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TAP BLOCK – A NEW TREND IN POSTOPERATIVE ANALGESIA AFTER MAJOR ABDOMINAL SURGERY?

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The transversus abdominis plane (TAP) is a peripheral nerve block and it is a relative recently described approach to providing analgesia to the anterior abdominal wall. This kind of anesthetic procedure is performed either before or after the surgical act, before or after general anesthesia. The technique itself blocks the abdominal wall neural afferents by introducing local anesthetic into the neurofascial plane between the internal oblique and transversus abdominis muscles. The main goal of this technique is to reduce the amount of opioid medication used in postoperative analgesia, and, maybe more important, to reduce the side effects of this medication, which includes sedation, nausea and vomiting. This article reviews the current literature regarding the patient selection, medication and dosage used for this procedure, side effects, the surgical pathology that can be used for and, last but not least, how can this procedure can increase the immediate postsurgical quality of life.

Keywords: TAP, anesthesia, block

INTRODUCTION

The transversus abdominis plane (TAP) block is a regional anesthesia technique that provides analgesia for the anterior and lateral abdominal wall (skin, muscles and parietal peritoneum)[1]. It was first described almost fifteen years ago and it has undergone several modifications which have accentuated its utility for lots of surgical procedures[2]. Despite a relatively low risk of complications and a high success rate using modern techniques TAP block remains underutilized[3]. The block is relatively easy to perform, but the fact that it is not very popular among anesthesiologists and the lack of experience of some of them makes it hard to apply in the clinical practice[4].

TAP block was first described by Rafi *et all* (2001) and McDonnell *et all* (2004)[5]. They described an anatomical landmark technique and provide evidence of blockade to the anterior and lateral abdominal wall with a targeted single shot of anesthetic delivered in the lumbar triangle of Petit which represented a major advance from earlier strategies that required ultiple injections[6]. The first one primarily identified the lumber triangle of Petit, an anatomical area marked by external oblique and latissimus dorsi muscles and by the iliac crest. Then he inserted a 24-Gauge 2-inch needle perpendicular to the skin until a confirmatory "pop" was appreciated, sensations which was thought to indicate the proper needle depth for anesthetic delivery[4]. Three years later, in 2004, McDonnell *et all* presented their work on cadavers and healthy volunteers regarding TAP block at the meeting of the American Society of the Anesthesiologists and they demonstrated sensory loss following delivery of local anesthetic to the TAP via the triangle of Petit. The study was completed and published in 2007 and demonstrated the TAP block analgesic utility in patients undergoing open retropubic prostatectomy[3].

The ultrasound-guided approach to the TAP block was first described in 2007 by Hebbard *et all*[7] with promises of better localization and deposition of the local anesthetic and nowadays this technique is widely spread among anesthesiologists.

MATERIAL AND METHODS

The anterolateral abdominal wall is innervated by the anterior rami of T7-L1 and is composed from the outside in of three muscle layers: external oblique (EO), internal oblique (IO) and transversus abdominis (TA). The anterior rami form nerves that pierce the TA and lie in the plane between the IO and the TA. They also give out

lateral cutaneous branches which travel through the IO and EO to supply the lateral abdominal wall. After giving off the lateral branch, the nerves finally reach the rectus abdominis, which they perforate to supply the skin of the anterior abdomen (Figure 1)[9-11]. The TAP block can be done either preoperative or postoperative, but because the abdominal wall is intact preoperatively is preferred to be done before the surgery. The procedure must be done under extreme aseptic technique due to the risk of peritoneum penetration[10]. The patient is positioned supine in both techniques.

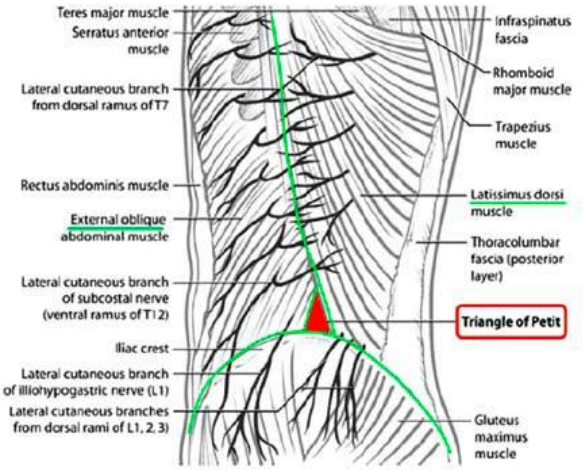

Figure 1 Landmarks for Triangle of Petit and innervations of the anterolateral abdominal wall

1. Blind TAP

The point of entry for the blind TAP is the lumber triangle of Petit. The needle is inserted cephalad to the iliac crest and advanced until two distinct "pops" are felt as the needle transverses the external oblique and internal oblique muscles. To make the loss of resistance more appreciable it is recommended to use a blunt needle 4, 12.

2. Ultrasound-guided TAP

The ultrasound probe is placed midway between the costal margin and the iliac crest to image in the transverse plane. The muscle layers are identified on the ultrasound image (Figure 2)[13]. The needle is gradually passed through the skin, subcutaneous tissue, EO and IO, until it lies between the IO and TA – this is where the local anesthetic should be injected (Figure 3)[9, 10, 12-13].

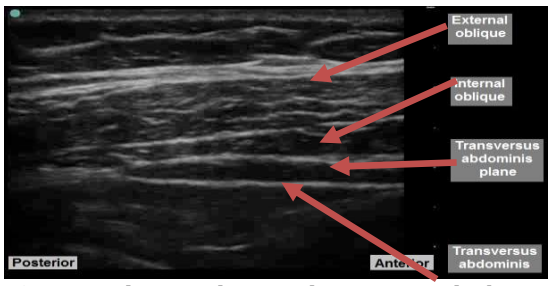

Figure 2 Ultrasound image during TAP Block

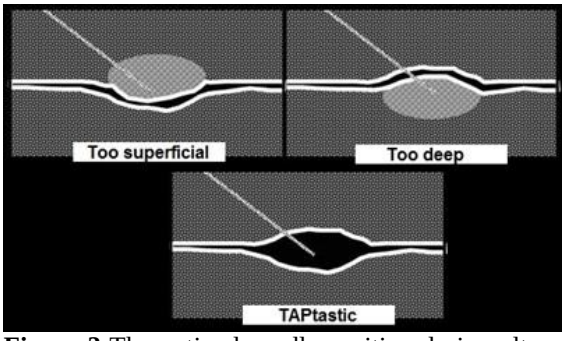

Figure 3 The optimal needle position during ultrasound-guided TAP block

TAP block is useful for any lower abdominal surgery including open or laparoscopic appendectomy, hernia repair, caesarean section, abdominal hysterectomy and open prostatectomy. Newer studies shows the efficacy of TAP block in laparoscopic surgery, laparoscopic cholecistectomy, colorectal surgery, major abdominal surgery, renal transplant surgery, abdominoplasty with/without flank liposuction[14-22]. Most of these trials show the efficacy of TAP block by reducing postoperative opioid requirement, lowering pain scores and reducing opioid-related side effects. TAP block is a safe technique with no reported complications using the ultrasound-guided technique. A few complications have been reported with blind TAP block, the most significant of which was a case report of intrahepatic injection[13,23]. Other complications and the contraindications of TAP block are shown in table 1[12-13].

COMPLICATIONS	CONTRAINDICATIONS	
Failure	Absolute	Patient refusal
Local anesthetic toxicity		Allergy to local anesthetic
Intraperitoneal injection		Localised infection over injection point
Bowel injury		
Hepatic injury	Relative	Coagulopathy
		Surgery at injection site

Table 1 The first column shows the complications that may occur during TAP block and in the second one we have the contraindications of TAP block

This article reviews the current literature regarding the benefits and the quality of life improvements of the TAP block procedure in patients undergoing major abdominal surgery. To identify trials for this review, a detailed systematic search using the Cochrane Library and Anesthesia & Analgesia Journal was performed. We used the following search terms for our research: TAP block, major abdominal surgery, analgesia and pain.

RESULTS AND DISCUSSIONS

TAP block is a new technique of analgesia and it has been described as a useful part of multimodal postoperative analgesia for lots of surgical procedures as detailed before. This article reviews the current literature to find out if this new trend has real benefits and should be considered at every major abdominal surgery as a part of multimodal analgesia or it shouldn't.

McDonnell *et all* randomized 32 adults undergoing large bowel resection via a midline abdominal incision to standard treatment (n=16), including morphine PCA, regular NSAIDs and acetaminophen, and TAP block performed just after induction of anesthesia. All patients received morphine 0.15mg/kg, rectal diclofenac 1mg/kg to a maximum of 100mg and acetaminophen 1g just before surgical incision. The presence and severity of pain, nausea and sedation were assessed periodically by an investigator blinded to group allocation. Pain severity was measured using a visual analog scale (VAS) and a categorical pain scoring system. They considered 60mg of morphine for postoperative analgesia and the analyses was based on this quantity. Patients in the TAP group had a lower VAS scores at rest and on movement over the first 24 hours, a longer time in first request for morphine and a reduced postoperative morphine consumption (control vs. TAP) at 4h (29.9±2.5 mg vs. 5.8±1.3 mg), 6h (40.4±3.1 mg vs. 7.8±1.6 mg) and 24h (80.44±4.8 mg vs. 21.94±2.2 mg)[24].

In another study, McDonnell *et all* randomized, in a controlled, double-blind clinical trial, fifty females undergoing elective total abdominal hysterectomy via a transverse lower abdominal wall incision. He formed two groups: TAP group (n=24) – TAP block with 1.5 mg/kg ropivacaine 0.75% (to a maximal dose of 150 mg) per side and the control group (n=26) – TAP block with saline 0.9%, procedures which were performed bilaterally just before the surgical incision. Patients ware randomly allocated to one of these two groups. All patients received IV morphine 0.15 mg/kg, rectal diclofenac 100 mg and acetaminophen 1 g just before the surgical incision. After the surgical procedure, patients were transferred to the postanesthesia care unit (PACU) where they received a standard postoperative analgesic regimen (rectal acetaminophen 1g every 6 hours, rectal diclofenac 100mg every 16 hours and IV PCA morphine). Patients undergoing TAP block had reduced 48-h morphine requirements and a longer time to first PCA morphine request compared to the control group. Morphine consumption (TAP block vs. Control) at 12 h intervals was also significantly lower at 12 h (14±9.2 mg vs. 29.8±12.7 mg), 36 h (3.3±5.3 mg vs. 8.3 ±5.6 mg) and 48 h (2.8±7.7 mg vs. 7.3±6.6 mg). Postoperative VAS pain scores at rest were also reduced in the TAP group compared with control at PACU (3 vs. 4.5), at 6 h (2 vs. 4), 24 h (1 vs. 3) and 48 h (0 vs. 2) [25]. Charlton S. et all reviewed 236 patients from five studies examining the effects of TAP block on pain relief after abdominal surgery[20]. They observed a significantly reduced requirement for morphine at 24 hours postoperatively in TAP group compared with no TAP or TAP placebo groups. TAP block also prolonged the time until first request for additional analgesia and pain scores was also lower in this group[20]. Although there was reduced morphine consumption, TAP blocks did not appear to reduce the incidence of the postoperative nausea and vomiting (PONV).

A number of new clinical studies utilizing TAP blocks have recently been published. Bharti et all randomized 40 patients undergoing colorectal surgery[18]. TAP block was performed at the end of surgery and patients were randomly assigned to receive either 20 ml of 0.25% bupivacaine (TAP group) or normal saline (control group) on each side of the abdominal wall. They observed a significant decrease in the 24-hour morphine consumption in the TAP group compared with control (6.45±3.26 mg vs. 17.55±5.78 mg, $p<0.0001$) as well as lower pain scores at rest and when coughing. Although the incidence of PONV was not statistically different between groups, the severity of nausea and vomiting was worse in the control group ($p<0.05$), 6 patients requiring antiemetic medication[18].

Gildasio S. de Oliveira Jr. *et all* analyzed ten randomized clinical trials to evaluate the effects of TAP block compared with an inactive group (placebo or "no treatment") on postoperative pain outcomes in laparoscopic surgery[21]. They analyzed postoperative pain at rest and on movement and postoperative opioid consumption (up to 24 hours). These ten clinical trials included 633 patients (346 patients receiving TAP block and 287 patients on control group) who suffered laparoscopic surgeries (gastric bypass, bariatric surgery, colorectal surgery, cholecystectomy, hysterectomy and nephrectomy). The first thing analyzed was early (0-4 hours) pain at rest in 6 studies and early pain on movement in 4 studies. For the first (rest group) subgroup analysis revealed a greater effect on early pain at rest when TAP block was performed preoperatively, compared with postoperatively. The others 4 studies evaluating the effect of TAP block on early pain on movement compared with control did not show a significant benefit. For the late pain (24 hours) at movement, Gildasio S. de Oliveira Jr. *et all* did not find a significant effect of TAP block compared with control groups. Postoperative opioid consumption (up to 24 hours) was also significantly reduced. After their meta-analysis, Gildasio S. de Oliveira Jr. *et all* concluded that TAP block has a significant effect in reduction postoperative pain (early and late pain at rest) and opioid consumption for laparoscopic surgical procedures, which suggests that this technique may be an effective strategy to improve analgesic outcomes. Another important finding of their investigations was that administration of TAP block preoperatively has more benefits than the postoperative one. They also detected a relationship between the local anesthetic dose and the effect on some outcomes – higher doses of local anesthetic did not lower

early postoperative pain but it has greater opioid-sparing effects and lower pain scores at 24 hours[21].

CONCLUSIONS

TAP block is a new technique that improves analgesia and may be an effective tool of multimodal postoperative analgesia after abdominal surgery. Lots of clinical trials have demonstrated its superiority over standard protocols regarding postoperative pain control. TAP block reduces significantly the consumption of opioid in the first 24-h and increases patient's satisfaction after abdominal surgery.

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REFERENCES

1. Charlton S., Cyna A. M., Middleton P., Griffiths J. D., "Perioperative transversus abdominis plane (TAP) blocks for analgesia after abdominal surgery", Cochrane Database of Systematic Reviews, 8, 2010.
2. Rafi A. N., "Abdominal field block: a new approach via the lumbar triangle," Anaesthesia, 2001, 56, 1024–1026.
3. Kearns R. J., Young S. J., "Transversus abdominis plane blocks; a national survey of techniques used by UK obstetric anaesthetists," International Journal of Obstetric Anesthesia, 2011, 20, 103–104.
4. Young M. J., Gorlin A., Modest V. E., Quraishi S. A., "Clinical implications of the transversus abdominis plane block in adults", Anesthesiology Research and Practice, 2012.
5. McDonnell J. G., O'Donnell B. D., Tuite D., Farrell T., Power C., "The regional abdominal field infiltration technique computerised tomographic and anatomical identification of a novel approach to the transversus abdominis neuro-vascular fascial plane", Anaesthesiology, 2004, 101: A899.
6 Atkinson R. S., Rushman G. B., Lee J. A. ,"A Synopsis of Anaesthesia", Wright, Bristol, UK, 10th edition, 1987, 637-40.
7 Hebbard P., Fujiwara Y., Shibata Y., Royse C., "Ultrasound guided transversus abdominis plane block", Anaesthesia & Intensive Care, 2007, 35(4), 616-617.
8 Yarwood J., Berrill A., "Nerve blocks of the anterior abdominal wall", BJA Education, 2010, 10 (6), 182-186.
9. Allman K. G., Wilson I. H., "Oxford handbook of Anaesthesia", 2011, 1155-1156.
10 Kaye A. D., Urman R. D., Vadivelu N., "Essentials of Regional Anesthesia", 2012, 448-452.
11 Cruc M., Gentile A., Fritsch N., Tran-Van D., Benois A., Fontaine B., "Plaidoyer pour l'utilisation du TAP Block échoguidé en opération extérieure", Reanoxyo, 2010, 26 (2): 40-42.
12 Mukhtar K., "Transversus abdominis plane (TAP) block", The journal of New York school of regional anesthesia (www.nysora.com), 2009, 12, 28-33.
13 Townsley P., French J., "Transversus abdominis plane block", Anaesthesia tutorial of the week 239 (www.totw.anaesthesiologists.org), 2011, 1-12.
14 Sooyoung Cho, Youn-Jin Kim, Dong-Yeon Kim, Soon-Sup Chung, "Postoperative analgesic effects of ultrasound-guided transversus abdominis plane block for open appendectomy", J Korean Surg Soc., 2013, 85(3): 128–133.
15 Abdallah F. W., Halpern S. H., Margarido C. B., "Transversus abdominis plane block for postoperative analgesia after Caesarean delivery performed under spinal anaesthesia? A systematic review and meta-analysis", Br. J. Anaesth, 2012, 109 (5): 679-687.
16 Bhattacharjee S., Ray M., Ghose T., Maitra S., Layek A., "Analgesic efficacy of transversus abdominis plane block in providing effective perioperative analgesia in patients undergoing total abdominal hysterectomy: A randomized controlled trial", J Anaesthesiol Clin Pharmacol, 2014, 30(3): 391–396.
17 Chetwood A., Agrawal S., Hrouda D., Doyle P., "Laparoscopic assisted transversus abdominis plane block: a novel insertion technique during laparoscopic nephrectomy", Anaesthesia, 2011, 66(4), 317–318.
18. Bharti N., Kumar P., Bala I., Gupta V., "The efficacy of a novel approach to transversus abdominis plane block for postoperative analgesia after colorectal surgery," Anesthesia and Analgesia,2011, 112(6), 1504–1508.
19. Araco A., Pooney J., Araco F., Gravante G., "Transversus abdominis plane block reduces the analgesic requirements after abdominoplasty with flank liposuction," Annals of Plastic Surgery, 2010, 65(4), 385–388.
20. Charlton S., Cyna A. M., Middleton P., Griffiths J. D., "Perioperative transversus abdominis plane (TAP) blocks for analgesia after abdominal surgery (Review)", article in Cochrane Database of systematic reviews (online), 2010, 1-59.
21 De Oliveira G. S. Jr., Castro-Alves L. J., Nader A., Kendall M. C., McCarthy R. J., "Transversus abdominis plane block to ameliorate postoperative pain outcomes after laparoscopic surgery: a meta-analysis of randomized controlled trials", Anesthesia & Analgesia, 2014; 118, 454–463.
22 Petersen P. L., Stjernholm P., Kristiansen V. B., Torup H., Hansen E. G., Mitchell A. U., Moeller A., Rosenberg J., Dahl J. B., Mathiesen O., "The beneficial effect of transversus abdominis plane block after laparoscopic cholecystectomy in day-case surgery: a randomized clinical trial", Anesthesia & Analgesia, 2012, 115, 527–533.
23 O'Donnell BD, Mannion S., "A case of liver trauma with a blunt regional anesthesia needle while performing transversus abdominis plane block", Reg Anesth Pain Med., 2009, 34(1), 75-76.
24 McDonnell J. G., O'Donnell B., Curley G., Heffernan A., Power C., Laffey J. G., "The analgesic efficacy of transversus abdominis plane block after abdominal surgery: a prospective randomized controlled trial", Anesthesia & Analgesia, 2007, 104, 193-197.
25 Carney J., McDonnell J. G., Ochana A., Bhinder R., Laffey J. G., "The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy", Anesthesia & Analgesia, 2008, 107, 2056 –2060.