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Regional Anaesthesia and Early Postoperative Quality of Recovery after Non-Cardiac Surgery: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

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Abstract **Original Research Article**

Background: Quality of recovery (QoR) is a multidimensional, patient-centred outcome that extends beyond pain intensity and opioid consumption. Regional anaesthesia may improve early recovery through superior dynamic analgesia, opioid-sparing effects, and reduction of opioid-related adverse effects. We performed a systematic review and meta-analysis of randomized controlled trials evaluating regional anaesthetic techniques and early postoperative quality of recovery, measured with the 15-item Quality of Recovery scale (QoR-15). ***Methods:*** Randomized controlled trials enrolling adults undergoing non-cardiac surgery were considered when a regional block was compared with a non-block or conventional control strategy and QoR-15 was reported at approximately 24 hours. Six trials with directly extractable means and standard deviations were quantitatively synthesized using a random-effects (DerSimonian–Laird) model. The effect measure was the mean difference (MD), calculated as regional anaesthesia minus control, with heterogeneity quantified using Cochran's Q and I^2. ***Results:*** Six randomized trials comprising 457 analyzed participants contributed to the primary quantitative synthesis. Regional anaesthesia significantly improved QoR-15 at approximately 24 hours (MD 11.38 points, 95% CI 9.02 to 13.73; $I^2 = 43.9\%$), an effect exceeding the established minimal clinically important difference for the scale. The direction of effect favored regional anaesthesia in all six trials. ***Conclusions:*** Regional anaesthesia was associated with a statistically robust and clinically meaningful improvement in early patient-reported recovery after non-cardiac surgery. These findings support incorporating regional techniques into individualized, patient-centred enhanced-recovery pathways, while recognizing heterogeneity in surgical populations, block techniques, and the limited number of directly poolable trials.

Keywords: Regional anaesthesia; peripheral nerve block; quality of recovery; QoR-15; meta-analysis; enhanced recovery after surgery.

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1. INTRODUCTION

Postoperative recovery is a multidimensional construct that extends well beyond pain intensity, opioid consumption, and length of hospital stay. Patient-reported outcome instruments such as the 15-item Quality of Recovery questionnaire (QoR-15) quantify physical comfort, physical independence, psychological support, emotional state and pain on a 0–150 scale, with higher scores representing better recovery [1]. The QoR-15 is a validated, reliable and responsive patient-centred outcome measure; a large psychometric systematic review and meta-analysis involving more than 22,000 patients confirmed its validity, internal consistency and responsiveness across diverse surgical populations [3], and an updated analysis established a minimal clinically important difference of approximately 6 to 8 points, providing a benchmark against which observed treatment effects can be judged as clinically and not merely statistically significant [2,19].

Since the introduction of multimodal, opioid-sparing analgesic strategies [17], regional anaesthesia has become increasingly integrated into contemporary perioperative and enhanced-recovery-after-surgery (ERAS) pathways [18]. By interrupting afferent nociceptive transmission at the peripheral or truncal level, regional blocks can provide effective dynamic analgesia while reducing systemic opioid requirements. This is clinically relevant because opioid-related adverse events including postoperative nausea and vomiting, sedation, dizziness, ileus and respiratory depression are common and are independently associated with longer

hospital stay, higher costs and increased morbidity [20]. Peripheral and truncal blocks may therefore decrease not only pain scores but also opioid-related adverse effects and functional limitations, with plausible downstream benefits for patient-reported recovery. A 2023 systematic review and meta-analysis restricted to thoracic surgery found improvement in both QoR-40 and QoR-15 after regional anaesthesia, although with substantial heterogeneity for QoR-40 [10].

The evidence base has subsequently expanded well beyond thoracic surgery to hip and hip-fracture surgery, neurosurgery, and laparoscopic abdominal procedures. We therefore performed an updated quantitative synthesis focused specifically on directly reported QoR-15 data at approximately 24 hours, a clinically important early time point at which regional techniques are most likely to exert a measurable effect on patient-reported recovery.

2. METHODS

2.1 Eligibility criteria

Randomized controlled trials were eligible if they enrolled adults undergoing non-cardiac surgery; compared a regional anaesthetic block (peripheral, fascial-plane, or truncal) with no block, a placebo/sham block, systemic analgesia, or conventional control management; and reported QoR-15 approximately 24 hours after surgery. Trials comparing two active regional techniques without a non-regional control arm were excluded from the primary analysis, as were trials reporting QoR-15 only as medians and interquartile ranges without accompanying means and standard deviations.

2.2 Outcome

The primary outcome was QoR-15 at approximately 24 hours after surgery. Mean differences were calculated directly from published group means and standard deviations. Studies reporting medians and interquartile ranges only were not statistically converted for the primary analysis, in keeping with a conservative approach that avoids unsupported distributional assumptions [14,15].

2.3 Statistical analysis

Data were pooled using a random-effects model (DerSimonian–Laird method) [21], reflecting the a priori expectation of clinical and methodological heterogeneity across surgical populations and block techniques. The effect measure was the mean difference (MD), calculated as regional anaesthesia minus control, with 95% confidence intervals. Statistical heterogeneity was quantified using Cochran's Q and the I^2 statistic, with τ^2 representing between-study variance. Because only six studies contributed to the primary analysis, formal assessment of small-study effects (e.g., funnel-plot asymmetry) was not considered statistically reliable and was not performed. Methodological conduct and reporting were guided by the Cochrane Handbook for Systematic Reviews of Interventions [14] and the PRISMA 2020 statement [15]; risk of bias in individual trials would ordinarily be assessed using the Cochrane RoB 2 tool [16], and certainty of the pooled evidence using the GRADE framework [22], as discussed further under Strengths and limitations (4.5).

3. RESULTS

Six randomized trials and 457 analyzed participants contributed directly usable QoR-15 data to the primary quantitative synthesis. The pooled effect favored regional anaesthesia by 11.38 points (95% CI 9.02–13.73). Heterogeneity was moderate ($I^2 = 43.9\%$; $\tau^2 = 3.77$). All six individual point estimates favored regional anaesthesia, and none of the 95% confidence intervals crossed the line of no effect.

3.1 Included trials

Trial	Reg. n	Ctrl. n	Regional QoR-15	Control QoR-15	MD	95% CI
Fujimoto *et al.,* QLB [4]	39	39	134.4 ± 7.8	117.5 ± 13.5	16.90	12.33–21.47
Chen *et al.,* FICB [5]	45	44	114.1 ± 8.3	104.6 ± 8.4	9.50	4.49–14.51
Gao *et al.,* continuous FICB [6]	27	29	114.11 ± 10.63	100.69 ± 7.65	13.42	9.32–17.52
Aygun *et al.,* PENG [7]	40	41	111.02 ± 9.67	99.51 ± 9.45	11.51	5.97–17.05
Lu *et al.,* scalp + intercostal NB [8]	44	44	122.0 ± 7.6	113.5 ± 11.3	8.50	4.48–12.52
Zhang *et al.,* TPVB, adrenalectomy [9]	32	33	122.2 ± 8.9	112.2 ± 10.8	10.00	5.21–14.79

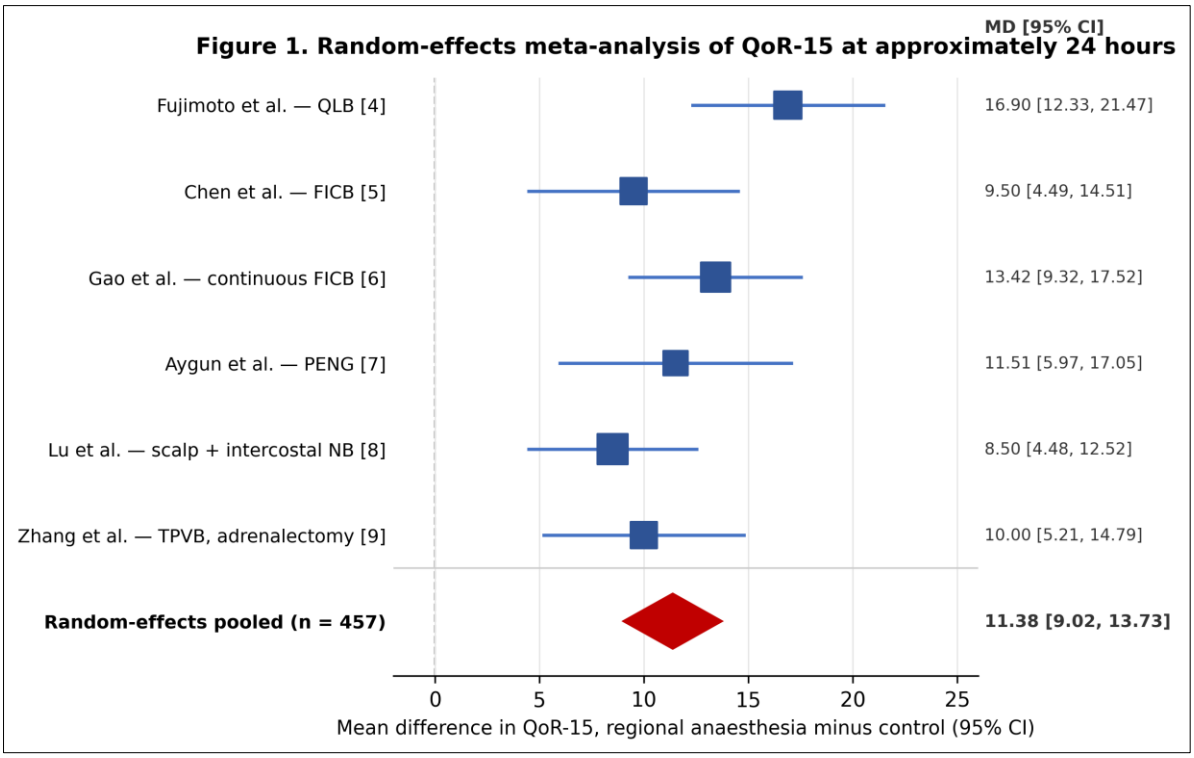
3.2 Evidence from individual trials

In a randomized trial of major gynaecological laparoscopic surgery, ultrasound-guided posterior quadratus lumborum block increased QoR-15 at 24 hours from 117.5 ± 13.5 to 134.4 ± 7.8 points [4].

In elderly patients undergoing hip arthroplasty for hip fracture under spinal anaesthesia, perioperative ultrasound-guided fascia iliaca compartment block increased 24-hour QoR-15 from 104.6 ± 8.4 to 114.1 ± 8.3 [5].

A randomized trial of continuous fascia iliaca compartment block after total hip arthroplasty in elderly patients reported 24-hour QoR-15 scores of 114.11 ± 10.63 with continuous block versus 100.69 ± 7.65 with patient-controlled intravenous analgesia [6].

A trial of ultrasound-guided pericapsular nerve group (PENG) block administered during patient positioning for central neuraxial blockade in hip fracture surgery reported QoR-15 scores of 111.02 ± 9.67 versus 99.51 ± 9.45 [7].



In patients undergoing deep brain stimulation for Parkinson's disease, combined scalp and intercostal nerve blocks increased 24-hour QoR-15 from 113.5 ± 11.3 to 122.0 ± 7.6 [8].

A contemporary randomized trial of thoracic paravertebral block during daytime laparoscopic partial adrenalectomy reported significantly higher QoR-15 scores at both 24 and 48 hours, together with reduced opioid consumption and rescue analgesia, and contributed the sixth trial to the primary synthesis [9].

4. DISCUSSION

The principal finding of this quantitative synthesis was that regional anaesthesia was associated with a statistically robust and clinically relevant improvement in patient-reported recovery at approximately 24 hours after non-cardiac surgery. Across six randomized controlled trials including 457 analyzed participants, the pooled mean difference in QoR-15 was 11.38 points (95% CI, 9.02–13.73), with moderate statistical heterogeneity (I^2 = 43.9%). Importantly, the direction of effect was concordant across all included trials. This finding extends previous evidence suggesting that regional anaesthesia may influence postoperative recovery beyond the isolated endpoint of analgesic efficacy. The QoR-15 was developed to capture multidimensional recovery including pain, physical comfort, physical independence, psychological support and emotional state and has demonstrated strong validity, reliability, responsiveness and clinical acceptability across diverse surgical populations [1–3].

4.1 Potential mechanisms

The mechanisms underlying the observed improvement are likely multifactorial. By interrupting afferent nociceptive transmission, regional blocks can provide effective analgesia while reducing the requirement for systemic opioids [17]. Reduced opioid exposure may attenuate nausea, vomiting, sedation, dizziness, ileus and other symptoms that adversely affect several QoR-15 domains and that are independently associated with worse perioperative outcomes [20]. Improved analgesia may also facilitate early mobilization, respiratory effort, sleep and functional independence, consistent with the broader rationale underlying enhanced-recovery pathways [18]. These interrelated effects provide a plausible pathway linking regional anaesthesia to broader patient-perceived recovery rather than to pain reduction alone [3,4,10,11].

4.2 Relationship to previous evidence

The clinical trials included in this analysis illustrate this multidimensional effect across markedly different anatomical targets and surgical specialties. Fascia iliaca compartment block and continuous fascia iliaca blockade have both been associated with higher 24-hour QoR-15 scores after hip arthroplasty [5,6].

Similarly, PENG blockade has been evaluated in hip fracture surgery [7], while combined scalp and intercostal nerve block improved 24-hour QoR-15 after deep brain stimulation [8]. A contemporary thoracic paravertebral block trial in laparoscopic partial adrenalectomy provided additional evidence from minimally invasive abdominal surgery, with benefit sustained to 48 hours [9]. These findings suggest that the potential benefit of regional anaesthesia on early patient-reported recovery is not restricted to a single surgical specialty or block technique.

Our findings are directionally consistent with previous systematic evidence. A 2023 systematic review and meta-analysis restricted to thoracic surgery reported improvement in both QoR-15 and QoR-40 following regional anaesthetic techniques, although substantial heterogeneity was observed for QoR-40 [10]. The present synthesis broadens that evidence base by incorporating randomized trials from several non-cardiac surgical populations and by focusing specifically on QoR-15 at approximately 24 hours. The broader literature also indicates that other opioid-sparing strategies, including opioid-free anaesthesia, can influence QoR, supporting the concept that analgesic and opioid-related effects are important but not exclusive determinants of patient-reported recovery [11,12].

Recent randomized evidence further supports this interpretation. A 2026 randomized trial in ambulatory breast-conserving surgery reported higher QoR-15 scores with regional anaesthesia combined with dexmedetomidine sedation than with general anaesthesia at multiple postoperative time points, together with less rescue analgesia and fewer episodes of postoperative nausea and vomiting [13]. Although this study was not incorporated into the primary pooled estimate because its QoR-15 results were reported as medians and interquartile ranges, its findings are directionally concordant with the present analysis and strengthen the contemporary external evidence base.

4.3 Clinical relevance and implications

The magnitude of the observed effect is noteworthy from a patient-centred perspective. The pooled estimate of 11.38 points exceeded the established minimal clinically important difference of approximately 6 to 8 points for the QoR-15 [2,19], suggesting that the observed benefit is unlikely to represent a purely statistical signal. More recent psychometric work has further supported the discriminant validity and responsiveness of QoR-15, including its ability to distinguish patients with and without postoperative complications [3]. Nevertheless, clinical interpretation should remain contextual: the meaningfulness of a given change may vary according to baseline recovery, surgical magnitude and perioperative care pathway.

From an enhanced-recovery perspective, these findings suggest that regional anaesthesia should be viewed not merely as an analgesic adjunct but as a potentially important component of patient-centred perioperative care [18]. This distinction is clinically relevant because interventions that improve pain without improving global recovery may have limited patient-centred value. Conversely, the multidimensional nature of QoR-15 allows the cumulative effects of analgesia, opioid sparing, nausea reduction, functional recovery and psychological well-being to be captured within a single outcome [1–3].

However, the results should not be interpreted as evidence that every patient or every operation requires regional anaesthesia. Technique selection should remain individualized according to surgical anatomy, anticipated postoperative pain, contraindications, anticoagulation status, local expertise, block success rates, and the broader multimodal analgesic pathway. In contemporary enhanced-recovery pathways, the incremental value of a block is also likely to depend on the quality of background analgesia and other opioid-sparing interventions [10–12].

4.4 Heterogeneity and methodological considerations

The moderate heterogeneity observed in the primary analysis (I^2 = 43.9%) is clinically understandable. Regional anaesthesia is not a single standardized intervention: quadratus lumborum, fascia iliaca, PENG, scalp/intercostal, and thoracic paravertebral blocks differ in anatomical target, local anaesthetic spread, duration of action and functional consequences [5–9]. Likewise, gynaecological, orthopaedic, neurosurgical and laparoscopic abdominal procedures generate different degrees of surgical stress and baseline functional impairment. The observed I^2 therefore appears compatible with meaningful clinical diversity rather than necessarily indicating methodological inconsistency. Interpretation of heterogeneity should consequently emphasize clinical and methodological sources rather than relying on I^2 alone [14,15].

A further methodological consideration is the increasing use of non-parametric reporting of QoR-15 outcomes. Several contemporary randomized trials report medians and interquartile ranges rather than means and standard deviations. We deliberately avoided unvalidated conversion of these data for the primary meta-analysis. This conservative approach reduced the number of quantitatively poolable studies but minimized assumptions and preserved the integrity of the pooled estimate, consistent with the principle that effect estimates should be based on reported distributional information rather than on unsupported statistical transformations [14,15,21].

4.5 Strengths and limitations

The principal strength of this analysis is the restriction of the primary quantitative synthesis to randomized trials with directly reported QoR-15 means and standard deviations at approximately 24 hours, thereby avoiding potentially consequential assumptions during data conversion. The consistency of effect direction across all six trials and the persistence of a clinically important pooled effect despite moderate heterogeneity further strengthen the findings. The review should nevertheless be interpreted within the framework of contemporary systematic-review standards, including transparent reporting [15] and structured risk-of-bias assessment [16].

Several limitations must nevertheless be acknowledged. First, the number of directly poolable trials remains limited, precluding reliable assessment of small-study effects or publication bias. Second, substantial clinical heterogeneity exists in both surgical population and regional technique. Third, patient and outcome-assessor blinding is inherently difficult in many regional anaesthesia trials, which may be particularly relevant when the primary outcome is patient-reported. Fourth, the analysis focuses on early postoperative recovery and does not establish whether the observed benefit persists over longer follow-up. Fifth, a formal risk-of-bias assessment using RoB 2 [16] and a structured certainty-of-evidence rating using GRADE [22] were beyond the scope of this focused quantitative synthesis and should be incorporated into a full systematic review. Finally, the inclusion of only trials with directly extractable mean ± SD data may introduce a form of reporting-related selection into the quantitative synthesis, despite reducing assumptions from statistical conversion [14–16].

4.6 Future research

Future trials should prioritize standardized reporting of QoR-15 at prespecified postoperative time points, ideally alongside opioid consumption, clinically relevant pain outcomes, mobilization, postoperative nausea and vomiting, sleep quality and patient satisfaction. Reporting of means and standard deviations, rather than medians and interquartile ranges alone, would materially increase the proportion of trials amenable to direct quantitative pooling. Stratification by surgical category and regional technique would allow assessment of whether particular blocks or perioperative pathways are associated with greater gains in global recovery. Prospective multicentre studies should also evaluate longer-term recovery trajectories, determine whether early QoR-15 improvements translate into shorter hospitalization and earlier functional independence, and apply a structured certainty-of-evidence framework such as GRADE [22] alongside prospective registration, for example in PROSPERO, to strengthen the transparency and reproducibility of future syntheses.

5. CONCLUSION

In six randomized controlled trials involving 457 participants, regional anaesthesia improved QoR-15 at approximately 24 hours by 11.38 points (95% CI 9.02–13.73; $I^2 = 43.9\%$). The magnitude of benefit exceeded the established minimal clinically important difference for the scale and was directionally consistent across all included trials. Regional anaesthesia should therefore be considered not only an analgesic intervention but also a potential strategy for improving patient-centred postoperative recovery, to be applied within an individualized, multimodal, enhanced-recovery framework.

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