https://doi.org/10.48047/AFJBS.6.2.2024.2938-2943

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

An Overview about Transversus abdominal plane (TAP) block for postoperative pain management

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Article History

Volume 6, Issue 2, Apr-Aug 2024

Received: 5 August 2024

Accepted: 15 August 2024

Published: 15 August 2024

doi:10.48047/AFJBS.6.2.2024.2938-2943

Abstract: Background: The TAP block has been around for a while, and there is a lot of clinical experience with them now. This review aims to summarize the current evidence regarding the effects of TAP block and offer recommendations for future studies in this area.A significant improvement in TAP block performance was made possible by the quick adoption of an ultrasound-guided technique, one of numerous methods for executing abdominal wall blocks. The surgeon may also insert an abdominal wall block while the patient is still within the abdomen.The effects of TAP block have been the subject of eleven meta-analyses, which together form a solid body of evidence. These evaluations compare the TAP block to other analgesic regimens and cover a range of processes and strategies for administering the block.It appears that TAP block has benefits during laparoscopic colon resection and results similar to local infiltration analgesia during laparoscopic cholecystectomy. These effects are dose-dependent on local anesthesia, and TAP has a stronger impact when given before surgery. Patients with conditions like extreme obesity, for whom epidural or spinal anaesthesia/analgesia is technically challenging or even dangerous, may find TAP block to be an appealing alternative. Additional high-quality research comparing TAP block to other analgesic options before surgery is clearly required. These options should include epidural, local infiltration, and single-shot spinal. Procedural specificity is key in these studies. It is important to assess the effects on postoperative nausea and vomiting, bowel function recovery, ambulation, discharge, and long-term recovery outcomes (e.g., postoperative quality of recovery scale) in addition to short-term pain and analgesic requirement.

Keywords: *Transversus abdominal plane (TAP) block*

Introduction

The effects of TAP block have been examined in eleven published meta-analyses. Both the most current one from September 2015 and the oldest one from 2010 were published in a Cochrane review by Charlton et al. They evaluate the efficacy of different abdominal blocks, with ultrasonography being the most common method of administration. The trials are difficult to compare due to the use of varied techniques, concentrations of local anesthetic, and volumes. A number of anesthetic procedures, including intrathecal anesthesia, local infiltration analgesia, and the "placebo" effect, have been likened to the abdominal block. In the September 2015 issue of

Anaesthesia and Analgesia 1, Baeriswyl et al. presented their most recent meta-analysis. A total of 611 adult patients were enrolled in the 31 controlled trials. Its main goals were to measure opioid-sparing effects and cumulative morphine consumption at 6 hours postoperatively; secondary goals included pain ratings, postoperative nausea and vomiting, and 24-hour morphine consumption. No matter if the surgery was performed under general anesthesia, spinal anesthesia, or intrathecal long-acting opioid — the results demonstrated that the ultrasound-guided TAP block was linked to a 6 mg reduction in IV morphine intake at 6 hours postoperatively. Even after 24 hours (mean 11 mg), the benevolent effects of cumulative morphine ingestion were still evident. No change was observed in the incidence of postoperative nausea and/or pruritus, either at rest or during activity, but pain ratings were lower six hours after surgery. "After abdominal laparotomy or laparoscopy and cesarean delivery, ultrasound-guided TAP block provides marginal postoperative analgesic efficacy," the scientists write. Patients who previously had spinal anesthesia with a long-acting opioid did not experience any further analgesic effects from this. Therefore, the most recent review's findings are consistent with those of earlier publications.

In a 2010 Cochrane systematic review, Charlton et al. evaluated the efficacy of TAP block in reducing post-operative abdominal pain 2. A total of eight prospective randomized trials were included. When compared to placebo or "no block," there was a noticeable reduction in the need for opioids. The use of a TAP block significantly reduced the amount of morphine needed 24 hours after surgery (mean difference -21.95 mg) and 48 hours after surgery (cumulative difference -28.50 mg), in comparison to either no TAP block or a saline placebo. Nausea and vomiting showed no improvement. In their call for additional research, the authors urged that future studies evaluate TAP block in comparison to other local anaesthetic methods, such as local infiltration and single-shot intrathecal anesthesia.

Regarding the effectiveness of TAP block 3, Siddiqui et al. released a second meta-analysis in 2011. The following procedures were considered for inclusion in the studies: laparoscopic cholecystectomy, total abdominal hysterectomy, caesarean section with Pfannenstiel incisions, and big bowel resection midline incision. Patients who were assigned to the active TAP block group showed a variety of positive outcomes following surgery: reduced pain up to 24 hours post-op, a much longer period before requiring rescue morphine, and a significantly lower cumulative morphine demand ($P<0.001$). There was no discernible impact of the TAP block on postoperative vomiting and nausea. When it came to TAP block effects, colon surgery and caesarean sections were the most noticeable.

In 2012, Mishriky et al. released a third meta-analysis that examined post-C-section analgesia. A total of nine studies were considered. Opioid use (in milligrams of morphine equivalents) following a cesarean section was shown to be substantially reduced by TAP block. At6,12, and 24 hours, the average difference in opioid requirement was -10.18 mg, -13.83 mg, and -20.23 mg, respectively. Even in patients who did not receive intrathecal morphine, TAP block alleviated pain and nausea throughout the first twelve hours. Within the first six hours following surgery, patients who had both the TAP block and spinal morphine reported slightly less discomfort when moving around. But intrathecal morphine worked better; it was linked to less opioid usage and a lower pain score at 24 hours post-op. Additionally, the duration between the initial request for rescue analgesia was longer in the intrathecal morphine group. Additional morphine-related adverse effects were brought on by the intrathecal morphine.

An additional meta-analysis examining the narcotic benefits of TAP block following abdominal surgery 5 was published in 2012 by Johns et al. There were a total of 413 patients analyzed throughout 9 investigations, with 205 receiving a TAP block and 208 serving as controls. The data were published and unpublished. There was a decrease in the occurrence of postoperative nausea and vomiting, and the usage of morphine was shown to be greatly reduced 24 and 48 hours after surgery, with a decrease of -23.71 mg ($P<0.002$) and -38.08 mg ($P<0.0001$), respectively, when TAP block was used. The procedure was also discovered to be safe and effective. No significant differences were found in pain scores.

A meta-analysis of TAP block for postoperative analgesia following spinal anesthesia cesarean birth was published in 2012 by Abdallah et al. 6. They looked at data from 5 trials that included 312 participants. When

intrathecal morphine was not utilized, the mean cumulative morphine demand in the first 24 hours after surgery decreased by 24 mg with the use of TAP block. Additionally, morphine-related side effects and pain scores were also reduced by TAP block (0.8/10). The results of intrathecal morphine and TAP block were statistically indistinguishable. In the first twenty-four hours following surgery, when intrathecal morphine is not administered, the application of a TAP block was found to decrease the requirement for morphine.

In 2013, Abdallah et al. performed a different meta-analysis that compared the effects of two TAP block techniques on the length of time that patients felt pain alleviation following lower abdominal surgery incision 7. Four studies used a posterior TAP approach and eight used a lateral technique; a total of six hundred forty-one participants were included in the analysis from these twelve randomized trials. A considerably decreased morphine demand of 9.1 mg ($P<0.02$) and 5 mg ($P<0.03$), respectively, was seen between 12 to 24 hours and 24 to 48 hours following surgery when the posterior route was analyzed. At24,36, and 48 hours post-op, the posterior TAP block significantly reduced pain ratings both at rest and when moving. No significant differences were linked with the lateral TAP.

A meta-analysis evaluating the analgesic effects of TAP blocks following laparoscopic surgery was published for the seventh time by De Oliviera et al. 8. Ten randomized trials including 633 individuals were included. Results showed that TAP block reduced resting pain by 2.41% and 1.33% in the first four hours after surgery, and by 1.33% in the day following. Weighted mean -5.74 mg morphine equivalents, TAP also decreased the demand for intravenous morphine. Additionally, compared to blocks placed after surgery, TAP blocks given before surgery were more successful in reducing postoperative pain and morphine usage. No adverse effects from local anesthesia were noted.

For postoperative analgesia following laparoscopic surgery, Zhao et al. 9 reported the eighth meta-analysis evaluating TAP block. This study includes 14 studies with 905 patients in total. Less analgesic intake at 24 hours postoperatively (mean difference = -25.46, $p<0.00001$) and fewer patients requiring analgesic postoperatively ($p=0.03$) were the results of TAP block. A substantial difference in pain scores was seen at 2 hours (mean difference = -1.55, $P<0.00001$) due to the TAP block's ability to diminish pain. At 6 hours, there was a slight difference between the control group and the active TAP block (mean difference = -1.13, $P=0.05$). 24-hour pain scores were unaffected by TAP block. More cases of postoperative nausea and vomiting were observed in patients with TAP block (odds ratio 2.04, $P=0.34$). The study's authors came to the following conclusions: TAP decreased the need for 24-hour analgesics, had no impact on early pain, and could raise the likelihood of postoperative vomiting and nausea.

Comparing TAP block with local wound infiltration analgesia in patients having lower abdominal surgery was the subject of the 9th meta-analysis published in December 2014 by Yu et al. 10. This meta-analysis drew from four randomized trials, including one with 100 patients receiving local infiltration analgesia and another with 96 patients receiving a TAP block. At 24 hours post-op, the TAP block showed a decrease in pain compared to local infiltration analgesia (-0.67, -0.89, $p<0.01$, respectively), and pain levels were lower when at rest and while moving. No significant differences were seen between the TAP and local infiltration analgesia groups in terms of postoperative 24-hour morphine demand, incidence of postoperative nausea and vomiting, or pain assessed by the visual analogue scale score at 2 and 4 hours.

An update and synthesis of the existing evidence was published by Ripollés et al. in early 2015, which supports the positive benefits of TAP block 11. Prospective randomized trials published in English or Spanish between 2007 and 2013 and having a Jadad score greater than 1 formed the basis of the study. Researchers compared ultrasound-guided blocks to other analgesic methods in studies involving adults. The study encompassed a total of twenty-eight randomized clinical studies. The designs of the studies varied greatly. Various TAP procedures, local anesthetic concentrations and volumes, and comparators were employed in the research. Although the majority of research compared TAP blocks to placebo, several also compared them to epidural analgesia, local infiltration, and ileoinguinal-ileohipogastric blocks. Pain at rest or while moving and opioid intake were the outcomes that were examined. The findings were not fully consistent, while the majority of research did find some positive impacts. The authors did, however, come to the conclusion that TAP block is a

useful method for lowering opioid consumption in the postoperative period after bariatric, colorectal, cholecystectomy, hysterectomy, appendectomy, donor nephrectomy, retropubic prostatectomy, and caesarean sections. The data from the available randomised clinical studies was not deemed completely conclusive, and they did notice clear gaps. In order to find answers to the current questions and evaluate the impact of TAP-block effects in everyday clinical practice, the authors propose new randomized clinical trials that are well-designed and have sufficient statistical power to compare various approaches, medications, dosages, and volumes for the same intervention.

In the past ten years, the transverse abdominal plane block has gained a lot of attention. Given the lack of reported serious adverse effects, TAP block appears to be a safe approach. Although the block reduces the need for opioids, it has mixed results when it comes to preventing or alleviating opioid-related adverse effects, postoperative nausea and vomiting, and bowel dysfunction. When compared to local infiltration analgesia and a single-shot spinal anaesthetic with intrathecal morphine, the effects on early postoperative pain and opioid consumption 24-48 hours after surgery appear to be comparable.

Patient- and surgery-related considerations, alternatives, and the technique to be used are all evident considerations prior to routinely implementing TAP blocks in clinical practice. The TAP block has recently gained interest as a component of multimodal postoperative pain management, thanks in part to the introduction of the ultrasound-guided block technique, and its relative technical simplicity is another reason for its appeal. Although the TAP block is now easier to conduct with the use of ultrasound, there is currently insufficient evidence to prove that ultrasound-guided procedures are more effective. In-plane needle guidance and high-frequency linear ultrasonography are the tools of choice for the ultrasound-guided bilateral TAP block 12. The TAP block is an opioid-sparing analgesic that works. Two drawbacks are that it doesn't work for visceral discomfort and that a bilateral block is required for midline incisions. The method and anatomy of the patient determine the block's effectiveness. The impact of TAP block was investigated in healthy volunteers by Støving et al. Objective sensory block and effect duration were found to vary greatly between individuals. Injecting local anaesthetic solutions into the transverse abdominis plane without making any particular reference to the nerves that innervate the abdominal wall is how the TAP block, a volume block, is performed. Under these circumstances, it should come as no surprise that the technique and volume used determine the TAP block's quality. Based on the surgical incision, a more targeted approach is taken by using blocks that target the implicated abdominal innervation. These blocks can be ilioinguinal, iliohypogastric, or intercostal blocks, either alone or in combination. It has been consistently found that the TAP block is associated with early reduced opioid intake. There is a dose effect and these effects seem to be more noticeable in transverse incisions when the block is given before surgery. Elective cholecystectomy with a preoperative TAP block was found to be cost-effective since it reduced the requirement for desflurane, according to Kokulu et al. 15. Surprisingly, there is still considerable debate over whether or not TAP reduces postoperative nausea and vomiting. considerable meta-analyses found no benefit, while others found that the TAP groups may actually experience more nausea and vomiting.

Additional research is needed to determine the aftermath. Adding TAP blocks to an enhanced recovery route allowed shorter length of hospital stay with lower readmission and reoperation rates, when compared to previously published series. Keller et al. found this after evaluating 200 consecutive patients who received a laparoscopic colon resection. The proposed TAP blocks have the potential to be a practical and economical way to enhance the outcomes of laparoscopic colorectal surgery 16. According to Favuzza et al. (17), there were also favorable encounters. Both investigations contrasted a TAP block done at the conclusion of surgery while the laparoscope was still in situ; this allowed the surgeon to view the structures' muscle layers from the "inside," a procedure that could not have been accomplished with ultrasonic technology. Surgeons insert needles through skin at mid-axillary, around half way between iliac crest and costal border, to execute blocks from the outside. Under laparoscopic guidance, 30 ml of 2.5 mg/ml bupivacaine was injected at the site for the transversus abdominis muscle using the typical two pops approach, which involves passing two fascia borders. The lack of randomization and blinding in these research should be noted.

How long a local anesthetic lasts is directly proportional to the length of its analgesic effects. When dexamethasone is administered to local anesthesia, the duration of the analgesic effects is prolonged (18). Additionally, liposomal bupivacaine had good effects: compared to non-liposomal bupivacaine, the group that received liposomal bupivacaine had a far lower total opioid consumption in the first 72 hours after injection. At all time points examined, patients in the liposomal bupivacaine group reported substantially less maximum pain and a lower incidence of nausea and vomiting. In the liposomal bupivacaine group, there was a general trend toward shorter hospital stays. For pain treatment following laparoscopic cholecystectomy, the combination of bupivacaine and sufentanil did not outperform bupivacaine alone, either in terms of duration or effectiveness.

While there have been a number of meta-analyses examining TAP block's impacts recently, further research is needed to determine exactly where TAP block is most effective. Developing new, well-designed randomized clinical trials with sufficient statistical power to compare different approaches, drugs, doses, and volumes for the same intervention is necessary to answer the current questions and monitor their effects in routine clinical practice. This is in response to the last meta-analysis by Ripollés et al., which found that the data found in randomized clinical trials are not conclusive. As part of a multimodal analgesic strategy, the TAP block decreased morphine consumption in the first 48 hours and improved quality of recovery in the long run, as measured by the postoperative quality of recovery scale (21), among other metrics. This was in comparison to local wound infiltration analgesia and spinal/intrathecal analgesia (IT morphine). Research contrasting the TAP block with paravertebral block also seems like it might be useful. After open radical retropubic prostatectomy, the paravertebral block effectively managed discomfort, according to Chelly et al. 22. The use of the TAP block in the perioperative treatment of children should also be further investigated.

Conclusion

To sum up, TAP block is an intriguing and safe option for postoperative analgesia and can be administered intraoperatively or via ultrasound guidance. It reduces the need for morphine analgesia in the first two days after abdominal surgeries. Preoperative administration of a TAP block decreases the need for both intraoperative anaesthesia and opioids after surgery. However, additional high-quality studies are needed to compare intrathecal morphine and local infiltration analgesia over a longer period of time, as well as to evaluate the effects of TAP block as a component of multimodal analgesia. Studies should also be conducted with a focus on certain procedures.

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