

Prelaminated Forehead Flap Nasal Reconstruction of Pediatric Nasal Defect Secondary to Necrotizing Soft Tissue Infection: A Case Report

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Abstract

Background: Necrotizing soft tissue infection (NSTI) in children that involves the nose is a rare presentation and requires serial surgical debridement followed by nasal reconstruction. Nasal reconstruction is often delayed until post-pubertal age due to ongoing facial growth, limited local tissue/donor sites, and poor adherence to post-surgical care. However, the facial defect has a greater psychosocial impact as the child grows.

Case: This case report describes an 8-month-old boy who developed necrotizing fasciitis of the right heminose/cheek following an iatrogenic laceration from a nasal oxygen cannula, which required urgent surgical debridement and antibiotic therapy. We performed a multi-stage reconstruction using a prelaminated forehead flap with a composite concha cartilage and skin graft.

Conclusion: This case highlights the importance of early diagnosis, aggressive treatment, and innovative reconstructive techniques in managing pediatric necrotizing soft tissue infection of the face, particularly in anatomically challenging areas like the nasal region.

Keywords: Naso reconstruction, Paramedian forehead flap, Pediatric necrotizing soft tissue infection

INTRODUCTION

Necrotizing Fasciitis is an aggressive and life-threatening soft-tissue infection involving the skin and subcutaneous tissue that rapidly spreads along the underlying fascial plane and adjacent musculature. In recent literature, the broader term necrotizing soft tissue infection (NSTI) is increasingly used to encompass this clinical entity. Pediatric NSTIs are rare, with reported incidence rates ranging from 0.02 to 0.8 per 100,000 children per year.¹

NSTIs can be classified microbiologically into four categories: Type I (polymicrobial), Type II (monomicrobial), Type III (gram-negative monomicrobial), and Type IV (fungal).² Type I is the most prevalent NSTI, accounting for up to 80% of cases.³ Recent studies using both culture and advanced molecular methods have shown that common

pathogens include group A Streptococcus (GAS), Staphylococcus aureus, Enterococcus, Escherichia coli, Bacteroides, and other gram-negative rods, with obligate anaerobes such as Prevotella, Peptoniphilus, and Porphyromonas being particularly abundant and associated with worse outcomes when present in high proportions.⁴⁻⁶ Klebsiella oxytoca and P. aeruginosa are uncommon isolated organisms associated with NSTI. It frequently affects previously healthy children and results in a significant rate of mortality and morbidity.⁷ Accurate early diagnosis and surgical intervention, combined with the administration of appropriate parenteral antibiotics, are the cornerstones of NSTI treatment.

NSTI of the head and neck can cause extensive soft-tissue loss and deformity, particularly when the nasal structures are involved. In children, the most common aetiologies of

Received for publication 19 December 2025; Revised 25 March 2025; Accepted 26 August 2026

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<https://doi.org/10.64387/tjs.2026.279041>

nasal deformities requiring reconstruction include congenital anomalies (cleft lip and palate, frontonasal dysplasia),⁸ accidental injury,⁹ and complications from medical interventions (nCPAP use).¹⁰ We present a case of a pediatric nasal defect secondary to NSTI caused by *Klebsiella oxytoca* and *Pseudomonas aeruginosa*, which was reconstructed using a prelaminated forehead flap.

CASE PRESENTATION

An 8-month-old boy was referred to our team with a history of progressive skin and soft tissue loss of the right heminose/cheek region. He was initially admitted to a district hospital for acute bronchiolitis that required oxygen supplementation. Alterations made to an adult nasal cannula caused an iatrogenic laceration of the right nasal ala. The wound progressively worsened, leading to sepsis.

At our center, the initial wound was a 1.5 × 1.5 cm full-thickness necrosis of the right nasal ala extending to the nasolabial fold. The patient was septic and required antibiotics. He started on IV cloxacillin but was escalated to IV ceftriaxone and Metronidazole the next day. A computed tomography of the face and brain shows NSTI of the right nasal ala extending to the right preseptal region of the lower eyelid, as shown in **Figure 1**.

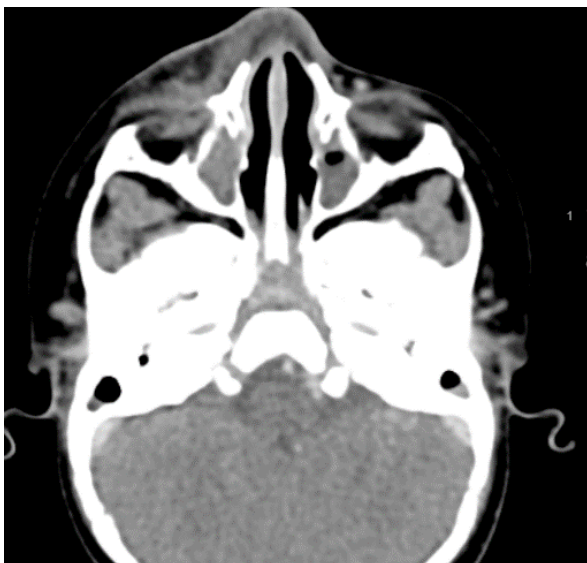


Figure 1 CT Brain prior to surgical debridement.

The child underwent urgent serial surgical debridement until the wound bed had healthy punctate bleeding. The intraoperative tissue culture revealed two organisms: *Klebsiella oxytoca* and *Pseudomonas aeruginosa*. The infectious disease team was consulted, and the antibiotics were changed to IV ceftazidime. Once the infection was controlled, we applied temporary coverage with a full-thickness skin graft. However, he was left with a right alar nasal defect as depicted in **Figure 2**. Therefore, we used a prelaminated forehead flap for nasal reconstruction.



Figure 2 Deformity post debridement at 8 months old

Surgical Technique

A prelaminated forehead flap incorporating a composite concha cartilage and skin graft was chosen for reconstruction. Prelamination enhances the stability and versatility of composite grafts, thereby improving integration and contour restoration. However, the interpolation of the forehead flap to support the composite graft stabilization requires a longer duration and increases the risk of trauma, particularly in a one-year-old patient.

A composite graft consisting of concha cartilage and overlying skin was harvested using the posterior auricular approach. An ipsilateral paramedian forehead flap was elevated according to the designed defect template. The flap was raised in a layered fashion: the distal third in the subcutaneous plane, the middle third in the subfrontalis plane, and the proximal third in the subperiosteal plane. Because the subcutaneous tissue and frontalis muscle were thin, the team performed dissection and hemostasis meticulously. The composite graft was then securely anchored to the distal segment of the forehead flap using absorbable sutures, as shown in **Figure 3**, after which the flap was reinserted into its native position.



Figure 3: Pre-lamination of chondral cartilage graft prior to reinsertion back to the original position at 18 months old

Two weeks after the initial elevation, the forehead flap was interpolated into the defect, as shown in **Figure 4**. However, one week after interpolation, the patient fell forward, resulting in partial flap dehiscence. The dehisced flap was resutured, and healing was uneventful. Subsequent flap division was performed two weeks after the injury, and the postoperative course was uneventful, as shown in **Figure 5**.



Figure 4 Forehead flap post-interpolation



Figure 5 Post division of forehead flap

DISCUSSION

Necrotizing fasciitis was first described in 1871 by Dr. Joseph Jones, a Confederate army surgeon, who referred to the condition as “hospital gangrene.” He documented 2,642 cases with a reported mortality rate of 46%. Over time, several terms, such as suppurative fasciitis, streptococcal gangrene, and necrotizing erysipelas, have been used to describe similar clinical entities. In 1951, Dr. Bernard Wilson popularised the term “necrotizing fasciitis,” emphasizing the disease’s hallmark feature: fascial layer necrosis. In recent years, the broader term “necrotizing soft tissue infection” (NSTI) has gained traction. This terminology aims to encompass all severe, rapidly progressive soft tissue infections with necrotic components, irrespective of the anatomical location or depth, to standardize diagnosis and guide multidisciplinary management.¹¹

Although direct comparative studies between pediatric and adult populations are limited, necrotizing soft tissue infections (NSTIs) are significantly less common in children. The reported incidence in the pediatric population ranges from 0.022 to 0.843 cases per 100,000 children annually, which is markedly lower than the adult incidence, which ranges from 0.4 to 1.5 per 100,000 adults per year.^{1,12} This means NSTIs are 1.8-18 times less frequent in children. Furthermore, pediatric cases are generally associated with lower mortality rates and more favorable outcomes than adult cases.

NSTI over the facial region has been described as ‘ex-

tremely rare,' regardless of age. Only 35 cases have been described in the literature from 1960 to 1997.¹³ The trunk remains the most common site in children aged < 2 years, whereas the extremities are affected in older children at 45.6%.¹⁴ Head and neck involvement is typically limited to isolated case reports and small case series. Notably, in recent years, only a single pediatric case involving the nasal alar region has been reported, necessitating urgent nasal reconstruction and resulting in excellent functional and aesthetic outcomes.¹⁵

Our patient had type 1 NSTI, with cultures that isolated *Klebsiella oxytoca* and *Pseudomonas aeruginosa*. *Klebsiella oxytoca*, a gram-negative rod closely related to *Klebsiella pneumoniae*, is part of the normal gastrointestinal flora but is an uncommon pathogen in NSTI. *Klebsiella oxytoca*-associated NSTIs are rare and typically limited to patients with poorly controlled diabetes or significant immunosuppression.¹⁶ *Pseudomonas aeruginosa*, another isolated organism in this case, is also an atypical cause of NSTI. While it more commonly affects immunocompromised hosts, cases have also been described in otherwise healthy infants, highlighting their unpredictable pathogenic potential.¹⁷

The infection was aggressive, necessitating multiple time-limited debridements to achieve adequate source control. Temporary coverage with a skin graft was performed before definitive reconstruction to facilitate flap planning and allow prelamination of the forehead flap. This interim coverage also minimizes the risk of ongoing blood loss and secondary infection.

Nasal reconstruction with a forehead flap is a well-established technique, and prelamination is a common armamentarium for creating a versatile flap that addresses the nasal lining, cartilage, and skin. In this case, we selected prelamination to achieve a more structurally robust reconstruction, particularly by reinforcing the nasal lining and cartilage framework. Additionally, this approach allowed us to avoid using a nasal stent, which is typically required to maintain graft adherence in composite reconstruction. Given the patient's young age and anticipated noncompliance with postoperative stenting, pre-lamination offered a more practical and reliable alternative.

Despite the traumatic injury causing dehiscence of the lateral part of the flap, division was still possible, demonstrating the flap's resilience. Functional outcomes were satisfactory, with the airway remaining patent without alar collapse, and the reconstruction achieved aesthetic goals with minimal donor-site morbidity, as shown in Figure 6. The child was planned for further thinning of his nasal alar flap. However, parents were not keen on another surgical intervention yet and defaulted on further follow-ups with our clinic.



Figure 6 3 months post-operation

The nasal reconstruction was done earlier than planned, as he became increasingly aware of his self-image. The nasal reconstruction was then performed to minimize the psychological impact on him.

CONCLUSION

Necrotizing fasciitis involving the face in pediatric patients is an exceptionally rare and potentially life-threatening condition that demands prompt recognition and aggressive intervention. Early surgical debridement combined with broad-spectrum antibiotics is essential to reduce morbidity and mortality. Subsequent targeted antibiotic therapy will further decrease infection and prevent antimicrobial resistance. Prelaminated forehead flap reconstruction offers a reliable and effective method for nasal reconstruction, especially in very young children, enabling both functional and aesthetic restoration following extensive tissue loss. Successful outcomes, as demonstrated in this case, highlight the importance of timely multidisciplinary management and tailored reconstructive strategies in pediatric necrotizing fasciitis of the nose.

REFERENCE

1. Al-Qurayshi Z, Nichols RL, Killackey MT, et al. Mortality Risk in Necrotizing Fasciitis: National Prevalence, Trend, and Burden. *Surg Infect (Larchmt)*. 2020 Dec;21(10):840-52. doi: 10.1089/sur.2019.277.
2. Sarani B, Strong M, Pascual J, et al. Necrotizing fasciitis: current concepts and review of the literature. *J Am Coll Surg*. 2009 Feb;208(2):279-88. doi: 10.1016/j.jamcollsurg.2008.10.032.
3. Yahav D, Duskin-Bitan H, Eliakim-Raz N, et al. Monomicrobial necrotizing fasciitis in a single center: the emergence of Gram-negative bacteria as a common pathogen. *Int J Infect Dis*.

- 2014 Nov;28:13-6. doi: 10.1016/j.ijid.2014.05.024.
4. Zhao-Fleming HH, Wilkinson JE, Larumbe E, et al. Obligate anaerobes are abundant in human necrotizing soft tissue infection samples: a metagenomics analysis. *APMIS*. 2019 Aug;127(8):577-87. doi: 10.1111/apm.12969.
 5. Rudkjøbing VB, Thomsen TR, Xu Y, et al. Comparing culture and molecular methods for the identification of microorganisms involved in necrotizing soft tissue infections. *BMC Infect Dis*. 2016 Nov 8;16(1):652. doi: 10.1186/s12879-016-1976-2.
 6. Bruun T, Rath E, Madsen MB, et al. INFECTION Study Group. Risk Factors and Predictors of Mortality in Streptococcal Necrotizing Soft-tissue Infections: A Multicenter Prospective Study. *Clin Infect Dis*. 2021 Jan 27;72(2):293-300. doi: 10.1093/cid/ciaa027.
 7. Szilagyi J, Kuester V, Reznicek J. Pediatric Necrotizing Fasciitis. *J Pediatr Soc North Am*. 2024 Feb 5;5(4):728. doi: 10.55275/JPOSNA-2023-728.
 8. Song SY, Choi JW, Lew HW, et al. Nasal Reconstruction of a Frontonasal Dysplasia Deformity Using Aesthetic Rhinoplasty Techniques. *Arch Plast Surg*. 2015 Sep;42(5):637-9. doi: 10.5999/aps.2015.42.5.637.
 9. Alshaikh N, Lo S. Nasal septal abscess in children: from diagnosis to management and prevention. *Int J Pediatr Otorhinolaryngol*. 2011 Jun;75(6):737-44. doi: 10.1016/j.ijporl.2011.03.010.
 10. Li Y, Sepulveda A, Buchanan EP. Late presenting nasal deformities after nasal continuous positive airway pressure injury: 33-year experience. *J Plast Reconstr Aesthet Surg*. 2015 Mar;68(3):339-43. doi: 10.1016/j.bjps.2014.10.036.
 11. Hakkarainen TW, Kopari NM, Pham TN, et al. Necrotizing soft tissue infections: review and current concepts in treatment, systems of care, and outcomes. *Curr Probl Surg*. 2014 Aug;51(8):344-62. doi: 10.1067/j.cpsurg.2014.06.001.
 12. Choi HK, Seo GH, Han E. The incidence and seasonal variation of necrotizing fasciitis in Korea: a nationwide cross-sectional study. *Clin Microbiol Infect*. 2020 Aug;26(8):1090.e1-1090.e6. doi: 10.1016/j.cmi.2020.01.002.
 13. Shindo ML, Nalbone VP, Dougherty WR. Necrotizing fasciitis of the face. *Laryngoscope*. 1997 Aug;107(8):1071-9. doi: 10.1097/00005537-199708000-00013.
 14. Schröder A, Gerin A, Firth GB, et al. A systematic review of necrotising fasciitis in children from its first description in 1930 to 2018. *BMC Infect Dis*. 2019 Apr 11;19(1):317. doi: 10.1186/s12879-019-3941-3. Erratum in: *BMC Infect Dis*. 2019 May 27;19(1):469. doi: 10.1186/s12879-019-4003-6. doi: 10.1186/s12879-019-3941-3.
 15. Ahmadi Moghadam M, Ahmadi Moghadam S. Use of Forehead Flap for Nasal Tip Reconstruction after Traumatic Nasal Amputation. *World J Plast Surg*. 2017 Sep;6(3):361-4. PMID: 29218287; PMCID: PMC5714983.
 16. Jin L, Fan K, Liu S, et al. Necrotizing fasciitis of the jaw, neck and mediastinum caused by *Klebsiella oxytoca* and *Streptococcus constellatus*: a case report. *Ann Palliat Med*. 2021 Jul;10(7):8431-6. doi: 10.21037/apm-20-2427.
 17. Chen JL, Huang TY, Kuo LT, et al. Monomicrobial Necrotizing Fasciitis and Sepsis Caused by *Pseudomonas aeruginosa* and *Pseudomonas fluorescens*: a Series of Ten Cases. *Jpn J Infect Dis*. 2022 Nov 22;75(6):554-9. doi: 10.7883/yoken.JJID.2022.087.
 18. Chen JL, Huang TY, Kuo LT, et al. Monomicrobial Necrotizing Fasciitis and Sepsis Caused by *Pseudomonas aeruginosa* and *Pseudomonas fluorescens*: a Series of Ten Cases. *Jpn J Infect Dis*. 2022 Nov 22;75(6):554-9. doi: 10.7883/yoken.JJID.2022.087.
 19. Fermi M, Bassano E, Molinari G, et al. Prelaminated flaps in head and neck cancer reconstructive surgery: A systematic review. *Microsurgery*. 2021 Sep;41(6):584-3. doi: 10.1002/micr.30751.