck to the carotid sheath and mediastinum, the mortality rate in the head and neck is particularly high [1,2]. Risk factors include diabetes mellitus, alcohol, renal failure and drug use.

The most common organisms are *Streptococcus pyogenes*, *Staphylococcus aureus*, *Streptococcus viridans*, *Prevotella*, *Pepto-*

*strep*tococci, *Bacteroides* and *Clostridium* [3], with infections caused by skin pathology more likely to grow *Streptococcus* and *Staphylococcus* [4].

This report describes a patient with posterior neck necrotising fasciitis which crossed the midline.

## 2. Presentation of case

A 64-year-old man presented to our district general hospital under the Ear, Nose and Throat (ENT) team with a two-week history of swelling in the left posterior triangle of his neck. He had no past medical history, was an ex-smoker and previous heavy alcohol drinker.

Examination revealed an indurated area in the left posterior triangle. His white blood cells (WBC) were  $31.6 \times 10^9/L$  and C-reactive protein (CRP) was 278 mg/L. Acute kidney injury (urea 34.5 mmol/L and creatinine 237 umol/L) was diagnosed and HbA1c was elevated at 126 mmol/mol.

A computerised tomography (CT) scan (Figs. 1, 2) revealed soft tissue oedema and swelling over 13 cm of the posterior and left

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**Fig. 1.** Axial CT Section Demonstrating Soft Tissue Oedema and Swelling on the Posterior Aspect of the Left Neck (Red Arrow to Soft Tissue Lucency at the Carotid Sheath).



**Fig. 2.** Sagittal CT Section Demonstrating Oedema Posteriorly and Abutment of the Posterior Neck Muscles.

neck, extending 7 cm from occiput to C7. Peripheral enhancement suggested possible early abscess formation. Oedema was abutting superficial posterior neck muscles (splenius capitis, trapezius and sternocleidomastoid). The literature suggests that CT findings of oedema and inflammatory changes in the subcutaneous fat, fascia and muscle are sufficient to determine a diagnosis of necrotising fasciitis [5].

The patient was referred to infectious diseases (ID), who advised to change his antibiotics from Ceftriaxone and Metronidazole to Flucloxacillin (blood cultures had grown *Staphylococcus aureus*).

By day five, an abscess was palpable, requiring incision and drainage under local anaesthesia. Samples were sent for microscopy, cytology and culture sensitivities. ID took over care, with a carbuncle considered as the origin of abscess development.

Whilst on the ID ward, skin necrosis appeared around the wound edges. A senior ENT decision was made (on day nine of admission) to perform debridement under general anaesthesia (GA). After



**Fig. 3.** Post Initial Debridement (Red Arrow shows Close Proximity to the Carotid Sheath).



**Fig. 4.** Intra-operative Wound at Second Debridement.

healthy vascularised tissue was demonstrated beneath, the wound was packed with bismuth iodoform paraffin paste (BIPP) gauze.

The neck defect was discussed (by the ID team) with Plastic surgery (based at a neighbouring hospital), to formulate a plan for future tissue reconstruction. The plastic surgeons recommended input from tissue viability to apply a vacuum-assisted closure device and arranged to review as an outpatient.

Unfortunately, the wound continued to enlarge with evidence of skin necrosis at the edges (Fig. 3). Little improvement was seen, despite reducing inflammatory markers.

At day 14, the patient underwent a further debridement under GA (Figs. 4, 5). As the wound crossed the posterior midline, the patient was placed in the right lateral position. Peripheral necrotic tissue was debrided by the ENT registrar and core trainee, using cold steel, until well-vascularised tissue was reached.

As the operation drew to a close, an area of poorly-viable tissue remained at the antero-superior aspect of the wound. As this tissue was grasped, it sheared off from underlying structures, giving rise to profuse bleeding. Rapidity of blood flow made identification of its origin difficult and manual pressure was unable to control it. Blood products were requested and a decision was taken to clamp adjacent structures; haemostasis was thus quickly achieved. Senior ENT (head and neck) and vascular surgery assistance were immediately sought, whilst the patient was resuscitated.



Fig. 5. Intra-operative Wound at Second Debridement.

Exploration of the wound bed permitted identification of the internal jugular vein (IJV), which was tied off, having been recognised as the source of bleeding. It was noted at this point that the common carotid artery had been inadvertently clamped together with the IJV.

Clamp removal did not demonstrate flow through the common carotid, suggesting possible dissection or thrombosis. Whilst a plan was devised between ENT and vascular surgery to repair this defect, the patient began to show signs of haemodynamic instability.

The surgical and anaesthetic teams prioritised repositioning the patient, for better exposure of the anterior neck structures and resuscitation. Immediately upon repositioning, the patient lost cardiac output and cardio-pulmonary resuscitation (CPR) was commenced. Return of spontaneous circulation was accompanied by bleeding from the debrided wound bed extending to the back of the neck (no longer in view).

The vascular supply in this region of the posterior neck comprised of communicating vessels across a watershed area. The transverse cervical artery passes anteriorly to the anterior scalene, and gives off the superficial cervical artery [6]. This runs along trapezius and subdivides into ascending and descending branches. The ascending branch anastomoses with a branch of the descending occipital artery, whereas the descending branch anastomoses with the deep and dorsal scapular arteries. Transverse cervical veins travel with the artery, becoming tributaries to the external jugular vein (EJV). Additionally, the posterior external jugular vein, running between splenius capitis and trapezius, also contributes to the EJV. Overall, the posterior neck region is one of notable collateral circulation making it futile to attempt selective ligation of specific vessels.

Despite deep tissue sutures to plicate wound edges, direct pressure with gauze swabs and application of haemostatic agents, haemorrhage continued. Unfortunately, despite blood transfusions, interspersed with CPR, the patient could not be resuscitated and sadly, following team agreement, resuscitation discontinued, and the patient passed away on the operating table.

Wound biopsy reported acute on chronic abscess with necrosis and culture revealed further evidence of *Staphylococcus aureus*; consistent with the diagnosis of necrotising fasciitis.

### 3. Discussion

Management of craniofacial necrotising fasciitis involves antibiotics and aggressive surgical intervention. Literature recommends addressing dental/oral causes for sepsis, drainage of deep neck spaces and debridement of tissue until bleeding is seen. Where

hyperbaric oxygen is available, this has been shown to reduce mortality [2]. It increases oxygen delivery to target tissues; important in necrotising fasciitis where tissue is poorly perfused [7]. It is also thought to be bactericidal on anaerobes, in addition to promoting fibroblast proliferation and collagen production [2]. Cumulatively, this is thought to improve healing and reduce the amount of tissue requiring debridement. The literature also supports use of vacuum-assisted closure to promote wound healing [8].

As tissue tore on minimal instrumentation, bleeding was suggestive of carotid sheath suppuration. The IJV in particular appeared to have lost its integrity. On reflection, it was felt likely that the patient would have had a major haemorrhage on the ward if conservative treatment had been pursued.

Emphasis should be placed on preoperative serial imaging for debridement planning, to assess disease progression and proximity to major vessels. Similarly, given the extension to the pre-vertebral fascia, chest CT be considered to assess for longitudinal spread. Becker et al. emphasised the role of serial imaging in their case series of patients with head and neck necrotising fasciitis [5]. 11 of 14 patients showed progression, none having been detected clinically and 9 necessitating further surgery. In the context of the patient's ongoing poor renal function however, a contrast scan would not have been without significant risk.

Although a multi-speciality team was involved throughout, there was room to further optimise this. Care was transferred between consecutive on-call consultants, potentially compromising continuity. Two head and neck ENT surgeons were additionally consulted, with regular input from ID and microbiology. Maxillo-facial surgery input would have been beneficial to offer further expertise in this complex anatomical area. Furthermore, although Plastic surgery advice was sought, they never physically reviewed the patient due to not being based onsite. Referral to Plastics by ENT, rather than ID colleagues, may have better conveyed the salient features and prompted a physical review. Overall, better cohesion between these teams could have been achieved.

Rare disease of the head and neck requires a multi-disciplinary approach. This is especially paramount when services are split across sites in a regional network. This large wound in the posterior neck would have benefited from MDT skillsets typically seen in the trauma setting in the United Kingdom. Early recognition and escalation through such a care pathway to a tertiary treatment hub, incorporating all critical services in one geographical location, would be the gold-standard.

Anatomical familiarity suggests head and neck surgeons are most familiar with antero-lateral neck neurovascular anatomy from the perspective of a patient lying supine. In contrast, neurosurgery or orthopaedics are more familiar with bony and soft-tissue structures with the patient lying prone or laterally. Such a complex and rare case therefore presents multiple difficulties even for the most experienced surgeon.

### 4. Conclusion

This case illustrates the complexities of managing a patient with necrotising fasciitis of the posterior neck, crossing the midline and extending to critical antero-lateral neck structures. The importance of multi-disciplinary team care is emphasised and although commendable on many fronts, has highlighted room for improvement. It invites novel considerations for more multi-disciplinary approaches to surgical simulation and cadaveric training in the head and neck.

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The authors report no declarations of interest.

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**Ethical approval**

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**Consent**

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**Author contribution**

Talisa Ross: Case report design, Data collection, Writing the paper.

Arran Patel: Case report design, Data collection, Writing the paper.

Vikas Acharya: Case report design, Next of kin consent, Editing manuscript.

Taran Tatla: Editing and approving manuscript.

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