Case Series

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Necrotising Soft-tissue Infection of the Breast: Case Series of a Rare but Fatal Entity

Surgery Section

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ABSTRACT

Necrotising Soft-tissue Infection (NSTI) of the breast is an exceedingly rare but highly aggressive condition that constitutes a true surgical emergency. It leads to extensive tissue necrosis, systemic toxicity and can be fatal if not treated promptly. The present case series includes seven patients, ranging in age from 30 to 55 years, all of whom presented with severe breast NSTI. These cases involved a variety of presentations, from sudden gangrene with maggot infestation to severe infections affecting multiple regions, such as the breast, axillae and upper arms. Laboratory findings commonly included elevated White Blood Cell (WBC) counts, while radiological imaging {ultrasound, Computed Tomography (CT) scans} identified extensive tissue damage and abscess formation. Surgical management consisted of extensive debridement and, in some cases, mastectomy with reconstruction. The clinical features across cases included pain, swelling, blackening of the skin, gangrene and purulent discharge. Blood cultures revealed pathogens such as *Enterococcus*, *E. coli* and *Proteus mirabilis*. Management involved intravenous antibiotics (piperacillin-tazobactam, vancomycin and others), debridement and wound care, with some patients requiring forequarter amputation or total mastectomy. In the present case series, 3 out of seven patients (42.8%) succumbed to death despite aggressive treatment. The mortality rate was high due to rapid progression to septic shock and multiorgan failure in some patients. Breast NSTI is a rare but fatal condition that requires early diagnosis and urgent intervention to reduce mortality. Surgical debridement and tailored antibiotic therapy are essential for successful outcomes. The present case series underscores the importance of early identification and the aggressive management of NSTI while highlighting the variable patient responses and the need for ongoing research to improve clinical outcomes.

Keywords: Gangrene, Maggot infestation, Mortality, Tissue necrosis

INTRODUCTION

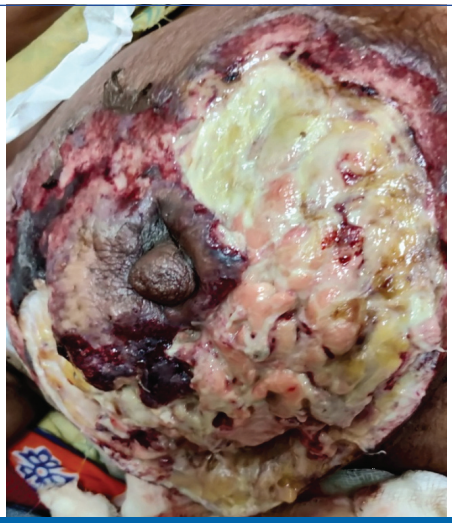
The NSTI of the breast is an exceedingly rare condition in surgical practice, yet it represents one of the most aggressive forms of soft-tissue infection and constitutes a true surgical emergency [1]. The infection can arise from various causes, including local trauma, breast infarction, or the application of topical agents, with a multifactorial or variable aetiology [2]. NSTI can be classified as either idiopathic or secondary to other conditions [3]. Due to its rare and often non specific presentation, it is frequently misdiagnosed as an abscess, cellulitis, or inflammatory breast cancer, which can delay the initiation of appropriate treatment [4].

Additionally, the psychosocial impact of breast NSTI is profound, often affecting body image and self-esteem [5]. Long-term follow-up and supportive care play a critical role in the recovery process, highlighting the need for a holistic approach to patient care [6]. Without prompt and effective treatment, NSTI can be fatal [2]. Therefore, early diagnosis, heightened awareness and aggressive treatment are crucial to improving survival outcomes [7].

CASE SERIES

A 30-year-old multiparous woman (Parity 2, Live births 2, Abortion 0; P2L2A0) who was lactating, presented with severe pain, swelling, blackening of the skin and pus discharge from her right breast, which had been ongoing for the past four days. The patient also had a notable high-grade fever. There was no history of trauma, insect bites, or the use of local remedies. The patient had no underlying medical conditions or significant prior health issues, with no history of diabetes, hypertension, or previous surgeries. No family history of breast cancer or other hereditary conditions.

On clinical examination, the patient was in critical condition, with unstable vital signs, including tachycardia and hypotension. Examination revealed gangrene affecting the entire right breast, while the Nipple-Areolar Complex (NAC) remained intact, as shown in [Table/Fig-1]. There was also a significant increase in local temperature, with signs of systemic infection.



[Table/Fig-1]: Clinical image of the right breast showing extensive gangrene.

Laboratory Investigations: The Complete Blood Count (CBC) shows an Elevated WBC count of 18,000/mm^3, raised urea and creatinine levels of 118 and 1.9 mg/dL and hyperkalemia of 5.9 mEq/L. Liver function test were within normal limits. Blood culture was positive for *Enterococcus* species.

Ultrasound of the right breast: Revealed significant fluid collection, diffuse oedema and tissue thickening, suggesting the presence of a breast abscess with possible gangrene.

The initial management for the patient's condition included prompt resuscitation. The patient was promptly resuscitated with intravenous fluids, electrolytes and broad-spectrum intravenous antibiotics (piperacillin-tazobactam and vancomycin). Pain management was initiated with opioids to control discomfort. The

patient was not suitable for general anaesthesia due to her unstable condition, so an initial extensive debridement was performed under local anaesthesia to remove necrotic tissue. Two days later, patient underwent second debridement done under general anaesthesia, preserving the NAC.

Postoperative treatment involved the application of Topical Negative Pressure (TNP) dressings, as shown in [Table/Fig-2]. Tissue biopsy results indicated breast gangrene. Culture of the pus revealed *Enterococcus*, leading to an adjustment of antibiotics according to sensitivity. Expression of milk from the unaffected contralateral breast was performed. The patient recovered and was followed-up with continued dressing changes, as shown in [Table/Fig-3]. Subsequent cultures showed negative results and breastfeeding was reinstated. She was further planned for a mammogram and skin grafting.

[Table/Fig-2]: Image after application of TNP. **[Table/Fig-3]:** Image of the right breast after recovery. (Images from left to right)

Case 1

A 34-year-old multiparous woman (P3L3A1) presented with severe pain, swelling and blackening of the skin over the left breast and arm, which had been ongoing for the past five days. She also exhibited high-grade fever. The patient had no history of trauma, insect bites, or the use of local remedies. She did not have any underlying medical conditions or significant past health issues and there was no relevant family history of breast cancer or other hereditary conditions.

Upon examination, the patient appeared critically ill, with unstable vital signs, including hypotension and tachycardia. Gangrene was observed involving the left breast and upper arm, progressing rapidly. The NAC was affected by the necrosis, as shown in [Table/Fig-4]. The patient also demonstrated signs of systemic infection, including fever and altered mental status.

[Table/Fig-4]: Clinical image of the left breast and arm showing extensive gangrene.

Laboratory investigations: The patient's laboratory results showed significant abnormalities. The CBC revealed a markedly elevated WBC count of 20,000/mm^3. Blood cultures were positive for *Proteus mirabilis*. Urea and creatinine levels were within normal limits, suggesting no significant renal involvement. Liver function tests were also normal. However, there was a significant electrolyte imbalance, with severe hyperkalemia (potassium level of 6.8 mEq/L), which required immediate management to prevent life-threatening complications.

The patient was rapidly resuscitated with intravenous fluids, broad-spectrum antibiotics (meropenem and vancomycin) and pain management. This electrolyte disturbance was closely monitored and corrected as part of the patient's treatment protocol. She was closely monitored in the Intensive Care Unit (ICU) for haemodynamic stability. The patient underwent extensive debridement of the left breast and arm under general anaesthesia. However, her critical condition necessitated a subsequent forequarter amputation to control the spread of the infection.

Postoperative care: Postoperatively, the patient was placed on broad-spectrum intravenous antibiotics. The patient was managed for systemic sepsis and closely monitored for any further complications. Pus culture results indicated the presence of *proteus mirabilis*, which was found to be sensitive to colistin. Antibiotics modified according to sensitivity. Despite aggressive medical and surgical interventions, the patient's condition continued to deteriorate rapidly. The infection spread to the systemic circulation, leading to septic shock and multiple organ failure. Unfortunately, the patient succumbed to the infection within a few days.

Case 2

A 34-year-old multiparous P2L2A0 woman presented with pain, swelling and gangrene affecting her right breast, along with visible maggots in the affected area for the last ten days. The condition progressed rapidly and there was an abrupt onset of symptoms. The infection progressed to include visible gangrene and maggots were found in the affected tissue. There was no history of trauma, insect bites, or local remedies and no underlying medical conditions were noted. The patient had no history of diabetes, hypertension, or any other systemic diseases, No significant family history of breast cancer or any genetic disorders.

Upon clinical examination, the patient appeared critically ill, with unstable vital signs, including tachycardia and hypotension. Gangrene was noted in the right breast and maggots were present in the necrotic tissue. There was a significant increase in local temperature, indicating ongoing infection. The NAC was severely affected by the gangrene, as shown in the [Table/Fig-5].

[Table/Fig-5]: Clinical image of the right breast showing gangrene and maggots.

Laboratory investigations: Mild anaemia with Haemoglobin (Hb) of 9.5 g/dL and an elevated WBC count of 18,500/mm^3, indicating an active infection. Blood cultures were negative, but pus culture revealed the presence of *Klebsiella* and *E. coli* species. Urea and creatinine levels were normal, as were liver function tests, with no evidence of hepatic dysfunction and electrolytes were within normal range.

The patient was promptly resuscitated with intravenous fluids, broad-spectrum antibiotics (piperacillin-tazobactam and vancomycin) and analgesia to manage pain. Serial debridement were performed under local anaesthesia to remove the necrotic tissue.

Postoperative care: The patient received wound care with regular dressing changes. *Klebsiella* and *E. coli* were isolated from the infected tissue, both of which were sensitive to colistin. Antibiotics were adjusted accordingly. The patient underwent a total mastectomy, followed by reconstruction using the Lateral Intercostal Artery Perforators (LICAP) based axial flap to reconstruct the breast tissue after pus culture came out to be negative for any organisms. The patient responded well to treatment and showed significant improvement. She was discharged after a period of recovery and continued with wound care and dressings at home. Follow-up visits showed good healing and no further infections were noted.

Case 3

A 32-year-old multiparous P4L3A0 woman presented with pain, swelling and blackening of the skin in her right breast, which had been progressing rapidly over the past three days. She had high-grade fever and signs of systemic infection. The infection began suddenly and there was no history of trauma, insect bites, or the use of local remedies. The patient reported no underlying medical conditions or significant health issues prior to this episode. No family history of breast cancer or other hereditary conditions.

Upon examination, the patient was critically ill, with unstable vital signs, including tachycardia and hypotension. Gangrene was observed affecting the right breast and the NAC was involved in the necrosis. The breast tissue showed significant discoloration and areas of blackened tissue, indicative of gangrene, as shown in the [Table/Fig-6].

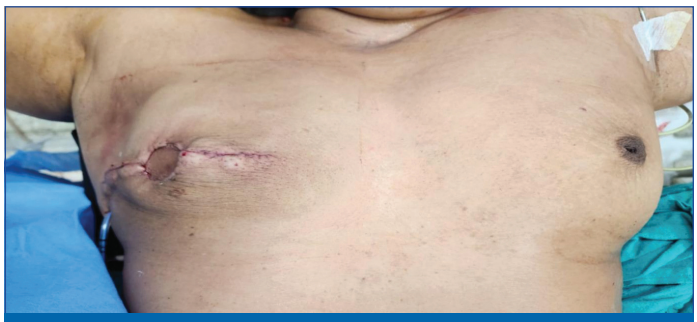
[Table/Fig-6]: Clinical image of the right breast showing rapid gangrene progression.

Laboratory investigations: Elevated WBC count of 27,000/mm^3, indicating active infection. Blood cultures were negative, but pus culture revealed the presence of *Enterococcus*. Urea and creatinine levels were normal, as were liver function tests. Electrolytes showed a mild electrolyte imbalance with normal levels of potassium and sodium.

Radiological findings: An ultrasound of the right breast revealed significant fluid collection, tissue oedema and areas of necrosis without any lump. A CT scan of the chest showed deep tissue involvement and subcutaneous emphysema, consistent with advanced tissue necrosis. The patient was immediately resuscitated with intravenous fluids, broad-spectrum antibiotics (piperacillin-tazobactam, clindamycin and vancomycin) and pain management.

Extensive debridement was performed under general anaesthesia to remove all necrotic tissue. The patient was managed with wound care and regular dressing changes. TNP therapy was applied to promote wound healing and reduce the risk of infection. Pus culture revealed *Enterococcus*, which was sensitive to ampicillin. Antibiotics were adjusted accordingly. After the pus culture came back negative, the patient underwent a total mastectomy due to the extent of tissue necrosis, followed by reconstruction using the latissimus dorsi flap to restore breast shape, as shown in [Table/Fig-7].

The patient responded well to the treatment, with no further complications. She continued with dressing changes and follow-up visits showed negative cultures and significant improvement in wound healing. She was discharged after a successful recovery, with instructions for continued wound care.



[Table/Fig-7]: Clinical picture showing restoration of breast using latissimus dorsi flap.

Case 4

A 42-year-old multiparous P2L2A0 woman presented with pain, swelling and gangrene affecting the lower outer and inner quadrants of her right breast, which had progressed rapidly over the past seven days. She also had high-grade fever and signs of systemic infection. The infection began suddenly, without any obvious predisposing factors or history of trauma, insect bites, or local remedies. There was no history of underlying medical conditions or significant past health issues. No family history of breast cancer or other hereditary conditions.

On clinical examination, the patient was in critical condition with unstable vital signs, including tachycardia and hypotension. Gangrene was observed in the lower outer and inner quadrants of the right breast, with areas of blackened tissue and signs of significant infection. The NAC was not involved. There was also a significant increase in local temperature, suggesting ongoing infection, as shown in [Table/Fig-8].

[Table/Fig-8]: Clinical image of the right breast showing gangrene in lower quadrants.

Laboratory investigations: Elevated WBC count of 18,200/mm^3 was noted. Blood cultures were negative. Urea and creatinine levels were normal, as were liver function tests.

Ultrasound of the right breast: Ultrasound of the right breast revealed extensive tissue necrosis and fluid collection.

The patient was resuscitated with intravenous fluids, broad-spectrum intravenous antibiotics (piperacillin-tazobactam and vancomycin) and pain management. She was admitted to the ICU for close monitoring.

The patient underwent debridement under general anaesthesia to remove necrotic tissue. Approximately 400 mL of purulent discharge was drained, which was sent for culture and sensitivity testing. A deep tissue biopsy was taken for Histopathological Examination (HPE) and anaerobic culture.

Postoperative care: The patient received ongoing wound care with dressing changes and TNP therapy was used to aid wound healing and reduce infection. Serial debridement was carried out under local anaesthesia to continue removing necrotic tissue, as shown in [Table/Fig-9].

Pus culture revealed *enterococcus* species were identified and the antibiotics were adjusted based on the sensitivity results. Histopathological Examination (HPE) showed severe tissue necrosis with acute inflammatory infiltrates, consistent with gangrene.

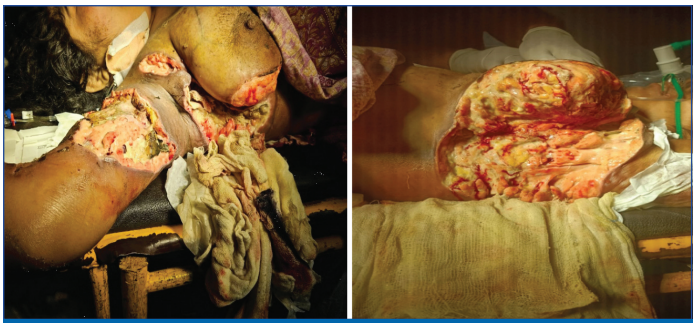
[Table/Fig-9]: Clinical Image of the right breast after debridement.

The patient responded well to treatment and the infection was controlled with continued antibiotic therapy and wound care. Subsequent cultures were negative for any further infection. The patient was discharged after a successful recovery with regular follow-up for wound healing.

Case 5

A 34-year-old multiparous obese woman presented with pain, redness, swelling and pus discharge from both breasts, axillae and upper arms, which had been ongoing for the past 15 days. She also had high-grade fever. The patient reported a gradual onset of symptoms, including swelling and pain in both breasts, axillae and upper arms. There was no history of trauma, insect bites, or the use of local remedies. The patient did not have any known underlying medical conditions or a history of systemic diseases, No family history of breast cancer or other hereditary conditions.

On clinical examination, the patient was in critical condition with unstable vital signs, including tachycardia and hypotension. Extensive NSTI was noted, involving both breasts, axillae and upper arms, while the Nipple-Areola Complex (NAC) was spared. There was marked erythema, swelling and purulent discharge from the affected areas, as shown in [Table/Fig-10, 11].



[Table/Fig-10]: Clinical image of right breast, axilla and upper arm showing extensive gangrene. **[Table/Fig-11]:** Clinical image of left breast, axilla and upper arm showing extensive. (Images from left to right)

Laboratory investigations: Elevated WBC count of 22,000/mm^3, indicating active infection. Blood cultures were negative, but pus culture revealed the presence of *E. coli* and *Acinetobacter*. Urea and creatinine levels were normal, as were liver function tests: Normal. Electrolytes: Mild electrolyte imbalance that was corrected with intravenous supplementation.

The patient was stabilised with intravenous fluids, broad-spectrum antibiotics (piperacillin tazobactam and vancomycin) and pain management. She was admitted to the ICU for close monitoring due to her unstable condition.

The patient underwent extensive debridement of both breast, axillae and upper arms under general anaesthesia, preserving the NAC. Necrotic tissue was removed to control the infection. Following the initial surgery, further debridements were performed under local anaesthesia to ensure complete removal of necrotic tissue. She was monitored closely for signs of systemic infection and sepsis.

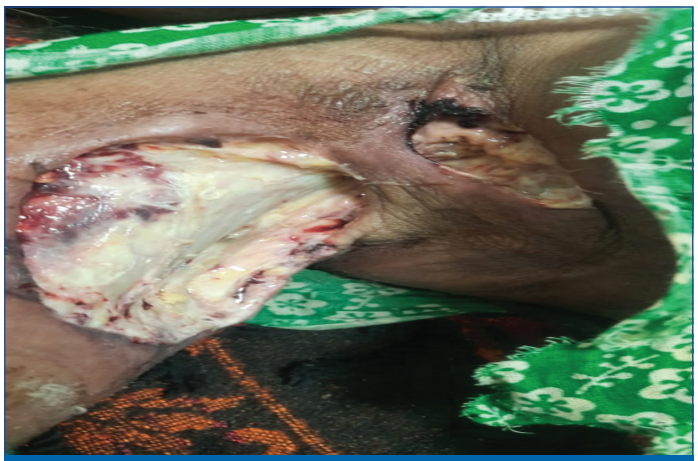
Pus culture revealed *E. coli* and *Acinetobacter*, both of which were sensitive to colistin. Antibiotic therapy was adjusted accordingly. Tissue biopsy confirmed the presence of breast gangrene with acute inflammatory changes and necrosis.

Despite aggressive medical and surgical interventions, including broad-spectrum antibiotics and serial debridements, the patient's condition deteriorated rapidly. She developed septic shock and despite attempts to manage the infection, she ultimately succumbed to the infection, resulting in a fatal outcome.

Case 6

A 55-year-old woman presented with pain, swelling and blister formation in the right upper arm and outer part of the right breast. The blisters burst open, forming ulcers over the past four days. The condition progressed rapidly, accompanied by foul-smelling discharge. No history of trauma, insect bites, or the use of local remedies.

The patient had a history of chronic kidney disease, but no other known co-morbidities or acute illnesses were present. There was no family history of breast cancer or other hereditary conditions. Upon clinical examination, the patient appeared acutely ill, with fever and unstable vital signs, including tachycardia and hypotension. Extensive tissue damage was noted in the right upper arm and outer part of the right breast, with blister formation, ruptured blisters and ulceration. There was also significant erythema and foul-smelling discharge from the affected areas, suggesting an ongoing severe infection, as shown in [Table/Fig-12].



[Table/Fig-12]: Clinical image of the right upper arm and breast showing blisters and ulceration.

Laboratory investigations: Elevated WBC count of 13,000/mm^3 was observed. Blood cultures were negative, but pus culture was pending. Urea and creatinine: Elevated creatinine levels (5.5 mg/dL), consistent with chronic kidney disease. Liver function tests were normal, with no evidence of hepatic dysfunction. Electrolytes indicated mild hyponatremia, with sodium level of 128 mEq/L and hyperkalemia of 6.5 mEq/L was managed with intravenous correction. Ultrasound of the right upper Arm and breast revealed fluid collection and soft-tissue oedema, suggestive of abscess formation and necrosis.

The patient was stabilised with intravenous fluids and intravenous antibiotics were administered, with dosages adjusted according to the patient's renal clearance. Broad-spectrum antibiotics, including piperacillin-tazobactam and vancomycin, were used to target the suspected bacterial pathogens. Pain management was initiated and the patient was monitored closely in the ICU due to her unstable condition.

Due to the patient's critical condition, debridement was performed under local anaesthesia to remove necrotic tissue. The patient received continuous wound care and dressing changes. Antibiotics were adjusted based on sensitivity results from the pending pus culture. Despite the use of higher antibiotic dosages and wound care, the patient's condition continued to deteriorate, Pus culture pending results at the time of her rapid deterioration. No specific microbial growth was observed before the patient's condition worsened.

Despite aggressive medical and surgical interventions, including debridement and antibiotic therapy, the patient's condition deteriorated abruptly within a very short time. She developed septic shock and despite all efforts to stabilise her, she succumbed to the infection, resulting in a fatal outcome.

DISCUSSION

The NSTI is an aggressive and rapidly progressive condition that primarily affects the fascia and subcutaneous tissue, often sparing the muscles. The infection spreads along the fascial planes, leading to extensive tissue necrosis and systemic toxicity, making early diagnosis and treatment crucial. It is considered one of the most severe forms of soft tissue infection due to its ability to rapidly escalate and cause widespread damage if not addressed promptly [1,2]. Despite advancements in surgical techniques and broad-spectrum antibiotics, NSTI remains associated with high morbidity and mortality rates, particularly if the infection progresses before intervention [3].

The aetiology of NSTI is multifactorial and can arise from various sources, including trauma, insect bites, or even postsurgical infections. In some cases, no clear cause can be identified, leading to the term "idiopathic" NSTI [4]. The infection is often misdiagnosed as other conditions, including abscesses, cellulitis, or inflammatory breast cancer, which can lead to delays in diagnosis and treatment [5]. In the present case series, most cases presented without any identifiable predisposing factors, but the severity of infection necessitated urgent and aggressive treatment.

Several key risk factors have been identified in the literature that predispose individuals to NSTI, including diabetes mellitus, immunocompromised states, peripheral vascular disease and obesity [6]. In the absence of underlying conditions, the presentation can be even more challenging, as seen in Case 2, where no significant co-morbidities were present. Additionally, while age does not serve as a reliable predictor for NSTI development, older patients tend to experience more complications due to co-morbidities and delayed healing [7]. The fact that NSTI can occur in previously healthy individuals highlights the need for vigilance in recognising early signs and symptoms.

The diagnosis of NSTI, particularly breast NSTI, poses significant challenges due to the unique anatomy of the breast tissue. The breast has a relatively thin layer of subcutaneous fat and the fascia is not as well defined as in other parts of the body, making the infection more difficult to detect until it has spread significantly. Imaging studies, such as ultrasound, CT scans and Magnetic Resonance Imaging (MRIs), are essential in diagnosing the extent of the infection. Ultrasound is typically the first line of imaging, revealing signs of fluid collection and tissue oedema [8]. CT scans may show deeper fascial involvement and subcutaneous emphysema, which is indicative of more advanced necrosis [9].

In Case 1, the patient's deterioration despite aggressive medical and surgical intervention exemplifies the often-fatal nature of this condition [2,4]. Forequarter amputation, as seen in Case 2, was necessary to control the infection and prevent further spread to other organs. While this procedure significantly impacted the patient's quality of life, it was crucial to halt the spread of the infection and improve the patient's chances of survival [10]. Unfortunately, as demonstrated in the same case, even with such aggressive measures, the patient's condition deteriorated swiftly, culminating in a fatal outcome. This underscores the importance of early diagnosis and intervention; once the infection spreads to systemic circulation, the prognosis becomes much poorer [7].

Recent studies suggest that the rate of NSTI remains high, with several studies showing a reduction in mortality from 35% to 23.5% due to improved medical and surgical management [1,11]. However, these improvements are still minimal, highlighting the need for more research into effective early interventions and better treatment protocols.

In the management of NSTI, the cornerstone of treatment is aggressive debridement to remove necrotic tissue, followed using broad-spectrum antibiotics [6]. The role of Vacuum-Assisted Closure (VAC) dressings and other advanced wound care techniques has become more prominent in managing large areas of necrosis [8]. In the present case series, the authors employed TNP dressing in many cases to facilitate wound healing and promote tissue regeneration. This approach has been shown to reduce infection rates and promote faster wound closure [8].

Although some patients can be successfully treated with extensive debridement and antibiotic therapy, the presence of systemic infection or failure to control the infection early often leads to septic shock and multiple organ failure [3]. In Case 2, the rapid progression of the infection led to sepsis, which ultimately overwhelmed the patient's body despite aggressive treatment. This highlights the importance of not only controlling the local infection but also addressing the systemic implications of NSTI as quickly as possible [4,9,10].

CONCLUSION(S)

Breast NSTI is an extremely rare but highly serious condition that requires early detection, aggressive surgical intervention and prompt antibiotic therapy. Clinicians must maintain a high index of suspicion for NSTI in patients presenting with rapidly progressing breast infections, especially when the typical signs of cellulitis or abscess formation are not responding to initial treatments. From the present case series of seven patients, the authors concluded that the most common infecting organism was gram-negative bacteria, which was sensitive to multiple antibiotics, emphasise of importance of change of antibiotic regimen from initial empirical therapy.

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