

CASE REPORT

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Head and neck necrotizing fasciitis: the importance of negative pressure wound therapy with literature review

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Abstract

Background: Necrotizing fasciitis is an aggressive infection of the soft tissues and subcutaneous fascia. The involvement of the head and neck region is very rare but carries significant mortality. Negative pressure wound therapy (NPWT) became very popular in treating complicated wounds.

Case presentation: We present a case of necrotizing fasciitis in cervical region. After surgical debridement, a NPWT device was applied. NPWT provides advantages compared to conventional debridement and drainage.

Conclusion: This method is recommended as an adjuvant tool in treating necrotizing fasciitis in head and neck region because it helps to eradicate infection, provides comfort to the patient and facilitates wound healing.

Keywords: Necrotizing fasciitis, Negative pressure wound therapy, Wound healing

Background

Necrotizing fasciitis (NF) is highly progressive subcutaneous tissue infection that causes necrosis of the skin and subcutaneous tissue. NF due to streptococci showed an incidence of 2.79/100,000 patient per year, with a slightly higher number of elderly male patients (53%). Skin lesions/wounds were the most common predisposing factor; it was reported in 25% of cases. Skin and soft tissue were the most common foci of infection, with 32% of patients having cellulitis and 8% necrotizing fasciitis (Lamagni *et al.* 2008). Immune compromised patients are more prone to develop this kind of infection.

NF is a life threatening condition, because of its rapid spread to adjacent tissues, causing significant tissue loss: mediastinitis, sepsis/multi-organ system failure and even death. Despite sepsis is the initial presentation, most mortalities are due to airway obstruction (Bahu *et al.* 2001). Early diagnosis and aggressive treatment are

utmost importance to prevent mortalities. The surrounding vital organs involvement made the surgical treatment challenging. Negative pressure wound therapy (NPWT) is a very promising treatment for complex soft tissue infections. It is based on the application of sub atmospheric pressure over a healing wound by applying flexible polyurethane foam over the raw area and covered with air-tightly adhesive film then connected to a vacuum machine by tubing for 48 h. The pressure used in head and neck region around -75 mmhg. This vacuum-assisted technique induces a physical and biological response that accelerates wound healing. It eliminates the exudate and bacterial toxin, providing oxygen and nutrients that are essential for healing process. It increases wound perfusion and stimulates granulation tissue growth (Mir *et al.* 2019).

Case presentation

Case history and hospital progression

A 28-year-old male patient presented to our emergency room complaining of painful swelling over anterior neck region since 10 days along with discharging wound. The wound was noted to have foul smell discharge. Patient

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reported difficulty in swallowing for 3 days. He also experienced difficulty in breathing for 1 day. Patient visited local health center 3 days before his presentation and was prescribed oral medications but the condition didn't improve. No other significant past medical or surgical history. The patient denied significant past medical, surgical and social history and was not known to have diabetes or other immunosuppressive conditions. He had no previous history of TB or known contact.

On inspection, a diffuse swelling was seen over anterior aspect of neck extending laterally till both sternocleidomastoids, superiorly extending from inferior border of mandible to supra sternal notch and upper border of clavicle. Also, a small active purulent discharging fistula was noticed around 2 cm in the midline below thyroid notch as shown in Fig. 1. On palpation, the swelling was warm, tender and indurated. Oral examination was normal. Patient was febrile with temperature 38 °C.

Blood investigations showed elevated inflammatory markers including white blood cell count of $14.25 \times 10^3/\mu\text{l}$, neutrophils— $12.5 \times 10^3/\mu\text{l}$, C reactive protein of 334 mg/l with high ESR 108. Tuberculosis and HIV work ups were negative. Contrast enhanced CT scans (Fig. 2) demonstrated extensive multi-loculated mixed air and fluid collection in the anterior neck involving the subcutaneous tissue and extending in between muscle fat planes, with air and fluid seen dissecting inter-muscular planes and deeply extending into the anterior cervical and carotid spaces on both sides. There was interrupted marginal enhancement of the soft tissue around the collection. The subcutaneous fat and inter-muscular fat plane were totally smudged and multiple enlarged cervical lymph nodes were noted on both sides.

Patient was started on culture directed antibiotics. Histopathological study performed which confirmed necrotizing fasciitis. Patient was then taken to theatre. Under general anesthesia Incision and drainage of deep neck abscess was carried out by giving Incision that extended from both sides of sinus opening



Fig. 1 Anterior profile of the patient at presentation, showing diffuse neck swelling with discharging sinus

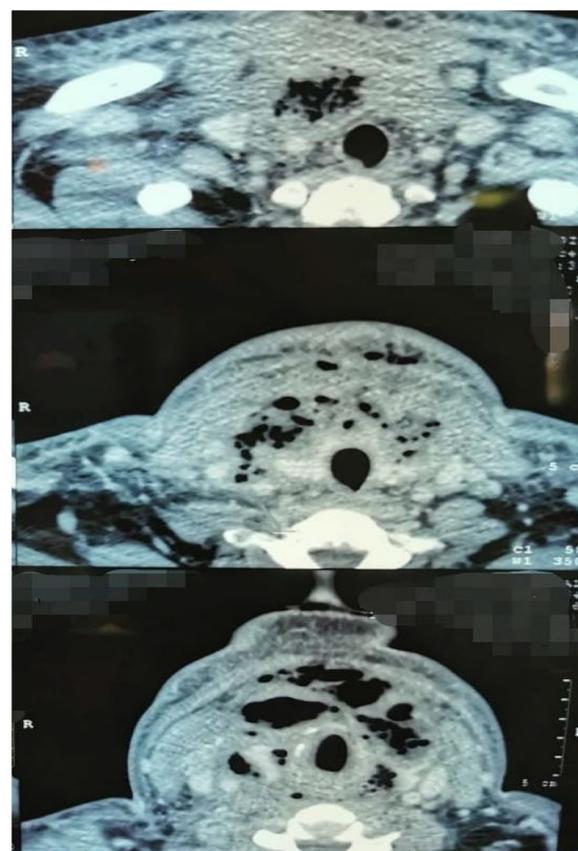


Fig. 2 CECT neck axial cuts showing multilevel extensive multi-loculated mixed air and fluid collection in the anterior neck involving the subcutaneous tissue and extending in between muscle fat planes, with air and fluid seen dissecting inter-muscular planes and deeply extending into the anterior cervical and carotid spaces on both sides

and around 70 ml of foul smelling pus was drained followed by necrotic tissue debridement. Necrotic tissue was seen covering platysma, sternocleidomastoid muscle bilaterally and strap muscles. Drained pus was sent for culture and debrided tissue for histologic evaluation. Postoperatively, wound dressing was done twice a day initially and then negative pressure wound therapy (NPWT) was started in every two days frequency. In addition each time the dressing was changed wound was irrigated with betadine and hydrogen peroxide solution. Pus culture showed presence of streptococcus group f and klebsiella which might cause foul smelling discharge, sensitive to almost all antibiotics. Biopsied tissues were reported as necrotizing fasciitis. Despite of antibiotic coverage in the form of Tazocin 4.5 g tid, patient had spikes of fever up to 39 degree for 3 days post operatively. Septic work up was performed. On 5th post-operative day, blood culture noted heavy growth of klebsiella pneumonia sensitive to benzyl penicillin

and ceftazidime, so injection benzyl penicillin 4 million IU and ceftazidime injection 2000 mg tid was started for 10 days.

Repeat CT scan of neck was done on 5th post-operative day which showed new localized fluid collection about $48 \times 35 \times 22$ mm, posterior to the right carotid sheath and deep to the sternocleidomastoid muscle at C3 level, it was surrounded with faint marginal enhancement. Therefore, the patient was taken to theatre for drainage of pus and debridement of necrotic tissue. This was carried out by giving horizontal incision at the posterior edge of right sternocleidomastoid and all the pus locules were broken down. A corrugated rubber drain was placed in posterior triangle which was removed after 3 days. Patient's condition dramatically improved afterwards.

On 12th post-operative day another CT scan with contrast was done which showed small residual collection seen at the right side of the hyoid bone about 1 cm, resolving previous collection seen posterior to right carotid sheath and deep to the sternocleidomastoid muscle at C 3 level.

By 14th post-operative day wound was healed with healthy granulation tissue (Fig. 3), secondary wound closure was done along with tracheostomy.

On 20th post-operative day weaning from tracheostomy tube was done and the patient was discharged.

Discussion

Cervical necrotizing fasciitis carries significant morbidity and mortality. Aggressive medical and surgical care is required because of rapid disease progression. Broad-spectrum, intravenous antibiotics and repeated, aggressive debridement with removal of all necrotic tissue are mandatory. Airway management is critical, and the surgeon should have a low threshold for intubation and tracheostomy (Ferzli et al. 2019).

Upon English literature review, the 3 largest series till date of necrotizing fasciitis of the head and neck are those by Lin et al. (2001), Lanisnik and Cizmarevic (2010), and Tung-Yiu et al. (2000). However, these studies are not limited to massive infections. Lin and co-authors described 47 cases over a 12-year period. Each patient underwent 2.6 surgical operations on average. Twelve patients received split thickness skin grafts, and 21 patients were reconstructed with local rotational or advancement flaps.

The overall mortality rate was 25.5%. Lanisnik's group reviewed 34 cases of Cervical NF over a 14-year period. All patients underwent debridement and were reconstructed with skin grafts. In the article by Tung-Yiu and colleagues, 11 cases of cervical necrotizing fasciitis of dental origin were presented. The patients underwent at least two debridement, with only 2 requiring split-thickness skin grafts for wound closure (Lin et al. 2001; Lanisnik and Cizmarevic 2010; Tung-Yiu et al. 2000). According to the above findings, it is not surprising that our patient required more than one surgical debridement.

The microbiology observed in our case is consistent with previously published data, with cultures demonstrating mixed flora and a high prevalence of group F Streptococcus. Group F streptococci have been shown to cause periodontal disease and odontogenic abscesses which was ruled out by dental team in our case. The group F streptococcus bacteria can form abscesses, commonly affecting the cutaneous system. It is often associated with trauma to tissues. This organism also can cause infections in the immune-compromised and the elderly (Libertin et al. 1985).

Histo-pathological studies are of limited values in diagnosing NF but studies showed that it is very helpful in predicting the mortality for patients with NF. Paucity of acute inflammatory response and the presence of



Fig. 3 Wound at day 12 (Right) and day 20(Left) post debridement and vacuum dressing

bacteria at the site of infection were associated with a poorer clinical outcomes (Bakleh et al. 2005).

Wound management is very important between operative interventions in necrotizing fasciitis, multimodality wound dressing described in literatures including negative pressure wound therapy. NPWT is a technique uses negative pressure for the purpose of wound healing as mentioned earlier (Morykwas et al. 1997), and has many benefits compared to standard necrotizing fasciitis wound management (Banasiewicz et al. 2011), which is usually painful or may cause large scars and end up requiring long-term treatment, sometimes skin graft or several plastic surgeries are required. NPWT demands less dressing changing because it eliminates the exudate reduces local edema and promote perfusion and granulation tissue. The continuous negative pressure stimulates local growth factors and enzymes regenerating the epithelial surface. Furthermore, it stimulates angiogenesis and arterial dilatation around the wound supplying oxygen in high-concentration (Banasiewicz et al. 2011). The wound micro-environment is altered because of this process and the antibiotic therapy. This suppresses original anaerobic bacterial growth and reduces new infections. The vacuum dressing also sealed the wound from outside contamination (Qiu et al. 2019). We recommend this method as an alternative in treating necrotizing fasciitis in head and neck region, because it eradicates infection and provides comfort to the patient. In our case, it was established that NPWT therapy was favorable in treating necrotizing fasciitis wound because no plastic surgery required. However, there are some obstacles with the use of NPWT for the treatment of deep fascial space infections. The first is that the contours of the head and neck make it challenging to obtain an airtight seal for NPWT systems. Second, the deep spaces in the head and neck make the filling of foam material very difficult. Since the foam material is reticulated and porous, the healing tissue can grow into the foam and make removal very difficult if the foam is plugged too deep. On the other hand, if the foam is not inserted to an appropriate depth, inadequate suction at the distal end of the spaces can lead to the accumulation of pus and debris (Loaec et al. 2014).

In our experience, well trained wound care nurse can perform sealing very well and can overcome the obstacles mentioned.

Conclusions

The NPWT has the potential to contribute positively in the management of head and neck necrotizing fasciitis. It has been proven to promote healing and increasing patient comfort. This technique has helped the surgeons to perform less complex reconstructive procedures. NPWT indications continue to expand because it can be

used in managing chronic and acute wounds, benefiting patients with a wide range of injuries.

Abbreviations

NPWT: Negative pressure wound therapy; NF: Necrotizing fasciitis.

Acknowledgements

Special thanks to all the teams helped in giving the care and treatment for this patient (ENT, Dental, medicine and ID team).

Author contributions

KSK (writing the manuscript); TA and AM (analyzed the manuscript). All authors read and approved the final manuscript.

Funding

There is no financial support received from any organization.

Availability of data and material

Not applicable.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Verbal Consent was taken from the patient family.

Competing interests

The authors declare that they have no competing interests.

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Received: 14 December 2021 Accepted: 13 May 2022

Published online: 26 May 2022

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