

Beyond Explantation: Early Seroma After Immediate Post-Mastectomy Implant-Based Breast Reconstruction - A Retrospective Cohort Study

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Case Report

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Abstract

Background.

Early seroma may compromise wound healing and implant preservation after immediate post-mastectomy breast reconstruction. This study evaluated factors associated with early seroma and the outcomes of a stepwise management strategy aimed at reconstructive salvage.

Methods.

This single-centre retrospective cohort included 115 patients undergoing 135 immediate implant-based breast reconstructions at a tertiary cancer centre between January 2019 and December 2025. Early seroma was defined as a clinically and/or ultrasonographically documented serous collection within 30 days requiring assessment or treatment. Clinical, surgical and drain-related variables and reconstructive outcomes were analysed.

Results.

Early seroma occurred in 15/135 reconstructions (11.1%). Incidence was higher after axillary lymph node dissection (ALND; 32.3%) than after sentinel lymph node biopsy (5.8%) or no axillary surgery (2.9%; $p < 0.001$). Seroma cases had a higher body mass index (27.1 vs 24.6 kg/m²; $p = 0.042$), longer drain duration (11.6 vs 9.0 days; $p = 0.031$) and higher 24-hour output before drain removal (25 ± 15 vs 10 ± 10 mL; $p = 0.002$). Implant plane was not significantly associated with seroma. Reconstructive salvage was achieved in 13/15 cases (86.7%); two required definitive explantation.

Conclusions.

Early seroma does not necessarily require implant removal. A stepwise strategy guided by persistence, infection, soft-tissue viability and local control may preserve reconstructive continuity. ALND and higher drain output before removal may identify patients at increased risk.

BACKGROUND

Implant-based breast reconstruction is widely used after mastectomy as part of contemporary breast cancer care, but early seroma remains a clinically relevant complication. Persistent or recurrent collections may interfere with wound healing, facilitate infection and dehiscence and, in more complex cases, lead to implant loss. Management is not uniform and may include observation, percutaneous or ultrasound-guided aspiration, pocket revision, washout, implant retention or implant exchange; explantation is generally reserved for settings in which local control and safe preservation of the

reconstruction are not achievable. In this context, seroma should not be regarded as synonymous with reconstructive failure [1–3].

Axillary surgery, patient characteristics, drain management and reconstructive technique may influence both the occurrence and subsequent course of the collection. The aim of this study was to describe the incidence, associated factors, management and outcomes of early seroma after immediate implant-based breast reconstruction, with particular attention to the feasibility of maintaining reconstructive continuity through a stepwise salvage-oriented strategy.

METHODS

Study design and population

This retrospective single-centre cohort included patients who underwent mastectomy and immediate implant-based breast reconstruction at a tertiary cancer centre between January 2019 and December 2025. Patients were included when clinical documentation and follow-up were sufficient to define the course of the complication and the reconstructive outcome. Reporting was structured according to the STROBE principles [4].

Reconstruction was performed in either the prepectoral or dual-plane position. Implant plane was selected intraoperatively according to the thickness, uniformity and viability of the mastectomy flaps: prepectoral placement was favoured when the flaps were well perfused and adequately represented, whereas dual-plane placement was preferred when flaps were thinner but viable. All reconstructions used anatomical silicone-gel implants with a polyurethane-foam coating.

A closed-suction Redon drain was placed in the breast pocket in all reconstructions and removed when output during the preceding 24 hours was < 30 mL. In patients undergoing ALND, a dedicated axillary drain was also placed. Perioperative antibiotic prophylaxis consisted of a first-generation cephalosporin (2 g intravenously at induction), with postoperative continuation according to the institutional protocol.

Early seroma was defined as a serous collection documented clinically and/or ultrasonographically within 30 days of surgery and requiring assessment or treatment; collections first occurring after day 30 were excluded. Recorded variables included age, body mass index (BMI), smoking, diabetes, preoperative oncological treatments, type of mastectomy, mastectomy specimen weight, implant plane, axillary surgery, drain duration and output during the 24 hours before drain removal.

Management of early seroma

At diagnosis, all patients underwent clinical and ultrasonographic assessment. In uncomplicated cases, the collection was aspirated either directly or under ultrasound guidance by the radiologist, and the aspirated fluid was systematically sent for microbiological culture. Antibiotic treatment was reserved for

patients with clinical or systemic signs suggestive of infection and was subsequently tailored according to culture and susceptibility results.

Patients were reassessed after approximately 7 days. Persistence, recurrence, suspected contamination or soft-tissue compromise prompted further assessment and, when required, surgical revision. In theatre, microbiological samples were obtained, the collection was evacuated, non-viable tissue was debrided, and the pocket was extensively irrigated with saline followed by povidone-iodine irrigation.

When soft tissues remained viable and local control was considered reliable, the implant could be retained. In the presence of significant contamination or suspected biofilm, immediate implant exchange was performed. Explantation without immediate replacement was reserved for uncontrolled infection, implant exposure in unfavourable conditions or marked soft-tissue compromise. The management pathway is summarised in Fig. 1.

Endpoints

The primary endpoint was successful reconstructive salvage among seroma cases, defined as maintenance of reconstructive continuity through retention of the original implant or immediate implant replacement during the same procedure. Failure was defined as explantation without immediate replacement. Secondary endpoints were seroma incidence, factors associated with its occurrence, clinical or microbiological infection, recurrence, reoperation and need for treatment escalation.

Statistical analysis

The unit of analysis was the individual breast reconstruction. In patients undergoing bilateral reconstruction, each breast was considered separately; when seroma occurred after bilateral reconstruction, it was always unilateral and no patient contributed more than one event to the primary outcome. Continuous variables were described using mean and standard deviation or median and interquartile range, according to distribution, and categorical variables using frequencies and percentages.

Normality was assessed using the Shapiro-Wilk test. Comparisons between reconstructions with and without seroma used the independent-samples t test or Welch test, the Mann-Whitney U test for non-normally distributed variables, and the chi-square or Fisher exact test for categorical variables. Pairwise comparisons for axillary surgery were performed using Fisher exact tests with Bonferroni correction. Risk ratios (RRs) with 95% confidence intervals (CIs) were reported when informative. All tests were two-sided, with $p < 0.05$ considered statistically significant. Given the 15 seroma events, a conventional multivariable model was not constructed to limit overfitting and unstable estimates. Analyses were performed using IBM SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 115 patients underwent 135 immediate implant-based breast reconstructions: 95 unilateral and 20 bilateral procedures. Early seroma occurred in 15/135 reconstructions (11.1%). In bilateral reconstructions, seroma was always unilateral.

Reconstructions complicated by seroma had a higher mean BMI, longer drain duration and greater output during the 24 hours before drain removal; the higher mastectomy specimen weight did not reach statistical significance (Table 1). Implant plane was not significantly associated with seroma: 10/85 dual-plane reconstructions (11.8%) and 5/50 prepectoral reconstructions (10.0%; $p = 1.000$; RR 1.18, 95% CI 0.43–3.25) (Table 3).

Table 1
Clinical and perioperative variables according to early seroma occurrence.

Variable	Seroma (n = 15)	No seroma (n = 120)	p
BMI, kg/m ²	27.1	24.6	0.042
Drain duration, days	11.6	9.0	0.031
24-h output before drain removal, mL	25 ± 15	10 ± 10	0.002
Mastectomy specimen weight, g	610	471	0.059
<i>Values are reported as mean or mean ± standard deviation according to the available data. BMI: body mass index.</i>			

Table 3
Incidence of early seroma according to implant plane.

Implant plane	Reconstructions, n	Seroma, n (%)	Effect measure
Dual-plane	85	10 (11.8)	RR 1.18 (95% CI 0.43–3.25)
Prepectoral	50	5 (10.0)	Reference
Fisher exact test: $p = 1.000$. CI: confidence interval; RR: risk ratio.			

Seroma incidence differed according to axillary surgery: 1/35 (2.9%) without axillary surgery, 4/69 (5.8%) after sentinel lymph node biopsy (SLNB) and 10/31 (32.3%) after ALND (global $p < 0.001$). Compared with SLNB, ALND was associated with an RR of 5.56 (95% CI 1.89–16.37); compared with no axillary surgery, the RR was 11.29 (95% CI 1.53–83.26) (Table 2).

Table 2
Incidence of early seroma according to axillary surgery.

Axillary surgery	Reconstructions, n	Seroma, n (%)	Main comparison
None	35	1 (2.9)	Reference
SLNB	69	4 (5.8)	vs none: p = 0.661
ALND	31	10 (32.3)	RR 5.56 vs SLNB; RR 11.29 vs none
Total	135	15 (11.1)	Global p < 0.001
Pairwise Fisher exact tests with Bonferroni correction: ALND vs SLNB corrected p $\approx$ 0.003; ALND vs none corrected p $\approx$ 0.006; SLNB vs none corrected p = 1.000. RR: risk ratio; SLNB: sentinel lymph node biopsy; ALND: axillary lymph node dissection.			

Seroma was diagnosed at approximately postoperative day 12. Clinical signs of infection were present in 5/15 cases (33.3%), and microbiological culture was positive in 4/15 (26.7%) (Table 4).

Table 4
Clinical characteristics of the 15 early seromas.

Characteristic	Value
Postoperative day of onset	$\approx$ 12
Clinical signs of infection	5/15 (33.3%)
Positive culture	4/15 (26.7%)

Table 5
Treatment strategy and reconstructive outcome.

Treatment	n (%)	Salvage
Conservative management / aspiration	4 (26.7)	4/4
Revision + implant retention	4 (26.7)	4/4
Washout + immediate implant exchange	5 (33.3)	5/5
Explantation without replacement	2 (13.3)	0/2
Total	15 (100)	13/15 (86.7%; 95% CI 59.5–98.3)

Reconstructive salvage was achieved in 13/15 cases (86.7%; exact 95% CI 59.5–98.3%): four cases were managed conservatively or by aspiration, four by revision with implant retention, and five by washout with immediate implant exchange. Two cases (13.3%) required explantation without immediate replacement. In the representative explantation case shown in Fig. 3, the 550-cc implant was complicated by persistent periprosthetic seroma followed by progressive compromise of the

mastectomy skin envelope, impaired wound healing, dehiscence and subsequent implant exposure; because the soft-tissue envelope was inadequate and local reconstructive integrity could not be safely restored, implant salvage was considered unfeasible and explantation was performed. Representative clinical examples of successful implant salvage and definitive explantation are shown in Figs. 2 and 3.

DISCUSSION

The principal finding of this cohort is that early seroma did not necessarily coincide with reconstructive failure. The observed incidence of 11.1% lies within the broad range reported in the literature, which is influenced by event definition, reconstructive technique and patient characteristics.

Among the associated factors, extensive axillary surgery showed the strongest signal: seroma incidence increased to 32.3% after ALND, compared with 5.8% after SLNB and 2.9% without axillary surgery. This association is biologically plausible because of the greater disruption of lymphatic pathways and the creation of axillary dead space; previous studies have also linked ALND with increased complications after immediate breast reconstruction. The wide 95% CIs, however, require caution when interpreting the magnitude of the association [5].

Drain management represented a second area of interest. Seroma cases showed both longer drain duration and greater output before removal. Although drains were removed according to the institutional threshold of < 30 mL/24 h, the higher final output among seroma cases may reflect persistent exudative or inflammatory activity before removal. Published protocols remain heterogeneous, and different output thresholds have been compared without establishing a universally accepted criterion. A recent study has also discussed the role of drainage in implant-based breast surgery and postoperative fluid management [7, 8].

Implant plane was not significantly associated with seroma. This finding is consistent with systematic reviews and meta-analyses that have not demonstrated a consistent difference in seroma between prepectoral and subpectoral or partial-subpectoral reconstruction. In the study cohort, dual-plane reconstruction was more frequent because mastectomy flaps were often thin, whereas prepectoral placement was reserved for flaps considered adequate in thickness and perfusion. This introduces confounding by indication: the two groups differ at baseline according to tissue characteristics, and the absence of statistical significance should not be interpreted as evidence of equivalence. In implant-based surgery and series using polyurethane-coated implants, patient selection, implant plane and soft-tissue quality remain central to the interpretation of complications [9–15].

The clinically most relevant result was the 86.7% salvage rate among seroma cases. Although the 95% CI was wide because of the small number of events, the finding supports a graded approach: aspiration and surveillance for uncomplicated collections; revision and washout for persistent or more complex cases; and implant retention or immediate exchange when soft-tissue viability and local control permit. Persistent periprosthetic collections may perpetuate dead space and inflammation and, when accompanied by infection or impaired flap healing, may progress to wound dehiscence and implant

exposure. Studies focused on prosthetic infection, a more severe condition that is not directly equivalent to non-infected seroma, nevertheless show that debridement, antibiotic therapy and implant exchange can preserve reconstruction in selected patients [1, 3, 6, 16–18].

These findings support a strategy driven by clinical severity rather than by the presence of a fluid collection alone. Reoperation should not automatically be considered reconstructive failure; in selected patients, it may represent the step required to control the complication while maintaining continuity of the reconstructive pathway.

This study has limitations. It is a retrospective single-centre cohort with a small number of seroma events, precluding a robust conventional multivariable model. In bilateral reconstructions, both breasts share patient-level characteristics and are therefore not fully independent observations, although no seroma was bilateral and no patient contributed more than one event to the primary salvage outcome. The comparison between implant planes is further affected by confounding by indication. These results should therefore be interpreted as exploratory and require confirmation in larger prospective cohorts.

CONCLUSIONS

Early seroma after immediate implant-based breast reconstruction does not necessarily require implant removal. A stepwise management strategy tailored to collection persistence, signs of infection, soft-tissue viability and pocket control may preserve reconstructive continuity in a substantial proportion of selected cases. ALND and higher drain output before removal emerged as potential risk indicators and warrant further evaluation in larger prospective cohorts.

Abbreviations

ALND, axillary lymph node dissection; BMI, body mass index; CI, confidence interval; RR, risk ratio; SLNB, sentinel lymph node biopsy; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology.

Declarations

Author Contribution

Michele Grieco: Wrote the paper; Conceived and designed the analysis, Collected the data; Performed the analysis; Wrote the paper
Simona Solari: Wrote the paper; Conceived and designed the analysis, Collected the data; Performed the analysis; Wrote the paper
Vincenzo La Montagna: Conceived and designed the analysis, Collected the data
Martina Iuliano: Collected the data

Data Availability

The datasets generated and/or analysed during the current study are not publicly available due to patient confidentiality and institutional and ethical restrictions, but are available from the corresponding author on reasonable request and subject to institutional and ethical approval.

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Figures

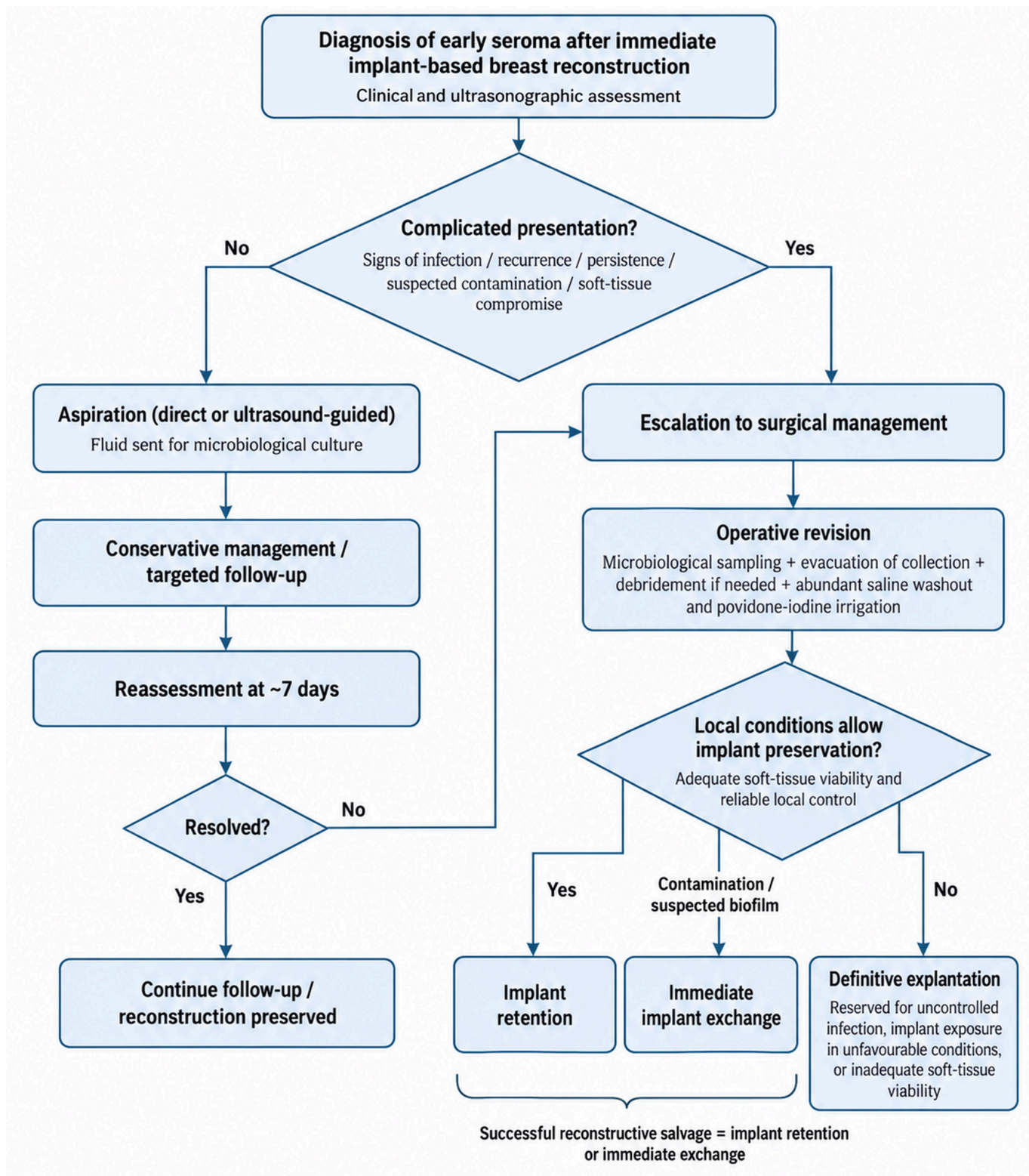


Figure 1

Stepwise management of early seroma after immediate implant-based breast reconstruction. Clinical and ultrasonographic assessment guides aspiration and microbiological sampling in uncomplicated cases; persistence, recurrence, suspected infection or soft-tissue compromise prompt escalation to surgical revision, washout and implant retention or immediate exchange. Definitive explantation is reserved for uncontrolled infection, implant exposure in unfavourable conditions or inadequate soft-

tissue viability. The figure represents the treatment pathway derived from the clinical practice described in this retrospective cohort and was not prospectively validated.

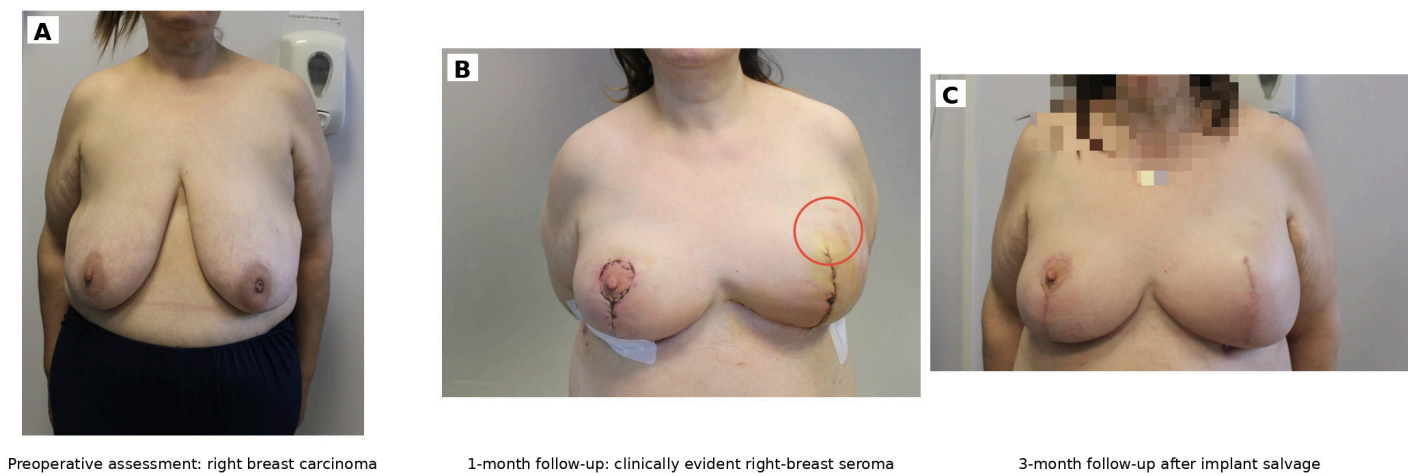


Figure 2

Representative case of successful implant salvage. (a) Preoperative assessment of a patient with right breast carcinoma. (b) One month after mastectomy, immediate submuscular reconstruction with a 665-cc polyurethane-coated anatomical implant and axillary lymph node dissection, a clinically evident superolateral seroma was associated with increased breast volume, erythema, tenderness and fever, without spontaneous wound drainage. (c) Three-month follow-up after pocket revision, debridement and washout with preservation of the original implant, showing resolution of inflammatory signs and successful maintenance of the reconstruction.

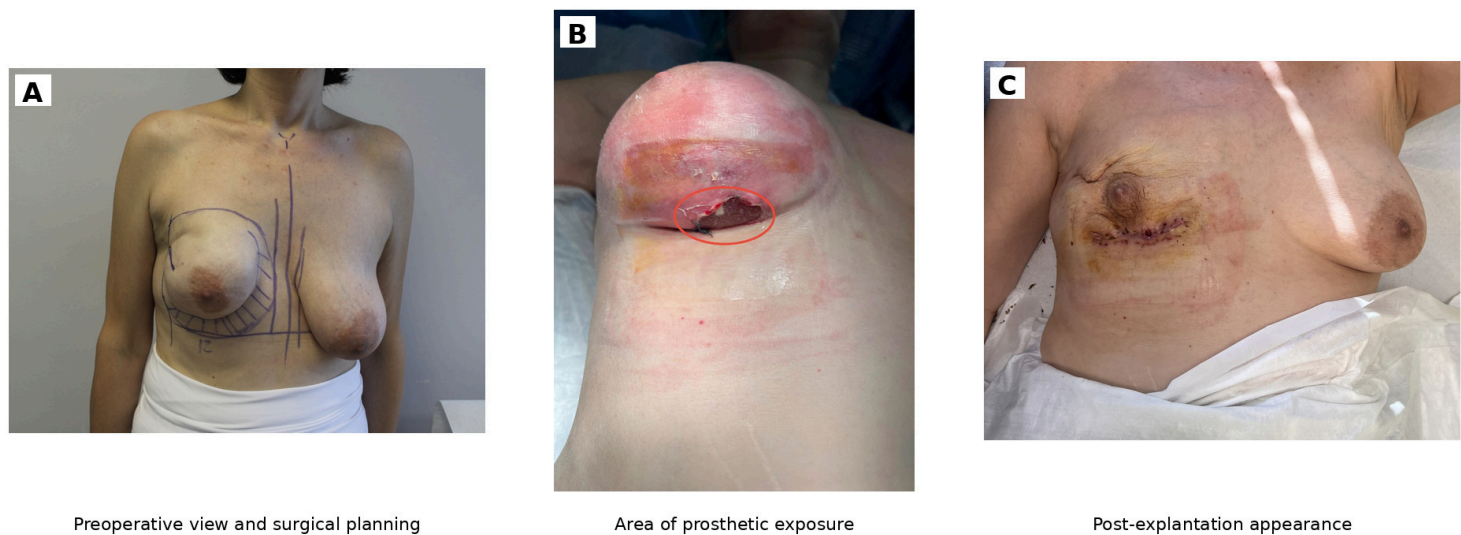


Figure 3

Representative case requiring definitive explantation. (a) Preoperative assessment of local tumour recurrence five years after breast-conserving surgery with implant placement. (b) One month after mastectomy and immediate replacement with a 550-cc implant, persistent periprosthetic seroma was associated with progressive soft-tissue compromise, impaired wound healing, dehiscence and implant exposure. Because the soft-tissue envelope was inadequate, salvage was considered unfeasible and explantation was performed. (c) Post-explantation appearance.