



The management of sternal mediastinitis in heart and lung transplant patients: An 8-year experience and application of reconstructive algorithm

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Summary *Background:* Sternal mediastinitis, the most severe form of deep sternal wound infection (DSWI), following heart and lung transplantation is uncommon but associated with substantial morbidity. Chronic immunosuppression, complex microbiological profiles and altered chest wall anatomy pose distinct reconstructive challenges. We present our experience from our tertiary transplant centre and evaluate the applicability of our reconstructive algorithm in this population.

Methods: A retrospective review was conducted of all heart and lung transplant recipients who were surgically managed for DSWI at a tertiary cardiothoracic transplant centre between June 2017 and December 2025. Demographic data, microbiology, operative details, reconstructive interventions and outcomes were analysed. A PRISMA-compliant systematic review was performed alongside.

Results: Ten patients were identified (7 lung and 3 heart transplant recipients). Median time from transplant to DSWI diagnosis was 95 (4–1486) days. Following diagnosis, median time to definitive reconstruction was 90 (32–722) days, during which patients underwent a median of 4 (1–10) debridements and received prolonged antimicrobial therapy. Negative pressure wound

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therapy was used for a median of 42.5 days (8–122 days; n=9). Median DSWI-related length of stay was 147 (62–321) days. Reconstructive strategy was guided by previous incision type: reverse abdominoplasty predominated following clamshell thoracotomy (5/7), whereas bilateral pectoralis major advancement flaps were most employed following median sternotomy (2/3). All patients were successfully discharged. There was no perioperative mortality.

Conclusion: Transplant-associated DSWI is characterised by prolonged treatment courses and complex microbiology. Aggressive source control within a multidisciplinary framework, combined with considered reconstructive planning, facilitates durable results and successful discharge in this high-risk population.

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Deep sternal wound infection (DSWI) is a serious complication following cardiothoracic surgery, with an incidence of 0.5–6%¹ and mortality of 10–25%.^{2–4} The Centres for Disease Control and Prevention (CDC) defines DSWI by one of the following: (1) organism isolated from mediastinal tissue/fluid culture, (2) mediastinitis identified intraoperatively or (3) chest pain, sternal instability or fever (> 38°C) with purulent mediastinal drainage or positive blood or mediastinal culture.⁵ Specifically, sternal mediastinitis involves the sternal bone with purulent drainage, representing the most severe form of DSWI and requires complex reconstruction.⁶

In transplant patients, lifelong immunosuppression and major surgery fundamentally alter immune response and wound healing. DSWI incidence in heart transplant recipients can range between 1.4–8.8%,^{6,7} compared to 0.5–6% in general cardiac surgery^{1,8} and long-term mortality following transplant-associated mediastinitis can approach 40%.⁹ Reconstructive management is further complicated by anatomical changes: heart transplantation via median sternotomy typically preserves the internal mammary arteries (IMAs), whereas lung transplantation via clamshell thoracotomy requires bilateral IMA ligation, creating extensive inferior mediastinal dead space and rendering IMA-based pectoralis turnover flaps unreliable.¹⁰

Current literature on reconstructive management of DSWI, and particularly sternal mediastinitis, in transplant-specific patients remains limited and is largely focused on heart transplantation with minimal attention to lung transplant recipients. Building on our previously published reconstructive algorithm,¹ we now present a focused systematic review and our 8-year experience in managing DSWI in heart and lung transplant recipients at a high-volume UK cardiothoracic transplant centre.

Methods

Study design

This retrospective case series examined DSWI management in adult transplant recipients at a tertiary cardiothoracic transplant centre performing 13–44 heart and 16–64 lung transplants annually over the past decade,^{11,12} in accordance with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

All heart and lung transplant recipients who developed DSWI or substantial sternal wound dehiscence that required operative intervention were identified through plastic surgery operative logs and electronic medical records.

Inclusion criteria: Adult patients (≥18 years) who underwent heart or lung transplantation, development of DSWI as defined by CDC criteria and treatment at our institution with plastic and reconstructive surgery involvement.

Exclusion criteria: Superficial wound infections managed with antibiotics alone and patients transferred to other institutions before definitive reconstruction.

Data collection and analysis

Comprehensive demographic and clinical data were extracted from electronic medical records after October 2023 and scanned paper records before October 2023, including patient demographics, transplant-specific factors, infection characteristics, operative management and outcomes. Descriptive statistics were used given the small sample size, with continuous variables reported as medians with ranges and categorical variables as frequencies and percentages. Infection control and wound bed readiness were determined by combined macroscopic (absence of dehiscence, purulent discharge and friable or necrotic tissue together with healthy granulation), microscopic (paired wound cultures were collected at each dressing change from healthy-appearing and suspicious areas) and multidisciplinary team (MDT) assessment. Outcomes were defined as ‘healed’ when stable soft-tissue coverage with intact skin at the relevant follow-up point without subsequent breakdown and ‘no recurrent mediastinal infection’ were observed, which denoted the absence of clinical, laboratory or imaging evidence of persistent or recurrent infection up to the final follow-up. Complications were captured from routine multidisciplinary follow-up up to six months. For this study, perioperative mortality was defined as all-cause death from the commencement of the definitive reconstructive procedure to hospital discharge.

Systematic review

A PRISMA-compliant review was performed using the Ovid-Embase, PubMed, and Cochrane databases up to November 2025 using the following search strategy: ((mediastinitis) OR

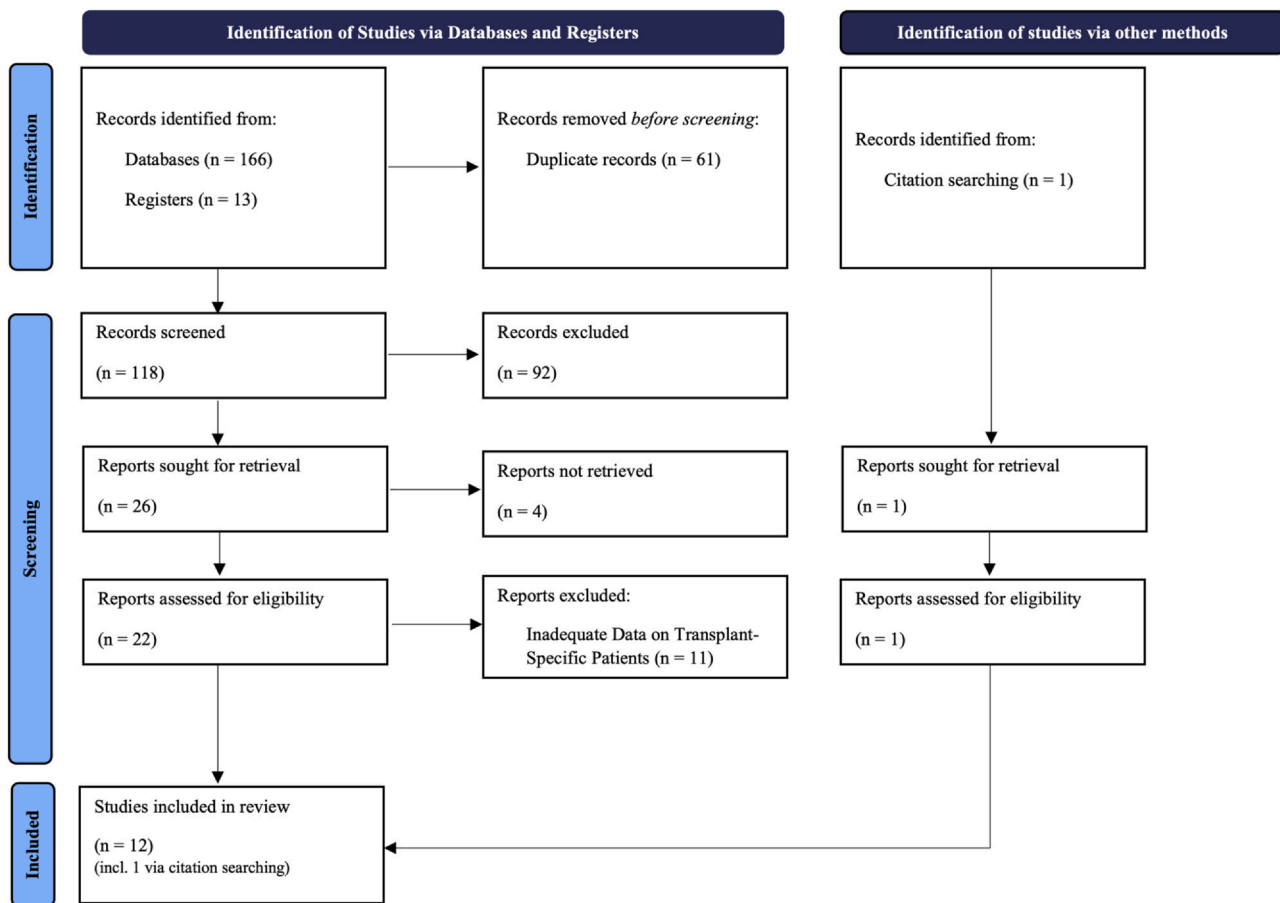


Figure 1 PRISMA flow diagram of the study selection process.

(sternal wound infection*) OR (DSWI)) AND (transplant*) AND ((flap*) OR (plastic*) OR (coverage) OR (reconstruction) OR (closure)). Case reports and papers in languages other than English were excluded (Figure 1).

Inclusion criteria: papers providing original outcome data on patients undergoing sternal reconstruction following wound complications after lung or heart transplantations.

Exclusion criteria: patients undergoing reconstructions following transplantations other than heart or lung, animal studies, cadaveric studies, reviews and any non-English articles.

The reference lists from the included studies were additionally searched manually, through which one further eligible study that was not captured in the original database search was identified (Diaddigo al.).¹³ The methodological quality of all the included studies was appraised using the Methodological Index for Non-Randomised Studies (MINORS) criteria (Appendix A).

Results

Patient demographics

Ten out of 524 heart and lung transplant patients (1.9%) met the inclusion criteria over the 8-year study period (June 2017-December 2025). The cohort comprised 5 women and 5

men with a median age of 45 years (range 29-62 years). Seven patients underwent lung transplantation via clam-shell incision whilst 3 patients underwent heart transplantation via sternotomy. All 10 patients developed sternal mediastinitis, the most severe form of DSWI, meeting the CDC criteria with sternal involvement and mediastinal extension. The interval between transplant surgery and DSWI diagnosis was highly variable (range 4-1486 days), with most cases occurring in the early postoperative period but some presenting substantially later (Table 1). Notable complications during the treatment course prior to definitive reconstruction included haemothorax, pleural effusions, deep vein thrombosis, pulmonary embolism, cardiac events, coagulopathy requiring massive transfusion, sepsis and atrial fibrillation (Table 2). Patients were maintained on standard tacrolimus- and prednisolone-based immunosuppression, with some receiving additional agents such as mycophenolate mofetil or methylprednisolone. Following DSWI diagnosis, immunosuppression was adjusted on an individual basis to support infection control via reduction or discontinuation of adjunct agents in selected cases (n=2).

Operative burden and microbiological profile

The median time from DSWI diagnosis to definitive reconstruction was 90 days (range 32-722 days) (Table 1). Infections were frequently polymicrobial with resistant and

Table 1 Summary of patient and operative characteristics (median and range).

Variable	Median (Range)
Age at closure (years)	45 (29-62)
BMI (kg/m ²)	22.9 (18.8-28.5)
Time from transplant to infection diagnosis (days)	95 (4-1486)
Time from diagnosis to closure (days)	90 (32-722)
Total no. of debridements (n)	4 (1-10)
NPWT length (days)*	42.5 (8-122)
Length of stay for DSWI (days)	147 (62-321)

* NPWT duration data only available for n=9

opportunistic organisms. Gram-negative organisms included *Pseudomonas aeruginosa*, which were isolated in 2 patients, and *Burkholderia gladioli*, which were isolated in 1 patient. Lung transplant recipients demonstrated greater microbiological diversity, including fungal pathogens (*Aspergillus spp.* and *Candida spp.*) and non-tuberculous mycobacteria. Heart transplant recipients most commonly had gram-positive organisms, particularly *Staphylococcus epidermidis*, with fungal co-infection observed in 2 cases (Table 3).

Reconstructive management

All cases were managed within a multidisciplinary team (MDT) framework with early joint involvement of plastic and reconstructive surgery, cardiothoracic transplant surgery, and infectious diseases. Management comprised:

1. Urgent surgical debridement with complete excision of necrotic tissue and removal of all infected foreign material
2. Broad-spectrum empiric antibiotics initiated immediately then narrowed based on culture results
3. Negative pressure wound therapy (NPWT) applied as temporising measure with dressing changes every 5-7 days
4. Serial debridements until infection control and viable wound bed is achieved
5. Definitive reconstruction based on wound readiness, when: (a) infection is controlled with negative or non-virulent cultures, (b) viable granulating wound bed is achieved, (c) patient physiologically is stable and (d) appropriate antimicrobial therapy duration is completed (Figure 2).

All 10 patients underwent complete removal of sternal metalwork. No patient exhibited retained or exposed prosthesis within the wound at the time of definitive reconstruction. The single recipient supported preoperatively by a temporary bi-ventricular assist device had the device explanted at transplantation along with all other foreign material. NPWT duration data were available for 9 of the 10 patients (n=9) prior to definitive reconstruction. Reconstructive strategy was determined according to our algorithm:

Clamshell cohort (n=7): Reverse abdominoplasty was used in 5/7 patients. Alternative approaches included split-thickness skin grafting (n=1) for a patient with no dead

space and adequately granulated wound following extended NPWT. One patient (n=1) required combined reverse abdominoplasty, bilateral pectoralis major advancement and omental flap for extensive mediastinal dead space and recurrent infection.

Median sternotomy cohort (n=3): Bilateral pectoralis major advancement flaps were employed in 2/3 patients. One patient (n=1) with extensive mediastinal dead space and compromised parasternal tissues from prolonged ventricular assisted device (VAD) support required a pedicled latissimus dorsi myofasciocutaneous flap.

Outcomes

All patients were discharged following definitive reconstruction, with no perioperative mortality within the six-month follow-up period. Follow-up was conducted at standardised intervals (1, 3 and 6 months), with outcome data available for all patients up to 6 months. One patient required re-operation owing to haematoma (n=1), and another patient required care for psychological impact (n=1). All 10 patients' wounds healed within the 6 months, and no recurrent mediastinal infection following definitive reconstruction was observed during this time.

Review outcomes

The systematic review identified 179 articles, among which 118 remained after duplicate removal; 11 studies met the inclusion criteria following screening and full-text review. The literature predominantly comprised small retrospective series of orthotopic heart transplant recipients, with even more limited data specific to lung or combined heart-lung transplantation. Study sample sizes were generally small, with the number of DSWI patients per study ranging from 1 to 36. Reported DSWI incidence in heart transplant patients ranged from 1.4-8.8%. Mortality attributable to DSWI or its sequelae was inconsistently reported; however, where available, it ranged from 14-50%, emphasising the substantial morbidity associated with this complication. The largest series was by Diaddigo et al., which was a single institution review of 66 orthotopic heart transplant recipients.

Management strategies varied across the studies; the majority started with aggressive debridement and employed vascularised tissue coverage when needed. Pectoralis major muscle flaps were the most frequently used, as advancement or turnover variants. Omental flaps were used selectively in complex or refractory cases. Conservative strategies such as debridement and irrigation alone were associated with higher rates of treatment failure. In one series, 5 out of 8 patients required escalation to muscle flap reconstruction (Table 4).

Discussion

This series highlights three principal findings: (1) transplant recipients represent a uniquely vulnerable population in whom immunosuppression, prior surgery and atypical microbiology alter the natural history of DSWI; (2) durable reconstruction requires aggressive source control within a

Table 2 Individual patient demographics and clinical course.

Patient No.	Sex	Age (yrs)	BMI (kg/m ²)	Transplant	Smoking	DM	Indication for transplant	Definitive reconstruction	Number of operations to closure [†]	Notable complications during treatment course
1	M	29	20.4	Lung	Never	Yes	Cystic fibrosis	Reverse abdominoplasty, bilateral pectoralis, omentoplasty	3	SVT, pneumonia, viral URTI, R subclavian thrombosis, pansinusitis
2	M	62	20.4	Lung	Former	No	COPD	Reverse abdominoplasty	2	R MCA, R occipital, L cerebellar embolic infarcts
3	F	31	21.9	Lung	Never	Yes	Cystic fibrosis	Reverse abdominoplasty	2	L Aspergilloma, haemothorax, PE, SVC thrombus
4	F	46	18.8	Lung	Never	No	Alpha-1 antitrypsin deficiency	Reverse abdominoplasty	1	Infected breast implant removal
5	F	37	22.1	Lung	Never	No	Pulmonary lymphangioleiomyomatosis	Reverse abdominoplasty	7	Cardiac arrest, coagulopathy, massive transfusion, haemothorax, sepsis, AF
6	M	54	23.7	Lung	Never	No	Sarcoidosis	Split-thickness skin graft	1	R haemothorax, PE
7	M	60	25.3	Lung	Former	No	Sjögren's syndrome	Reverse abdominoplasty	5	Candidaemia
8	M	44	26.8	Heart	Never	No	Dilated cardiomyopathy	Bilateral pectoralis major advancement	6	Prior BIVAD, L haemothorax, pre-sternal haematoma, PE, thyroiditis, HIT
9	F	50	24.6	Heart	Never	Yes	Lymphocytic myocarditis	Pedicle latissimus dorsi	7	R pleural effusion
10	F	40	28.5	Heart	Never	No	Arrhythmic right ventricular dysplasia	Bilateral pectoralis major advancement	3	TIA

[†] Includes all surgical procedures following initial transplant, including haematoma evacuation, sternal wire removal and debridements. Simple NPWT dressing changes are excluded.

Table 3 Isolated organisms and antimicrobial therapy for each patient.

Patient No.	Transplant	Organisms isolated	Antimicrobial/Antifungal therapy
1	Lung	<i>Acinetobacter junii</i> , <i>Burkholderia gladioli</i> , <i>Corynebacterium</i> spp., <i>Staphylococcus epidermidis</i>	Avibactam, bacteriophage therapy, ceftazidime, colistin, meropenem, minocycline, piperacillin-tazobactam, teicoplanin, tigecycline, tobramycin
2	Lung	<i>Mycobacterium abscessus</i> , <i>Staphylococcus epidermidis</i>	Amikacin, avibactam, azithromycin, ceftazidime, ciprofloxacin, clofazimine, meropenem, minocycline, teicoplanin
3	Lung	<i>Aspergillus</i> spp., <i>Mycobacterium avium</i> complex, <i>Mycobacterium chimaera</i> , <i>Pseudomonas aeruginosa</i> , <i>Staphylococcus epidermidis</i> , <i>Stenotrophomonas maltophilia</i>	Amikacin, clofazimine, ethambutol, posaconazole, rifabutin, teicoplanin
4	Lung	<i>Corynebacterium striatum</i> , <i>Enterococcus</i> spp., <i>Staphylococcus epidermidis</i>	Azithromycin, colomycin, doxycycline, piperacillin-tazobactam, teicoplanin
5	Lung	<i>Aspergillus fumigatus</i> , <i>Candida albicans</i>	Amphotericin B, amikacin, aztreonam, caspofungin, ciprofloxacin, colistin, linezolid, nystatin, teicoplanin, vancomycin, voriconazole
6	Lung	<i>Aspergillus fumigatus</i> , <i>Candida albicans</i> , <i>Enterococcus hormaechei</i> , <i>Staphylococcus capitis</i> , <i>Staphylococcus epidermidis</i> , <i>Staphylococcus haemolyticus</i>	Amphotericin B, caspofungin, daptomycin, minocycline, piperacillin-tazobactam, posaconazole, teicoplanin, terbinafine
7	Lung	<i>Candida albicans</i> , <i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i>	Caspofungin, daptomycin, linezolid, meropenem, piperacillin-tazobactam, posaconazole, teicoplanin
8	Heart	<i>Candida parapsilosis</i> , <i>Micrococcus</i> spp., <i>Proteus</i> spp., <i>Staphylococcus epidermidis</i>	Doxycycline, posaconazole
9	Heart	<i>Aspergillus</i> spp., <i>Enterococcus faecium</i> (VRE), <i>Pseudomonas aeruginosa</i> , <i>Staphylococcus epidermidis</i>	Amphotericin B, caspofungin, ciprofloxacin, meropenem, piperacillin-tazobactam, posaconazole, teicoplanin, vancomycin, voriconazole
10	Heart	<i>Staphylococcus aureus</i> , <i>Staphylococcus epidermidis</i> , <i>Staphylococcus haemolyticus</i>	Cefepime, co-trimoxazole, doxycycline, linezolid, meropenem, posaconazole, teicoplanin

structured multidisciplinary framework and (3) our previously published reconstructive algorithm remains applicable in this complex transplant cohort.

(1) Vulnerability of transplant recipients

Whether transplant recipients experience higher incidence or greater severity of DSWI remains variably reported across series.^{6,7,14} Our series found an incidence of 1.9%, which is higher than the reported incidences in general cardiothoracic populations.⁸ The vulnerability of this population, particularly with respect to wound healing and infection complexity, may be explained by the nature of their medical history. Chronic immunosuppression with calcineurin inhibitors, mycophenolate mofetil and corticosteroids impairs inflammatory signalling, angiogenesis and fibroblast function, whereas pre-transplant deconditioning and physiological demands of prolonged post-transplant recovery further compromise baseline tissue quality.¹⁴⁻¹⁷

The microbiological profile in our series reinforces this distinction from conventional DSWI populations. Although standard cardiothoracic DSWI literature is dominated by *Staphylococcus* species,^{7,18,19} our cohort demonstrated frequent fungal pathogens, non-tuberculous mycobacteria, vancomycin-resistant *Enterococcus* and resistant gram-negative organisms. Lung transplant recipients were

particularly affected, consistent with environmental exposure and colonisation patterns. This diversity necessitated the prolonged, multi-agent antimicrobial regimens and careful coordination with transplant infectious disease specialists.

Anatomical factors further compound the risk. Clamshell thoracotomy requires bilateral IMA sacrifice,²⁰ precluding turnover-based pectoralis techniques that underpin conventional reconstructive algorithms.²¹⁻²³ The transverse sternal component introduces inferior and lateral tension patterns distinct from median sternotomy. Among heart transplant recipients, previous sternotomy was identified as a significant risk factor for DSWI.¹⁹ Notably, 2 of our 3 heart transplant recipients with more microbiologically diverse infections (Patients 8 and 9) underwent prior sternotomy for VAD implantation or re-exploration, supporting the observation that a history of sternotomy may predispose to complex wound breakdown.

(2) Aggressive source control and multidisciplinary management

Across historical series, conservative strategies such as debridement and irrigation alone have demonstrated high failure rates,¹⁸ with subsequent need for muscle flap reconstruction. Jurkiewicz and colleagues advocated early

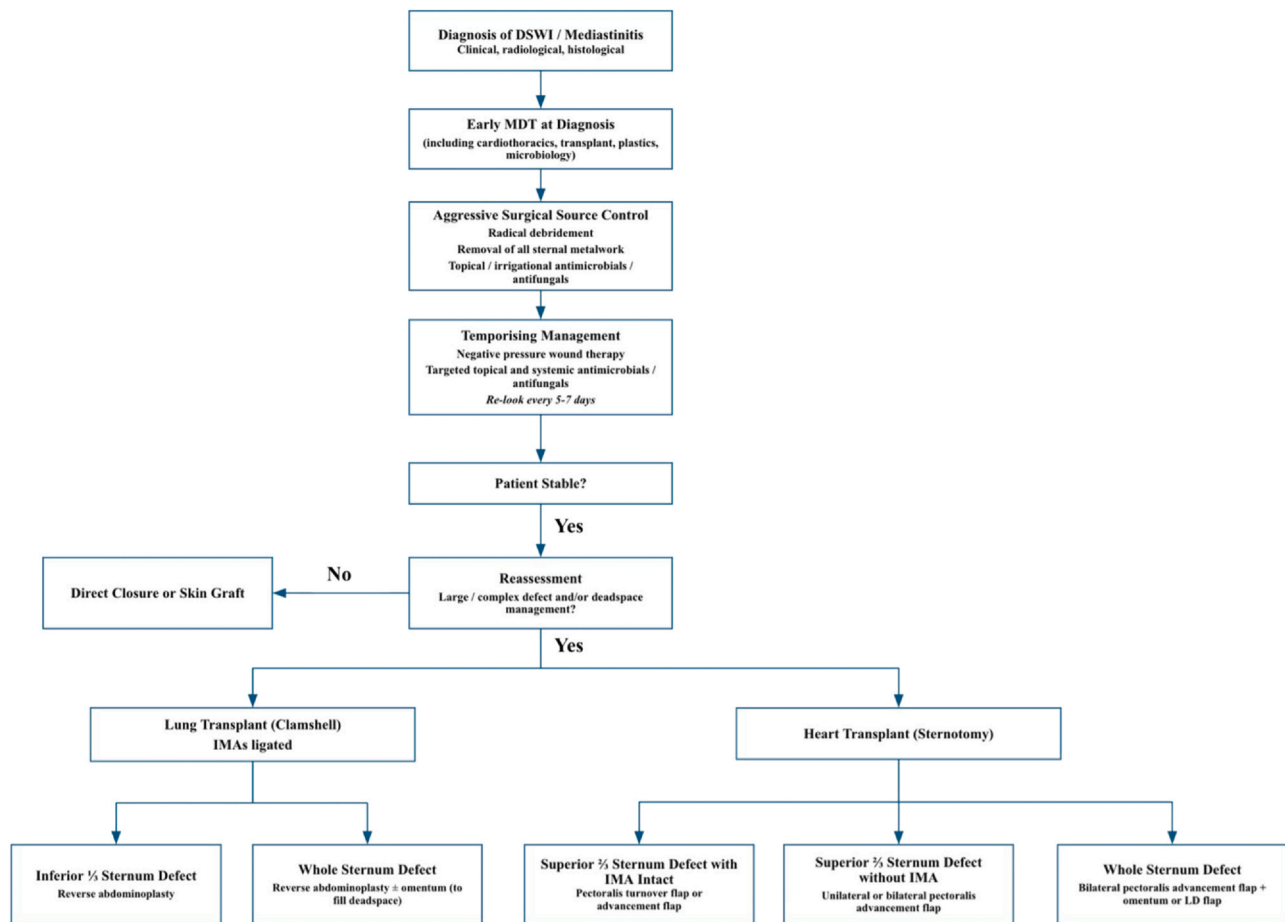


Figure 2 Algorithm for acute management and surgical reconstruction of DSWI in transplant recipients, based on the analysis of literature, consideration of the anatomical defect and our experience.

consideration of muscle flap coverage as definitive management rather than salvage,²² a principle that remains particularly relevant in immunocompromised transplant recipients.

Our series supports this advocacy. A structured multidisciplinary pathway approach enabled coordinated debridement, culture-directed antimicrobial therapy, optimisation of immunosuppression and appropriate planning and timing of definitive reconstruction once infection control and patient stability were achieved. We additionally support complete removal of all sternal hardware, as retained foreign material in immunosuppressed patients promotes persistent infection and biofilm formation.^{18,19} Negative pressure wound therapy should be used as a temporising adjunct, as it facilitates granulation, reduces bacterial burden and optimises the wound bed prior to reconstruction.^{15,19}

Importantly, the prolonged interval to closure should be considered in the context of our series which is focused on patients who required reconstruction intervention. Patients managed successfully with debridement and NPWT alone or those who achieved direct closure without reconstruction were not included in our study or analysis. The time from diagnosis to reconstruction in our cohort may seem to contrast with previous sternal wound literature. For example, Diaddigo et al. reported a median of 25 days from transplantation to flap closure,¹³ and Levy et al. found

earlier closure to be associated with fewer wound complications.²⁴ Although opinions differ on the optimal timing of reconstruction, our cohort comprised established, severe sternal mediastinitis, in which eradication of frequent fungal or mycobacterial infection, patient stabilisation and physiological optimisation necessarily took precedence before closure. This approach is corroborated by Diaddigo et al.,¹³ who attributed the longer intervals to reconstruction in their series in part to deep *Candida* infection in immunosuppressed patients, which is similar to our experience. Hence, the timing of definitive reconstruction was ultimately determined by multidisciplinary consensus once the patient was judged as ready, and our 90-day interval should be read as an observation of the clinical course in our unit rather than as a recommended target.

(3) Reconstructive strategy

Clamshell incisions

Reverse abdominoplasty was employed in 5 of 7 lung transplant recipients. In the setting of bilateral IMA sacrifice, its vascular reliability via superior epigastric and intercostal perforators allows robust inferior mediastinal coverage independent of parasternal perfusion. It provides effective dead space obliteration and favourable scar concealment. Although infrequently reported in the transplant-

Table 4 Summary of the studies included in the systematic review.

Study	Transplant type	DSWI Patients (n)	Reconstruction method (s)	Mortality due to DSWI or Reconstruction (n)	Notes
Abid 2003	Heart ± Lung	14 Heart 4 Lung	Resternotomy + debridement + primary closure ± irrigation; 1 pectoralis flap	6	Predominantly cardiac surgical management
Bhatia 1997	Heart only	3 Heart-Lung 5	Debridement; local pectoralis advancement flaps (n=3); bilateral pectoralis + rectus abdominis advancement flap (n=2)	1	-
Carrier 2001	Heart only	20	Debridement + sternal rewiring; 2 omentoplasty + pectoralis flaps (complex cases)	2 infection-related deaths; 5-yr survival 80% (deep cases)	Aggressive debridement with selective flap reconstruction
Chou 2008	Heart only	4	2 conservative (no flap); 2 aggressive (muscle ± omental flap)	1 overall; death in non-flap group	Survival observed in flap-treated patients
Diaddigo 2024	Heart only	66	Bilateral pectoralis advancement flaps (n=63); rectus abdominis advancement flap (n=2); pectoralis turnover flap (n=1)	2 related to sternal wounds	Emphasis on early intervention at the initial clinical signs of infection, even in cases where wound cultures are not yet positive
d'Udekem 1998	Heart only	1	Debridement + omentoplasty	-	Only 1 patient with DSWI, successful discharge
Karwande 1992	Heart only	12	Debridement + irrigation; muscle flaps (n=9)	-	Debridement + irrigation was initially employed for 8 patients, which was unsuccessful for 5/8 patients. All 5 eventually required muscle flaps 4 patients were determined to require muscle flaps from first assessment. All 4 were successfully discharged
Kaye 2010	Heart ± Lung	28 Heart 8 Lung	OHT Patients: left pectoralis advancement flap (n=3); left pectoralis turnover flap (n=5); right pectoralis turnover flap (n=2); bilateral pectoralis advancement flaps (n=2); greater omental flap (n=10); other flaps (n=6) BSLT Patients: pectoralis advancement flaps or pectoralis turnover flaps	4	26/28 (93%) of the heart transplant patients had a history of sternotomy prior to their transplant. All lung transplant patients had multiple pre-existing medical conditions, including diabetes. No LIMAs were harvested in any of the lung transplant patients; hence healthier sternal bone or smaller wounds
Soto 2022	Heart only	3	Debridement + flap reconstruction	-	Pectoralis advancement flaps based on thoracoacromial arterial blood supply or turnover flaps based on medial internal mammary arterial blood supply
Tortoriello 2003	Heart only	2	Direct sternal closure	1	Paediatric cases
Wallen 2019	Heart only	27	Sternal debridement + primary closure (n=5); pectoralis muscle flap (n=14); omental flap (n=3)	-	Follow-up not reported
Wornom 1995	Heart only	7	Debridement; Muscle flaps x3 (n=1); Pedicled omental flap based on right gastroepiploic artery ± pectoralis major (n=5); Pectoralis turnover flap (n=1)	1	3 of the 5 patients who received omentum flaps required a single medially based pectoralis major muscle flap to obliterate the space between the sternal edges

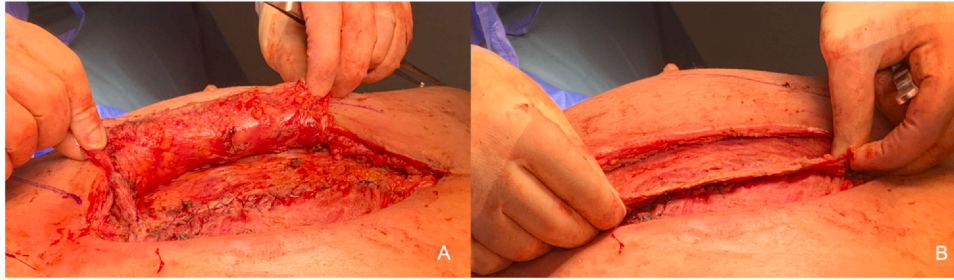


Figure 3 A. Elevation of bilateral pectoralis major advancement flaps following sternal debridement. B. Double breasting of the flaps to improve sternal integrity.

specific literature,²⁰ our consistent outcomes support its use as a first-line option in clamshell-associated mediastinitis.

Median sternotomy

Following median sternotomy in heart transplant recipients, bilateral pectoralis major advancement flaps remained the workhorse reconstruction to obliterate dead space (Figure 2). This approach was employed in 2 patients, and in

both cases, direct skin closure was achieved following flap inset. Where direct closure is not possible, a split-thickness skin graft can be used. Double breasting the flaps helped provide sternal stability (Figure 3). Formal sternal rewiring is not advocated, as patients often heal with fibrous union. Where parasternal tissues were compromised by prior sternotomy or VAD implantation, alternative regional flaps were necessary. In 1 such patient, a pedicled myocutaneous latissimus dorsi flap provided durable coverage (Figure 4,



Figure 4 A. Post-debridement sternal defect with NPWT interface. B. Pedicled LD flap transposition. C. Immediate postoperative closure. D. 30-day postoperative result.

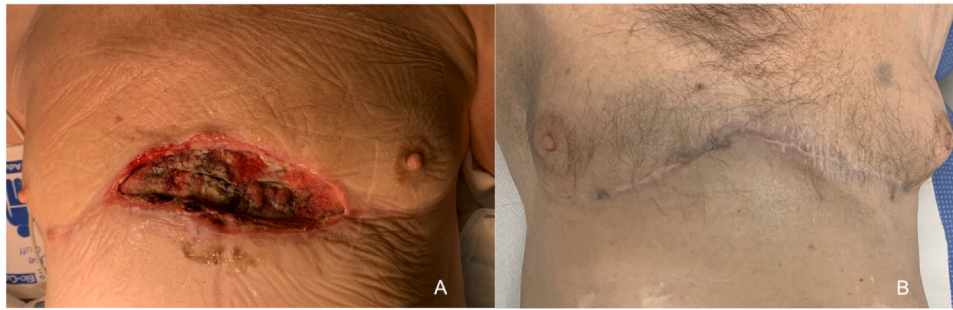


Figure 5 Before and after from a reverse abdominoplasty following clamshell thoracotomy.

[Supplementary Material 1](#)). Overall, our experience aligns with the established principle of early muscle flap coverage as definitive management.

Omental transposition

The greater omentum was selectively employed to obliterate extensive mediastinal dead space. It is particularly valuable for obliterating large mediastinal or retrosternal dead space following extensive debridement, for inferior or lower-third sternal defects where pectoralis advancement alone may provide insufficient coverage and as a salvage option once other reconstructive options have been exhausted. Its exceptional conformational flexibility, reliable vascular supply via the gastroepiploic arcade—advantageous in IMA sacrifice as it arises from a vascular system independent of the chest wall—and its intrinsic immunological properties make it a valuable adjunct in complex cases.^{9,25–27} Consistent with prior series in which omentum was often reserved for salvage,^{20,27} we advocate selective omental mobilisation in combination with muscle flaps for extensive mediastinal dead space, exposed vascular structures or recurrent infection refractory to single-flap reconstruction. Nevertheless, these benefits are balanced against meaningful risks. Omental harvest requires entering the abdominal cavity and creating thoraco-abdominal communication which can increase risk of donor site morbidity, including ventral hernia, intra-abdominal infection, bowel injury or adhesions. For these reasons we do not consider it as a first-line option for defects that can be adequately reconstructed with regional muscle flaps alone.

Outcomes in context

Published mortality rates for transplant-associated mediastinitis range from 9.6–40%,^{6–8,18} reflecting the fragility of this population. Although our cohort experienced no perioperative mortality and no recurrent mediastinal infection within 6 months of definitive reconstruction, direct comparisons to published rates should be interpreted cautiously. During the study period, patients with DSWI were referred to Plastic Surgery; however, we acknowledge that patients who may have deteriorated prior to referral are not represented. Although hospital stays were prolonged, successful discharge was achieved in all 10 of our patients, including those with considerable systemic complications.

These outcomes suggest that, although transplant recipients exhibit demonstrable vulnerability in terms of

microbiological complexity and wound healing, aggressive source control combined with timely vascularised reconstruction within a multidisciplinary framework was associated with durable results in this cohort. Rather than representing a deviation from the established DSWI principles, transplant-associated mediastinitis demands their rigorous application, adapted to incision type, prior surgery and microbiological context.

Limitations

A primary limitation is that the sample size is small ($n=10$), reflecting the rarity of transplant-associated mediastinitis. In the UK, heart transplants are reported at 3.0 per million population (pmp), and lung transplants at 2.2 pmp.^{11,12} Therefore, the findings should be interpreted descriptively. Secondly, the series only includes patients who survived to referral and underwent reconstruction. The absence of perioperative mortality should not be taken to imply that transplant-associated sternal mediastinitis carries a low mortality risk overall. Similarly, those managed successfully via debridement, NPWT, and direct closure are not represented, so the series cannot indicate how often reconstruction is necessary. Thirdly, this single-centre cohort is clinically heterogenous, combining heart and lung recipients with differing incisions, comorbidity profiles and microbiological pathogens. Although this reflects real-world complexity, it limits the ability to isolate independent predictors of outcome. Finally, follow-up was limited to 6 months, precluding assessment of late wound breakdown, delayed recurrence, chest wall stability, functional morbidity and quality of life; moreover, longer-term recurrence cannot be excluded based on our data.

Nevertheless, given the rarity of transplant-associated mediastinitis, prospective comparative trials are unlikely to be feasible. Therefore, detailed institutional series remain valuable, providing pragmatic insight into reconstructive decision-making and multidisciplinary management in a uniquely vulnerable patient population.

Conclusions

Mediastinitis following heart and lung transplantation requires coordinated multidisciplinary management to address the unique vulnerabilities of this population. Our proposed reconstructive framework provides a practical

decision-making tool accounting for specific anatomical constraints imposed by transplant surgery. Nevertheless, as this is a descriptive series, these observations should be regarded as illustrative rather than as evidence of improved survival.

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Declaration of Competing Interest

None declared.

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APPENDIX A

0 = not reported in the article; 1 = reported inadequately; 2 = reported adequately; N/A = Not applicable, as not a comparative study.

	Clearly stated aim	Inclusion of consecutive patients	Prospective collection of data	Endpoints appropriate to the aim of the study	Unbiased assessment of the study endpoint	Follow-up period appropriate to the aim of the study	Loss to follow up less than 5%	Power analysis	Adequate control group	Contemporary groups	Baseline equivalence of groups	Adequate statistical analyses	Total Score
Abid et al. 2003	2	2	0	2	0	1	2	0	N/A	N/A	N/A	2	11
Bhatia et al. 1997	2	2	0	2	0	1	1	0	N/A	N/A	N/A	1	9
Carrier et al. 2001	2	2	2	2	1	2	2	0	1	2	1	2	19
Chou et al. 2008	2	1	0	1	0	1	2	0	N/A	N/A	N/A	0	7
D'Udekem et al. 1998	2	2	0	2	0	2	2	0	N/A	N/A	N/A	1	11
Karwande et al. 1992	2	2	0	2	0	2	1	0	2	2	1	2	16
Kaye et al. 2010	2	1	0	2	0	1	1	0	N/A	N/A	N/A	1	8
Soto et al. 2022	2	2	0	2	0	1	1	0	N/A	N/A	N/A	2	10
Tortoriello et al. 2003	2	2	0	2	0	2	2	0	N/A	N/A	N/A	1	11
Wallen et al. 2019	2	2	0	2	0	1	2	0	2	2	2	2	17
Wornom et al. 1995	2	2	0	2	0	1	2	0	N/A	N/A	N/A	0	9

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.bjps.2026.06.028](https://doi.org/10.1016/j.bjps.2026.06.028).

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