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Review Article

Necrotising Fasciitis of the Abdominal Wall After Laparoscopic Appendicectomy: A Review of Published Cases

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Abstract

Background: Necrotising fasciitis (NF) is a rare but frequently fatal complication of laparoscopic appendicectomy, one of the commonest emergency operations performed worldwide.

Objective: To review published case reports of NF after laparoscopic appendicectomy and related port-site/appendicitis-associated abdominal-wall NF, alongside the epidemiology, pathophysiology, diagnosis and management literature for necrotising soft tissue infection (NSTI) in this setting.

Methods: Narrative review of individually verified case reports, epidemiological cohorts, microbiological and outcome studies, and society management guidelines.

Findings: Ten published cases were tabulated; onset ranged from postoperative day 2 to several weeks, infections were typically polymicrobial (*E. coli*, *Bacteroides*, *Klebsiella*, anaerobes), and four of nine cases with a stated outcome were fatal. Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) scores, reported only in recent cases, correlated poorly with disease severity.

Conclusions: A high index of suspicion, disproportionate pain or systemic toxicity out of keeping with local findings, and immediate surgical exploration rather than reliance on scoring systems or imaging remain the determinants of survival.

Keywords: Necrotising fasciitis; Laparoscopic appendicectomy; Necrotizing soft tissue infection; Port-site infection; LRINEC score

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Introduction

Laparoscopic appendicectomy is among the most frequently performed emergency general surgical operations, generally associated with fewer wound infections than the open approach [1,2]. Necrotising fasciitis (NF) — a rapidly progressive infection of the subcutaneous fascia with variable involvement of overlying skin and underlying muscle, driven by toxin-producing, often polymicrobial bacteria — was first reported after any laparoscopic operation in 1996,

following a laparoscopically-assisted vaginal hysterectomy [3]. The first case following laparoscopic appendicectomy specifically was not published until 2008, when a previously fit, non-diabetic woman died within hours of developing fulminant abdominal-wall NF on the second postoperative day [4]. Since then a small but informative literature of individual case reports has accumulated, almost all citing the paradox that a minimally invasive operation associated with reduced wound morbidity can, rarely, be followed by one of the most lethal soft tissue infections in surgery.

This is a narrative review of the published literature — not a report of the authors' own patient — surveying case reports of NF after laparoscopic appendicectomy and closely related laparoscopic port-site/abdominal-wall NF, together with the epidemiology, pathophysiology, diagnostic approach, management and outcomes of NSTI relevant to this clinical scenario. Because individual case reports of this specific complication remain few, we also draw on the broader NSTI literature — general surgical, emergency medicine and critical care — wherever it directly informs the recognition or management of abdominal-wall NF arising from an appendiceal source.

Epidemiology

NF as a complication of any appendicectomy is rare; abdominal-wall NF following perforated appendicitis alone carries a reported mortality of 13.6-38% [5,6], and after laparoscopic appendicectomy specifically only a handful of individual reports exist worldwide [4,7,2]. At the population level, necrotising soft tissue infection (NSTI) as a whole has an estimated incidence in the range of 0.04 per 1000 population annually in high-income settings, though earlier estimates put annual US case counts at 500-1500 [8]. A Danish nationwide register-based cohort spanning 2005-2018 found NSTI incidence rising over the study period while overall mortality remained high and largely unchanged [9], and a global systematic review and meta-analysis pooling data

across dozens of studies confirmed persistently elevated mortality worldwide despite advances in critical care [10]. Against this backdrop, appendicitis-related and laparoscopic port-site NF represent a numerically small but clinically important subset, disproportionately reported because of their diagnostic and educational value: the same organisms responsible for intra-abdominal sepsis can, via direct extension, specimen retrieval, or trocar-site contamination, seed the abdominal wall fascia [4,7]. Laparoscopic NF is not unique to appendicectomy: individual reports also exist after total extraperitoneal inguinal hernia repair [11], sleeve gastrectomy and other bariatric procedures, laparoscopic colectomy and gynaecological surgery, underscoring that any procedure combining bowel or contaminated-field handling with small trocar incisions carries at least a theoretical risk, even though absolute numbers remain extremely small relative to overall laparoscopic case volumes performed worldwide each year.

Pathophysiology and Microbiology

Three non-exclusive routes of abdominal-wall contamination have been proposed for post-appendicectomy NF: direct spread from an inflamed or perforated appendix to the adjacent abdominal wall; contamination during trans-port specimen extraction; and exogenous wound contamination in the perioperative period, with haematogenous seeding a rare fourth possibility [4,7]. Most cases are Type I (polymicrobial) infections combining Gram-positive cocci, Gram-negative facultative anaerobes and obligate anaerobes acting synergistically to produce toxins and enzymes that destroy fascial planes while sparing muscle and, initially, skin [12,1]. Across the case reports reviewed here, causative organisms included *Escherichia coli*, *Klebsiella pneumoniae*, *Bacteroides fragilis* and other *Bacteroides* species, *Clostridium* species, *Streptococcus anginosus/milleri*, *Enterococcus* and *Aggregatibacter segnis* (Table 1) — a spectrum entirely consistent with

enteric/appendiceal flora rather than the monomicrobial group A streptococcal disease more typical of NF at other body sites [13]. Recognised risk factors for NSTI generally, several present in the fatal cases reviewed, include diabetes mellitus, immunosuppression, advanced age, perforated or gangrenous appendicitis, and delayed or omitted antibiotic prophylaxis [12,2,6,14]. Notably, the index laparoscopic appendicectomy case occurred in a young, non-diabetic, immunocompetent woman with early, non-perforated appendicitis who had declined antibiotic prophylaxis because of a reported penicillin allergy [4], illustrating that absence of the classical risk factors does not exclude fulminant disease and that omission of perioperative antibiotic prophylaxis — even for a seemingly straightforward, non-perforated case — may be an independently modifiable contributor.

Clinical Presentation

The case reports document a consistent pattern: an apparently uneventful early postoperative course followed by disproportionate pain, low-grade or absent fever, and subtle local signs that progress rapidly to systemic toxicity. In the sentinel case, a 54-year-old woman was afebrile and ambulant on postoperative day 1 but developed septic shock, metabolic acidosis and violaceous skin discolouration spreading from the right iliac fossa within hours on day 2, dying seven hours after debridement [4]. In the first successfully managed UK case, a 19-year-old man with perforated appendicitis developed port-site erythema on day 2 that was initially unremarkable on examination but, when reassessed hours later because of escalating analgesia requirements, showed progressive cellulitis and subcutaneous crepitus, prompting immediate exploration and survival [7]. Presentation can also be markedly delayed: a diabetic man re-presented 45 days after laparoscopic appendicectomy for perforated appendicitis, having apparently recovered from an earlier superficial wound infection [2], and a woman with an appendicocutaneous fistula presented a week after the

onset of foul-smelling drainage with extensive subcutaneous emphysema on imaging [5]. Extension beyond the abdominal wall occurs: NF has tracked into the thigh and scrotum via the femoral neurovascular bundle [14] and into the lumbar region via the triangle of Jean-Louis Petit [15]. Underlying autoimmune or inflammatory comorbidity can also complicate the picture, as in a fatal case of appendicitis-related NF in a patient with adult-onset Still's disease, in whom concurrent disease activity and immunosuppressive therapy may have masked or accelerated the septic process [16]. Across these reports, pain disproportionate to examination findings, and clinical deterioration out of proportion to apparent local disease, were the most consistent early clues (Table 1). Fever was inconsistently present at onset, and classical hard signs — crepitus, bullae, skin necrosis — typically appeared late, often only after the diagnosis had already been suspected on the basis of pain, tachycardia and clinical trajectory rather than examination alone; several authors explicitly warn that waiting for these late signs before intervening materially worsens the chance of survival [7,14].

Table 1: Published cases of necrotising fasciitis after laparoscopic appendicectomy, appendicitis-related abdominal-wall infection, and comparator laparoscopic port-site necrotising fasciitis reviewed here [4,7,2,11,5,6,21,16,14,15]; N = 10 reports.					
Report	Age/s ex	Onset	Organisms	Treatment	Outcome
Ahmed 2008	54/F	Day 2	E. coli, Clostridium spp.	Debridement; broad-spectrum antibiotics	Fatal
Raghavendra 2010	19/M	Day 2	Gram-negative bacilli (presumed Enterobacter)	Early exploration; NPWT	Survived
Tavares 2018	52/M	Day 45	Klebsiella pneumoniae	Fasciotomy, escharotomy; meropenem+vancomycin	Survived
Golash 2007*	41/M	Day 5	E. coli, Klebsiella, Proteus, S. aureus	Mesh removal, debridement, skin graft	Survived

Report	Age/s ex	Onset	Organisms	Treatment	Outcome
Falconi 2023	72/F	~1 week	E. coli, Bacteroides fragilis, Clostridium perfringens	Ileocecectomy, repeated debridement	Fatal
Suleimanov 2022	75/M	Day 4	S. anginosus, E. coli, anaerobes	Repeated debridement; pip-tazo+clindamycin	Survived
Lim 2024	65/M	9-day history	E. coli, Bacteroides, Clostridium innocuum	Lap appendectomy + 3-layer debridement, reconstruction	Survived
Huang 2018	Not stated	Not stated	Not stated	Medical and surgical management	Fatal
Chin 2018	60/M	6-day history	E. coli, B. fragilis, S. milleri	Amputation, debridement	Fatal
Bergeron 2022	Not stated	Not stated	Not stated	Not stated	Not stated

Diagnostic Approach

NF remains fundamentally a clinical diagnosis; no laboratory test or score substitutes for surgical exploration when suspicion is high [17,12]. The Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) score, derived from white cell count, haemoglobin, sodium, creatinine, glucose and C-reactive protein, was designed to help distinguish NF from severe cellulitis [18] and has been externally validated with a sensitivity of only 59.2% and specificity of 83.8% at the standard threshold of ≥6 [19]. A systematic review and meta-analysis of physical examination, imaging and LRINEC accuracy concluded that no single test reliably rules out NSTI and that a low threshold for operative exploration is essential [20]. Among the appendicectomy-related cases reviewed here, LRINEC was reported in only the two most recent (scores of 10 and 7, both only "intermediate-to-high" risk rather than diagnostic) [6,21], while earlier reports relied entirely on clinical crepitus, disproportionate pain and rapidly spreading cellulitis [4,7]. Computed tomography can support the diagnosis — subcutaneous gas tracking along

fascial planes and fascial non-enhancement are characteristic — and was used to plan the extent of surgery in several cases [4,21,14], but imaging should never delay operative exploration when clinical suspicion is high [22,20]. Where diagnostic uncertainty persists despite imaging, bedside or theatre exploration of the affected wound or port site under local or general anaesthesia — looking for the classic "dishwater" fluid, non-bleeding oedematous fascia, and a lack of normal resistance to blunt dissection — remains the most reliable confirmatory step and should be pursued without delay rather than awaiting further biochemical or radiological corroboration [12,6].

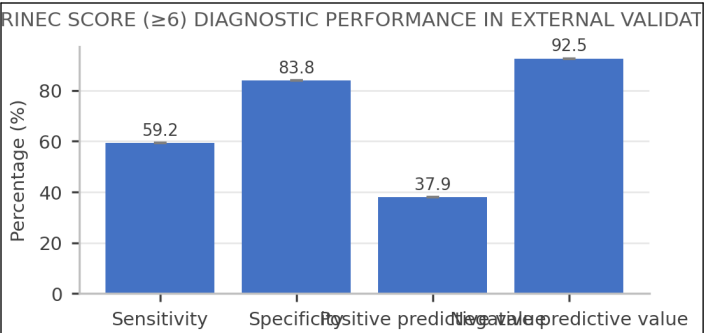


Figure 1: External validation of the LRINEC score (threshold ≥6) in 233 necrotising fasciitis and 3155 severe cellulitis patients: sensitivity 59.2%, specificity 83.8%, positive predictive value 37.9%, negative predictive value 92.5% [19].

Management

Successful outcomes across the reviewed cases uniformly combined early recognition, immediate broad-spectrum antimicrobial therapy, and prompt, often repeated, radical surgical debridement — the cornerstone recommended by both the 2014 Infectious Diseases Society of America guideline [23] and the World Society of Emergency Surgery guidelines [22,24]. Antibiotic regimens in the reviewed reports typically combined a broad-spectrum beta-lactam or carbapenem (piperacillin-tazobactam, meropenem) with an anti-anaerobic/toxin-suppressing agent such as clindamycin or metronidazole, later narrowed to culture results [2,6,21]. Surgically, debridement extent ranged

from limited port-site exploration in an early, localised case [7] to three-layer abdominal-wall debridement with staged reconstruction using acellular dermal matrix and split-thickness skin grafting [21], mesh removal and skin grafting after hernia-repair-associated NF [11], and above-knee amputation when infection had tracked irreversibly into the thigh [14]. Multidisciplinary input — critical care, microbiology, tissue viability and, where reconstruction was extensive, plastic surgery — featured in every survivor's care [7,21]. Hyperbaric oxygen therapy was considered in one case but not used, and a Cochrane systematic review found no high-quality trial evidence to support or refute its adjunctive use in NF, concluding it should never delay surgery [25,2].

Table 2: Society guideline recommendations for diagnosis and management of necrotising soft-tissue infection relevant to post-appendicectomy abdominal-wall necrotising fasciitis [23,22,24,25].				
Society (year)	Diagnostic stance	First-line treatment	Adjuncts	Source
IDSA (2014)	Clinical diagnosis; low threshold for exploration	Broad-spectrum empiric antibiotics + urgent debridement	Narrow to culture results	steven 2014
WSES (2014)	Treat as NSTI until proven otherwise	Early operative debridement + resuscitation + antibiotics	Repeat debridement as needed	sartelli 2014
WSES/GAIS/WSIS/SIS-E/A AST (2022)	Structured global clinical pathway	Source control + targeted antimicrobial stewardship	Multidisciplinary reconstruction	sartelli 2022
Cochrane review (2015)	Not a diagnostic tool	Not a substitute for surgery	Hyperbaric oxygen: no high-quality evidence either way	levett 2015

Outcomes and Prognosis

Delay to debridement remains the principal modifiable determinant of mortality in NSTI, a finding established in a landmark 1995 series and echoed in subsequent outcome studies [26,27]. Among the ten cases tabulated

here, four of nine with a stated outcome were fatal, a case fatality broadly consistent with contemporary NSTI mortality estimates of 20-30% and with the higher historical range of 29-76% quoted in earlier reports [7,10]. Survivors were characterised by earlier recognition (within 2-4 days) and immediate exploration, while fatal cases involved either delayed presentation, extensive fistulating disease, or rapid fulminant progression despite prompt intervention [4,5,14]. These outcome patterns mirror the wider NSTI literature, in which age, extent of infection at presentation, and physiological derangement on admission independently predict death and limb loss [27,9].

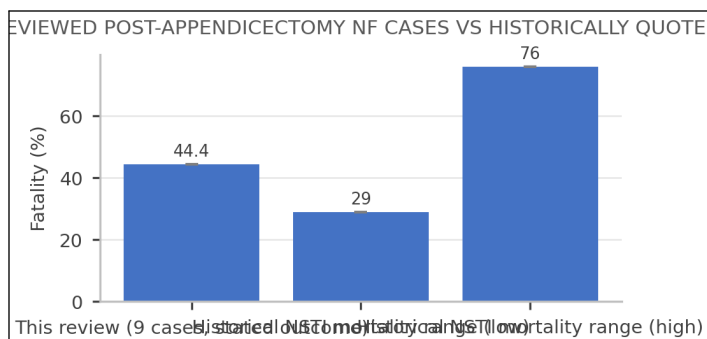


Figure 2: Case fatality among the nine reviewed post-appendicectomy/port-site necrotising fasciitis cases with a stated outcome (44.4%) compared with the historically quoted necrotising soft-tissue infection mortality range of 29-76% [26,7].

Conclusion

Published cases of NF after laparoscopic appendicectomy, though few, are consistent in their teaching: presentation is often deceptively mild in the first 24-48 hours, disease can progress within hours to fulminant sepsis, and no biomarker or score reliably excludes the diagnosis. Surgeons managing patients after laparoscopic appendicectomy who develop pain, systemic upset or wound changes disproportionate to expected recovery should maintain a very low threshold for surgical exploration; early, aggressive debridement combined with broad-spectrum antimicrobial therapy remains the only intervention consistently associated with survival in this literature.

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