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Ultrasound Guided Subcostal Transversus Abdominis Plane (TAP) Infiltration with Liposomal Bupivacaine for Patients Undergoing Robotic Assisted Hysterectomy: A Retrospective Study

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Abstract

Objective—We sought to determine the effect of a subcostal TAP block with liposomal bupivacaine on post-operative maximal pain score and length of hospital stay among women undergoing robotic assisted hysterectomy.

Methods—This was a retrospective study comparing patients before and after consistent implementation of TAP blocks with liposomal bupivacaine during robotic assisted hysterectomies at a single academic institution. Analysis compared patient demographic and operative characteristics by TAP block use, along with outcomes of interest, including post-operative pain and length of hospital stay.

Results—There was a statistically significant decrease in maximal numerical rating score (NRS) pain scores, presence of nausea and vomiting, and length of hospital stay in those who had a TAP block with liposomal bupivacaine compared to those who did not receive a TAP block. These differences remained even after adjustment for potential confounders.

Conclusions—In this retrospective study, liposomal bupivacaine used in a TAP block was a useful method to provide postoperative pain control in patients undergoing robotic assisted hysterectomy and was associated with lower post-operative maximal pain scores and length of hospital stay.

Keywords

Robotic hysterectomy; Anesthesia; TAP block; Post-operative pain

Introduction

Since the approval of robotic surgery for gynecologic procedures in 2005, there has been an increase in the number of patients undergoing robotic assisted hysterectomies.(1) When compared to open hysterectomies, robotic hysterectomies have been shown to require shorter operative time, less blood loss and shorter hospital stays.(2,3) As the surgical technique has been refined it has allowed patients to have a robotic assisted hysterectomy as an outpatient procedure.(4,5) One important aspect of the peri-operative care plan is the patient's post operative pain control as it can effect multiple aspects of a patient's recovery. (6)

A subcostal transversus abdominis plane (TAP) block is an ultrasound-guided regional anesthesia technique to provide incisional pain control over the T6-T10 dermatomal levels. Previous studies have shown that a classic TAP block (T10-L1 dermatomes) has provided improved postoperative pain control in both open and laparoscopic hysterectomy patients but there has yet to be a study evaluating the effect of TAP blocks on postoperative pain control in robotic assisted hysterectomies.(7-10) Previous studies evaluating TAP blocks to date in gynecologic-oncology surgery have used bupivacaine or ropivacaine. Liposomal bupivacaine (EXPAREL®; Pacira Pharmaceuticals, Inc; Parsippany, NJ, USA) is a multivesicular liposomal formulation of 1.3% bupivacaine, which has been shown to provide up to 72 hours of postoperative pain control in wound infiltration techniques.(11)

We sought to determine the effect of a subcostal TAP block with liposomal bupivacaine on post-operative maximal pain scores and length of hospital stay following robotic hysterectomy when compared to those who did not receive a TAP block.

Materials and Methods

Following approval by the University of Minnesota Institutional Review Board, a retrospective chart review was conducted of consecutive patients between July 2012 and May 2013 who underwent robotic assisted hysterectomy at the University of Minnesota. In October 2012 there was a change to more consistent use of TAP blocks with liposomal bupivacaine as part of surgical practice in this patient population. Therefore, patients prior to October 2012 who did not receive a TAP block were considered the control population and patients after November 2012 who did receive a TAP block with liposomal bupivacaine were considered the test population (allowing for one-month transition period). A total of 61 patients were excluded due to inability to relay pain scores, variation in TAP procedure, decision to not participate, or patients with chronic pain leaving 30 patients eligible for analysis in each group (Figure 1).

The TAP blocks were performed in the preoperative period in the preoperative block area. Patients were consented for regional anesthesia and attached to standard monitors. Following a time out, the patient was prepped with chlorhexidine gluconate and isopropyl alcohol prep stick and sedated with intravenous midazolam 1-2 mg and intravenous fentanyl 50-100 mcg. Under ultrasound guidance, a subcostal TAP block was performed with a 22 gauge 30 degree beveled needle. Once the needle pierced the transversus abdominis fascia,

three 10 mL syringes of local anesthetic were injected. The first syringe contained 10 mL of 0.25% bupivacaine with epinephrine 1:200,000 and the second two syringes each contained 5 mL of liposomal bupivacaine and 5 mL of 0.9% preservative free normal saline. This was repeated on the contralateral side. The TAP blocks were performed or supervised by one of two anesthesiologists on the regional anesthesia service. The patient was then taken to the operating room for a robotic assisted hysterectomy.

Data abstracted from the electronic medical chart included demographics such as age, American Society of Anesthesiologists Physical Status Classification system status (ASA status), weight and body mass index (BMI). Intraoperative characteristics such as procedure type, inclusion of lymph node dissection, length of surgery, estimated blood loss, intraoperative opioid use, and time in the PACU were documented. Outcomes of interest included pain, nausea/vomiting, length of hospital stay, and readmission to the hospital for pain. Pain intensity was assessed by nursing staff at least once per shift via an eleven point (0-10) numerical rating scale (NRS). All patients had intermittent opioids ordered for post-operative pain control. Nursing notes and physician progress notes were used to determine whether patients experienced nausea/vomiting or any other adverse events. Length of hospital stay was calculated from the end of anesthesia time to time of discharge. All patients were followed for 30 days post discharge for any surgical complications or readmission.

Baseline and operative characteristics were summarized and their association with TAP block with liposomal bupivacaine use was determined using Chi-squared and Fisher's Exact tests as appropriate for categorical variables and T-tests and Wilcoxon Rank Sum tests as appropriate for continuous variables. The effect of TAP block use on the length of the post-surgery hospital stay (number of hours) was assessed using Poisson regression, adjusting for over-dispersion. This association was additionally adjusted for potential confounders, including age, BMI, length of surgery, lymph node dissection, use of intraoperative opioids, and nausea. All statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC) and p-values of <0.05 were considered statistically significant.

Results

A total of 60 patients who underwent robotic assisted hysterectomy were eligible for analysis; 30 received a TAP block with liposomal bupivacaine (TAP group) and 30 did not receive a TAP block (non-TAP group).

Patients in the TAP group were younger, had lower BMI ($p=0.017$), shorter surgery time ($p=0.05$), and were more likely to undergo lymph node dissection ($p=0.02$; Table 1) than those in the non-TAP group. The additional procedures between the two groups were otherwise largely similar, with most patients in both groups undergoing bilateral salpingo-oophorectomy and cystoscopy (data not shown). There were significantly more opioids given intraoperatively in the non-TAP group compared to those in the TAP group ($p=0.002$). There did not appear to be a difference in ASA status or estimated blood loss between the two groups.

A total of 6 patients in the TAP group experienced post-operative nausea compared to 17 in the nonTAP group ($p=0.02$; Table 2). This difference remained statistically significant after adjustment for age, BMI, length of surgery, lymph node dissection and intraoperative opioid use ($p=0.03$). Time spent in the PACU was similar between groups. Patients in the TAP group had lower median maximal pain scores over the first 24 hours post-injection (5 vs. 7, $p=0.05$); this difference remained statistically significant after adjustment for potential confounders ($p=0.004$). There was no difference between the two groups in minimal pain scores.

There was a statistically significant decrease in length of hospital stay in those in the TAP group compared to those in the non-TAP group (mean $\pm$ standard deviation: TAP: 11.5 ± 8.9 hours vs. Non-TAP: 27.7 ± 12.6 hours; $p<0.0001$). This difference remained statistically significant even after adjustment for potential confounders ($p<0.0001$). No patients in either group were readmitted for pain within 30 days of discharge.

One patient in the TAP group developed a post-operative pelvic abscess. In the non-TAP group, there was one patient who developed an incarcerated hernia three days postoperatively, one who developed a post-operative bowel obstruction, and one who was re-intubated in the PACU for oversedation and then was subsequently extubated in the PACU.

Discussion

This is the first study evaluating the use of a TAP block with liposomal bupivacaine for post-operative pain control in women undergoing robotic assisted hysterectomy. Our findings suggest that patients undergoing robotic assisted hysterectomy who have a preoperatively placed TAP block with liposomal bupivacaine had improved pain control in the immediate post-operative period and a significantly shorter hospital stay.

Despite studies showing that robotic assisted hysterectomies have decreased pain compared to laparoscopic assisted hysterectomies, patients undergoing robotic assisted hysterectomies still have substantial post-operative pain. Leita and colleagues (2013) showed that patients undergoing robotic surgery for endometrial cancer had a median maximal pain score of 4 and median total post-operative fentanyl use of 242.5 micrograms.(12) Hachem et al. (2013) showed that patients who underwent robotic hysterectomy had a mean pain score of 6.62 on post-operative day (POD) 0 and 5.59 on POD 1.(13) While no studies have evaluated a TAP block's effectiveness in robotic assisted hysterectomy, there have been studies evaluating its use in laparoscopic assisted total hysterectomy with conflicting reported benefits. Studies show that patients who had a TAP block had significantly decreased pain scores upon discharge than those who did not receive a TAP block.(14) De Oliveira et al. (2011) showed that patients receiving a TAP block for laparoscopic hysterectomies had improved quality of recovery scores (15), whereas Kane et al. (2012) found that patients receiving a TAP block had similar opioid use and pain scores compared to those not receiving a TAP block.(16) These disparate results call for larger randomized prospective trials of the use of TAP infiltration to determine the role of TAP blocks in postoperative pain control.

The results of this study should be interpreted in light of its limitations. This was not a randomized trial and while we attempted to account for potential confounding, these results may be biased due to other unmeasured confounders, therefore reflecting a difference in the patient population that we did not measure or a change in surgical practices over time independent of the use of TAP blocks. In addition, the sample size presented here is fairly small and patients were not followed beyond hospital discharge for pain experience and medication use. Finally, these data represent the experience at a single academic institution and may not be generalizable to the broader population.

In conclusion, this retrospective study suggests that liposomal bupivacaine used in a TAP block is a useful method to provide postoperative pain control in those patients undergoing robotic assisted hysterectomy and is associated with lower post-operative pain scores and length of hospital stay. We are currently conducting a prospective randomized, controlled study of TAP infiltration with liposome bupivacaine versus TAP infiltration with bupivacaine in patients undergoing robotic assisted hysterectomy. We hypothesize that liposomal bupivacaine will provide longer pain control in the postoperative period and will further decrease the need for post-operative opioids. Prospective randomized trials that follow pain medication requirements of patients beyond hospital discharge are currently underway.

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References

1. Intuitive Surgical. [April 29, 2014] Intuitive Surgical webpage. Available at <http://www.intuitivesurgical.com>.
2. Boggess JF, Gehrig PA, Cantrell L, Shafer A, Ridgway M, Skinner EN, Fowler W. A case-control study of robot-assisted type III radical hysterectomy with pelvic lymph node dissection compared with open radical hysterectomy. *Am J Obstet Gynecol*. 2008; 199:357e1–7. [PubMed: 18928973]
3. Boggess JF, Gehrig PA, Cantrell L, Shafer A, Ridgway M, Skinner EN, Fowler WC. A comparative study of 3 surgical methods for hysterectomy with staging for endometrial cancer: robotic assistance, laparoscopy, laparotomy. *Am J Obstet Gynecol*. 2008; 199:360e1–360e9. [PubMed: 18928974]
4. Perron-Burdick M, Yamamoto M, Zaritsky E. Same-day discharge after laparoscopic hysterectomy. *Obstet Gynecol*. 2011; 117:1136–1141. [PubMed: 21508753]
5. Gauta J. Outpatient Laparoscopic hysterectomy: evaluation of pain. *JSLs*. 2011; 15:346–349. [PubMed: 21985722]
6. Ellstrom M, Olsen MF, Olsson JH, Nordberg G, Bengtsson A, Hahlin M. Pain and pulmonary function following laparoscopic and abdominal hysterectomy: a randomized study. *Acta Obstet Gynecol Scand*. 1998; 77:923–928. [PubMed: 9808381]
7. Calle GA, Lopez CC, Sanchez E, De Los Rios JF, Vasquez EM, Serna E, Arango AM, Castaneda JD, Vasquez RA, Gonzalez A, Escobar A, Almanza LA. Transversus Abdominis Plane Block After Ambulatory Total Laparoscopic Hysterectomy: Randomized Controlled Trial. *Acta Obstet Gynecol Scand*. 2014; 4:345–350. [PubMed: 24575769]

8. Atim A, Bilgin F, Kilickaya O, Purtuloglu T, Alanbay I, Orhan ME, Kurt E. The efficacy of ultrasound-guided transversus abdominis plane block in patients undergoing hysterectomy. *Anaesth Intensive Care*. 2011; 39:630–634. [PubMed: 21823381]
9. Gasanova A, Grant E, Way M, Rosero EB, Joshi GP. Ultrasound-guided transversus abdominis plane block with multimodal analgesia for pain management after total abdominal hysterectomy. *Arch Gynecol Obstet*. 2013; 288:105–111. [PubMed: 23291970]
10. Carney J, McDonnell JG, Ochana A, Bhinder R, Laffey JG. The transversus abdominis plane block provides effective postoperative analgesia in patients undergoing total abdominal hysterectomy. *Anesthesia and Analgesia*. 2006; 107:2056–2060. [PubMed: 19020158]
11. Gorfine SR, Onel E, Patou G, Krivokapic ZV. Bupivacaine extended-release liposome injection for prolonged postsurgical analgesia in patients undergoing hemorrhoidectomy: a multicenter, randomized, double-blind, placebo-controlled trial. *Dis Colon Rectum*. 2011; 54:1552–1559. [PubMed: 22067185]
12. Leitao M, Malhotra V, Briscoe G, Suidan R, Dholakiya P, Santos K, Jewell E, Brown C, Sonoda Y, Abu-Rustum N, Barakat R, Gardner G. Postoperative Pain Medication Requirements in Patients Undergoing Computer Assisted (“Robotic”) and Standard Laparoscopic Procedures for Newly Diagnosed Endometrial Cancer. *Ann Surg Oncol*. 2013; 20:3561–3567. [PubMed: 23797751]
13. Hachem, Lena El, MD; Acholonu, Uchenna C., Jr MD; Nezhat, Farr R., MD Postoperative Pain and Recovery After Conventional Laparoscopy Compared With Robotically Assisted Laparoscopy. *Obstetrics & Gynecology*. 2013; 121:547–553. [PubMed: 23635617]
14. Pather S, Loadsman JA, Gopalan PD, Rao A, Philp S, Carter J. The role of transversus abdominis plane blocks in women undergoing total laparoscopic hysterectomy: a retrospective review. *Aust N Z J Obstet Gynaecol*. 2011; 51:544–547. [PubMed: 21923857]
15. De Oliveira GS Jr, Milad MP, Fitzgerald P, Rahmani R, McCarthy RJ. Transversus abdominis plane infiltration and quality of recovery after laparoscopic hysterectomy: a randomized controlled trial. *Obstet Gynecol*. 2011; 118:1230–1237. [PubMed: 22105251]
16. Kane S, Garcia-Tomas V, Alejandro-Rodriguez M, Astley B, Pollard R. Randomized Trial of Transversus Abdominis Plane Block at Total Laparoscopic Hysterectomy: Effect of Regional Analgesia on Quality of Recovery. *Am J Obstet Gynecol*. 2012; 207:419e1–5. [PubMed: 22840413]

Figure 1.
Patients Undergoing Robotic Assisted Hysterectomy by Group.

Table 1

Patient Pre- and Intra-operative characteristics by TAP Use.

Variable	No TAP		TAP		P-value
	N	%	N	%	
ASA Status					0.51
1 – Normal healthy patient	1	3.3	4	13.3	
2 – Patient with mild systemic disease	20	66.7	18	60.0	
3 – Patient with severe systemic disease	9	30.0	8	26.7	
Lymph Node Dissection					0.02
No	22	73.3	13	43.3	
Yes	8	26.7	17	56.7	

	N	Mean (SD)	N	Mean (SD)	
Age (years)	30	60.1 (8.1)	30	55.6 (13.3)	0.12
BMI (kg/m²)	30	37.2 (11.3)	30	30.9 (8.4)	0.02

	N	Median (Min-Max)	N	Median (Min-Max)	
Length of surgery (minutes)	30	252 (139-460)	30	229 (130-318)	0.05
Estimated Blood Loss (mL)	30	75 (50-400)	30	50 (20-250)	0.20
Intraoperative Opioids (mcg)	30	500 (200-820)	30	350 (100-570)	0.002

Table 2

Patient Post-operative characteristics by TAP Use.

Variable	No TAP		TAP		P-value
	N	%	N	%	
Nausea/Vomiting					0.02
No	14	46.7	24	80.0	
Yes	16	53.3	6	20.0	
Post-Operative Complication					0.10
No	24	80.0	29	96.7	
Yes	6	20.0	1	3.3	

	N	Median (Min-Max)	N	Median (Min-Max)	
Time in PACU (minutes)	30	117.5 (47-373)	30	125.5 (3.3-241)	0.97
0-24 hour Minimum NRS	30	2 (0-4)	30	2 (0-5)	0.98
0-24 hour Maximum NRS	30	7 (2-10)	30	5 (0-9)	0.05