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IDENTIFICATION AND ASSESSMENT OF MYOMETRIAL PATHOMORPHOLOGICAL CHANGES IN PURULENT-INFLAMMATORY COMPLICATIONS AFTER REPEAT CESAREAN SECTION

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Abstract. Objective: to demonstrate how myometrial pathomorphological features are identified and assessed in a simulated case–control dataset of purulent-inflammatory complications after repeat cesarean section. Methods: 70 synthetic patients (35 cases, 35 controls); Welch's t-test, Mann–Whitney U test and Fisher's exact test with effect sizes, 95% confidence intervals and Benjamini–Hochberg adjustment. Results: cases had more fibrous tissue (38.1±7.7% vs 28.9±7.1%; $p = 1.97\times10^{-6}$), less smooth muscle (51.0±6.7% vs 66.7±7.4%; $p = 1.23\times10^{-13}$) and more necrosis foci (16/35 vs 1/35; $p = 3.72\times10^{-5}$). Conclusion: the findings are artificial and have no clinical evidentiary value.

Keywords: pathomorphology; myometrium; repeat cesarean section; purulent-inflammatory complications; fibrosis;

Introduction

Cesarean delivery is the most common major operation worldwide, and post-cesarean surgical site infections, including organ/space infections such as postpartum endometritis, are reported in 3–15% of cases (Hayasaka et al., 2026). In a Norwegian cohort (516,874 deliveries), endometritis or puerperal sepsis occurred in 1.15% (5,942 cases); emergency cesarean section carried an adjusted relative risk of 2.8 (95% CI 2.6–3.0) (Røe et al., 2026).

Uterine scars show disorganized smooth muscle, collagen-rich fibrosis and fewer endometrial glands (Debras et al., 2024), with ultrastructural disruption (Paping et al., 2023); repeated cesarean sections may increase fibrosis (Milovanov et al., 2025). Scar defects are linked to chronic endometritis (Wang et al., 2025), and scars from pregnancies with unfavorable perinatal outcomes more often showed uneven microvascular filling and stromal edema (Pachkovskaya et al., 2023). Studies grading a broad panel of myometrial features in purulent-inflammatory complications after repeat cesarean section appear scarce in the reviewed sources.

This educational study aimed to identify, assess and compare myometrial pathomorphological features between simulated cases and controls, with effect sizes and 95% confidence intervals (CIs).

Materials and Methods

35 cases with purulent-inflammatory complications after repeat cesarean section (group A) and 35 controls without complications (group B). Parameters followed the literature's direction (more fibrosis, less smooth muscle, more inflammation in cases).

Variables. Morphometric: fibrous tissue area (%), smooth muscle area (%), neutrophils per high-power field (HPF, ×400). Semi-quantitative (0–3): inflammatory infiltrate, stromal edema. Binary: necrosis foci, microabscesses, perivascular fibrosis, smooth muscle disarray, uneven vascular filling. Baseline: age and number of previous cesarean sections (2–4).

Statistics. Normality was checked with the Shapiro–Wilk test. Normally distributed variables (mean±SD) were compared with Welch's t-test (mean difference and Hedges' g, both with 95% CI);

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counts and ordinal scores (median [Q1–Q3]) with the Mann–Whitney U test (rank-biserial r, bootstrap 95% CI); binary features (n/N, %) with Fisher's exact test (odds ratio [OR], Woolf 95% CI). Twelve comparisons were adjusted with the Benjamini–Hochberg procedure (q); two-sided $\alpha = 0.05$. Analyses used SciPy and were independently rechecked.

Results

Baseline. Age was 29.5±5.1 vs 30.5±4.2 years (Welch $t(65.5) = -0.89$, $p = 0.3753$; $g = -0.21$, 95% CI −0.68 to 0.25); previous cesarean sections had median 3 (2–3) in both groups ($U = 675.5$, $p = 0.4261$; $r = 0.10$).

Morphometry. Fibrous tissue area was higher in group A than in group B (38.1±7.7% vs 28.9±7.1%; $t(67.5) = 5.21$, $p = 1.97\times10^{-6}$; difference 9.2 percentage points, 95% CI 5.7 to 12.7; $g = 1.23$, 95% CI 0.72 to 1.74), and smooth muscle area was lower (51.0±6.7% vs 66.7±7.4%; $t(67.3) = -9.27$, $p = 1.23\times10^{-13}$; difference −15.7, 95% CI −19.1 to −12.3; $g = -2.19$, 95% CI −2.78 to −1.60). Neutrophils per HPF were higher in group A (median 25 [17.5–31] vs 7 [3.5–8]; $U = 1146.0$, $p = 3.63\times10^{-10}$; $r = 0.87$, 95% CI 0.73 to 0.97).

Semi-quantitative scores. The inflammatory infiltrate score was higher in group A (median 3 [2–3] vs 1 [0–1]; $U = 1102.0$, $p = 2.44\times10^{-9}$; $r = 0.80$, 95% CI 0.65 to 0.92), as was the stromal edema score (2 [2–3] vs 1 [0.5–2]; $U = 987.5$, $p = 4.00\times10^{-6}$; $r = 0.61$, 95% CI 0.41 to 0.79).

Qualitative features. Necrosis foci: 16/35 (45.7%) vs 1/35 (2.9%) (Fisher $p = 3.72\times10^{-5}$; OR 28.6, 95% CI 3.5 to 233.1); perivascular fibrosis: 25/35 (71.4%) vs 13/35 (37.1%) ($p = 0.0078$; OR 4.23, 95% CI 1.55 to 11.55); smooth muscle disarray: 26/35 (74.3%) vs 12/35 (34.3%) ($p = 0.0016$; OR 5.54, 95% CI 1.98 to 15.52). Microabscesses (8/35, 22.9% vs 3/35, 8.6%; $p = 0.1875$; OR 3.16, 95% CI 0.76 to 13.11) and uneven vascular filling (19/35, 54.3% vs 13/35, 37.1%; $p = 0.2301$; OR 2.01, 95% CI 0.77 to 5.22) did not differ significantly.

After Benjamini–Hochberg adjustment, differences remained significant for all morphometric and semi-quantitative features, necrosis, perivascular fibrosis and smooth muscle disarray ($q \leq 0.0118$), but not for age ($q = 0.4094$), previous cesarean sections ($q = 0.4261$), microabscesses ($q = 0.2500$) or uneven vascular filling ($q = 0.2761$).

Discussion

Cases showed less smooth muscle and more fibrous tissue, neutrophil-rich inflammation, edema, necrosis, perivascular fibrosis and smooth muscle disarray. Because parameters followed the literature, this resembles reports of fibrosis, disorganized smooth muscle (Debras et al., 2024; Paping et al., 2023), edema and vascular changes (Pachkovskaya et al., 2023), but does not confirm them.

Teaching points: (1) effect sizes and CIs show precision: the necrosis OR of 28.6 has a very wide CI (3.5–233.1) because only one control was positive; (2) non-significant microabscess and vascular-filling results do not mean no effect, as power is limited and both CIs include 1; (3) morphology is not function: Debras et al. (2024) found no correlation between collagenous scar and biomechanical strength, so contractile dysfunction cannot be inferred.

Conclusion

Cases showed more fibrosis, neutrophilic infiltration, edema, necrosis, perivascular fibrosis and smooth muscle disarray and less smooth muscle than controls; age, previous cesarean sections, microabscesses and uneven vascular filling did not differ significantly.

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