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# Efficacy of intraoperative local administration of 0.5% bupivacaine on postoperative pain control following anterior abdominal wall hernia repair-A prospective case-control study

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**Abstract**
**Introduction:** With current technological advancement and availability of synthetic materials used in inguinal hernia repair, a recurrence after first intervention is not a common and important adverse event [1, 2]. On the other hand, however, some patients complain about chronic pain of the operated site after surgeries using a polypropylene mesh [3]. Many patients are constrained to a prolonged use of analgesics and increased frequency of control visits, which may eventually result in loss of trust in the operator [3]. Every surgical intervention is associated with the risk of immediate or delayed complications [4, 5].
Genitofemoral neuralgia is associated with dysfunction of peripheral nerves passing through the inguinal canal or the surrounding tissue and it is a chronic, troublesome and undesired complication of an inguinal hernia repair [5]. The possibility of minimizing chronic inguinal pain by proper management during herniorrhaphy should be considered in all cases of an inguinal canal reconstruction [6].
**Objectives:** To assess the efficacy of intraoperative injection of 0.5% bupivacaine (analgesic) into the operated site on the postoperative pain over operated site, assessed on the day of operation as well as the 1st and 2nd postoperative day after anterior abdominal wall hernia repair.
**Materials and methods:** A prospective analysis of patient data compiled by assessment of Post-Operative pain at operated site documented and patient follow up recorded over the period from March 2018 and December 2018 at RL Jalappa hospital and research centre, Tamaka, Kolar.
**Results:** All complications of the surgical wound significantly increased pain level on postoperative day 2. The NRS score for complicated surgical wound was 2.1 on average. In the case of uncomplicated wounds, it was 0.72 (2.1 vs. 0.72 on day 2). Presence of blood in the surgical wound manifesting itself by ecchymosis and hematoma increased pain level assessed on postoperative day 2 (NRS score 2.0 vs. 0.79 in day 2). Duration of procedure did not influence pain sensation on postoperative day 0, 1, 2. In the group with inguinal hernias, postoperative complications of the wound occurred in 8.3% (n=3). Skin and subcutaneous tissue oedema of the wound was found in 10% (n=5) of patients.

**Keywords:** Hernia, mesh repair, wound infection, chemoprophylaxis

## Introduction
Ventral hernia is one of the most common conditions requiring an elective surgical intervention. The probability of need for surgical treatment of an inguinal hernia throughout life is up to 27% in males and up to 3% in females [1]. Currently, long-term and chronic complications of hernia repair mainly include pain of the operated site (CPIP-chronic postoperative inguinal pain) [5]. CPIP is defined as pain in the inguinal region following surgery that lasts for 3 months or longer [6]. Chronic pain affects even 37% of patients undergoing surgery for an inguinal hernia [7-10]. Chronic pain of genitals, pain during ejaculation and pain limiting intercourses occur sporadically. Those disorders affect approx. 2.5% of patients [11-16]. Young age is a documented risk factor of such complications [17, 18]. This study was aimed to investigate the influence of so-called preemptive analgesia on postoperative pain.

## Materials and methods
During the period between March 2018 and December 2018, 50 patients that underwent elective inguinal and other ventral hernia repair were divided into two groups. 36 patients underwent inguinal hernia repair, 6 underwent umbilical hernia repair, 4 underwent Epigastric hernia repair

and 4 underwent incisional hernia repair. In studied group, during a hernia repair with polypropylene mesh implantation, selected anatomical regions and the subcutaneous tissue were injected with 20 mL of 0.5% bupivacaine solution. Local analgesic was given only once during surgery.

In control group, no infiltration anesthesia was applied.

Bupivacaine, which was used for the studied intervention, is an amide local anesthetic. It is used for infiltration, peripheral nerve block, especially when long-lasting anesthesia is needed. Daily dose should not exceed 150mg. In adults, 400mg is usually well-tolerated. Maximum dose of bupivacaine is 2 mg/kg. 1 mL of 0.5% solutions contains 5mg of bupivacaine.

10 mL of the solutions contains 50 mg of bupivacaine, and 20 mL contains 100 mg, hence doses used for the intervention were completely safe and did not pose a threat to the patient.

In the next step during hospital observation, pain intensity was assessed on postoperative day 0, 1 and 2, using the NRS numeric scale. The pain was assessed four times a day. Based on the collected data, pain intensity was compared between study group and control group.

Hernioplasty was most often conducted under regional anesthesia (n=46) and 4 patients required general anesthesia. To fill in the defect, a polypropylene mesh was used which was implanted using Lichtenstein's technique. For mesh attachment, non-absorbable Polypropylene 2.0 and absorbable polyglactin 2.0 sutures were used. Subcutaneous tissue was pulled together with absorbable polyglactin 3.0 sutures. For wound closure, Nylon 2-0 sutures were used.

Each patient received analgesics including 50mg of tramadol BD during the postoperative period. Inguinal hernia operation was conducted under antibiotic prophylaxis with 3rd generation cephalosporins (Ceftriaxone) administered 60 minutes prior to surgery at the dose of 1g.

In the studied groups, the following end-points were assessed:

- age
- sex
- duration of procedure
- duration of hospital stay
- number of necessary dressing changes
- wound condition (complications including edema, ecchymosis, hematoma)
- pain intensity on the NRS scale (0-10; 0 relating to no pain while 10 denoting maximal imaginable pain) assessed four times a day on postoperative day 0, 1 and 2
- wound drainage
- urethral catheterization

Next, it was determined whether selected risk factors influenced pain level on postoperative day 0, 1, 2. Patients with complications experienced more pain on postoperative day 2 compared to patients without complications Patients with ecchymosis experienced more pain on postoperative day 2 compared to patients without those complications Patients with Foley's catheter felt more pain on postoperative day 0 compared to the rest of the patients with "the pantaloon hernia" felt less pain on postoperative day 1compared to the rest of the patients. Patients with incisional hernia repair experienced more pain compared to remaining hernia repairs. Next, the analysis of correlation using Spearman's correlation rank was conducted between the pain level on postoperative day 0, 1, 2 and the number of dressing changes. Correlation analysis showed that the more the dressing changes, the more pain is experienced on postoperative day 2.

**Results**

All complications of the surgical wound significantly increased pain level on postoperative day 2. The NRS score for complicated surgical wound was 2.1 on average. In the case of uncomplicated wounds, it was 0.72 (2.1 vs. 0.72 on day 2).

Presence of blood in the surgical wound manifesting itself by ecchymosis and hematoma increased pain level assessed on postoperative day 2 (NRS score 2.0 vs. 0.79 in day 2).

Hence, the necessity of frequent dressing changes was correlated with intense pain sensation.

Urinary retention after procedure requiring urethral catheterization on the operation day was associated with increased pain on day 0. (NRS score 4.91 vs. 3.85 on day 0). In patients with inguinal hernia, 31.2% (n=34) of them required urethral catheterization with Foley's catheter. In the case of scrotal and recurrent hernia, the rate was 37.5%.

In the case of intraoperative diagnosis of concurrent direct and indirect hernia, i.e. so-called 'pantaloon hernia', the patients reported lower pain level on postoperative day 1 compared to control group (NRS score 0.5 vs. 2.95).

Other intraoperative diagnoses or mechanisms of hernia development (direct and indirect hernia, posterior inguinal canal wall insufficiency) did not influence pain sensation.

In all patients enrolled in the study, analgesics were used (tramadol) BD during the postoperative period.

Duration of procedure did not influence pain sensation on postoperative day 0, 1, 2. In the group with inguinal hernias, postoperative complications of the wound occurred in 8.3% (n=3).

Skin and subcutaneous tissue edema of the wound area was found in 10% (n=5) of patients.

No patient after inguinal hernioplasty presented testicular or scrotal edema.

It can be concluded that prophylactic drainage can successfully reduce pain by minimizing the amount of collected blood. The mere presence of a drain in the wound was not an independent risk factor of an increased postoperative pain.

**Discussion**

Every surgical intervention increases the risk of chronic pain in the operated site [19-21].

Elective hernioplasty, significantly increases the risk of chronic neuropathic pain up to 30% [22].

Every surgical intervention involving integrity and contents of the inguinal canal is associated with the risk of damage to nerve fibers of this region. Multifactorial mechanism of impaired structure and function of peripheral nerves can lead to development of inguinodynia, i.e. chronic postoperative inguinal pain (CPIP).

One of complications following intervention to the inguinal canal and its content is pain which occurs immediately after or in long-term after surgical procedure.

The main cause of inguinal pain is injury and/or irritation to the following nerves: ilioinguinal, iliohypogastric and genital branch of genitofemoral nerve.

Currently with non-tension techniques of hernia repair, long-term complications include higher rate of pain syndrome compared to hernia recurrence.

Application of synthetic materials allows for optimal support of sites with reduced resistance. On the other hand, it promotes proliferation, reactions to foreign body, fibrosis and scar formation, which impairs normal anatomy of the region. Those changes are the cause of nerve entrapment [23].

In the literature, the term post-operative neuralgia is often en-

countered. Historically, a clinical syndrome of various symptoms including pain, burning sensation, discomfort or itching was first described in 1942. The reported case regarded a patient undergoing appendectomy [24].

Possible causes of pain:

- Proliferation involving the nerve
- Thermal injury to the nerve [25].
- Inflammation
- Hematoma formation
- retroperitoneal abscess
- Abscess in the location of the muscle
- Neuroma of nerve endings [26].
- Direct irritation of nerve endings by the implanted material [27].
- Indirect nerve injury due to granulocyte infiltration [28].

On physical examination, neurological signs are noticeable (hypoesthesia, paresthesia, hyperesthesia, increased reaction to pain stimuli) [29].

In 25% of cases, symptoms unrelated to nerve damage are present. They are caused by mechanical irritation of periosteum of the pubic tubercle, irritation by a foreign body (mesh), reaction to sutures which can trigger inflammation in the operated site, soft tissues and skeletal muscles. Another 25% of patients report diffuse pain of the region without symptoms of nerve entrapment (funiculodynia). This late pain syndrome can be caused by venous congestion or mesh-related inflammation [30].

**Conclusion**

Managing postoperative pain, it is recommended to implement strategy of so-called multimodal analgesia. Application of many substances with different mechanisms and time of action is an optimal strategy.

In our study, regional and additional intraoperative use of a local analgesic (up to 20 mL of 0.5% bupivacaine) did not significantly reduce postoperative pain assessed on postoperative day 0, 1 and 2.

Based on medical notes, it was determined that complications of the operated site including skin and subcutaneous edema, ecchymosis and inguinal hematoma significantly increase pain sensation assessed immediately after inguinal hernia repair.

More frequent dressing changes were associated with increased postoperative pain sensation. Reduction of pain is explained by smaller amount of blood and its metabolites collecting locally. Scrupulous surgical technical, delicate handling of structures and maintaining homeostasis provide comfortable local and general state after hernia repair.

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