



Case series

Ultrasound guided transversus abdominis plane (TAP) block utilization in multimodal pain management after open gynecologic surgery

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ABSTRACT

Transversus abdominis plane (TAP) block is a peripheral nerve block directed at the nerves in the anterior abdominal wall. We sought to determine whether TAP block reduces post-operative narcotic use or length of stay after open gynecologic surgery. Among 98 women who underwent an open hysterectomy between July 2016 – July 2017 by a gynecologic oncologist, 73 (74.5%) received a TAP block. The majority of patients who received a TAP block had a vertical incision (86.3%) while the majority of patients who did not receive TAP block had a transverse incision (64%). More patients in the TAP block group underwent cancer debulking compared to the no TAP block group (65.7% versus 8%). The two groups did not differ in post-operative pain scores on day 1, 2, or 3, cumulative narcotic use by post-operative day 3, length of stay, or ileus. We found TAP block after vertical skin incision results in comparable pain scores, narcotic use, and length of stay compared to patients undergoing transverse incisions without TAP block.

1. Introduction

Surgical outcomes are generally improved when pain control is optimized in the postoperative setting (Kehlet and Holte, 2001). After laparotomy, the traditional modality for pain control remains narcotics. Unfortunately, narcotics are associated with side effects including nausea and delayed recovery of bowel function. Multimodal approaches to postoperative pain management are often utilized to attempt to avoid these side effects, including the incorporation of epidurals and spinal anesthetics. Recently, the utilization of the transversus abdominis plane (TAP) block has been on the rise. TAP block is a peripheral nerve block designed to anesthetize the afferent nerves supplying the anterior abdominal wall from T6 to L1 (Johns et al., 2012). By incorporating TAP block in post-operative management, it may be possible to decrease narcotic use while also avoiding some of the potential side effects of neuraxial anesthesia such as respiratory depression and risk of spinal hematoma.

TAP block has been studied in comparison to, and in addition to, a variety of pain management strategies in patients undergoing hysterectomy (Atim et al., 2011; Carney et al., 2008; Griffiths et al., 2010). Results from these trials show variable outcomes, with some studies showing no difference in post-operative pain scores at two and 24 h (Griffiths et al., 2010; Ghisi et al., 2016), while others show a significantly decreased use of opioids at 24 and 48 h post-operatively after

abdominal surgery (Johns et al., 2012; Carney et al., 2008; Bhattacharjee et al., 2014). Meta-analyses regarding pain control after a variety of surgeries have also shown TAP block to be an effective post-operative pain management strategy, with decreased morphine consumption (Ma et al., 2017). Additionally, within the colorectal literature there are also mixed conclusions regarding return of gut function (Ris et al., 2014; Smith et al., 2015; Pedrazzani et al., 2016). Several studies suggest that narcotic use is reduced and time to return of gut function is improved with the use of TAP block (Ris et al., 2014; Hain et al., 2018; Liu et al., 2018).

Whether these findings can be generalized to the gynecologic oncology population remains uncertain, as there is a paucity of literature in this area. We hypothesized that patients who receive multimodal anesthesia with patient controlled anesthesia devices and TAP blocks experience improved pain resulting in decreased intravenous and oral narcotic use, decreased length of stay, and improvement of bowel function as compared to traditional post-operative pain management with patient controlled analgesic devices in patients who undergo open gynecologic surgery involving a hysterectomy.

2. Methods

This study was an IRB approved retrospective review conducted at a single institution from July 2016 – July 2017. Any patient who

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underwent an open hysterectomy with a gynecologist oncologist in this time period was included in the study. All TAP blocks were given in the post-operative period. Patients were excluded if we were unable to obtain post-operative pain scores through chart review. Clinical information was collected from the electronic medical record including patient demographic data, type of surgery, baseline narcotic or muscle relaxant use, type of incision, post-operative pain regimen, mean post-operative pain scores on post-operative days 1, 2, and 3, cumulative narcotic use (converted to oral morphine equivalent in milligrams) on post-operative days 1, 2, and 3, post-operative ileus, and total length of stay. Pain scores were averaged over the course of a 24-h period for each day, with verbal pain scores assessed per nursing protocol using a 10-point scale. Total narcotic use was similarly tallied over the course of each 24-h period and converted into oral morphine equivalents to allow for comparison among patients. Outcomes were then compared between patients with and without TAP block. Statistical analyses were performed using Chi-square, Mann-Whitney U, and univariate regression.

3. Results

98 patients who underwent open hysterectomy with a gynecologic oncologist were identified. 73 (74.5%) patients received a TAP-block post-operatively, while 25 patients did not. Patient characteristics are described in Table 1. There were no differences between the two groups in race, median age, history of prior abdominal surgery, prior narcotic or muscle relaxant use, depression, or BMI. However, the two groups differed significantly in surgical characteristics. In comparing the groups receiving TAP block versus no TAP block, the majority with TAP block had vertical incisions (86.3% versus 36%, $p < .001$) and underwent debulking surgery (65.7% versus 8%, $p < .001$).

Table 2 demonstrates that there was no difference in post-operative pain scores on day 1, 2, or 3 between the two groups. There was no significant difference in post-operative ileus in the two groups (8% vs 26%, $p = .06$). There was no difference in total length of stay between the two groups ($p = .12$).

Table 3 shows no difference in cumulative narcotic use on post-operative days 1 and 3 between the two groups. There was a significant difference in total narcotic use on post-operative day 2. Patients who received TAP block used a median of 170 mg of morphine equivalents, while patients who did not receive TAP block used a median of 127.5 mg of oral morphine equivalent ($p = .045$).

Our data were not different when analyzing by incision type. When limiting the analysis to patients who underwent vertical skin incisions, there were no differences in pain scores between the two groups. Similar to the overall cohort, there was a higher total narcotic used on

Table 1
Characteristics of patients undergoing open gynecologic surgery. N = number of patients in each cohort.

	TAP Block N = 73 (%)	No TAP Block N = 25 (%)	P value
Race			
African American	9 (12.3%)	4 (16%)	
Asian	11 (15.1%)	3 (12%)	
Caucasian	44 (60.3%)	17 (68%)	
Hispanic	8 (10.9%)	1 (4%)	
Other	1 (1.4%)	0 (0%)	
Median Age	63 (33–89)	63 (35–89)	0.66
History of prior abdominal surgery	39 (53.4%)	15 (60%)	0.57
History of prior narcotic use	9 (12.3%)	2 (8%)	0.55
History of depression	14 (19.2%)	3 (12%)	0.41
Median BMI	23.4 (17–40.3)	25.1 (18.9–35.45)	0.33
Vertical incision	63 (86.3%)	9 (36%)	< 0.001
Transverse Incision	10 (13.7%)	16 (64%)	< 0.001
Debulking surgery	48 (65.7%)	2 (8%)	< 0.001

Table 2
Median post-operative pain scores, length of stay in days, and post-operative ileus in patients undergoing open gynecologic surgery.

	TAP Block	No TAP Block	P Value
POD1 Median Pain Score	4	4.6	0.84
POD2 Median Pain Score	4	3.8	0.51
POD3 Median Pain Score	3.8	3.5	0.53
Length of Stay	4 (2–65)	4 (2–28)	0.12
Ileus	19 (26%)	2 (8%)	0.06

Table 3
Median cumulative narcotic use in patients undergoing open gynecologic surgery.

	TAP Block	No TAP Block	P Value
POD1 Median Narcotic Use	106 mg	86 mg	0.12
POD2 Median Narcotic Use	170 mg	127.5 mg	0.045
POD3 Median Narcotic Use	327.75 mg	300 mg	0.51

postoperative day 2 among the TAP block cohort. These groups were imbalanced with 48 patients undergoing ovarian cancer debulking surgery among the group receiving TAP block compared to only 1 patient among the group receiving no TAP block. When limiting the analysis to patients who underwent transverse skin incisions, there were no differences in pain scores or cumulative narcotic use. Of the patients who underwent transverse incisions and TAP block, surgeries included 2 ovarian cancer debulking, 1 hysterectomy for uterine cancer, 1 cesarean hysterectomy and 6 benign hysterectomies. In the group undergoing transverse incisions and no TAP block, surgeries included 2 radical hysterectomies with lymph node dissection, 3 hysterectomies for uterine cancer, 1 ovarian cancer debulking, 2 cesarean hysterectomies and 8 benign hysterectomies.

4. Discussion

In this cohort of patients who underwent open hysterectomy, there was no significant difference in postoperative pain scores or length of stay with the use of post-operative TAP block. However, this was an observational study and the groups were imbalanced in terms incision type, with a significantly lower number of patients in the TAP block group receiving transverse incisions than in patients who did not receive TAP block. Our providers preferentially use TAP block in patients who undergo open surgery with a vertical skin incision. Vertical incisions are often used for larger surgeries involving more extensive dissection and may indicate a higher complexity of surgery, as a significantly higher percentage of these patients underwent ovarian cancer debulking surgery. This could translate into anticipated higher pain scores and longer length of stay compared to surgeries performed with transverse incisions. These findings suggest that TAP block may provide a benefit in patients undergoing gynecologic surgery with a vertical skin incision, as their pain scores and length of stay are comparable to that of patients who undergo transverse skin incisions.

We found a significant difference between cumulative narcotic use on post-operative day 2 between the two groups, with the TAP block group using a higher total dose of morphine equivalents. TAP block involves the administration of bupivacaine, which has a half-life of 3 to 8 h; as the analgesic wears off, more narcotic medications are likely required to achieve the same level of pain relief. This effect appears to be overcome by post-operative day 3, as evidenced by no difference in the cumulative narcotic amount and pain scores.

Interestingly, there was no significant difference in post-operative ileus between the two groups. The TAP block group had a significantly higher proportion of patients undergoing cancer debulking surgery, which often involves bowel manipulation and surgery. We did not

control for bowel surgery in our analysis, however it is reasonable to expect that ileus would be more likely to occur in this situation.

Our current practice is to use plain bupivacaine hydrochloride in TAP block. Studies have also evaluated utilization of liposomal bupivacaine in the setting of post-operative pain management. Liposomal bupivacaine consists of microscopic vesicles with a lipid soluble lining and an aqueous core containing encapsulated bupivacaine, which allows it to be released slowly over a period of 72–96 h (Kalogera et al., 2016). When compared to bupivacaine hydrochloride, liposomal bupivacaine significantly decreased opioid use in the gynecologic population when used as local infiltration in abdominal incisions (Kalogera et al., 2016). The cost of liposomal bupivacaine is currently 100 fold higher than bupivacaine hydrochloride and thus has not been as widely used. However, the incorporation of this drug in TAP block has been shown to decrease pain scores over bupivacaine hydrochloride in the urologic literature and is worthwhile to consider in the future for gynecologic surgery (Hutchins et al., 2016).

Overall, these findings suggest that TAP block may be an effective component of a multimodal approach to pain management in the post-operative period in patients undergoing open gynecologic surgery, particularly in those undergoing vertical skin incisions and cancer debulking surgery. In the era of enhanced recovery pathways and the current opioid crisis, alternative strategies for pain control are a crucial component of future research. More investigation into the utility of TAP block in the gynecologic oncology population is indicated.

Conflict of interest statement

The authors of this manuscript certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Author contribution

Study conception and design: Chang, Walsh
 Acquisition of data: Chang, Cass, Li, Karlan, Rimel, Walsh
 Analysis and Interpretation of Data: Chang, Walsh
 Drafting of manuscript: Chang, Walsh
 Critical Revision: Chang, Cass, Li, Karlan, Rimel, Walsh

References

Atim, A., Bilgin, F., Kilickaya, O., Purtuloglu, T., Alanbay, I., Orhan, M.E., Kurt, E., 2011.

- The efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing hysterectomy. *Anaesth Intensive Care* 39 (4), 630–634.
- Bhattacharjee, S., Ray, M., Ghose, T., Maitra, S., Layek, A., 2014 Jul. Analgesic efficacy of transversus abdominis plane block in providing effective perioperative analgesia in patients undergoing total abdominal hysterectomy. *J. Anaesthesiol. Clin. Pharmacol.* 30 (3), 391–396.
- Carney, J., McDonnell, J.G., Ochana, A., Bhinder, R., Laffey, J.G., 2008. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. *Anesth Analg* 107 (6), 2056–2060.
- Ghisi, D., Fanelli, A., Vianello, F., Gardini, M., Mensi, G., La Colla, L., Danielli, G., 2016 Aug. Transversus abdominis plane block for postoperative analgesia in patients undergoing total laparoscopic hysterectomy: a randomized controlled trial. *Anesth. Analg.* 123 (2), 488–492.
- Griffiths, J.D., Middle, J.V., Barron, F.A., Grant, S.J., Popham, P.A., Royse, C.F., 2010 Sept. Transversus abdominis plane block does not provide additional benefit to multimodal analgesia in gynecologic cancer surgery. *Anesthesia & Analgesis* 111 (3), 797–801.
- Hain, E., Maggiori, J., Prost La Denise, L., Panis, Y., 2018 Apr. Transversus abdominis plane (tap) block in laparoscopic colorectal surgery improves postoperative pain management: a meta-analysis. *Color. Dis.* 20 (4), 279–287 PMID: 29381824.
- Hutchins, J.L., Keshava, R., Blanco, F., Dunn, T., Hochhalter, R., 2016 Aug. Ultrasound-guided subcostal transversus abdominis plane blocks with liposomal bupivacaine vs. non-liposomal bupivacaine for postoperative pain control after laparoscopic hand-assisted donor nephrectomy: a prospective randomized observer-blinded study. *Anaesthesia* 71 (8), 930–937.
- Johns, N., O'Neill, S., Ventham, N.T., Barron, F., Brady, R.R., Daniel, T., 2012 Oct. Clinical effectiveness of transversus abdominis plane (TAP) block in abdominal surgery: a systematic review and meta-analysis. *Color. Dis.* 14 (10), 635–642.
- Kalogera, E., Bakkum-Gamez, J., Weaver, A., Moriarty, J., Borah, B., Langstraat, G., Jankowski, C., Lovely, J., Cliby, W., Dowdy, S., 2016. Abdominal incision injection of liposomal bupivacaine and opioid use after laparotomy for gynecologic malignancies. *Obs & Gyn Nov* 128 (5), 1009–1017.
- Kehlet, H., Holte, K., 2001 Jul. Effect of postoperative analgesia on surgical outcome. *Br. J. Anaesth.* 87 (1), 62–72.
- Liu, L., Xie, Y.H., Zhang, W., Chai, X.Q., 2018. Effect of transversus abdominis-plane (TAP) block on postoperative pain control after colorectal surgery: a meta-analysis of randomized controlled trials. *Med Pinc Pract* 27 (2), 158–165 PMID: 29402875.
- Ma, N., Duncan, J.K., Scarfe, A.J., Schuchman, S., Cameron, A.L., 2017 Jun. Clinical safety and effectiveness of transversus abdominis plane (TAP) block in post-operative analgesia: a systematic review and meta-analysis. *J. Anesth.* 31 (3), 432–435.
- Pedrazzani, C., Menestrina, N., Moro, M., Brazzo, G., Mantovani, G., Polati, E., Guglielmi, A., 2016 Nov. Local wound infiltration plus transversus abdominis plane (TAP) block versus local wound infiltration in laparoscopic colorectal surgery and ERAS program. *Surg. Endosc.* 30 (11), 5117–5125.
- Ris, F., Findlay, J.M., Hompes, R., Rashid, A., Warwick, J., Cunningham, C., Jones, O., Crabtree, N., Lindsey, I., 2014 Nov. Addition of transversus abdominis plane block to patient controlled analgesia for laparoscopic high anterior resection improves analgesia, reduces opioid requirement and expedites recovery of bowel function. *Ann. R. Coll. Surg. Engl.* 96 (8), 579–585.
- Smith, S.R., Draganic, B., Pockney, P., Holz, P., Holmes, R., Mcmanus, B., Carroll, R., 2015 Sep. Transversus abdominis plane blockade in laparoscopic colorectal surgery: a double blind randomized clinical trial. *Int. J. Color. Dis.* 30 (9), 1237–1245.