

# Trans abdominis plan block reduce postoperative analgesic requirement and prolong time to first analgesic request in abdominal surgery at university of Gondar hospital: prospective observational study

## Abstract

**Background:** Poorly controlled pain after abdominal surgery is associated with patient suffering and prolonged hospital stay. The increasing use of Transverse abdominis plan block (TAP), as a form of pain relief after abdominal surgery warrants evaluation of its effectiveness as an adjunctive technique to routine care and, when compared with other analgesic techniques. This observational study evaluated the efficacy of blindly performed TAP block after abdominal surgeries.

**Methods:** Prospective observational study was conducted in patients with abdominal surgery (N=420) at University of Gondar Hospital for six months. Bilateral blind TAP blocks were performed with 20ml of 0.25% Bupivacaine after wound closure prior to extubation. Postoperatively patients were categorized as exposed to the block (TAP group) and non-exposed (Non TAP group). Severity of pain, analgesic consumption and time to first analgesic request were assessed at 2<sup>nd</sup>, 6<sup>th</sup> and 24<sup>th</sup> hours.

**Results:** During the study period, 1,020 patients were underwent abdominal operations. Of these, 420 (41.2%) received a bilateral TAP block for postoperative pain control and the remaining received a standard postoperative pain control care. TAP block reduced visual analog scale (mean  $\pm$  SD) pain scores as compared with Non-TAP at 2<sup>nd</sup> hr (24 $\pm$ 8, 58 $\pm$ 22), 6<sup>th</sup> h rest (22 $\pm$ 6, 46 $\pm$ 14), 6<sup>th</sup> h coughing (28 $\pm$ 7, 61 $\pm$ 19) and at 24<sup>th</sup> h (26 $\pm$ 11, 53 $\pm$ 16);  $P < 0.001$ ). It also significantly reduced total postoperative tramadol (mean (IQR) consumption: (90(150) mg, 38(50) mg;  $P = 0.002$ ). Time to first analgesic request (mean (IQR) were also prolonged in favor of TAP group (360(500) min Vs 156(80) min;  $P < 0.001$ ). These results were similar in elective and urgent cases.

**Conclusion:** Transverse abdominis plan block is safe, reduces postoperative tramadol requirement and possibly the severity of pain in the first 24 hours after abdominal surgery. It should be considered as multimodal analgesia approach in patients undergoing abdominal surgery.

**Keywords:** postoperative pain, tramadol requirements, multimodal analgesia

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**Abbreviations:** TAP, transverse abdominis plan block; TAH, total abdominal hysterectomy; CPS, categorical pain scoring system; VAS, visual analogous scale

## Introduction

In patient with abdominal surgery, multimodal analgesic technique reduces morbidity, costs and hospital stay.<sup>1</sup> Abdominal wall incision is the major origin of pain experienced by patients after abdominal surgery.<sup>2</sup> Through systematically administered opiates and central neuraxial techniques cause considerable adverse effect, they remain the mainstay analgesic modality after abdominal surgery.<sup>3-5</sup> Nowadays, peripheral nerve block techniques have been introduced to the practice of anesthesia to prevent surgical abdominal pain successfully and thereby preventing problems associated with the use of systemic opioids or central neuraxial blocks.<sup>6-8</sup> Transversus abdominis plane (TAP) block, in which analgesia to the skin, muscles of anterior abdomen and parietal peritoneum are obtained,<sup>9</sup> is one of the new technique used to block the sensory afferent nerves of the anterior abdomen through bilateral triangle of petit.<sup>6,10</sup> TAP block reduces postoperative analgesic consumption, prolong the time to first

analgesic request and reduces opioid related side effects.<sup>8</sup> It can be practiced either blindly or using an ultrasound guided technique.<sup>10,11</sup> As an ultrasound helps to delineate abdominal wall layers, it increases the efficacy of the block while the blind technique efficacy is uncertain.<sup>12</sup> However, a number of studies showed a comparable efficacy of the blindly performed TAP block to ultrasound guided ones after abdominal surgery for variety of surgical cases if done appropriately.<sup>7,13</sup> Factors determining the efficacy of the block can either be the result of technical trouble in performing, surgical and patient factors.<sup>14,15</sup>

In one research, the efficacy of a blindly done TAP block in midline abdominal incision of large bowel surgery showed a reduction in pain score at emergence and 24hrs postoperatively.<sup>6</sup> Another study conducted after cesarean delivery found that TAP group had reduced pain score and total morphine consumption in the first 48 postoperative hours.<sup>13</sup> The same promising results were also obtained on patients undergoing prostatectomy,<sup>7</sup> appendectomy, cesarean section,<sup>16-18</sup> colorectal resections<sup>19</sup> and total abdominal hysterectomy.<sup>14</sup> In contrary, the block does not provide additional benefit to multimodal analgesia in gynecological cancer surgery.<sup>20</sup> In Ethiopia in general

and University of Gondar Hospital (UoGH) in particular, TAP block was performed blindly using landmark technique by non-physician anesthetists as multimodal analgesia in patients with abdominal surgery postoperatively. It is done by master's students of anesthesia for academic purpose. As far as advantage of TAP is considered, it has to be performed by all level of anesthesia providers so as to achieve multimodal analgesia. Therefore, this observational study was designed to evaluate the efficacy of the block and eventually to diffuse the practice to other staffs working in the field. Moreover it could be used as a baseline data for further research.

## Methods

After obtaining Ethical approval from institutional research and publication office (RPO) and informed consent from individual patients preoperatively, a prospective comparative observational study was conducted at University of Gondar Hospital, Northwest Ethiopia from January to June 2012. The hospital is a tertiary hospital with catchment of more than 5 million populations. Based on annual report of 2011, total abdominal operations performed were 2,340. All consecutive postoperative abdominally operated patients (Cesarean section, Total Abdominal Hysterectomy (TAH), Trans-Abdominal Prostatectomy and Gynecologic case) were included. Bilateral blind TAP blocks were performed on a supine lying patient by palpating the iliac crest from anterior to posterior until the muscle latissimus dorsi appreciated. On this position, the triangle of petit can easily identified anterior to latissimus dorsi muscle. Using a blunt (short beveled) needle skin was pierced posterior to the mid-axillary line and cephalad to the base of triangle over the triangle. The needle was then further advanced until a "pop" sensation (as the needle passed external oblique muscle) felt on hand. Introducing the needle further results a second "pop," as the needle traversed internal oblique muscle or needle tip is in fascial plane of transversus abdominis. After aspiration to exclude vascular puncture, 20milliliter of Bupivacaine 0.25% was then injected<sup>7,10</sup> without complications. All of the TAP blocks were performed after wound closure, prior to extubation. Patients were identified as exposed to the block (TAP group) and non-exposed (Non TAP group) in the postoperative period. Similarly, the presence and severity of pain and analgesic needs were assessed systematically by trained data collectors who were blinded to group allocation. All patients were requested to give scores for their pain at rest and on movement. These assessments were performed at 2, 6, and 24hours postoperatively. Pain severity was measured using both a visual analogous scale (VAS) (0 = No Pain, 10 = Worst Imaginable) and a categorical pain scoring system (CPS) (None = 0; Mild = 1; moderate = 2; Severe = 3). The VAS was determined by the patient making a mark of their pain intensity on a line which is 100 millimeter long. Statistical analyses were performed using a SPSS version 16.0. Chi-

Square test and Fisher's exact test were utilized as appropriate. Pain severity was analyzed with independent t-test and Mann-Whitney U-test. Normally distributed data were presented as mean ± SD while non-normally distributed data were presented as mean (IQR). A P value <0.05 was considered to be statistically significant.

## Results

During the study period 1,020 patients were underwent elective and emergency abdominal operations. Majority of the study subjects were female (78.0%) patients with ASA physical status I (77.5%) who were performed in the elective base (69.8%). From total patient evaluated (N=1,020), bilateral TAP block were performed on 420 (41.2%) patients leaving the other patient as a comparison group (58.8%). All patients underwent abdominal surgery for variety of cases through a midline abdominal incision after general anesthesia and ETT intubation. The case mixes of the TAP group were Cesarean section (172), total Abdominal Hysterectomy (45), Trans-Abdominal Prostatectomy (52), Gynecologic cases (38) and other abdominal surgeries (113). Both groups were comparable in age, gender, BMI and operative procedures performed (Table 1). Postoperative pain scores (VAS and categorical score in cm) assessed blindly at 2, 6, and 24hours postoperatively in post anesthesia care unit/recovery room; at rest, coughing and on movement (knee flex). Pain scores on VAS showed a significantly less severe pain at all postoperative time points in patients who received TAP block, both at rest and on movement (overall P<0.001) Pain on coughing also showed a significantly less pain at 2 and 24hours in the TAP block group compared with the group without TAP block using VAS scale (Figure 1). In parallel to the VAS, TAP significantly reduced postoperative pain as assessed by categorical pain score (CPS) at all postoperative time points both at rest and on movement (overall P<0.001). On the 2<sup>nd</sup> hour, 242(57.8%) of the patients with the block complain moderate to severe pain while 345(82.2%) of their counterparts felt so. Similarly, on the 24<sup>th</sup> postoperative hour, around half of the patients with the block felt severe pain while more than 80% in Non-TAPs (Figure 2). In this study TAP block reduced the severity of postoperative pain in the first 24 postoperative hours by more than 70% as measured by VAS compared to the Non-TAPs. In Table 2 below, patients with TAP block had a prolonged time to first tramadol request and reduced total tramadol requirements in the first 24 hours postoperatively at P<0.001. Accordingly, TAP block reduced total postoperative tramadol consumption (Non-TAP versus TAP) described as mean (IQR) mg at 2 h (22(50) mg vs 6(0) mg), 6 h (46(75) mg vs 18(50) mg) and at 24 hour. It indicates that TAPs have significantly required (overall P<0.001) less tramadol consumption and prolonged time to first analgesic request when compared with the TAP block group.

**Table 1** Demographic and anesthetic baseline characteristic of abdominally operated patients at UoG Hospital, January to June 2012, North West Ethiopia

Variables	TAP group (n=420)	Non TAP group (n=600)	Total (N= 1020)
<b>Sex</b>			
Male	104 (24.7%)	120(19.8%)	224 (22.0%)
Female	316(75.3%)	480 (80.2%)	796(78.0%)
<b>Age in Years</b>	36.9±14.3*	35.1±15.5*	-
<b>Body mass index (Kg/m<sup>2</sup>)</b>	21.7±3.1*	23.1±3.5*	-
<b>ASA physical status</b>			
I	326 (77.6%)	464 (77.3%)	790(77.5%)
II	94 (22.4%)	136 (22.7%)	230(22.5%)
<b>Type of operation</b>			
Elective	280(66.7%)	432(72.0%)	712(69.8%)
Emergency	140(33.3%)	168(28.0%)	308(30.2%)

Table Continued...

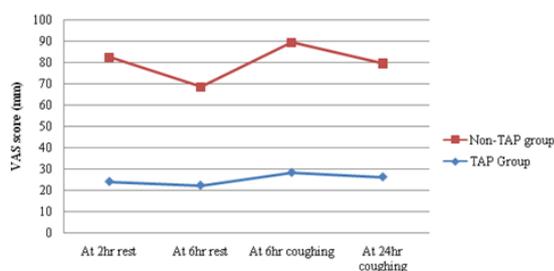
Variables	TAP group (n=420)	Non TAP group (n=600)	Total (N= 1020)
Anaesthesia time(minutes)	85.3±34.6*	82.2±34.7*	
incision height			
At the Umbilicus	168 (40%)	360 (60%)	528(51.8%)
Below the Umbilicus	140 (33.3%)	160 (26.7%)	300(29.4%)
Above the Umbilicus	112 (26.7%)	80 (13.3%)	192(18.8%)
Pethidine(mg) given intraoperatively	36.7±43.2*	25±32.6*	
Diclofenac(mg) given intraoperatively	33.3±37.4*	42.5±37.8	

\* Indicates mean values.

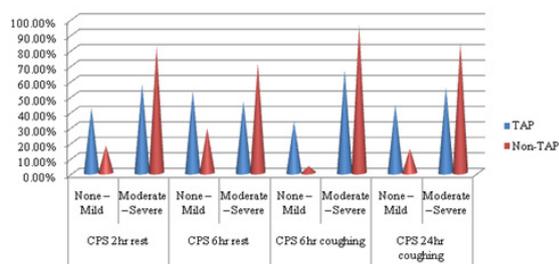
**Table 2** Time to first tramadol request and total tramadol consumption in each group over the first 24 postoperative hours at UoG Hospital, January to June 2012, North West Ethiopia

	TAP (n = 420)	Non-TAP (n = 600)	P-value
Time to First Request for Tramadol (min)	360 (500) ‡	156 (80)	0.00001
2hours	6 (0) †	22 (50)	0.003
6hours	18 (50) †	46 (75)	0.001
24hours	38 (50) †	90 (150)	0.004

†P<0.01 and ‡P<0.001 when compared with non-TAPs. Data presented as mean (IQR).



**Figure 1** Mean postoperative visual analog scale (VAS) pain scores at rest & on movement in each group over the first 24 postoperative hours at UoGH, January to June 2012, North West Ethiopia.



**Figure 2** Categorical pain score (CPS) at rest & on movement in each group over the first 24 postoperative hours at UoGH, January to June 2012, North West Ethiopia.

## Discussion

Postoperative analgesia reduces postoperative stress response,<sup>8</sup> pain intensity<sup>11</sup> and postoperative morbidity.<sup>9</sup> It also facilitates rehabilitation, accelerates recovery from surgery<sup>9,21</sup> which in turn improve surgical outcome.<sup>14,22</sup> In the current study, it was found that the TAP block provided effective analgesia, when used as part of a multimodal analgesic regimen in the first 24 postoperative hours as its efficiency was measured by pain severity (VAS and CPS), postoperative opioid consumption and time for first rescue tramadol request. Accordingly, TAP block reduced the severity of postoperative pain in the first 24 postoperative hours by more than 70% as measured by VAS compared to the Non-TAPs. Studies conducted on patients undergoing abdominal surgery<sup>6</sup> total abdominal hysterectomy<sup>14</sup> and cesarean delivery showed a comparable reduction in the VAS of TAP

group.<sup>13,17</sup> Similar to the VAS, TAP block significantly reduced pain severity at all postoperative time points as pain intensity assessed by CPS. It indicates that TAPs have significantly (overall P<0.01) lower CPS score when compared with the non-TAP block group. Study on patients undergoing cesarean section and total abdominal hysterectomy showed the same reduction of CPS in patients who received the TAP block at 6<sup>th</sup> hour.<sup>13,14</sup>

In this study TAP block reduced overall postoperative 24 hour tramadol requirements by 60% (100mg). This was comparable with study done on abdominal surgery and cesarean deliveries,<sup>6,18</sup> in which the TAP block reduced 24 hour mean intravenous morphine requirements by 60-70% (25-30mg). A meta-analysis (180 cases and 184 Non-TAPs) showed a reduction in mean 24 hour morphine consumption by 22mg in favor of TAP block group.<sup>23</sup> Similarly, another meta-analysis involving 236 participants showed that the existence of the block significantly reduced the mean 24hour morphine consumption by 22mg.<sup>9</sup> Though the current study showed a reduction in analgesic requirement of the TAP group, the tramadol consumption difference between the groups was not as large as the referenced studies. In this study the mean difference was 100mg of tramadol or comparable 10mg of morphine<sup>24</sup> while 25 mg of morphine in references. This discrepancy could be the result of poor pain management protocol, difference in intraoperative analgesic protocols and different types of surgery. Unlike the referenced study areas, patients in the current study were managed with small dose (commonly 25-50mg) of tramadol after repetitive attempts made to kill pain with Non Steroidal Anti Inflammatory Drugs, though it is known that NSAIDs are not sufficient as the sole analgesic agent after major surgery.<sup>25,26</sup> Time for the first rescue tramadol request was significantly prolonged in favor of the TAP group (360 min vs 156 min). Studies showed that patients with the block request further analgesia after 150 minutes while non-TAPs in 30 minutes period postoperatively.<sup>6,18</sup> The variability in pain management protocol of the referenced and current study areas contributed much for the minute interval differences. The possible limitations of this study were considered. This was a prospective observational study and suffered the limitations that are evident in such studies and hence could not be sure that all potential factors that influence the outcome were controlled. The other limitation was failure to assess efficacy of the block beyond 24 hours as the TAP block has been demonstrated to produce analgesia at least for 48 hours postoperatively.<sup>7</sup> However, this study was the first of its type to include variety of surgical cases

(general surgical, obstetrics and gynecologic). In addition, data collectors, patients and respective anesthetists were blinded.

## Conclusion and recommendation

In conclusion, TAP block produced effective and prolonged postoperative analgesia as compared with standard therapy in patients undergoing midline abdominal surgery in a variety of cases. It showed a considerable reduction in mean intravenous postoperative tramadol requirements, reduction in postoperative pain scores and increased time to first request for further analgesia, both at rest and on movement. Though, TAP block provides effective postoperative analgesia after abdominal surgery for variety of cases, it requires confirmation by further studies using different study design and various groups of patients (children, obese, elderly). As a final recommendation, the investigators believed that the block should be considered in all patients undergoing midline abdominal surgery proving that they have no contraindication for regional nerve blocks. The need for opioid supplementation to cover visceral pain should never be forgotten.

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## Conflicts of interest

Author declares there are no conflicts of interest.

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