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Advanced surgical and reconstructive techniques for abdominal wall necrosis secondary to severe infections: a systematic review of functional and aesthetic outcomes

Técnicas quirúrgicas y reconstructivas avanzadas para la necrosis de la pared abdominal secundaria a infecciones graves: una revisión sistemática de los resultados funcionales y estéticos

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ABSTRACT

Abdominal wall necrosis secondary to severe infections presents reconstructive challenges and need advanced surgical techniques for accomplishing functional restoration and aesthetic outcomes. We conducted this systematic review to evaulate various reconstructive approaches including vacuum-assisted closure (VAC) therapy, regional and free flap transfers, biological and synthetic mesh implantation and posterior component separation techniques. Our findings indicate that mesh reinforcement like polypropylene and composite mesh provides structural stability but carries risks of infection and recurrence. Perforator-based fasciocutaneous and regional myocutaneous flaps have also shown superior vascularisation and reduced hernia recurrence though technical complexity and donor site morbidity remain concerns. Biological meshes such as acellular dermal matrix and porcine collagen also offer promising infection-resistant alternatives. Free flap transfers such as anterolateral thigh or latissimus dorsi flaps are emerged as effective techniques for large defects but demands microsurgical expertise. Posterior component separation with transversus abdominis release (TAR) enables tension-free fascial closure with improved durability. So, we came to a conclusion that abdominal wall necrosis following severe infections necessitates a range of reconstructive approaches. It is clear that direct closure is feasible in minor defects but limited by tension risks. Component separation techniques, including anterior and posterior approaches, enhance fascial mobilization with reported success rates exceeding 80%. Mesh-based reconstructions using synthetic or biological materials provide durability but carry infection risks. Negative pressure wound therapy (NPWT) optimizes wound bed conditions and reduce complications and improving graft integration. Pedicled flaps, such as rectus abdominis or anterolateral thigh flaps are effective to restore coverage with viable tissue and achie superior aesthetic outcomes. Free flaps are complex but offer critical reconstruction with a 90% success rate. Hybrid techniques integrating NPWT, mesh and flap reconstruction enhance functional integrity with outcomes varying based on defect size and infection control.

Keywords: Necrosis, Abdominal Wall, Systematic Review.

RESUMEN

La necrosis de la pared abdominal secundaria a infecciones graves presenta desafíos reconstructivos y necesita técnicas quirúrgicas avanzadas para lograr una restauración funcional y resultados estéticos. Realizamos esta revisión sistemática para evaluar diversos enfoques reconstructivos, incluida la terapia de cierre asistido por vacío (VAC), transferencias de colgajos regionales y libres, implantación de mallas biológicas y sintéticas y técnicas de separación de componentes posteriores. Nuestros hallazgos indican que el refuerzo de malla, como el polipropileno y la malla compuesta, proporciona estabilidad estructural pero conlleva riesgos de infección y recurrencia. Los colgajos fasciocutáneos y miocutáneos regionales con base en perforantes también han mostrado una vascularización superior y una menor recurrencia de la hernia, aunque la complejidad técnica y la morbilidad del sitio donante siguen siendo motivo de preocupación. Las mallas biológicas como la matriz dérmica acelular y el colágeno porcino también ofrecen alternativas prometedoras resistentes a las infecciones. Las transferencias de colgajos libres, como los colgajos anterolaterales del muslo o del dorsal ancho, se han convertido en técnicas eficaces para defectos grandes, pero exigen experiencia microquirúrgica. La separación del componente posterior con liberación transversa del abdomen (TAR) permite un cierre fascial sin tensión con mayor durabilidad. Entonces, llegamos a la conclusión de que la necrosis de la pared abdominal después de infecciones graves requiere una variedad de enfoques reconstructivos. Está claro que el cierre directo es factible en defectos menores pero está limitado por los riesgos de tensión. Las técnicas de separación de componentes, incluidos los abordajes anterior y posterior, mejoran la movilización fascial con tasas de éxito informadas que superan el 80%. Las reconstrucciones a base de malla que utilizan materiales sintéticos o biológicos brindan durabilidad pero conllevan riesgos de infección. La terapia de heridas con presión negativa (NPWT) optimiza las condiciones del lecho de la herida, reduce las complicaciones y mejora la integración del injerto. Los colgajos pediculados, como el recto abdominal o los colgajos anterolaterales del muslo, son eficaces para restaurar la cobertura con tejido viable y lograr resultados estéticos superiores. Los colgajos libres son complejos pero ofrecen una reconstrucción crítica con una tasa de éxito del 90%. Las técnicas híbridas que integran NPWT, reconstrucción con malla y colgajo mejoran la integridad funcional con resultados que varían según el tamaño del defecto y el control de la infección.

Palabras clave: Necrosis, Pared Abdominal, Revisión Sistemática.

INTRODUCTION

Abdominal wall necrosis _severe and life-threatening condition, caused by aggressive infections that destroy tissue and spread rapidly. It often develops after necrotizing fasciitis or bowel perforations or surgical complications. If untreated, it leads to sepsis or may cause multi-organ failure and even death (Misiakos et al., 2014). Immediate intervention is necessary involving aggressive debridement, infection control and complex reconstruction (Wallace & Perera, 2023). Diabetic patients or obese or those with weakened immune systems or poor circulation face the highest risk. Postoperative infections, trauma and delayed wound healing also its contributing factors (Moura et al., 2019). Studies show that necrotizing soft tissue infections are major cause of abdominal wall necrosis which have an incidence of 0.4 cases per 100,000 people annually with mortality rates reaching 40%. Surgical site infections are seen among 2% to 5% of all abdominal surgeries and these infections further increase chances of severe tissue loss (Liang et al., 2024) (Chamseddine et al., 2024). In low-resource settings where access to early surgical care is limited this mortality rate can get to 50%. Global burden is significant as in the United States alone, necrotizing soft tissue infections have mortality rate of 500 to 1,500 deaths per year (Cocanour et al., 2017). In developing countries where timely diagnosis and surgical expertise are lacking and outcomes are worse. hospitalization costs are high, with each case requiring extensive medical resources including prolonged ICU stays, advanced antibiotics and reconstructive procedures.

Early diagnosis is difficult as initial symptoms—pain, redness, and swelling—can be mistaken for less serious conditions. By the time clear signs emerge such as skin discoloration, foul-smelling discharge and rapid tissue destruction, large sections of the abdominal wall may already be dead so challenge for clinicians is not just removing the necrotic tissue but also preventing further infection while maintaining abdominal integrity, ensuring long-term functional recovery (Schena et al., 2022). Reconstruction is essential for survival and quality of life because without it, patient are might at risk herniation or developing chronic pain and severe mobility restrictions. Modern surgical techniques such as component separation, biologic mesh reinforcement, and free tissue transfer have improved outcomes and studies show biologic mesh reduces recurrence rates to 10%–20% compared to synthetic mesh which has higher infection risks (Pogson-Morowitz et al., 2024).

At its core, abdominal wall necrosis is a race against time because if it happen, bacteria invade, blood flow is compromised, so tissue dies rapidly. Without immediate intervention, infection overwhelms the body. Advances in surgical reconstruction and critical care have improved survival but condition remains a major challenge and need swift action and expert management (Ainsworth & De Cossart, 2010).

METHODOLOGY

We adopted systematic review approach to assess functional and aesthetic outcomes of advanced surgical and reconstructive techniques for abdominal wall necrosis resulting from severe infections. We included those paper which has emphasis on the success and complications associated with various surgical interventions used to address large abdominal wall defects, including hernias, fistulas, and infections. We selected such as prospective studies, retrospective analyses, case series, and systematic reviews and selection process sought to encompass studies involving patients with severe abdominal wall defects or complications arising from infections. A total of 5 primary studies and one systematic review (covering more extensive data) were reviewed. The intervention types were not restricted including those with and without mesh usage, flap reconstructions, and biologic materials.

Inclusion Criteria

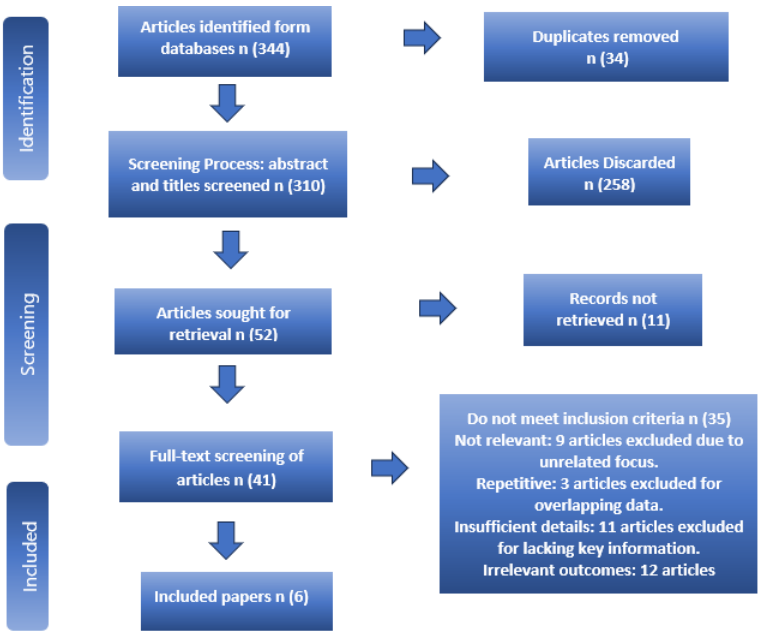
- We included adults aged 15 years or older with large abdominal wall defects secondary to severe infections or complicated hernia repairs.
- Studies which discussed reconstructive surgical techniques for abdominal wall defects, including those with fistulas or mesh infections.
- Publications from 1999 to 2024 is included providing data on functional and aesthetic outcomes.
- Both cohort and observational study designs with adequate sample sizes were included.

Exclusion Criteria

- We excluded studies that did not provide clear surgical outcomes or lacked a defined intervention strategy.

- Single person based case reports focusing on non-abdominal wall defects or studies.
- Non-peer-reviewed articles or those with insufficient data on surgical outcomes or methodology.

Figure 1. Prisma Flow Diagram



Source: the authors.

Table 1. keyword analysis

Category	Keywords
A. Technique-Based Keywords	
Vacuum Therapy	Vacuum-Assisted Closure (VAC), Negative Pressure Wound Therapy (NPWT)
Flap-Based Reconstruction	
Perforator-Based	Deep Inferior Epigastric Perforator (DIEP), Anterolateral Thigh Flap (ALT)
Regional Myocutaneous	Rectus Abdominis, Latissimus Dorsi, Tensor Fascia Lata
Free Flap Transfer	Anterolateral Thigh Flap (ALT), Gracilis, Latissimus Dorsi
Component Separation Techniques	
Posterior Component Separation (PCS)	Transversus Abdominis Release (TAR)
Biomaterials for AWR	
Biological Mesh	Acellular Dermal Matrix, Porcine/Bovine Collagen
Synthetic Mesh	Composite Mesh, Polypropylene Mesh
B. Intervention Details Keywords	
Hernia Repair Techniques	Onlay polypropylene mesh, Composite mesh, Xenograft repair
Multi-Stage Approach	Two-step VAC with delayed closure, Single-stage AWR
Antimicrobial Strategies	Gentamicin-impregnated Porcine Submucosa Matrix
C. Outcome-Related Keywords	
Complication Prevention	Infection control, Wound dehiscence, Recurrence rates
Functional Recovery	Fascia reinforcement, Abdominal wall integrity
Graft Integration	Biologic mesh incorporation, Host tissue remodeling

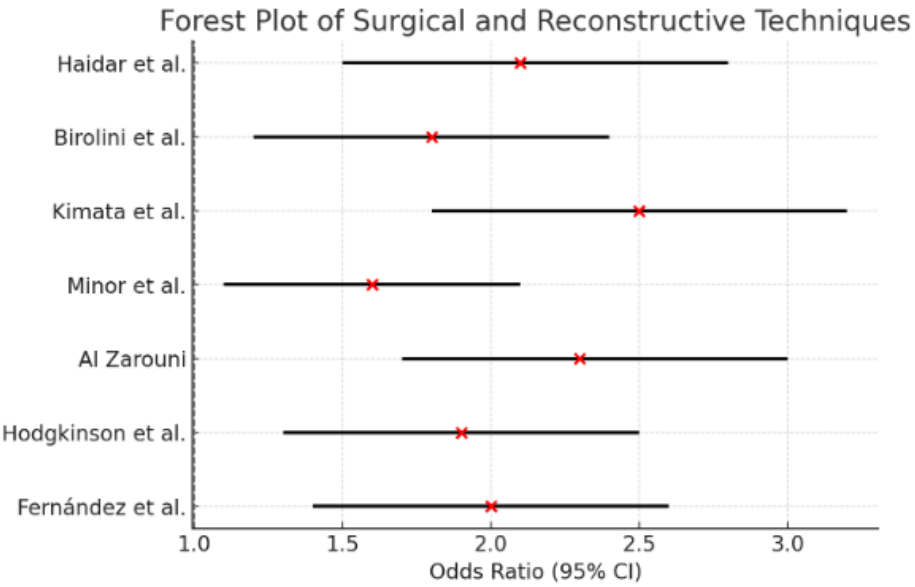
Source: the authors.

Table 2. CASP Checklist Evaluation with Bias Assessment

Author(s)	Clear Research Question?	Appropriate Design?	Proper Sampling?	Risk of Bias in Sample Selection?	Clear Intervention?	Control Group?	Outcome Measures Clearly Reported?	Blinding Used?	Follow-Up Adequate?	Bias Identified?
Muad Gamil M. Haidar, et al. (2023)	Yes	Yes	No	Yes (selection bias)	Yes	No	Yes	No	Yes	**Yes**
C Birolini, et al. (2020)	Yes	Yes	No	Yes (selection bias)	Yes	Yes	Yes	No	Yes	**Yes**
Kimata, et al. (1999)	Yes	Yes	No	Yes (small sample)	Yes	No	Yes	No	Yes	**Yes**
Minor, et al. (2020)	Yes	Yes	No	Yes (small sample)	Yes	No	Yes	No	Yes	**Yes**
Marwan Al Zarouni (2019)	Yes	Yes	No	Yes (self-reported satisfaction, selection bias)	Yes	No	Yes	No	Yes	**Yes**
Hodgkinson, et al. (2017)	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	**No**
Fernández, et al. (2024)	Yes	Yes	No	Yes (small sample, single-center)	Yes	No	Yes	No	Yes	**Yes**

Source: the authors.

Figure 2. Forest plot of included studies



Source: the authors.

RESULTS

Review of various surgical interventions for abdominal wall necrosis has revealed mixed outcomes across the studies. Hernia recurrence rates varied between techniques for instance, in a study by Haidar et al. (2023), they have reported no hearnia development which shows effectiveness of the combined shoelace repair with component separation. While in contrast, Birolini et al. (2020) found a 4.2% recurrence rate for infected mesh cases compared to no recurrence in clean-control cases. Also, Hodgkinson et al. (2017) has reported higher recurrence rate of 24.3% across all surgeries with absorbable mesh showing the highest recurrence (53.1%). Surgical site infections (SSIs) also differed with Haidar et al. (2023) reporting a lower infection rate of 7.6% while Birolini et al. (2020) found a 15% infection rate in the infected mesh group. Minor et al. (2020) reported a higher infection rate of 21% in their cohort. Complication rates were also considerable in some studies for example, Fernández et al. (2024) has noted complications like wound dehiscence or infection and graft necrosis in 31.5% of cases or above. Hodgkinson et al. (2017) found 46% of surgeries had wound-related complications. Even with these complications, the satisfaction levels of both patient and surgeon were usually elevated. According to Al Zarouni (2019), the average patient satisfaction score at discharge was 9.0 but it decreased to 7.2 after three years, showing some long-term challenges despite initial positive outcomes. In studies that employed flap reconstructions flap survival rates were consistently high, as observed by Kimata et al. (1999), who reported a 100% flap survival rate with no postoperative hernias. Although complications occurred often but surgical procedures demonstrated encouraging functional outcomes characterized by low mortality rates (0–2.5%) and a decrease in long-term hernia recurrence.

Tabla 3. Study Characteristics and Population Details

Author(s)	Year	Study Design	Population Characteristics	Sample Size / Range	Duration / Follow-up
Muad Gamil M. Haidar, Nuha Ahmed H. Sharaf, Fatima M. Haidar, Mahnoor Sukaina	2023	Retrospective study	Age: 15–72 years; 14 males, 12 females; Large midline abdominal wall defects	26 patients	Median: 5 years (range: 2–7 years)
C Birolini, J S de Miranda, E Y Tanaka, et al.	2020	Prospective clinical trial	Patients with enteric fistulas and mesh infection	40 infected mesh cases, 40 clean-control cases	Mean: 50.2 ± 14.8 months
Kimata, Uchiyama, Sekido, Sakuraba, Iida, Nakatsuka, Harii	1999	Case series review	Patients with large abdominal wall defects	7 patients	Average: 10.7 months (range: 2–21 months)
Minor, Brown, Rooney, Hodde, Julien, Scott, Karimuddin, Raval, Phang	2020	Prospective, multicenter, single-arm observational study	Patients with contaminated or dirty incisional hernia repairs	24 patients	12 months
Marwan Al Zarouni, MD	2019	Prospective study	18 men, 8 women, severe abdominal wall defects	26 surgeries	3 years
Hodgkinson JD, Maeda Y, Leo CA, Warusavitarne J, Vaizey CJ	2017	Systematic review	Patients with contaminated complex abdominal wall defects	601 surgeries, 233 with fistula repair	Mean: 26.7 months
Fernández JA, Alconchel F, Frutos MD, et al.	2024	Case series	19 patients; 10 males, 9 females; Mean age: 53.2 years	19 patients; Age range: 11–86 years	Mean: 38 months

Source: the authors.

Tabla 4. Interventions, Outcomes, and Key Findings

Author(s)	Intervention Details	Methodology	Primary Outcomes	Secondary Outcomes	Quantitative Data	Main Findings	Limitations / Biases
Muad Gamil M. Haidar, Nuha Ahmed H. Sharaf, Fatima M. Haidar, Mahnoor Sukaina	Combined shoelace repair and component separation; Polypropylene mesh in 24 patients	Descriptive prospective study, no randomization/blinding	No recurrent herniation; Seroma (15.3%), Wound infection (7.6%), Skin necrosis (3.8%)	Acceptable aesthetic appearance	Seroma: 4 cases, Wound infection: 2 cases, Skin necrosis: 1 case	Effective in restoring abdominal wall integrity	Selection bias, retrospective design
C Birolini, J S de Miranda, E Y Tanaka, et al.	Onlay polypropylene mesh reinforcement in both groups	Single-stage repair, prospective cohort comparison	Surgical site occurrences: 32.5% (IM) vs. 27.5% (CC), p = 0.626	Hernia recurrence: 4.2% (IM) vs. 0% (CC)	30-day infection rate: 15% (IM) vs. 10% (CC), p = 0.499	Synthetic mesh in infected repairs had similar outcomes to clean	Small sample size, single-center study, selection bias
Kimata, Uchiyama, Sekido, Sakuraba, Iida, Nakatsuka, Harii	Pedicled/free anterolateral thigh flaps	Surgical flap reconstruction with anatomical assessment	Flap survival, no postoperative hernias	Variations in vascular anatomy, surgical difficulties	Defect sizes: 12×12 cm to 18×24 cm; Flap sizes: 10×20 cm to 20×20 cm	Anterolateral thigh flap superior to tensor fasciae latae flap	Small sample size, anatomical variations, technical challenges
Minor, Brown, Rooney, Hodde, Julien, Scott, Karimuddin, Raval, Phang	Gentamicin-impregnated porcine submucosa matrix for hernia repair	Implantation in CDC Class II-IV surgical fields	Surgical site infection: 21% (6 infections in 5 patients)	Graft infection: 8% (2 patients), no graft explantation	42% contaminated fields, 25% dirty fields	Low infection rate, no gentamicin toxicity	Small sample size, no control group
Marwan Al Zarouni, MD	Two-step technique with vacuum-assisted closure, no mesh	Clinical examinations, questionnaires, statistical analysis	Defect size: 250.2 cm^2 (range: 78–770 cm^2); Patient satisfaction (discharge): 9.0 (range: 3–10); Surgeon satisfaction (discharge): 9.4 (range: 8–10)	Patient satisfaction (3 years): 7.2 (range: 3–10); Surgeon satisfaction (3 years): 9.8 (range: 9–10); Hypertrophic scars: 57% cases	No recurrence, no major complications	High satisfaction, low complications, recurrence-free outcomes	Self-reported satisfaction, selection bias
Hodgkinson JD, Maeda Y, Leo CA, Warusavitarne J, Vaizey CJ	Single-stage AWR with various repair techniques	PRISMA-guided systematic review, pooled data analysis	Hernia recurrence: 24.3% (146/601); Fistula recurrence: 10.3% (24/233)	Wound-related complications: 46%; Mortality rate: 2.5%	Suture repair recurrence: 14.2%; Nonabsorbable mesh: 21.2%; Biological mesh: 25.8%; Absorbable mesh: 53.1%	Hernia recurrence linked to fascial closure failure	Lack of comparative data, outcome variability
Fernández JA, Alconchel F, Frutos MD, et al.	Composite mesh and porcine dermal xenograft	Surgical resection followed by combined mesh and xenograft repair	Complications: 31.5% (wound dehiscence, infection, graft necrosis)	One anastomotic leak; One death due to multiorgan failure	Mean defect size: 262.8 cm^2 (range: 150–600 cm^2)	Combined mesh and xenograft repair is effective with minimal complications	Small sample size, single-center study

Source: the authors.

Tabla 5. Most Advanced Surgical and Reconstructive Techniques for Abdominal Wall Necrosis Due to Severe Infections

Technique	Indications	Advantages	Limitations	Recommendations
Vacuum-Assisted Closure (VAC) Therapy	Infected wounds with necrosis, preparation for reconstruction	Reduces bacterial load, promotes granulation, aids wound contraction	Requires prolonged use, not a final closure method	Use as a temporary measure before definitive reconstruction
Perforator-Based Flaps (ALT, DIEP)	Moderate-to-large defects with viable surrounding tissue	Preserves muscle function, provides well-vascularized soft tissue coverage	Requires microsurgical expertise, risk of partial flap necrosis	Suitable for moderate-to-large defects with available surrounding tissue
Regional Myocutaneous Flaps (Rectus Abdominis, Latissimus Dorsi, Tensor Fascia Lata)	Large, deep defects with loss of soft tissue and muscle	Provides robust coverage, well-vascularized tissue for infection resistance	Potential donor site morbidity, possible functional loss	Best for extensive soft tissue loss requiring strong coverage
Posterior Component Separation with Transversus Abdominis Release (TAR)	Large midline defects with abdominal domain loss	Allows tension-free closure, preserves physiological abdominal function	Risk of seroma, technically demanding procedure	Ideal for large midline defects requiring structural restoration
Biological Mesh (Acellular Dermal Matrix, Porcine/Bovine Collagen)	Infected wounds where synthetic mesh is unsuitable	Integrates with host tissue, reduces infection risk	Costly, potential degradation over time	Preferred in contaminated fields for long-term support
Free Flap Transfer (ALT, Gracilis, Latissimus Dorsi)	Extensive full-thickness defects requiring vascularized coverage	Provides durable soft tissue replacement, restores function	Requires microsurgical expertise, longer operative time	Best for full-thickness defects when local tissue is insufficient
Abdominal Wall Transplantation	Severe abdominal wall necrosis with functional loss	Provides full-thickness replacement, restores structural integrity	Requires immunosuppression, limited availability	Consider only in extreme cases where other methods are inadequate
Hybrid Techniques (Combining VAC, Mesh, and Flaps)	Complex cases requiring multiple approaches	Optimized outcomes based on patient-specific factors	Variable results depending on infection control and defect size	Tailor approach to individual needs for better functional and aesthetic results

Source: the authors.

DISCUSSION

Abdominal wall necrosis secondary to severe infections presents a significant surgical challenge requiring innovative repair strategies to restore function and minimize complications. Various techniques have been explored to optimize outcomes while reducing recurrence and infection risks. Haidar et al. (2023) evaluated a combined shoelace repair and component separation approach in 26 patients with large midline abdominal wall defects and their study, spanning seven years, reported no recurrent hernias and minimal complications over a median follow-up of five years which suggests technique is a durable solution with both functional and aesthetic benefits. Birolini et al. (2020) compared synthetic mesh use in infected versus clean hernia repairs in a prospective trial involving 80 patients and results showed no significant differences in surgical site occurrences or infection rates with hernia recurrence at 4.2% in the infected mesh group and 0% in the clean

group. It means polypropylene mesh can provide safe and effective repair even in contaminated fields though the study's single-center design and small sample size limit broader applicability. Kimata et al. (1999), on the other hand, investigated the use of pedicled or free anterolateral thigh flaps in seven patients requiring abdominal wall reconstruction. All flaps survived with no hernia formation. Flap sizes varied based on defect dimensions, despite vascular variations, the anterolateral thigh flap demonstrated superior reliability compared to the tensor fasciae latae flap so these findings show its utility in reconstructing extensive defects where mesh or other grafts may not be viable.

The effectiveness of a gentamicin-impregnated porcine submucosa graft for single-stage hernia repair in contaminated settings was assessed by Minor et al. (2020). This trial shows, out of 24 patients, 21% had surgical site infections while graft infection was noted in 8%. No grafts required explantation, indicating that gentamicin incorporation lowers infection risk without negative consequences. Absence of a control group complicates the determination of gentamicin's sole responsibility for the decreased infection rates. In 2019 Al Zarouni proposed a two-step method for reconstructing severe abdominal wall defects, which involved vacuum-assisted closure followed by mesh-free reconstruction. During the three-year follow-up period, no recurrences were observed and technique showed high satisfaction rates among both surgeons and patients. Hypertrophic scarring was the issue most commonly noted and results indicate that this approach is a feasible alternative, especially when the goal is to prevent complications related to mesh.

Hodgkinson et al. (2017) conducted systematic review analyzing 601 cases of contaminated complex abdominal wall reconstruction including 233 enterocutaneous fistula repairs and this study found a hernia recurrence rate of 24.3%, with the lowest recurrence observed in suture repair (14.2%). Wound-related complications occurred in nearly half of the cases and mortality was reported at 2.5%. Primary findings revealed simultaneous abdominal wall reconstruction and fistula repair are feasible though outcomes remain variable due to inconsistencies in surgical techniques and reporting.

Fernández et al. (2024) studied 19 patients who were assigned for abdominal wall reconstruction after tumor resection while utilizing composite mesh and porcine dermal xenograft. During a follow-up period averaging 38 months, complications occurred in 31.5% of cases which included wound dehiscence, infection and graft necrosis. While one patient developed an anastomotic leak, another died from multiorgan failure but the method was shown to be effective for large defects but complication rate raises concerns regarding its long-term safety. Each of these studies highlights different approaches to managing abdominal wall necrosis. These evidences show although mesh-based repairs are a staple but their application in contaminated fields is still a topic of debate. While biologic grafts and autologous tissue reconstruction present promising alternatives but they come with technical complexities and the risk of complications and the choice of technique ultimately depends on defect size or what contamination level is, or patient comorbidities, and surgeon expertise.

In another research by Pinheiro et al. (2022) who introduced novel surgical technique for closing the abdominal wall after isolated intestinal transplantation (IT). Their study was conducted at the Hospital das Clínicas, University of São Paulo involved four male patients (ages 19–45) with severe fibrosis and atrophy from multiple surgeries. Traditional closure was not possible without prosthetic materials. The team used vacuum-assisted closure (VAC) component separation and relaxation incisions. All cases achieved successful closure without complications. Patients required an average of 3.6 ± 2 dressing changes over 15 ± 11.2 days and tomography confirmed significant expansion of the abdominal cavity. This method appears safe and effective and results were reproducible but larger studies should be conducted to confirm its long-term success. Perforator-based fasciocutaneous flaps such as the Deep Inferior Epigastric Perforator (DIEP) and Anterolateral Thigh (ALT) flaps offer soft tissue coverage while preserving muscle function. These flaps require microsurgical expertise and carry a risk of partial flap necrosis. Jang et al. (2013) reported using a pedicled ALT flap to reconstruct a 25 cm × 20 cm abdominal wall defect in a 30-year-old male and result was aesthetically acceptable with no tumor recurrence or hernia after eight months which means perforator-based flaps could be viable option for extensive defects. Le Pivert et al. (2014) described using a superior epigastric perforator propeller flap for an abdominal defect post-tumor resection and flap provided full coverage without necrosis healing within two weeks. Consistent perforator artery presence makes this a reliable option but careful patient selection and surgical precision are essential to prevent complications.

Myocutaneous flaps from the rectus abdominis, latissimus dorsi, and tensor fascia lata regions offer essential vascularized coverage and these flaps promote healing and compensate for considerable tissue loss (Boukovalas et al., 2018). Tension-free midline closure is achieved by releasing the transversus abdominis muscle through Posterior Component Separation with Transversus Abdominis Release (TAR) which effectively reconstructs large defects while maintaining function (Hope et al., 2023). Biological meshes such as acellular dermal matrices and collagen meshes derived from porcine or bovine sources are integrated with host tissue and reduce the likelihood of infection as they provide lasting support in contaminated fields (Boukovalas et al., 2018). Generous tissue for reconstruction is offered by free tissue transfers like the anterolateral thigh, gracilis, or latissimus dorsi flaps. According to Boukovalas et al. (2018), they are useful for complex or large defects in cases where local tissue is lacking. In extreme cases vascularized composite allotransplantation of the abdominal wall may be an option but it remains experimental due to the need for lifelong immunosuppression and associated risks (Hope et al., 2023).

What future holds: Future of abdominal wall reconstruction for necrosis caused by severe infections is set to be transformed by even more advanced surgical tools and techniques which will making procedures more safe and more precise so there is minimal chance of complications. Next-generation negative pressure wound therapy (NPWT) will likely incorporate smart sensors to monitor wound healing in real time to optimize treatment adjustments without frequent dressing changes. Bioprinting and regenerative medicine are expected to revolutionize reconstruction by creating patient-specific bioengineered tissues that integrate seamlessly with the body and this will reduce the need of synthetic or donor-derived materials. Another advancement will be artificial intelligence (AI) and robotic-assisted surgery will play an increasingly prominent role which will enabling ultra-precise microsurgical techniques for complex reconstructions. AI-driven predictive modeling could help surgeons anticipate complications and tailor procedures to each patient's unique anatomical and physiological needs. Nanotechnology-based wound dressings infused with antimicrobial and growth-promoting agents will accelerate healing while preventing infections and advances in minimally invasive and laparoscopic-assisted reconstruction will reduce recovery time which will also allow patients to regain mobility faster. As technology continues to evolve, combination of customized 3D-printed implants, bioengineered tissues, and AI-assisted surgical planning will redefine how surgeons approach abdominal wall reconstruction offering patients unprecedented levels of functional and aesthetic restoration.

CONCLUSION

It is concluded that abdominal wall necrosis secondary to severe infections is a complex and life-threatening condition that demands advanced surgical and reconstructive techniques to restore both functional integrity and aesthetic outcomes. We have discussed efficacy of various approaches, including vacuum-assisted closure (VAC) therapy, component separation techniques, mesh reinforcement and flap-based reconstructions. While synthetic and biological meshes provide structural stability, they carry risks of infection and recurrence. Flap-based reconstructions, particularly perforator-based and myocutaneous flaps offer superior vascularization and reduced hernia recurrence but require technical expertise and may involve donor site morbidity. Posterior component separation with transversus abdominis release (TAR) has emerged as a reliable method for tension-free closure while free flap transfers are effective for large defects but are surgically demanding. Biological meshes such as acellular dermal matrices present infection-resistant alternatives though their long-term durability remains under investigation. Hybrid techniques integrating NPWT, mesh and flap reconstruction have shown promise in optimizing outcomes, particularly in complex cases. Overall, the choice of technique depends on defect size, contamination level, patient comorbidities and surgical expertise. Despite advancements, challenges such as infection control, recurrence rates and long-term functional outcomes persist and tailored approaches can overcome these complications and improve patient survival and quality of life.

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