Ultrasound-guided transversus abdominis block as part of multimodal analgesia 
In comparison with systemic morphine during laparoscopic operations


Background
Transversus abdominis plane (TAP) block is a regional anesthetic technique that blocks the abdominal wall neural afferents by introducing local anesthetic into the neurofascial plane between the internal oblique and transversus abdominis muscles. Randomized controlled trials have demonstrated the efficacy of TAP block as a component of a multimodal regimen, in providing postoperative analgesia after abdominal surgery.

Methods: 80 patients undergoing laparoscopic surgery were randomized to receive standard general anaesthesia either with (Group A, n 40) or without TAP block (Group B, n 40). Ultrasound-guided bilateral TAP block was performed with a high frequent linear ultrasound probe and an in-plane needle technique with 15 ml plain bupivacaine 0.5 % on each side. Intraoperative, postoperative demand of morphine were recorded and complications also were recorded in 1st 24 hours.

Results: 80 patients were randomized for this study. Divided into two groups according to use of ultrasound guided transversus abdominis block or systemic morphine analgesia. Intraoperative morphine use is lower number of patients in group A than group B which statistically highly significant (p value = 0.00003) and total opioid dose in mg used in recovery area was lower in group A compared to group B which show highly significant value (p value = 0.0001) also total 24 morphine is significantly lower in ultrasound group A than group B (p value = 0.0001).

Conclusions: Ultrasound-guided TAP block substantially reduced the perioperative opioid consumption and nausea vomiting and respiratory depression with less complications.

Keywords: Ultrasonographic guidance, TAP block, Abdominal laparoscopy

Introduction
Majority of patients scheduled to undergo surgery suffer from emotional stress due to anxiety about the pain which is expected in the postoperative period. Moreover, pain which is not treated promptly after surgery can impair the patient's ability to ambulate which may lead to adverse effects such as thromboembolism, myocardial ischemia, arrhythmia.

Noxious stimuli, once initiated, may produce prolonged changes in central neural processing that contribute to postoperative pain and associated pain behavior long after central afferent input has ceased. This phenomenon of neuroplasticity has resulted in the practice of preemptive analgesia.

Although abdominal laparoscopic surgery is considered to be a minimally invasive surgical procedure with lower perioperative pain scores compared with open procedures it is associated with significant levels of postoperative pain.

Usually, general anaesthesia is given to patients undergoing laparoscopic surgery. However, the use of neuraxial analgesia or intra-peritoneal local anaesthesia has been shown to increase the efficacy of perioperative pain therapy and reduce the consumption of opioid drugs. Peripheral regional anesthetic techniques could be considered as an attractive alternative to central blocks or high-dose intraperitoneal anaesthesia.

The transversus abdominis plane (TAP) block involves the sensory nerve supply of the antero-lateral abdominal wall, where the T7–12 intercostal nerves, the ilioinguinal and iliohypogastric nerves, and the lateral cutaneous branches of the dorsal rami of L1–3 are blocked with an injection of local anaesthetic between the internal oblique abdominal muscle (IOAM) and the transverse abdominal muscle (TAM). TAP blocks are performed for indications such as Caesarean delivery, bowel surgery, or retropubic prostatectomy.

The block is performed by so called ‘pop’ (8–9) or ‘double-pop’ (7) methods in the anatomical area of the ‘Petit’ triangle, which is located between the iliac crest, the latissimus dorsi, and external oblique abdominal muscles (EOAM). Consequently, inadvertent needle positions with subsequent severe complications are described. Direct ultrasonographic visualization of the anatomy involved and the spread of local anaesthetic could serve as an alternative technique to perform a TAP block. Only anecdotal reports are available about the use of ultrasound for TAP blocks.

Aim of study
Our aim is to determine whether Transversus abdominis plane block as part of a multimodal perioperative analgesia is superior to control and reduce the use of opioids analgesic efficacy after abdominal laparoscopic surgery.

Patient and Method
After written informed consent, 80 patients (ASA I or II), undergoing laparoscopic varicocelectomy, cholecystectomy and ovarian cysts manipulation, were randomly assigned to receive general anaesthesia combined with an ultrasound-guided TAP block (Group A) or standard general anaesthetic technique with systemic opioids (Group B).

Exclusion criteria were blood coagulation pathologies, or infection at the site of technique and patient refusal.

After premedication with i.v Midazolam 2 mg 1h before operation, administration of 500 ml lactated Ringer’s solution via a peripheral venous access was started. On arrival to the operating table, monitors (pulse oximetry, ECG, and non-invasive arterial pressure and Etco2) were connected to...
Patients. Induction for general anaesthesia with atropine 0.1 mg/ kg, propofol 2 mg/ kg, and rocuronium 0.6 mg kg and monitoring of muscle relaxant until patient completely paralysed. Subsequently, the trachea was intubated and maintenance with 1.5 MAC isoflurane and rocuronium 0.3 mg at need. At the end the full dose of neostigmine was given and tracheal extubation performed once the patient was awake.

After induction of general anaesthesia, bilateral TAP block was performed under ultrasonographic guidance with a linear 7–12 MHz ultrasound transducer. Once the external oblique muscle, internal oblique muscle, and transversus abdominis muscle were visualized at the level of the anterior axillary line between the 12th rib and the iliac crest the puncture area sterilized with antiseptic solution and sterile probe sheath and sterile ultrasound gel were applied. Then, the block was performed with a 21 G 90 mm needle. Once the tip of the needle was placed in the space between the Internal Oblique Muscle and Transversus Muscle and negative aspiration to check for blood to avoid accidental intravascular injection, 15 ml bupivacaine 5 mg / ml was administered under direct ultrasonographic guidance. The contralateral block was performed equally. Skin incision was given in both study groups 15 min after the TAP block.

Heart rate and non-invasive blood pressure, 5 minutes after tracheal intubation, were taken as baseline. If heart rate, non-invasive arterial pressure, or both increased by 20 % relative to the baseline measurements, morphine 1 mg increments was administered. The total amount of morphine administration was recorded. After operation, the patients were admitted to the post anaesthetic care unit (PACU), where the analgesia was maintained using a 2 mg bolus administration of morphine. The patients observed for 6 hrs in the PACU and when met complete discharge criteria patients transferred to the ward. During period in the recovery room and subsequent 24 h on the ward, the total amount of morphine administration was recorded. Postoperative nausea, vomiting, and respiratory depression were observed and recorded.

**Results**

Eighty patients were randomized blindly in the study into two groups (40 patients in each group) group A ultrasound group (US-TAP) and group B systemic anaesthesia group.

<table>
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<th>Table 1: Demographic data of both groups</th>
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<tr>
<td>Variables</td>
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<tr>
<td>Age</td>
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<tr>
<td>Weight (kg )</td>
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<td>Sex ( female/male )</td>
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<td>Duration of surgery ( min )</td>
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Data are presented as mean ( range ), mean (SD) or ratio and n = number of patients.

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<th>Table 2: Intraoperative and postoperative morphine demand</th>
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<tr>
<td>Variables</td>
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<tr>
<td>Intraperative morphine ( n )</td>
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<tr>
<td>Recovery morphine dose ( mg )</td>
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<td>Total 24 hrs postoperative morphine dose ( mg )</td>
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Data are presented as mean ( range ), mean (SD) or ratio and n = number of patients.

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<th>Table 3: Postoperative complications of both groups</th>
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<td>parameter</td>
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<td>Respiratory depression ( n )</td>
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<td>Nausea and vomiting ( n )</td>
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Table 3: Which show high respiratory depression and increased nausea and vomiting with statistically significant difference.
Discussion

Efforts have been tried to control the postoperative pain effectively. Multimodal techniques consist of a combination of opioids (either systemic or neuraxial), non-steroidal anti-inflammatory drugs and acetaminophen as well as patient-controlled analgesia (PCA) are currently used for pain control after surgery. But there are concerns with regard for the potential of systemically administered opioids to cause nausea, vomiting, drowsiness and respiratory depression (20). Further, epidural patient-controlled analgesia which delivers the analgesics through a catheter placed into the epidural space can develop serious complications such as epidural abscess, meningitis, vertebral canal hematoma, spinal cord ischemia and paraplegia (21, 22). Recently, a peripheral nerve block has been implemented to alleviate the problems above in addition to controlling the postoperative pain effectively at the same time and successful cases have been reported (23, 24) and this correlate with our study which demonstrate lower number of patients need intraoperative morphine and reduced total morphine consumption in 1st 24 hours postoperatively. Especially, the use of ultrasound-guided nerve block has increased and ultrasound guidance offers the advantage of direct visualization of the needle and the anatomical structures. Therefore, one can see real time images during the procedure and for that reason, drugs can be injected more accurately and rapidly into the target site than the use a nerve stimulator or blindly blocking peripheral nerves. Ultimately, this enhances the safety and efficacy of the procedure (25).

The TAP block considered as an effective regional anaesthetic technique for various abdominal surgical procedures and part of multimodal analgesic techniques to reduce opioids use and side effects which cause less patient satisfaction postoperatively. These initial findings were used in clinical applications by the same authors, where the efficacy of TAP blocks during abdominal surgery and Caesarean delivery was investigated. (7, 8, 9). All the studies have reported superiority of the TAP block in terms of reduction in visual analogue scale scores and morphine consumption. Careful examination of the results raises some questions. In two studies, authors suggest that the decrease in morphine consumption lasted for 2 days (26). A total of 41 TAP blocks were performed in both studies with superior postoperative analgesia when compared with pure systemic administration of analgesic drugs. The ‘pop’ technique is also described for other regional anaesthetic methods such as ilioinguinal / iliohypogastric nerve blocks, (14) where severe complications such as colonic puncture, nerve injury, or unpredictable spread of local anaesthetic with subsequent extension of motor block are reported. (15 – 19). Direct visualization of all anatomical structures, the needle, and the spread of local anaesthetic by ultrasonographic guidance may be associated with an increased margin of safety and optimal block qualities. The TAP block raises some important questions. Analgesia qualities of TAP blocks in previous and the recent study are excellent, and systemic opioid demand was significantly decreased when compared with standard general anaesthetic (8 – 10).

These results could be interpreted in two ways. On one hand, it could be suggested that effective analgesia provided by a TAP block is of limited duration. On the other hand, one can argue that, though decreasing, the analgesic effect of the block persists for at least 24 h and that the block could be considered as an integral part of a multimodal analgesic strategy including systemic analgesic agents to control residual pain. The fact that block may contribute to decreasing the incidence of morphine side-effects such as nausea and vomiting is also beneficial to the patient’s rehabilitation. Potential advantages include that it is a simple and effective analgesic technique, appropriate for surgical procedures where parietal pain is a significant component of postoperative pain. It can be performed when neuroaxial blocks are contraindicated, and it provides an alternative analgesic solution in that setting.

In our study we demonstrate reduced postoperative respiratory depression and incidence of nausea and vomiting which commonly associated with opioids and this lower in group A in comparison with group B, Taylor et al. reported that the incidence of respiratory depression is higher in the first 24 hours of the postoperative period. For this reason, many authors recommend that patient observation and monitoring of the level of sedation and respiratory frequency should be done more frequently in the first 24 hours (27). In conclusion, the ultrasound-guided TAP block enables exact placement of the local anaesthetic between the internal and TAM and a significant decrease of systemic analgesics demand when compared with a standard general anaesthetic.

References
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