

ประสิทธิภาพของการระงับปวดแผลหลังการผ่าตัดปิดรูทวารเทียมด้วยเทคนิควิธีประยุกต์การใส่สายให้ยาอย่างต่อเนื่องที่ชั้น Transversus Abdominis Plane ด้วยการให้ปริมาณยาชาในระดับต่ำ

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Analgesic Effectiveness of Modified Continuous Transversus Abdominis Plane Block with Low Dose of Local Anesthetic Continuous Infusion in Closure Loop Stoma

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Background: Postoperative pain is a major suffering of the patients undergoing closure loop stoma. Transversus abdominis plane (TAP) block was introduced as an alternative analgesia for abdominal surgery. Regarding continuous TAP block, we modified a catheter insertion technique into TAP plane by a surgeon under direct visualization. This study aimed to evaluate the analgesic effectiveness of modified continuous TAP block (MCTAP) compared with opioid-based analgesia in stoma reversal patients.

Methods: Patients undergoing closure loop stoma during January 2014 and December 2015 were examined and divided into two groups. Patients receiving MCTAP block with bupivacaine 0.2% (2 mL/h) over three consecutive postoperative days were enrolled in MCTAP group. While patients receiving opioid-based analgesia were enrolled in conventional group. Opioid consumption, numeric rating pain scores (NRPS) over three consecutive postoperative days (POD), times to bowel function recovery were recorded.

Results: A total of 42 patients were enrolled into MCTAP group (20) and conventional group (22). Total morphine consumption in MCTAP patients was significantly lower than conventional patients (7.4, 19.59 mg respectively, $P < 0.005$). No significant difference was detected in NRPS. The median of time to first flatus, time to first liquid intake, and postoperative length of stay was significantly less in MCTAP patients (35 and 42 h; $P < 0.05$, 41 and 46.5 h; $P < 0.05$, 85 and 96 h; $P < 0.01$, respectively).

Conclusions: MCTAP block with low dose local anesthetics is an effective analgesia in closure loop stoma and may also be a useful alternative analgesia regarding to ERAS concepts.

Keywords: Continuous Transversus abdominis plane block, Closure loop stoma, ERAS - Enhanced recovery after surgery, Postoperative Analgesia, Stoma reversal, TAP block

วิสัญญีสาร 2561; 44(2): 79-84. • Thai J Anesthesiol 2018; 44(2): 79-84.

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Received 21 Nov 2017, Accepted 29 Mar 2018

Introduction

Closure loop stoma is a common operation for patient who remains ostomy with status post colorectal surgery in order to prevent anastomosis leakage. Lysis of adhesion and tension from reclosure of the abdominal wall causes patients severe postoperative pain. Previous studies experimented with several modalities including intravenous (IV) opioid-based analgesia, epidural analgesia, and continuous wound infiltration (CWI). A conventional technique, IV opioid-based analgesia, is seemingly convenient, but often requires high doses of opioid for adequate pain relief and leaves systemic side effects including suppressed bowel movement, nausea/vomiting, sedation and respiratory depression.¹⁻² Epidural analgesia is one of the most effective pain controls, but potentially leads to serious complications such as epidural hematoma and urinary retention. The use of CWI has ever been reported in major abdominal surgery but its effectiveness is still unclear. While transversus abdominis plane (TAP) block under ultrasound guidance is an alternative analgesic technique for abdominal surgery with a number of advantages including reducing opioid requirements, pain scores and undesirable side effects.³⁻⁵ However, continuous TAP block has not been popular as it requires precisely skilled anesthesiologists to identify and place a catheter into an accurate TAP plane. Therefore, it is not easy to achieve success, and has several limitations such as accuracy, time consuming, and high expenditure.⁶

We, therefore, have modified a catheter insertion technique by surgeon under direct visualization instead in order to overcome those disadvantages. This modified continuous TAP (MCTAP) block was seemingly first introduced by Jankovic and colleagues in 2009 for renal transplant recipients.⁶ Regarding to the tip of catheter sitting in the same dermatome of surgical wound, we considered in terms of targeted therapy that it might not need volume effect as generally ever used. The lowest volume ever literally used for continuous TAP block was 6 mL/h.³ However, a minimal effective volume for continuous TAP block has never been definitely

determined. We initially created a minimal trials to test three volume-effects (10, 5, and 2 mL/h). Then, we found anesthetic leakage through out the wound at 10 and 5 mL/h, while our patients seemed to be satisfied with analgesia in all. We thus decided to try 2 mL/h of bupivacaine (0.2%) in our clinical practice. This study is aimed to evaluate the effectiveness of MCTAP block with low dose of local anesthetics (2 mL/h) compared with opioid-based analgesia in stoma reversal patients.

Methods

After approved by the Institutional Review Board of Faculty of Medicine, Chulalongkorn University, a retrospective observational study was conducted with database review of all patients with age 18-80 years old, ASA class I-III undergoing closure loop stoma surgery between January 2014 and December 2015 at the King Chulalongkorn Memorial Hospital. Patients who were pregnant, had history of chronic use of analgesic drugs were excluded. All patients were prescribed conventionally intravenous opioid-based analgesic plus oral acetaminophen (500 mg prn) when tolerated. Only patients who received add-on MCTAP block (at the end of surgery, the surgeons inserted an 18-gauge Tuohy needle (Portex™ Epidural Minipack System 2, Smiths Medical Czech Republic, Hranice, Czech Republic) into a plane in between transversus abdominis and internal oblique muscle under direct vision followed by tracing a multiorifice catheter with a railroad technique, and then 5 mL bolus of 0.2% bupivacaine plus a continuous infusion of 2 mL/h over two consecutive days) were classified into the MCTAP group. While, patients who did not have MCTAP block were count in the conventional group. Clinical characteristics, surgical data, preoperative, intraoperative and postoperative data were obtained from medical records and compiled to create a comprehensive database.

The primary outcome of this study was to measure opioid consumption collected as cumulative quantity at PACU and over a 12-hour period at 12, 24 and 48 hours postoperatively. The secondary outcomes were including the ten-level numeric rating pain scores

(NRPS) at rest and on motion at PACU, 12, 24 and 48 hours postoperatively; total paracetamol requirement at PACU and over a 12-hour period at 12, 24 and 48 hours postoperatively; time to first clear liquid intake, time to first flatus; time to first ambulation; postoperative length of stay; total number of nausea and vomiting; total number of complications related MCTAP block.

For statistical analysis, GraphPad Prism 7.0 software was used. Missing data were treated using the complete case analysis method. The Little's test of missing completely at random (MCAR) was performed using the R package BaylorEdPsych (Little, 1988), revealing that data were missing completely at random ($\chi^2 = 97.81$, $DF = 98$, $p = 0.4865$). Continuous data were expressed as means with standard deviations (SD) and/or 95% confidence interval, or medians with inter quartile ranges (IQR). Opioid consumption and paracetamol consumption were assessed using a two-way repeated measure analysis of variance (ANOVA) with *pos hoc* multiple comparisons and Bonferroni corrections. Time-to-event variables were compared using the

log-rank (Mantel-Cox) test. Student's *t* test was used to compare normally distributed variable, whereas the Mann-Whitney *U* test was used to compare variables with skewed distribution. Fisher's exact test was used to assess categorical variables. Pearson correlation analysis was used to assess the correlation between variables. The number of cases during the defined period determined the sample size. Level of significance was set at 0.05.

Results

Of all 42 cases undergoing closure loop stoma surgeries during the study period, one was excluded due to the lack of data in most of the variables studied. The remaining 41 patients were analyzed. 21 patients were classified into the conventional group and 20 patients were classified into the MCTAP group. Demographic data was compared as shown in Table 1. No significant difference was found in any of the demographic variables between the two groups and interoperation variables did not differ (Table 1).

Table 1 The demographic data

Parameter	MCTAP Block (N=20)	Conventional (N=21)	P-value
Sex (Male/ Female)	14/6	11/11	> 0.05
Underlying disease (negative/ positive)	14/6	13/9	> 0.05
Age (yr) (mean $\pm$ SD)	58.65 $\pm$ 12.41	52.82 $\pm$ 14.8	> 0.05
BMI (kg/m ²) (mean $\pm$ SD)	23.18 $\pm$ 4.79	23.84 $\pm$ 4.16	> 0.05
Operative time (min) (mean $\pm$ SD)	103 $\pm$ 21.05	90.91 $\pm$ 29.22	> 0.05
Intraoperative opioid use with equivalent to morphine (mg) (mean $\pm$ SD)	8.48 $\pm$ 5.04	8.38 $\pm$ 4.18	> 0.05

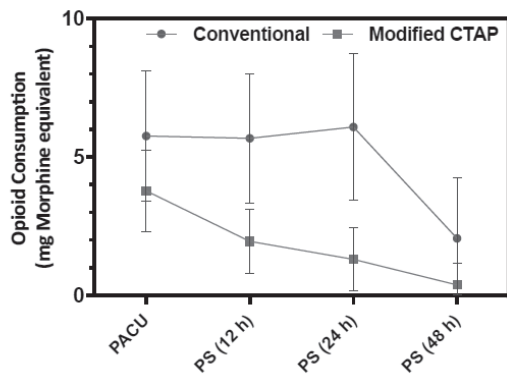
Postoperative opioid consumption with equivalent to morphine was significantly lower in the MCTAP group compared to the conventional group ($F(1,39) = 11.07$, $P < 0.01$, Table 2). The marked differences in opioid consumption were at post surgery (PS) 12 h (mean

difference [95% CI] 3.86 [0.93 - 6.79], $P < 0.01$) and PS 24 h (5.09 [2.16 - 8.02], $P < 0.001$) as revealed by *pos hoc* multiple comparisons with Bonferroni corrections (Table 2 and Figure 1).

Table 2 Postoperative opioid consumption

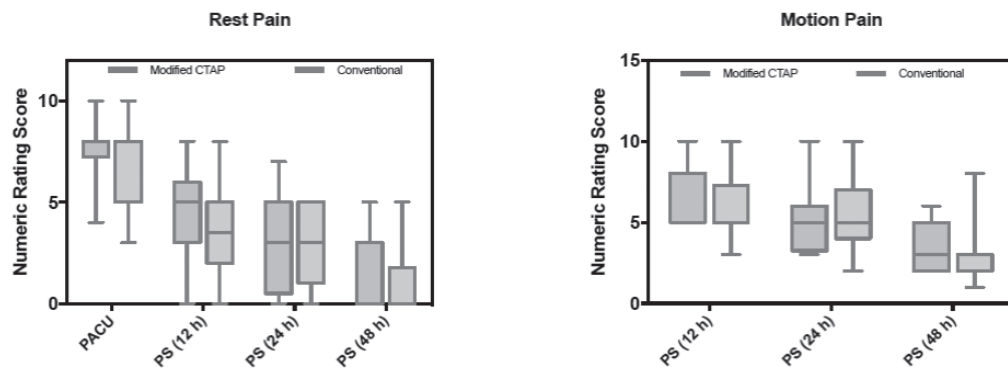
	Opioid Consumption (mg Morphine) Mean [95% CI]			
	PACU	PS 12 h	PS 24 h	PS 48 h
Conventional (N=21)	5.67 [3.40-8.12]	5.68 [3.34-8.01]	6.09 [3.43-8.74]	2.07 [-1.30-4.26]
Modified CTAP (N=20)	3.78 [2.30-5.25]	1.95 [0.78-3.12]	1.30 [0.16-2.45]	0.38 [-0.41-1.16]

PS represents post surgery



PS represents post surgery

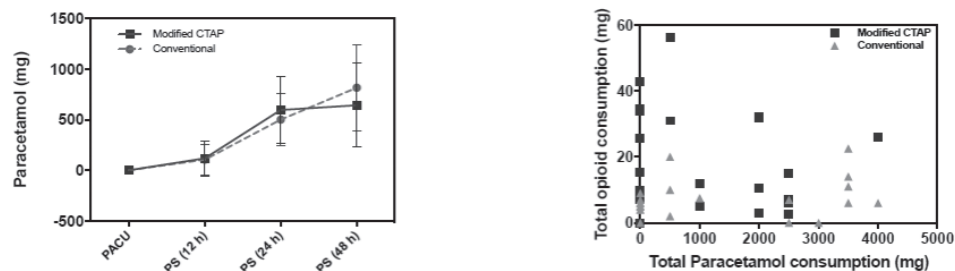
Figure 1 Postoperative opioid consumption



Time	Control median [n]	MCTAP Median [n]	P value
PACU	8 [20]	8 [16]	0.13
12	5 [21]	3.50 [20]	0.22
24	3.05 [21]	2.80 [20]	0.79
48 h	1.43 [21]	7.5 [20]	0.19

Time	Control median [n]	MCTAP Median [n]	P value
12 h	8 [15]	5 [19]	0.12
24 h	5 [16]	5 [20]	0.82
48 h	13 [15]	3 [20]	0.28

Figure 2 The numeric rating pain scores at rest and on motion



No significant difference between paracetamol consumption between the conventional and modified CTAP groups ($p = 0.8836$). (Repeated Measure Two-way ANOVA)

No correlation between total paracetamol and total opioid consumption in either conventional ($r = 0.2302$, $p = 0.3286$) or modified CTAP group ($r = -0.2608$, $p = 0.2411$). (Pearson correlation analysis)

Figure 3 Postoperative Paracetamol consumption

For recovery outcomes, patients receiving MCTAP block required significantly less time to first clear liquid intake (median [IQR] 41 h [37-45] vs. 46.5 h [43.75-48.13], $P < 0.05$), less time to first flatus (35 h [23.5-40.75] vs. 42 h [33.5-50], $P < 0.05$) and less postoperative length of stay (85 h [76.5-93.75] vs. 96 h [90-117.5], $P < 0.05$) than those receiving conventional analgesic method. However, there is no significant difference in time to first

ambulation (21.75 h [19.25-31.5] vs. 24 h [20-30], Figure 4). The MCTAP group showed significantly fewer incidents of nausea and vomiting than the conventional group (0% vs. 49.2%, $P < 0.01$). Within the MCTAP group, only one out of 20 patients reported a minor complication about local anesthetic leakage causing the need for frequent gauze replacement.

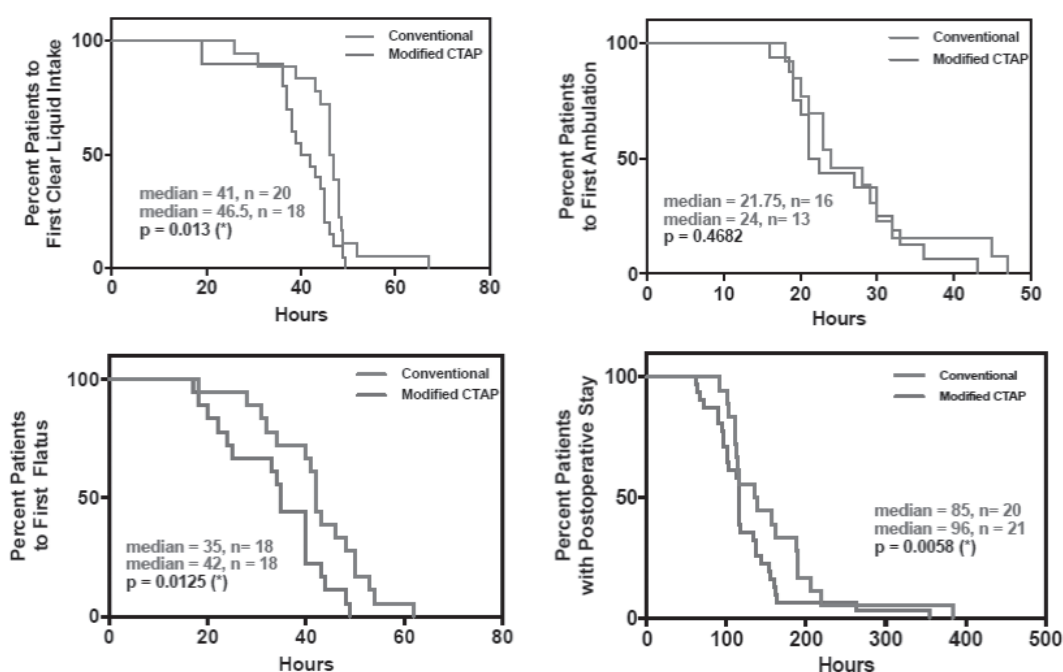


Figure 4 Postoperative recovery outcomes

Discussion

This study demonstrated that the patients in MCTAP group required less postoperative opioid consumption as compared to the conventional group. Pain scores were not different between the two groups. The patients receiving MCTAP block also expressed better postoperative recovery status with showing less time to first clear liquid intake, time to first flatus, and postoperative length of stay, but time to first ambulation was not different. In addition, the MCTAP group showed significantly less nausea and vomiting, which are common side effects of systemic opioid-based analgesia. This

highlights that the key advantage of MCTAP block is not only to provide effective analgesia, but also to reduce unwanted side effects from systemic opioid use.

Generally, most of the patients require pain relief until achieve their satisfaction. Therefore, pain scores did not differ among the two groups understandably. This is why pain scores do not truly reflect and less commonly be used as a primary outcome for measurement of analgesic effectiveness than opioid consumption in current studies. However, there are some studies reported that TAP block can reduce pain scores postoperatively.³⁻⁵

Secondary outcomes including times to return of bowel functions were significantly better recovered in MCTAP group. This infers that MCTAP block is seemingly associated with help promote better surgical recovery. To test this hypothesis, it needs further studies with a calculation of sample size based on these recovery outcomes in particular. Lastly, this study is the first to describe and to evaluate the analgesic effectiveness of the MCTAP block in the context of closure loop stoma surgery.

Because of being a retrospective study, there were some intrinsic limitations in this study worth noting. First, it was not possible to control some variables that might have confounded the results and could obscure interpretation of the primary outcome. For instance, paracetamol is a major non-opioid supplemental analgesia in this study. Higher paracetamol consumption could potentially lead to an underestimation of opioid requirement. However, a repeated ANOVA revealed no significant difference in paracetamol consumption between the two groups. Also, no significant correlation between opioid and paracetamol consumption was detected. Only two patients in the conventional group received intravenous parecoxib (40 mg) at PACU and two patients in MCTAP group received oral etoricoxib (90 mg) at POD 1 and POD 2. Therefore, it may say that non-opioid supplemental analgesia results were unlikely and/or insignificantly affected. And it should be noted that there was different in the pattern of opioid administration. Most patients were given intravenous morphine (3 mg) as needed every 4 h, while 4 patients (19%) in the control group were given continuous morphine infusion (1 mg/h). These confounding factors should be carefully controlled if any upcoming studies expected.

Conclusion

This study demonstrates that MCTAP block with low dose local anesthetics is an effective analgesic technique in closure loop stoma and may also be a promising alternative analgesic remedy for patients undergoing stoma reversal in accordance with ERAS concepts.

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