Head and neck necrotising fasciitis: an Australian rural experience

Original Article

Head and neck necrotising fasciitis: an Australian rural experience

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Background: Necrotising fasciitis (NF) is a rare but life-threatening soft tissue infection. In the head and neck (HN) region, it is associated with up to 70% mortality rates. It can pose a diagnostic challenge due to the rare nature of this infection, overlapping clinical features with less severe infections, and lack of gold standard diagnostic testing. In rural and regional areas, HN NF treatment is further complicated by limited resources for investigations, operative treatments, and timely transfer to a centre for definitive management. We aim to review presentations, management, and outcomes of HN NF in rural Australia setting, and raise awareness regarding importance of prompt intervention.

Methods: Retrospective review of HN NF treated by Ear, Nose, Throat (ENT) team at Toowoomba Base Hospital (TBH) over 10 years from June 2013 to June 2023.

Results: Five HN NF presentations were identified. No patients were diagnosed as HN NF on presentation prior to referral. Time from presentation to ENT referral ranged from 0.8–48 hours (mean 12.6 hours). Time to operative management was 2–52 hours (mean 26.7 hours). All cases required multiple operative interventions (4–10, mean 6 procedures), and two patients required tracheostomy. All required intensive care unit admission, and broad-spectrum intravenous antibiotic therapy. Two patients required metropolitan centre transfer for further subspecialty input. The remainder were treated within our ENT service. One patient died due to their infection.

Conclusions: HN NF is a life-threatening infection that is difficult to diagnose and manage, especially in rural Australian settings. High clinical suspicion and early diagnosis is required to overcome the logistical and geographical barriers. This study demonstrates that with multidisciplinary approach, swift interhospital coordination, and ongoing education, favourable outcomes can be achieved for HN NF in rural ENT service.

Keywords: Head and neck (HN); necrotising fasciitis (NF); deep neck space infection; rural surgery

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Introduction

Necrotising fasciitis (NF) is a rare but life-threatening soft tissue infection. Colloquially known as the 'flesh eating infection', NF can spread within hours along the tissue fascia planes to cause extensive damage and sepsis before associated skin changes have occured (1). In the current literature, NF is associated with a significant morbidity and mortality rate of 25–40%. Head and neck (HN) NF is even more aggressive and associated with worse prognosis, with Lin *et al.* [2001] reporting a mortality rate up to 70% (1,2). In context of the recent coronavirus disease 2019 (COVID-19) pandemic, Feeney *et al.* [2022] have reported that there has been a rise in the incidence of NF due to delayed presentation and progression of previously easily treated skin infections (3).

The gold standard of NF treatment is early diagnosis and aggressive surgical debridement (4-6). Prompt diagnosis and referral to relevant surgical specialties is crucial, especially in the HN region, where NF can result in acute airway obstruction (4). However, NF poses a diagnostic challenge due to the absence of visible cutaneous signs in early stages of disease, non-specific imaging findings, and absence of systemic features (6). When coupled with unfamiliarity with NF diagnosis, this can often lead to detrimental delays in referral to surgical specialty and management (7). Stewart *et al.* found that most common delay in time to treatment of NF was delayed diagnosis by non-surgical clinicians (8). Risk stratification tools have been developed, such as Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) scoring system, which uses serology markers to produce a score >8 indicating high risk, score of 6–8 indicating intermediate risk, and score <6 indicating low risk of NF (9,10). However, meta-analysis by Fernando *et al.* found that LRINEC system had limited sensitivity in mild NF infections and could not be used to exclude diagnosis of NF (10).

In rural and regional areas, NF diagnosis and treatment is further complicated by limited resources for adequate investigations, operative treatments, and timely transfer to a centre for definitive management (7,8). This is particularly challenging for HN NF where airway intervention and subspecialty surgical input is often required. In the literature, there is lack of evidence to address this challenge with no previously reported case series or review of HN NF in rural setting to inform and provide guidance on clinical management.

Toowoomba Base hospital (TBH) Ear, Nose, Throat (ENT) department is the referral base for a large regional area in south-west Queensland, and is uniquely placed to assess our management of this life threatening condition. Through this retrospective case series, we aim to review the presentation, management, and outcomes of HN NF in our region, and raise awareness regarding importance of prompt intervention for NF in rural Australian setting.

Methods

Cases of HN NF treated by TBH ENT department were retrospectively identified through review of emergency operations performed over a 10-year period from June 2013 to June 2023. Data were obtained through electronic and paper-based medical records. Data collected included patient demographics, comorbidities, presenting symptoms, pathology, radiology, surgical and medical interventions, length of hospital stay, complication, and mortality. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved for exemption from ethics through Darling Downs Hospital and Health Services research committee (EX/2023/QTDD/102072). Written informed consent was obtained from the patient for the publication of this study and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

Results

Five cases of HN NF were identified over the 10-year period, with patient presentation and initial treatment summarised in *Table 1*.

Demographics and presentation

There were three male and two female adults treated with HN NF. Most patients were >55 years of age, except one 26-year-old aboriginal female who had a background of intravenous drug use (IVDU) and poorly controlled type 2 diabetes mellitus (T2DM). T2DM was present in three patients, while two patients had significant obesity with BMI >45 kg/m^2. None of the five patients were diagnosed with HN NF on their initial ED presentation.

NF in cases 2 and 3 were secondary to odontogenic infections, case 1 was secondary to peritonsillar abscess, while case 4 had superficial folliculitis which led to extensive soft tissue necrosis (*Figure 1*). These patients presented

Table 1 Patient presentation and initial management

Category	Case 1	Case 2	Case 3	Case 4	Case 5
Demographic (age/sex)	58 years/M	59 years/M	26 years/F	56 years/F	76 years/M
Source of NF	Oropharynx	Odontogenic	Odontogenic	Cutaneous	Cutaneous malignancy
ATSI	No	No	Aboriginal	No	No
Comorbidity	Nil	Obesity, T2DM	T2DM, IVDU	Obesity, T2DM	B cell lymphoma
Symptom duration prior to presentation	4 days	7 days	7 days	10 days	In-patient at time of NF diagnosis
Referred working diagnosis	Peritonsillar abscess	Dental infection	Dental infection	Folliculitis	Post operative wound infection*
Sepsis on arrival	Yes	No	Yes	Yes	N/A
Radiology on presentation					
Imaging on referral	No	Yes (CT)	Yes (CT)	Yes (US, CT)	No*
CT findings	–	Collection at anteroinferior submandibular region with extensive associated subcutaneous gas	Large abscess at angle of mandible with extensive subcutaneous gas and myositis	Extensive subcutaneous gas in posterior neck extending anteriorly	–
Pathology on presentation					
LRINEC score	5	4	8	8	N/A*
WCC ($\times 10^9$/L)	20.1	20	51.5	22.4	N/A
CRP (mg/L)	309	N/A	382	427	N/A
Lactate (mmol/L)	3	1.9	2.3	1.9	N/A

*, patient was inpatient under TBH ENT following wide local excision of neck cutaneous squamous cell carcinoma + superficial parotidectomy + neck dissection, with suspected post operative infection. On post-operative day 4, patient returned to theatre where diagnosis of NF was made intra-operatively. M, male; F, female; NF, necrotising fasciitis; ATSI, Aboriginal and/or Torres Strait Islander; T2DM, type 2 diabetes mellitus; IVDU, intravenous drug user; N/A, not applicable; CT, computed tomography; US, ultrasound; LRINEC, Laboratory Risk Indicator for Necrotizing Fasciitis; WCC, white cell count; CRP, C-reactive protein; TBH, Toowoomba Base Hospital; ENT, Ear, Nose, Throat.

Figure 1 Case 4, clinical presentation of head and neck NF in a 56-year-old female following posterior neck folliculitis detailing spreading posterior neck fold erythema with a central pit of skin necrosis. NF, necrotising fasciitis.

with a history of 4 to 7 days of worsening symptoms. Out of these four patients, three presented to TBH emergency department (ED) while one presented to their local hospital which was 150 km from TBH. On initial presentation, three patients met criteria for sepsis according to International Guideline for Management of Sepsis 2021.

Case 5 developed neck NF while still an in-patient following wide local excision of neck cutaneous squamous cell carcinoma + superficial parotidectomy + neck dissection + cervicofacial flap. Post-operative prophylactic antibiotic was used, however, patient was immunosuppressed with a background of B cell lymphoma. There was increased purulent drain output and patient returned to theatre on post-operative day 4, where extensive pus and necrotic tissue characteristic of NF was found.

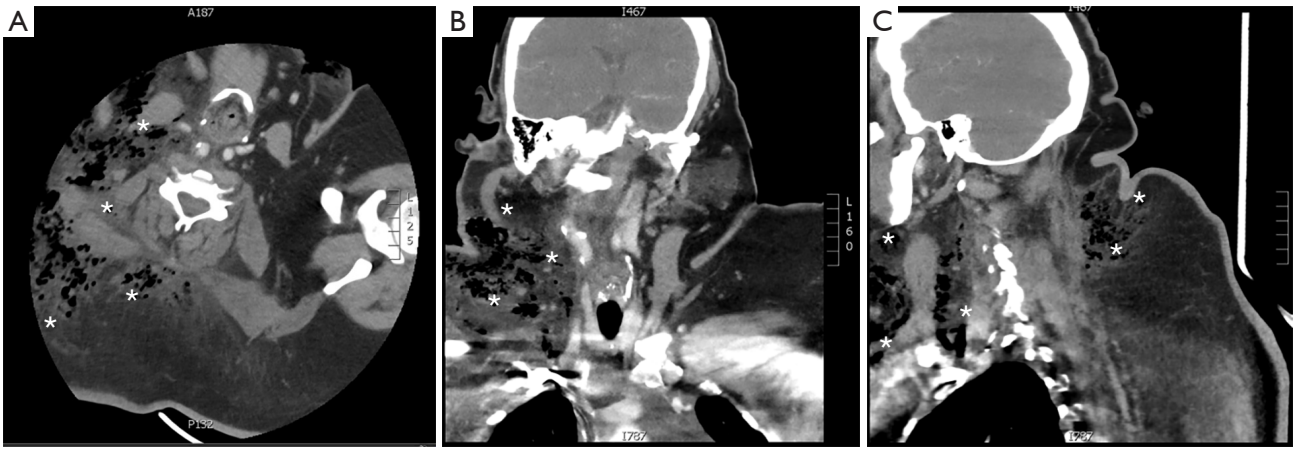

Figure 2 Case 4, CT findings of head and neck NF in a 56-year-old female showing extensive subcutaneous gas (*) in region of infection with mass effect on adjacent upper airway structures, with limited view secondary to large patient body habitus. (A) Axial view at level of hyoid, showing extent of subcutaneous gas along fascia plane into posterior neck; (B) coronal view and (C) sagittal view, showing NF in deep neck space with potential extension into mediastinum. CT, computed tomography; NF, necrotising fasciitis.

Laboratory investigations

All four patients that presented through ED had bloods at their local hospitals showing significantly elevated inflammatory markers including white cell count (WCC) and C-reactive protein (CRP) levels. WCC ranged from (20–51.5)×10^9/L, while CRP levels were significantly elevated >300 mg/L. Case 3 and 4 had LRINEC scores of 8, indicating high risk of NF. However, cases 1 and 2 had LRINEC score of 5 and 4 respectively, stratifying as low risk of NF.

Radiological investigation

Two cases (case 2 and 3) had computed tomography (CT) imaging as the initial imaging modality on presentation, but cases 1 to 4 all had CT imaging during their admission. Case 1 was initially treated as clinical peritonsillar abscess with no initial imaging, while case 4 had ultrasound neck as initial imaging, followed by a subsequent CT scan. All the ED where cases presented had availability of onsite CT scans. All the CT scans found extensive subcutaneous gas in the region of infection with mass effect causing displacement of adjacent upper airway structures (*Figure 2*). Case 5 was taken to theatre for washout of suspected post operative infection, and did not have any radiological investigation performed.

Surgical management

There was variability in time to referral to surgical specialty, ranging from 0.8–48 hours with a mean time of 12.6 hours. Time to subsequent operative intervention for debridement ranged from 2–52 hours with a mean time of 26.7 hours. Case 5 was already under the care of a surgical team at time of NF development, and there was 6 hours between recognition of infection and surgical intervention. A summary of the surgical management of each case is outlined in *Table 2*.

The mean number of operative interventions was 6, ranging from 4–10 procedures. Indications included tissue debridement, dressing changes and reconstruction. The highest number of surgeries was required for case 4, including 9 debridements. Due to location of infection, three cases required awake nasal fibreoptic intubation at time of their initial operation. Two cases required intra-operative tracheostomy insertion as part of their management. Both of these were performed at time of initial debridement in anticipation of prolonged intubation due to extensive infection requiring multiple debridement, as well as concerns for infection spread to airways.

In all cases, extensive debridement and washout of necrotic tissue was performed (*Figure 3*). Case 1 had primary closure of their wound, case 5 required split thickness skin graft, while 3 cases required reconstruction with pectoralis

Table 2 Surgical management

Category	Case 1	Case 2	Case 3	Case 4	Case 5
Time to (h)					
Referral to surgical specialty	0.8	2	1	48	Under ENT care at time of diagnosis
Operative intervention	52	11.5	2	62	6
Surgical interventions					
Number of surgeries	4	5	6	10	4
Number of debridement	2	2	4	9	1
Operative airway management	Awake nasal fibreoptic intubation	Oral ETT	Awake nasal fibreoptic intubation	Awake nasal fibreoptic intubation	Oral ETT
Tracheostomy	No	Yes	No	Yes	No
Wound management					
Vacuum dressing	No	No	No	Yes	Yes
Saline soaked gauze	Yes	Yes	Yes	Yes	Yes
Graft/flap	No	Pectoralis major flap	Pectoralis major flap, STSG	Pectoralis major flap, STSG	STSG

ENT, Ear, Nose, Throat; ETT, endotracheal tube; STSG, split thickness skin graft.

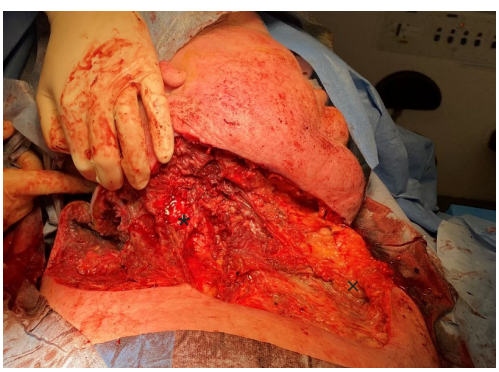

Figure 3 Extensive intra-operative debridement and washout of affected necrotic subcutaneous tissue, overlying skin, and 'dishwater' fluid of neck (*) extending onto anterior chest wall (×) in case 4, a 56-year-old female with neck NF infection secondary to cutaneous folliculitis. NF, necrotising fasciitis.

major flap and/or split thickness skin graft. One flap was performed locally by ENT department, while two cases were transferred for further surgical subspecialty input in metropolitan centres, and had reconstruction performed whilst at these centres.

Medical management

All five cases were given intravenous antibiotic therapy during their management. Initial antibiotic of choice varied, as listed in *Table 3*. Multiple species of pathogens were identified from intraoperative tissue of each patient, and infectious disease team was involved in all cases for guidance on antibiotic choices. All five patients required admission to intensive care unit for management of sepsis, organ support, and control of comorbidities.

Clinical outcomes

Three cases were managed locally, while two cases required further transfer to a tertiary centre for involvement of maxillofacial, cardiothoracic, and/or plastics and reconstructive teams. Case 4 was initially transferred from a regional hospital, thus requiring total of two transfers for their definitive treatment.

Length of hospital stay varied from 18–172 days, with a mean time 57 days. At the time of this review, case 4 had been admitted for 172 days and was still undergoing treatment. Mortality rate was 20% over the ten-year review

Table 3 Antibiotic treatment and clinical outcomes

Category	Case 1	Case 2	Case 3	Case 4	Case 5
Antibiotic therapy					
Empirical antibiotics	Benzylpenicillin, metronidazole	Amoxycillin/ clavulanic acid	Piperacillin/tazobactam, metronidazole	Lincomycin, vancomycin, meropenem	Lincomycin, flucloxacillin, meropenem
Microbiology	Mixed anaerobes, Streptococcus milleri	Mixed anaerobes, Streptococcus milleri	Mixed anaerobes, GPC, GPB, GNB, Staphylococcus lugdunensis	GPC, GPB, Actinotignum schaalii	Mixed enteric bacteria, Pseudomonas, Citrobacter, Enterococcus faecalis, Streptococcus mitis
Clinical outcomes					
Number of transfers	0	0	1	2	0
Transfer to tertiary hospital	No	No	Yes	Yes	No
Length of hospital stay (days)	20	49	26	Ongoing (172 at time of review)	18
Mortality	No	No	No	No	Yes

GPC, Gram positive cocci; GPB, Gram positive bacilli; GNB, Gram negative bacilli.

period, with one patient dying because of their NF infection.

Discussion

HN NF is a life-threatening infection with high mortality rates of up to 70% (4). Management requires prompt recognition and early aggressive debridement. This is particularly challenging in rural Australia where patients experience further unexpected delays due to logistical barriers and need for transfers to tertiary hospitals for definitive management (7). In addition, HN NF poses unique challenges due to its close proximity to upper aerodigestive tract, large vasculature, and potential for infection progression to deep neck spaces and/or mediastinum. Anatomical constraints collectively impact both surgical debridement and challenges reconstructive options often with the requirement of definitive airway management. Overall, combination of the above factors impede prompt patient care for HN NF in rural and remote areas.

Despite these challenges, most HN NF patients managed at TBH ENT department underwent their treatment and reconstruction locally, with only two patients requiring transfers for further subspecialty input. There was one death out of the five cases. However, there was wide variability in time to referral to surgical specialty, and time to subsequent operative intervention, leaving room for improvement in early recognition and management. This is the first article to date exploring these challenges and reviewing current management and outcomes of HN NF infections in a rural Australian setting.

Clinical features of NF include soft tissue swelling, erythema, and pain out of proportion, especially in patients with background of immunocompromise, diabetes, or IVDU (10). This is consistent with our patient population with 80% of patients having contributing co-morbidities. Often there are concurrent precipitating infections which are difficult to distinguish from NF, such as cellulitis, dental infections, and tonsillitis. This was seen in this study where none of the four patients who presented initially to ED were recognised as having NF. The overlapping clinical picture, in conjunction with rare nature of HN NF, makes early NF diagnosis challenging, as suggested by Stewart et al., who found that only 14% of NF were given correct diagnosis on initial ED presentation (8). This delayed recognition can result in subsequent delayed management of these infections.

In addition, there is lack of gold standard diagnostic testing, and accurate diagnosis is reliant on high clinical suspicion of presenting clinic picture, pathology, and imaging. Although risk stratification tools such as LRINEC score has been shown to have 75% sensitivity and 85% specificity in diagnosis of HN NF when using a cut off score of 6, LRINEC score does not exclude NF in patients

with high clinical suspicion, as shown by our review where only two patients had score greater than 6 (11).

Characteristic features seen on CT include extensive subcutaneous gas, soft tissue oedema, and fascia enhancement (10). However, in extensive HN NF, patients need to be assessed for airway stability prior to scan. Also, in regional areas, CT may not be readily available to aid in NF diagnosis, a plain film or ultrasound may be used to exclude subcutaneous gas (10)

Other factors also contribute to diagnostic challenge of NF and subsequent wide variability in time to referral to a surgical specialty, ranging from 0.8 to 48 hours, as seen in this study. This includes the rare nature of HN NF, limited clinician experience with this diagnosis, higher proportion of junior staff at rural ED, high staff turnover, and lack of standardised training for non-specialist emergency medicine doctors working in rural hospitals (8). It is worth keeping in mind the potential rise of NF following recent COVID-19 pandemic (3), and this article highlights the importance of continuing education to raise awareness regarding HN NF.

Once diagnosis, or clinical suspicion, of HN NF has been made, there are multiple barriers in rural and regional areas that further delay definitive operative intervention (8). Firstly, in HN NF, potential for airway involvement and need for subspecialty surgical input often limit extent of management that can be provided at initial regional hospital. Swift coordination of interhospital transfer is required between multiple teams at various sites to avoid unnecessary delays to treatment (12). Early consideration should be given to additional logistic challenges of transferring airway and septic patients, including equipment, staffing, and skill level of transfer personnel. This challenge was demonstrated in case 4 where requirement of bariatric equipment and inability for air transfer, resulted in 14 hours delay between referral to ENT and operative intervention.

In addition, multiple potential reasons for transfer delays from rural Australian areas have been identified in literature, including administrative delays, incorrect handover, lack of consultant surgeon input, accepting hospital bed availability, and transportation (12).

The cornerstone of NF management include extensive debridement, and semi-elective return to theatre for further debridement 24–48 hours post initial debridement (7). This was seen in our study where patients required between 2–9 debridements to control the infection. Although tracheostomy insertion can risk further spread of infection to the tracheal lumen and delayed decannulation, it may be required in some patients as seen in cases 2 and 4 (13). There may be various reasons for tracheostomy from difficult airway access due to trismus and altered anatomy, to anticipated prolonged ventilation. In some cases, tracheostomies inserted for oncological reasons can be aetiological site for NF (4). In current literature, it is unclear whether tracheostomy in NF increases mortality, and did not seem to be the case in this study (13).

Due to the extensive debridement required for management, variety of wound closure methods may be required. All patients in this study had saline soaked gauze packings in between planned debridement, with two patients receiving vacuum assisted closure (VAC) therapy. Although it has been suggested that VAC reduced NF mortality rate compared to conventional dressing, the utility in HN NF remains debated (14,15). Three patients required pectoralis major flap for reconstruction, while one patient required a split thickness skin graft only. In case 1, there was limited disease in oropharynx and floor of mouth which was controlled with two debridements, and was able to be closed primarily.

Majority of HN NF are poly-microbial in aetiology and require initial broad spectrum antibiotic administration (4). Current Therapeutic Guidelines on empirical antibiotic choice for soft tissue necrotising infections recommend vancomycin and, either piperacillin/tazobactam or meropenem, and either clindamycin or lincomycin (16). Despite clear guidelines, there was wide variety of empirical antibiotic use seen in this study (16). Although all five cases received initial broad spectrum antibiotics, only one empirical antibiotic regime was in line with therapeutic guidelines (16). Overall, it is important HN NF is recognised early to not only ensure prompt time to theatre, but also appropriate antimicrobial coverage.

A major limitation of this review is the small study population of five patients that were treated over a 10-year period. Although small, this is the first review of HN NF in rural setting to inform and provide guidance on clinical management. It is hoped that this study can highlight challenges and trends in diagnosis and treatment of HN NF, while raising awareness regarding importance of prompt intervention for NF in rural Australian setting.

Conclusions

HN NF is a life-threatening infection that is reliant on early accurate diagnosis and prompt surgical intervention for optimisation of patient outcomes. In addition to the diagnostic dilemma, further unique challenges are posed

in regional areas due to lack of local surgical specialties, under-resourced ED, and delayed transfers. This study is the first in literature to explore management of HN NF in rural and regional Australia, and demonstrates that with multidisciplinary approach, swift interhospital coordination, and ongoing education, favourable outcomes can be achieved for these patients.

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Footnote

Data Sharing Statement: Available at https://www.theajo.com/article/view/10.21037/ajo-24-21/dss

Peer Review File: Available at https://www.theajo.com/article/view/10.21037/ajo-24-21/prf

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://www.theajo.com/article/view/10.21037/ajo-24-21/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved for exemption from ethics through Darling Downs Hospital and Health Services research committee (EX/2023/QTDD/102072). Written informed consent was obtained from the patient for the publication of this study and accompanying images. A copy of the written consent is available for review by the editorial office of this journal.

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