



Research article

Efficacy of combined ultrasound guided anterior and posterior rectus sheath block for postoperative analgesia following umbilical hernia repair: Randomized, controlled trial

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ABSTRACT

Background: Anatomical variations in the thoracic nerves T7 to T11 was found in up to 30% of the population as the anterior cutaneous branch of the nerves are formed before the rectus sheath and so do not penetrate the posterior wall of the rectus sheath. Posterior rectus sheath block was found to be effective for perioperative analgesia. We tested the efficacy of addition of anterior rectus sheath block to capture the anterior cutaneous branch of intercostal nerves as they emerge from the rectus muscle in anterior rectus sheath.

Method: Sixty-three ASA I/II adult patients listed for elective umbilical hernia repair were randomly allocated in one of three groups: Bupivacaine hydrochloride 0.25% was injected by ultrasound guided bilateral posterior rectus sheath in Group I (PRSB) and bilateral anterior and posterior rectus sheath in Group II (APRSB). Group III received bilateral anterior and posterior rectus sheath block using isotonic saline. Twenty-four hours postoperative morphine consumption, Intraoperative rescue fentanyl dose, equivalent morphine dose in the recovery unit and first morphine dose were recorded. The quality of analgesia is assessed by Visual Analogue Scale for 24 h.

Results: Mean intraoperative rescue fentanyl dose was $19.23 \pm 4.96 \mu\text{g}$, $15.28 \pm 2.75 \mu\text{g}$ and $12.85 \pm 3.65 \mu\text{g}$ in control, PRSB and APRSB groups respectively ($P < 0.001$). The mean opioid consumptions in PACU was PRSB $3.47 \pm 0.13 \text{ mg}$, APRSB $2.91 \pm 0.15 \text{ mg}$ and control $4.04 \pm 0.56 \text{ mg}$ respectively ($P < 0.001$). Significant difference in intraoperative rescue fentanyl was found between PRSB and APRSB group ($P = 0.020$). Also statistically significant difference was found between PRSB and APRSB groups in 24 h morphine consumption ($P = 0.034$).

Conclusion: Addition of ultrasound anterior rectus sheath block together with posterior rectus sheath block added more significant analgesia than if we perform posterior rectus sheath alone. This was evidenced by decrease in Intraoperative rescue fentanyl, PACU morphine analgesia, 24 h morphine and pain assessment score.

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1. Introduction

1.1. Anatomical background

The key to understand abdominal wall nerve blocks is to know the applied anatomy of anterior abdominal wall and its innervation.

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tion. From superficial to deep, there are the external oblique, internal oblique, and transverses abdominis. In addition, the paired rectus abdominis muscle forms a muscle layer either side of the midline (Fig. 1). The anterior abdominal wall can be described as the area surrounded by the inguinal ligament and the pelvic bone inferiorly, the costal margin and xiphoid process of the sternum superiorly, and laterally, the mid-axillary line [1].

Between the internal oblique and transverses abdominis muscles lies a plane that corresponds with a similar plane in the intercostal spaces. In so doing they provide a compartment for the injection of local anesthetic. This plane contains the anterior rami of the lower six thoracic nerves (T7 to T12) and first lumbar nerve (L1), supplying the skin, muscles, and parietal peritoneum [2].

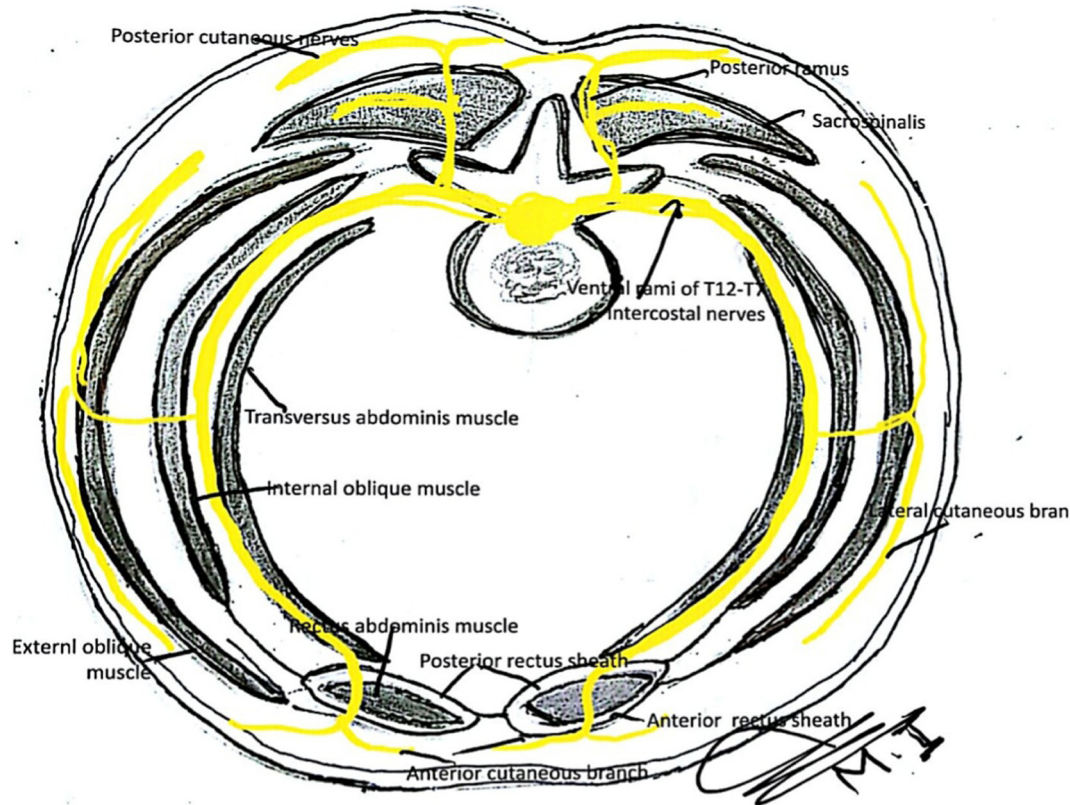


Figure 1. Transverse section of abdominal wall showing the path of nerves T7-T12 as they travel from spine to the abdomen.

At the costal margins, the thoracic nerves T7 to T11 enter this neurovascular plane of the abdominal wall, travelling along this plane to pierce the posterior wall of the rectus sheath as anterior cutaneous branches supplying the overlying skin [2].

The nerves T7 to T9 emerge to supply the skin superior to the umbilicus. The T10 nerve supplies the umbilicus, whereas T11, the cutaneous branch of the subcostal T12, the iliohypogastric nerve, and the ilioinguinal nerve supply the skin inferior to the umbilicus [3].

Rectus sheath block (RSB) has gained popularity for abdominal surgery in the era of fast track day case surgery [4,5]. Schleich firstly described it in 1899 [6], aiming at deposition of local anesthetic (LA) in the virtual space between the posterior wall of the rectus abdominis muscle and its sheath. The anesthetic injected into this space is proposed to spread freely up and down and to block the terminal branches of the intercostal nerves before they leave the rectus sheath [7].

The use of ultrasound (US) has helped to increase the feasibility and clinical applications for truncal block, allowing precise identification of the target structures and accurate visualization of the needle and LA spread [8,9]. US reopened the way for clinical application, study and refinement of RSB [10–15].

Anatomical variations were found in up to 30% of the population as the anterior cutaneous branch of the nerves are formed before the rectus sheath and so do not penetrate the posterior wall of the rectus sheath (Fig. 2) [16,17].

Objectives

Strong evidence is lacking, and no studies to date have examined the addition of anterior rectus sheath block ARSB to posterior rectus sheath block PRSB will add more perioperative analgesia in umbilical herniorrhaphy.

We hypothesized that blocking the anterior cutaneous branch of intercostal nerves as they emerge from the rectus muscle in anterior rectus sheath will increase the chance and effectiveness of block.

For that we planned to test the hypothesis that adding US-guided ARSB to PRSB can offer more reduction in opioid consumption during the first 24 h after umbilical herniorrhaphy in comparison to US-guided PRSB and the systemic analgesia.

2. Methods

The study design was a prospective, randomized, observer double blinded trial with 3 parallel arms.

2.1. Inclusion and exclusion criteria

Inclusion criteria After approval from our Al Jedaani Hospital ethics committee, written informed consent was gained from 70 ASA I/II adult (>18 years old) at least 72 h before surgery by the surgical and anesthetic team. Patients listed for elective umbilical hernia repair with body mass index (BMI) less than 35.

Exclusion criteria included 1 - Patients allergic to amino-amide local anesthetics, 2 - presence of coagulopathy, 3 - local skin infection at the needle puncture sites, 4 - preoperative chronic dependence upon opioid and NSAIDs medications, 5 - liver or renal insufficiency; 6 - a history of psychiatric or neurological disease; 7 - deafness; 8 - previous open surgery; 9 - patients with that need of extending the incision and more extensive surgical manipulations than expected with more tissue trauma and loss of over 500 mL of blood during surgery e.g. hemicolectomy, 10 - American Society of Anesthesiologists (ASA) above Class II were excluded (Fig. 4).

All procedures were performed by the same surgeon. All patients received general anesthesia for the surgery. Preoperative

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