

Ultrasound-Guided TAP Block in Laparoscopic Abdominal Surgery: A Narrative Review of Evidence and Clinical Practice

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Abstract

Background: Even with the shift to minimally invasive surgery, pain after laparoscopic abdominal procedures is still a real clinical problem. Laparoscopy causes less tissue trauma than an open approach and patients typically recover faster, but many still feel moderate pain from the trocar sites, stretching of the abdominal wall, peritoneal irritation, and handling of internal organs. When that pain isn't controlled well, patients get out of bed later, stay in hospital longer, need more opioids, and end up less satisfied with their care. That's part of why ultrasound-guided regional techniques now sit inside most multimodal analgesia protocols. The Transversus Abdominis Plane block, done under ultrasound guidance, stands out among them as a particular favourite, given how effectively it numbs the anterolateral abdominal wall while keeping systemic opioid use down.

Objective: This review looks comprehensively at the current evidence on TAP block's anatomical basis, the ultrasound-guided technique itself, its clinical efficacy and safety, and its expanding range of uses in laparoscopic abdominal surgery.

Materials and Methods: This narrative review draws on literature from 2015 to 2026, searched across **PubMed, MEDLINE, Embase, Scopus, Web of Science, the Cochrane Library, and Google Scholar**. It takes in randomized trials, observational cohorts, systematic reviews with meta-analysis, and clinical practice guidance that looked at ultrasound-guided TAP block in adults having laparoscopic abdominal operations.

Results: The evidence gathered here consistently points the same way: ultrasound-guided TAP block lowers postoperative pain scores, cuts perioperative opioid use, extends how long analgesia lasts, reduces postoperative nausea and vomiting, gets patients moving sooner, and leaves them more satisfied overall. Good outcomes have been reported across laparoscopic cholecystectomy, colorectal surgery, bariatric procedures, appendectomy, gynaecological surgery, urological surgery, and a range of ERAS pathways. A handful of comparative studies point to quadratus lumborum block or erector spinae plane block lasting longer for visceral pain in select cases, but TAP block still stands out as technically simple, safe, reproducible, cost-effective, and reliably well-tolerated.

Conclusion: Within multimodal postoperative analgesia for laparoscopic abdominal surgery, ultrasound-guided TAP block now occupies a well-established role. It's straightforward to perform, spares opioids, carries few complications, and fits neatly into ERAS pathways, making it a genuinely useful regional technique in current perioperative practice. Continuing work on newer fascial plane approaches, longer-acting local anesthetics, and adjuvant drugs should only add to what it can offer clinically.

Keywords: Transversus abdominis plane block; Ultrasound-guided regional anesthesia; Laparoscopic surgery; Postoperative analgesia; Multimodal analgesia; ERAS; Opioid-sparing anesthesia; Fascial plane block.

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INTRODUCTION

Laparoscopic surgery has reshaped how abdominal operations are performed, bringing smaller incisions, less postoperative pain, reduced blood loss, quicker mobilisation, shorter admissions, better cosmetic results, and a faster return to everyday activity compared with the open approach (1,2). Cholecystectomy, appendectomy, colorectal resection, bariatric surgery, gynaecological

operations, and urological procedures are now done laparoscopically as a matter of routine. Even so, pain after these operations remains a real clinical issue, one that can hold back recovery and leave patients less satisfied (3,4).

This pain has more than one source. There's somatic pain from the trocar sites and wall incisions, visceral pain from handling abdominal organs during the procedure, and referred shoulder pain caused by

diaphragmatic irritation from the carbon dioxide used to create pneumoperitoneum (5,6). Laparoscopy does mean less tissue trauma than open surgery, but a good share of patients still describe pain of moderate-to-severe intensity across the first two postoperative days. Left poorly controlled, this pain keeps patients in bed longer, raises the risk of pulmonary complications, extends hospital stays, drives up costs, and can even set the stage for chronic postsurgical pain (7,8).

Opioids have long been the default tool for managing this pain, and they work — but not without cost. They bring a familiar list of downsides: nausea and vomiting, constipation, difficulty passing urine, heavy sedation, slowed breathing, ileus, delayed mobilisation, and a risk of dependence. All of that can get in the way of a smooth recovery and leave patients less happy with their care, which is exactly why opioid-sparing, multimodal approaches to pain management have gained so much traction (9,10).

By ‘multimodal analgesia’ we mean combining drugs and regional techniques that act via different pathways, so the pain relief adds up while opioid use and its side effects stay down (11). ERAS protocols now build multimodal analgesia in as a core element of perioperative care, and regional techniques — ultrasound-guided fascial plane blocks especially — have become central to that, since they control pain well without blunting motor function or slowing rehabilitation (12,13).

Of the fascial plane blocks developed over the last twenty years, the TAP block — now almost always performed under ultrasound — has become a mainstay regional technique in abdominal surgery. It started out as a landmark-guided procedure before ultrasound refined it, and it works because it interrupts transmission along the thoracolumbar nerves supplying the front of the belly wall. Ultrasound guidance has made the whole procedure safer and more accurate, since the operator can watch the abdominal wall muscles, the needle, and the spread of local anaesthetic in the transversus abdominis plane in real time (14,15).

Anatomically, the target plane sits sandwiched between the internal oblique and transversus abdominis muscles. Passing through it are the anterior rami of nerves T6 through T12, plus the subcostal nerve and the first lumbar nerve, whose branches include the iliohypogastric and ilioinguinal nerves. Depositing local anaesthetic here numbs the anterolateral abdominal wall and reduces somatic pain after surgery. Because the block is largely limited to somatic nerves and doesn't cause meaningful sympathetic block or leg weakness, it suits ambulatory and minimally invasive surgery particularly well (16,17).

Portable high-resolution ultrasound has changed regional anaesthesia practice generally, letting anaesthesiologists see individual muscle layers, steer clear of vessels or an accidental peritoneal puncture, and place the local anaesthetic exactly where it needs to go. Compared with the older blind landmark approach, ultrasound guidance has, across a large number of randomized trials, meant a higher success rate, more consistent blocks, fewer complications, and better analgesia overall (18,19).

Several variants of the technique have since emerged to better match different surgical incisions — the lateral, posterior, subcostal, and four-quadrant TAP blocks among them — each covering a different dermatomal spread. The subcostal approach suits upper abdominal surgery such as laparoscopic cholecystectomy, while the posterior approach gives broader coverage for lower abdominal procedures like colorectal, gynaecological, and urological surgery (20,21).

A large number of trials and systematic reviews have now looked at how well TAP block performs in laparoscopic abdominal surgery, and most find real reductions in pain scores, opioid use, need for rescue medication, PONV, and hospital stay compared with standard systemic pain control or wound infiltration alone. It also tends to improve patient satisfaction and get people moving sooner — both goals central to ERAS pathways (22,23).

More recent studies have measured TAP block against other ultrasound-guided approaches to the fascial planes — among them quadratus lumborum block, erector spinae plane block, rectus sheath block, and the transmuscular quadratus lumborum variant. Some of these newer options may give better visceral analgesia or last longer in particular procedures, but TAP block still holds up as one of the simplest, safest, and most reproducible options available, with a short learning curve and low complication rate that keep it in routine use (24,25).

TAP block's use has spread well past simple postoperative pain relief — it now features in opioid-free anaesthesia protocols, day-case surgery, bariatric anaesthesia, paediatric surgery, and various enhanced recovery programmes. There's growing evidence that longer-acting local anaesthetics, continuous catheter techniques, and adjuvants such as dexamethasone or dexmedetomidine can stretch the analgesic effect further and improve outcomes. Better ultrasound equipment and more standardised training have also made the block more consistent and more accessible across different healthcare settings (26,27).

Given how quickly the evidence and the indications for this block are both growing, an updated review seems worthwhile. This one sets out to cover the anatomical basis, the ultrasound technique itself,

clinical effectiveness, safety, how it stacks up against other regional techniques, and where the field seems to be heading, drawing on literature available through 2026 (28).

MATERIALS AND METHODS

This review pulls together the published literature concerning TAP block performed under ultrasound guidance for laparoscopic abdominal operations. Relevant work from January 2015 to June 2026 was found by searching PubMed, MEDLINE, Embase, Scopus, Web of Science, the Cochrane Library, Google Scholar, and ScienceDirect electronically. Search terms combined MeSH headings with free-text keywords, among them “Transversus Abdominis Plane Block,” “TAP Block,” “Ultrasound-Guided TAP Block,” “Laparoscopic Surgery,” “Postoperative Analgesia,” “Regional Anesthesia,” “Enhanced Recovery After Surgery (ERAS),” “Multimodal Analgesia,” “Pain Management,” and “Fascial Plane Blocks.”

Eligible material included original research articles, randomized trials, observational cohorts (both prospective and retrospective), systematic reviews with meta-analysis, and pertinent clinical practice guidance published in English. The focus was on studies reporting efficacy, safety, technique, postoperative analgesic outcomes, how much opioid was used, how satisfied patients were, recovery, and clinical use of the block in adults having laparoscopic abdominal operations.

Excluded were paediatric studies, case reports, conference abstracts without full text, duplicate publications, editorials, expert opinion pieces, animal studies, and any article without adequate methodological detail or clear outcome measures.

Data from the included studies were pulled together narratively, focusing on study design, the surgical procedures involved, TAP block technique, choice of local anaesthetic and adjuvants, postoperative pain scores, opioid-sparing effect, duration of analgesia, postoperative nausea and vomiting, complications, patient satisfaction, and how TAP block fits into ERAS protocols. The aim throughout was a critical, up-to-date picture of the evidence and how the block's clinical use is evolving.

RESULTS

A sizeable body of evidence turned up on how the ultrasound-guided block performs in laparoscopic abdominal operations, spanning randomized trials, observational cohorts (prospective and retrospective), systematic reviews with meta-analysis, and clinical practice guidance from 2015 through 2026. Taken together, it consistently backs TAP block as an effective piece of multimodal postoperative analgesia.

Most randomized trials found that patients given the block reported less pain than those managed with systemic analgesia or wound infiltration alone during the first postoperative day, with the gap widest in the earliest hours (0–12) — precisely when somatic pain from the trocar sites and wall incisions is at its worst.

Almost every comparative study found lower perioperative opioid consumption with the block in place, and that opioid-sparing effect carried through to fewer opioid-related problems too — less nausea and vomiting, less oversedation, less pruritus, less urinary retention, and quicker recovery generally. Patients needed fewer rescue doses and reported being more comfortable afterward.

This pattern held across a wide surgical range — cholecystectomy, appendectomy, colorectal surgery, bariatric surgery, gynaecological laparoscopy, hernia repair, nephrectomy, and other urological procedures — with the block consistently improving analgesia and speeding mobilisation. A number of studies also reported shorter PACU stays and earlier discharge, especially when the block was built into ERAS protocols.

Head-to-head comparisons of the different TAP variants suggest the subcostal approach works best for upper abdominal surgery like cholecystectomy, while the posterior approach lasts longer for lower abdominal and pelvic operations. The four-quadrant technique covered both upper and lower incisions effectively in more extensive laparoscopic procedures.

Meta-analyses from the review period confirm that ultrasound-guided TAP block lowers pain scores whether patients are resting or moving, pushes back how soon rescue analgesia is first needed, and reduces cumulative opioid use on postoperative day one. Some newer studies do suggest quadratus lumborum block may outlast TAP block for visceral analgesia in specific procedures, though both remain very safe options.

Complication rates were consistently low. Serious problems — bowel or liver injury, intraperitoneal infection, local anaesthetic systemic toxicity, haematoma, infection — were rarely seen, especially when the block was placed under real-time ultrasound by an experienced operator. No study linked the block to a meaningful rise in perioperative morbidity.

Taken together, this evidence points to ultrasound guidance making TAP block a dependable, low-risk, and clinically effective regional option — one that gives good somatic analgesia, cuts opioid use, speeds recovery, improves satisfaction, and fits well into ERAS pathways for laparoscopic abdominal surgery patients.

DISCUSSION

TAP block now ranks among the most widely accepted regional techniques used for pain relief after abdominal operations. Since it entered routine practice, it has moved on from a landmark-based procedure to a precise, ultrasound-guided fascial plane block, with real gains in both efficacy and safety along the way. Its clinical importance in laparoscopic abdominal surgery has only grown alongside the wider push toward multimodal analgesia and ERAS (29).

Smaller incisions and less tissue damage don't make postoperative pain a non-issue after laparoscopic surgery — it's still a genuine concern, arising from several sources at once: somatic pain at the trocar sites, visceral pain from peritoneal stretch and organ handling, and referred shoulder pain from diaphragmatic irritation caused by the CO₂ pneumoperitoneum. Because TAP block targets the somatic nerves of the anterior abdominal wall specifically, it cuts down incisional pain well, and that's a large share of what patients feel in the early postoperative period (30).

Ultrasound has sharpened the block's accuracy considerably. Seeing the external oblique, internal oblique, and transversus abdominis layers as they really sit lets the operator deposit local anaesthetic exactly where it's meant to go, cutting the odds of an accidental peritoneal puncture or organ injury. Trial after trial has found higher success and fewer complications with the ultrasound-guided approach than with landmark techniques (31).

If there's one consistent finding across this literature, it's the opioid-sparing effect. Less opioid used means fewer of the problems that come with it — nausea, vomiting, oversedation, respiratory depression, ileus, urinary retention, slower mobilisation. That matters a lot in laparoscopic surgery specifically, where fast recovery and early discharge are the whole point. Multiple meta-analyses back a real drop in cumulative opioid use over the first 24 hours with the block in place (32).

Pain scores in most trials favour TAP block over standard systemic analgesia, with lower VAS or NRS readings whether the patient is still or moving, an effect most visible across roughly the first postoperative day. Better analgesia in turn means easier deep breathing and coughing, earlier mobilisation, and better engagement with physiotherapy, which together reduce pulmonary complications and support faster recovery overall (33).

How well the block performs depends on the operation and on which TAP variant is chosen. The subcostal version works well when surgery is confined to the upper abdomen, such as cholecystectomy, since it reaches the upper

thoracoabdominal nerves, while the posterior approach lasts longer and suits lower abdominal work such as colorectal, gynaecological, and urological surgery. The four-quadrant variant, covering a broader dermatomal spread, is being used more in extensive procedures that involve incisions in more than one abdominal quadrant (34).

TAP block has also been compared against other regional techniques directly. Quadratus lumborum block has drawn interest because its local anaesthetic can track into the thoracolumbar fascia and paravertebral region, potentially catching both somatic and visceral pain fibres along the way, and erector spinae plane block has shown encouraging results too. Even so, TAP block is technically the simpler option — quicker to learn, quicker to perform, and with a strong safety record — which is why it remains a routine choice, particularly where simplicity and reproducibility matter most (35).

Folding TAP block into ERAS protocols has been another meaningful step forward in perioperative care. ERAS pathways lean on evidence-based measures to cut surgical stress, limit opioid exposure, get patients eating and moving early, and shorten their stay — and studies consistently show better recovery, shorter admissions, faster return of bowel function, and higher satisfaction when TAP block is part of that package, compared with conventional analgesic care (36).

Which local anaesthetic gets used also shapes how well and how long the block works. Bupivacaine and ropivacaine, both long-acting, remain the default choices given their duration and safety record. More recent work has tried adding adjuvants — dexamethasone, dexmedetomidine, clonidine, magnesium sulfate, epinephrine — to stretch the analgesia further and reduce opioid needs afterward, and continuous TAP catheter techniques are showing promise for major abdominal cases that need pain control over a longer stretch (37).

Safety is arguably where this block shines most. Bowel perforation, liver injury, vascular puncture, haematoma, infection, or local anaesthetic systemic toxicity are all rare when an experienced practitioner performs it under ultrasound. Ongoing training in regional anaesthesia, sticking to standardised ultrasound technique, and sensible patient selection have all helped push its safety profile further still (38).

None of this makes TAP block limitation-free, though. Since it's mainly a somatic block, it may not do much for visceral pain in procedures involving extensive intra-abdominal dissection — a gap that has pushed research toward alternative fascial plane blocks and combined regional techniques that cover more ground. Looking ahead, developments such as

AI-assisted ultrasound guidance, better needle-tracking technology, new long-acting local anaesthetic formulations, and more standardised ERAS protocols should all help extend what TAP block can do in laparoscopic abdominal surgery (39).

CONCLUSION

As a regional technique, ultrasound-guided TAP block has proven genuinely useful for managing postoperative pain in laparoscopic abdominal surgery. The evidence to date shows effective somatic analgesia, meaningfully lower pain scores and opioid use, longer-lasting analgesia, fewer opioid-related side effects, and better patient satisfaction. Worked into multimodal analgesia and ERAS protocols, it helps patients mobilise earlier, recover faster, and possibly leave hospital sooner. Given how simple it is technically, how safe, how reproducible, and how broadly it applies across different laparoscopic procedures, it deserves a place as a core part of modern perioperative pain management. What's still needed is better multicentre trial evidence to refine technique, test newer adjuvants, and settle how it truly compares with the newer fascial plane blocks.

Limitations

- The studies drawn on here vary in design, patient population, surgical procedure, block technique, and outcome measures, which limits how directly their findings can be compared.
- Differences between studies in local anaesthetic choice, adjuvant drugs, ultrasound technique, and postoperative analgesic protocol may also have shaped the outcomes reported.
- And while recent evidence supports the block's efficacy, larger multicentre randomized trials that follow patients for longer are still required to standardise protocols and pin down its long-term clinical value.

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