Intraoperative Remifentanil Consumption with PECS and Erector Spinae Plane Block in Breast Surgery Using Nociception Level (NOL) Monitoring: A Randomized Controlled Trial

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Background

- Breast surgery causes substantial perioperative pain; opioid-sparing multimodal analgesia is now standard practice.
- PECS-II is recommended in procedure specific analgesia guidelines. The ESP block is technically simpler with a favourable safety profile but the two have never been separated convincingly.
- Almost every comparison relies on postoperative pain scores. Intraoperative nociception is rarely measured objectively; heart rate and blood pressure are non-specific surrogates.
- The NOL index integrates autonomic signals into a real-time measure of the nociception antinociception balance, allowing individualized opioid titration.

Methods

Design

- Prospective, randomized, controlled single-centre trial.

Patients

- 89 adults (ASA I–III, 18–80 y) undergoing elective breast surgery, randomized 1:1:1 by computer-generated sequence

Interventions

- ESP
- PECS-II
- Control — no regional block.

Anaesthesia & opioid titration

- Standardized GA, desflurane titrated to BIS 40–60.
- NOL monitored continuously (PMD-200, Medasense).
- Remifentanil titrated to hold NOL between 10 and 25
- All patients received IV ibuprofen, dexamethasone, paracetamol and morphine 0.1 mg·kg^{-1} before extubation, plus PONV prophylaxis.

Outcomes

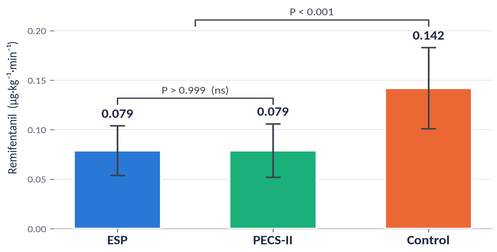
- Primary — total intraoperative remifentanil (μg·kg^{-1}·min^{-1}).
- Secondary — NRS at 1/6/12/24 h morphine via PCA (1 mg bolus, 10-min lockout), PONV, length of hospital stay. Postoperative assessors were blinded to allocation.

Statistics

- Shapiro–Wilk for normality; one-way ANOVA with Tukey HSD or Kruskal–Wallis with Bonferroni-corrected Mann–Whitney U; χ^2 or Fisher's exact test for categorical data; two-sided P < 0.05.

ESP and PECS-II blocks cut intraoperative remifentanil by **44%** versus no block and performed identically to each other under **objective nociception monitoring.**

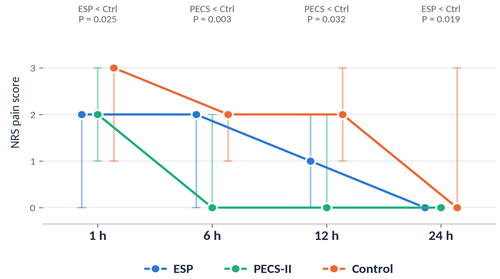
Fig. 1 — Intraoperative remifentanil consumption



Mean ± SD. One-way ANOVA P < 0.001; Tukey HSD post hoc.

Primary outcome. Both blocks reduced remifentanil ~44% vs control; ESP and PECS-II were indistinguishable.

Fig. 2 — Postoperative NRS pain scores



Median (IQR). Kruskal–Wallis with Bonferroni-corrected post hoc.

Pain was lower than control at 1, 6, 12 and 24 h; ESP and PECS-II never differed from each other.

Key outcomes

Outcome	ESP (n=30)	PECS-II (n=30)	Control (n=29)	P
Remifentanil, μg·kg^{-1}·min^{-1}, mean ± SD	0.079 ± 0.025	0.079 ± 0.027	0.142 ± 0.041	<0.001
24-h morphine, mg, median (IQR)	4 (4–8)	4 (3–5)	8 (4–12)	<0.001
NRS at 6 h, median (IQR)	2 (0–2)	0 (0–2)	2 (1–2)	0.005
NRS at 24 h, median (IQR)	0 (0–0)	0 (0–0)	0 (0–3)	0.016
Nausea / vomiting, n (%)	4 (13.3)	2 (6.7)	10 (34.5)	0.015
Surgery duration, min, median (IQR)	120 (95–185)	120 (90–155)	120 (80–200)	0.732

Mean ± SD or median (IQR). ANOVA / Kruskal–Wallis; χ^2 for categorical data.

Results

Primary outcome

- Remifentanil requirement differed across groups (one-way ANOVA P < 0.001): 0.079 ± 0.025 (ESP) and 0.079 ± 0.027 (PECS-II) vs 0.142 ± 0.041 μg·kg^{-1}·min^{-1} (control). Both blocks used less than control (Tukey HSD, both P < 0.001); ESP and PECS-II did not differ (P > 0.999).

Nociception control

- Time-weighted mean NOL, and time spent above 25 or below 10, did not differ between groups — the same nociceptive target was reached, at a markedly lower opioid dose.

Postoperative outcomes

- 24-h morphine: 4 (4-8) ESP, 4 (3–5) PECS-II vs 8 (4-12) mg control (P < 0.001).
- NRS lower than control at 1 h (ESP, P = 0.025), 6 h and 12 h (PECS-II, P = 0.003 / 0.032) and 24 h (ESP, P = 0.019). No ESP vs PECS-II difference at any time point.
- Nausea and vomiting: 13.3% ESP, 6.7% PECS-II vs 34.5% control (P = 0.015).
- Surgical and anaesthesia duration and length of hospital stay were similar across all three groups.

Discussion

- Under nociception-guided anaesthesia the two blocks produced indistinguishable intraoperative opioid requirements , a comparison rarely made with objective nociception monitoring rather than postoperative surrogates.
- Despite different anatomical targets and spread patterns, both cover the dermatomes relevant to breast surgery. Coverage of the surgical field appears to matter more than local anaesthetic volume alone.
- Equal NOL profiles at very different remifentanil doses argue the effect is genuinely analgesic rather than a monitoring artefact.
- Limitations: Single center; not powered for rare complications or small differences between blocks; anesthetists were not blinded (objective endpoints mitigate this); chronic post-surgical pain was not assessed

Conclusions

- ESP and PECS-II provide comparable intraoperative nociception control and both markedly reduce perioperative opioid requirements in breast surgery. Objective nociception monitoring is a useful tool for evaluating regional techniques

Selected references

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