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Pilot Study of Ambulatory Inguinal Hernia Repair under Ultrasound-guided Transversus Abdominis Plane Block Anesthesia Plus Conscious Sedation

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Authors' contributions

This work was carried out in collaboration between all authors. Author DKM designed the study protocol, collected the data and wrote the draft of the manuscript. Authors NS, IDD and CA performed data analysis and managed the literature searches. Authors MG and MAK performed the TAP blocks. Authors IDK and DD critically revised the manuscript. All authors read and approved the final manuscript.

Short Communication

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ABSTRACT

Aim: Transversus abdominis plane (TAP) block is mainly used as part of multimodal postoperative analgesia regimens in a wide variety of abdominal operations. Our purpose was to evaluate feasibility and safety of TAP block as anesthesia method for inguinal hernia repair.
Methodology: Twenty patients scheduled to undergo ambulatory inguinal hernia repair were selected and consented to ultrasound-guided TAP block anesthesia plus conscious sedation. Twenty to 25 ml of ropivacaine 0.5% were administered into the TAP and sensory blockade of T11-L1 dermatomes was examined 30 minutes later. Data on

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intraoperative tolerance, postoperative pain levels, rescue analgesia requirements, ambulation and complications were recorded.
Results: Nineteen blocks (95%) were successful. One patient (5%) required conversion to general anesthesia. One patient (5%) needed further local anesthetic infiltration before mesh fixation. Postoperative pain levels were excellent, with only one patient (5%) requiring rescue analgesia at home. No complications were observed and all patients were discharged on the evening of surgery.
Conclusion: Inguinal hernias can be safely repaired under ultrasound-guided TAP block anesthesia. Preliminary data are encouraging, in terms of intraoperative anesthesia adequacy, postoperative pain levels and rescue analgesia requirements. The role of TAP block as anesthetic modality for abdominal wall operations should be further investigated.

Keywords: Inguinal hernia; transversus abdominis plane; TAP block; ambulatory surgery; regional anesthesia.

1. INTRODUCTION

Transversus abdominis plane (TAP) is the neurovascular plane between the internal oblique and transversus abdominis muscles [1]. TAP block was first described in 2001, and targets segmental nerves T7-L1 coursing through the plane, to provide sensory blockade to the skin, musculature and parietal peritoneum of the anterolateral abdominal wall [2]. It has since become increasingly popular in multimodal postoperative analgesia regimens and as an alternative when neuraxial blocks are contraindicated [3]. Recently its role as anesthetic method for varicocele repair was also investigated with encouraging results [4]. In inguinal hernia repairs, the block has been studied before, as complement to general, spinal or local anesthesia for postoperative analgesia [5-9]. The purpose of this pilot study was to determine feasibility and safety of ambulatory, open inguinal hernia repair under TAP block anesthesia plus conscious sedation.

2. METHODOLOGY

After local ethics committee approval (Protocol No 13021/18-03-2013, Head: Dr E. Neonakis), 20 consecutive patients, scheduled to undergo ambulatory, open inguinal hernia repair, were screened for enrollment and consented to ultrasound-guided TAP block anesthesia plus conscious sedation. Exclusion criteria included age <18 years, ASA class IV or higher, allergy to paracetamol or amino amide local anesthetics and recurrent, bilateral, irreducible, incarcerated and scrotal hernias.

The Sonosite Nanomaxx Ultrasound System (Sonosite Inc., Bothell, WA, USA) with a 10-5MHz linear probe was utilized. The probe was placed transversely in the midaxillary line, between the costal margin and the iliac crest, and the three muscles of the anterolateral abdominal wall (external oblique, internal oblique and transversus abdominis) were identified. Twenty to 25ml of ropivacaine 0.5% were administered into the TAP, under direct vision, through a 22G needle (Stimuplex D Plus 22G x 50mm, B. Braun, Melsungen, Germany). A successful block was defined as sensory blockade of T11-L1 dermatomes within 30 minutes of injection, judged by pinprick and cold sensation.

Intraoperatively patients were under conscious sedation (spontaneous breathing and verbal response) with intravenous propofol at 12.5-25μg/kg/min and received paracetamol 30mg/kg

(maximum dose 2gr) and diclofenac 75 mg. Our standard operative technique was the tension-free, plug-and-patch repair, performed by surgical trainees under the direct supervision of a consultant surgeon.

Pain levels were assessed in the postanesthetic care unit 30 minutes after surgery and in the surgical ward at 2 and 8 hours postoperatively, on a 4-point verbal analog scale (none=0, mild=1, moderate=2, severe=3). Standard postoperative analgesia consisted of paracetamol 1gr i.v. every 6 hours. Rescue analgesia consisted of NSAID (lornoxicam 8mg i.v.). After the evening ward round, patients were discharged according to standard, same-day discharge criteria (oral analgesics for pain control, no postoperative nausea and vomiting, resumption of normal diet, caretaker at home, residence maximum 60 minutes drive away from hospital) [10].

Oral paracetamol tablets (500 mg) were prescribed every 6 hours as standard analgesia, plus oral lornoxicam tablets (8 mg) for breakthrough pain. Patients were contacted by telephone on the 2nd postoperative day and physically examined on the 8th postoperative day, during the scheduled outpatient follow-up.

3. RESULTS AND DISCUSSION

Demographic and operative characteristics are shown in Table 1. Outcomes are summarized in Table 2. TAP blocks added 9±3 minutes to the overall procedure time. T11-L1 sensory blockade was achieved in 19/20 (95%) patients within 30 minutes. One overweight (BMI 32.1) patient (5%) required conversion to general anesthesia, because of block failure. One patient (5%) reported occasional “needle prick” sensation, and additional local anesthetic was applied around the pubic tubercle before mesh fixation. All 19 patients with successful blocks reported “mild” or “no pain” in the postanesthetic care unit and the ward (Fig. 1) and only one patient (5%) required rescue analgesia at home (lornoxicam 8mg bid for three days). No major intra- or postoperative complications related to TAP block occurred. The patients were discharged on the evening of surgery, highly satisfied with the anesthetic choice.

Table 1. Demographic and operative characteristics

Age (years)	55.1±13.2
Sex (male/female)	19/1
BMI (kg/m^2)	27.1±1.3
ASA score (I / II / III)	10 / 7 / 3
Hernia type (indirect / direct / combined)	11 / 7 / 2
Operative time (minutes)	58.7±11
TAP block time (minutes)	9±3

Table 2. Anesthetic outcomes (per protocol analysis)

Successful blocks n (%)	19/20 (95%)
Conversion to general anesthesia n (%)	1/20 (5%)
Adequate anesthesia n (%)	18/19 (95%)
Same day discharge n (%)	19/19 (100%)
Rescue analgesia n (%)	1/19 (5%)

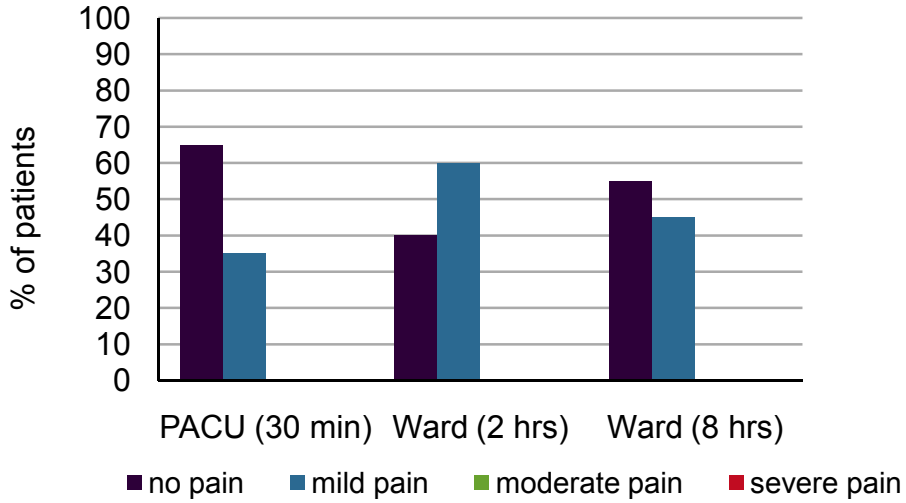

Fig. 1. Postoperative pain levels (VAS scale 0-3)

Although blind TAP block has been shown to be effective, recent ultrasonographic studies reveal that injection of local anesthetic by this technique can be not only inaccurate but also potentially dangerous, with an unacceptably high percentage of intraperitoneal injections [11,12]. Failed blocks are more common than expected and remain probably underreported. Accessing the TAP under ultrasound guidance was first described in 2007 and has since been demonstrated to be safer and more accurate than blind blocks [11-13]. Ultrasound-guided infiltration achieves faster absorption and higher plasma concentrations of local anesthetic, implying that smaller volumes may be required, to minimize risk of systemic toxicity and complications [14]. Handling both probe and needle requires skill and experience and the learning curve has not been established yet [11,15]. However in experienced hands application of ultrasonography has a high rate of success and it should be considered the gold standard in TAP blocks [11,15]. In our study successful administration of ropivacaine was judged clinically, by pinprick and ice sensation 30 minutes after the block. Our success rate of 95% is in accordance with rates of >90% found in the literature [4,5]. Only one block failure occurred, in an overweight patient (BMI 32.1), despite the application of ultrasound.

Obesity per se is no contraindication for TAP blocks, although excessive subcutaneous fat is a challenge to correct palpation of surface landmarks and proper ultrasonographic identification of the abdominal wall layers [2,16,17]. We found that the semilateral position described by Toshniwal and Soskin is a helpful adjunct. By placing a wedge under the ipsilateral flank, the flank fat is displaced towards the midline, reducing the depth between the skin and the TAP [16]. Long Tuohy-tip needles can be used in overweight patients to facilitate injection.

Intraoperatively, the surgeon should pay particular attention during the encirclement of the spermatic cord and the dissection of the hernia sac. We observed that these two surgical maneuvers might elicit pain or discomfort, which can be annoying both to patient and

surgeon. Like local infiltration, TAP block does not eliminate pressure or traction sensation from deeper tissues like the peritoneum [18]. Gentle tissue handling is of utmost importance, as in all herniorrhaphies under local anesthesia [19]. Adjuvant intravenous light sedation offers amnesia and increases patient tolerance and satisfaction [18]. In this series, intraoperative tolerance was adequate and only one patient needed additional infiltration around the pubic tubercle before mesh fixation. As far as recurrent and scrotal hernias are concerned, they can be repaired under local anesthesia, but they may require extensive manipulation and our institutional policy favors general anesthesia [20,21].

TAP block has been shown to reduce postoperative pain scores and opioid consumption, allowing for early ambulation and faster discharge, after a multitude of lower abdominal operations (colectomy, appendectomy, hysterectomy, cesarean section, abdominoplasty, renal transplantation, prostatectomy, iliac crest bone harvest) [22]. Particularly in day-case protocols for inguinal hernia repairs, pain management is crucial and is one of the main reasons for unplanned overnight stay [23,24]. In our series postoperative analgesia was excellent and all cases were discharged on the evening of surgery, as planned. For abdominal wall surgery, TAP block is indeed a clever choice, combining both effective intraoperative anesthesia and postoperative analgesia.

TAP blocks are generally considered safe, with only few cases of complications published [25-27]. In our past experience with TAP blocks, we encountered two cases of temporary femoral nerve palsy, both after blind blocks [28]. A review of the literature revealed that femoral neuroapraxia complicates 5-8% of ilioinguinal/iliohypogastric blocks, lasts usually for 6-8 hours and is self-limiting [29,30].

The small sample size is a limitation to this pilot study, but we showed that inguinal hernias can be safely repaired under TAP block anesthesia. Furthermore our preliminary data are promising in terms of postoperative pain control, analgesia requirements, patient ambulation and satisfaction. A larger randomized prospective trial is currently under way in our institution, to compare TAP block versus general anesthesia.

4. CONCLUSION

Transversus abdominis plane block is a safe and effective anesthetic modality for outpatient inguinal hernia repair. Our preliminary results are promising, in terms of intraoperative anesthesia adequacy, postoperative pain levels and rescue analgesia requirements, with further randomized trials required to compare TAP blocks versus general and local anesthesia for inguinal hernioplasties.

CONSENT

All authors declare that written informed consent was obtained from the patients for publication of this case series.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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