

ORIGINAL ARTICLE

Percutaneous ilioinguinal-iliohypogastric nerve block or step-by-step local infiltration anesthesia for inguinal hernia repair: what cadaveric dissection says?

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Purpose: The repair of groin hernias with local anesthesia has gained popularity. Two main methods have been described for local anesthesia. This study was aimed at comparing percutaneous truncular ilioinguinal-iliohypogastric block and step-by-step infiltration technique by using cadaver dissections. **Methods:** The study was performed on an adult male cadaver by using blue dye injection. A percutaneous nerve block simulation was done on right side and the dye was given in between the internal oblique and transversus muscles. On the left side, a skin incision was deepened and the dye was injected under the external oblique aponeurosis. Following the injections, stained areas were investigated superficially and within the deeper tissues with dissection. **Results:** There was a complete superficial staining covering the iliohypogastric and ilioinguinal nerves in the inguinal floor at both sides. On the right side, intraabdominal observation showed a wide and intense peritoneal staining, while almost no staining was seen on the left side. Preperitoneal dissection displayed a massive staining including testicular vascular pedicle and vas deferens on the right side. The dye solution also infiltrated the area of the femoral nerve prominently. On the contrary, a very limited staining was seen on the left. **Conclusion:** It may not always be easy to keep the percutaneous block within optimum anatomical limits without causing adverse events. A step-by-step infiltration technique under direct surgical vision seems to be safer than percutaneous inguinal block for patients undergoing inguinal hernia repair.

Key Words: Inguinal hernia, Local anesthesia, Infiltration anesthesia, Nerve block, Femoral nerve

INTRODUCTION

Truncular ilioinguinal and iliohypogastric nerve block has long been considered a suitable anesthetic method for both children and adult patient populations during surgical procedures in the inguinal region, mainly hernia repairs [1]. The technique is also used for postoperative an-

algesia for surgical procedures completed under general anesthesia [2,3]. Additionally, nerve block may be an effective solution for primary or surgery related pain of the inguinal region [4].

The technique requires a blind puncture at a point close to the anterior superior iliac spine (ASIS) and a 10 to 15 mL local anesthetic agent injection into the planes between ex-

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ternal and internal oblique muscles or internal and transverse muscles to block the nerves before entering the inguinal region [5-8]. However, it has been reported that inguinal nerve block can have 10 to 30% failure rate when a blind technique is used [9]. In addition, this technique may result in complications such as peritoneal puncture, small or large bowel perforations, and femoral nerve palsy even in experienced hands [10-15].

Numerous repair procedures have been described to date for groin hernias. Almost all of them, excluding laparoscopic techniques, can be performed with local anesthesia [16-18]. Lichtenstein repair by using prosthetic mesh has gained great popularity because of its simplicity and low recurrence rate [17]. The Lichtenstein Institute also described a novel technique for local anesthesia in groin hernia repair [19]. This is a step-by-step infiltration procedure that has a main phase of giving a volume of 8 to 10 mL local anesthetic agent under the external oblique aponeurosis prior to its opening. Additional doses may be given when needed with no blind or deep injections with long needles.

Both techniques are in use in our daily practice. Step-by-step infiltration is a more frequent procedure with better patient and surgeon satisfaction. No complications related to this technique have been recorded. However, truncular percutaneous block technique has rarely caused transient femoral nerve palsy as previously reported by the others. We aimed to see objectively how far these two

procedures diffuse and what depth is reached when the same volume of agent is given to display the difference between the methods regarding femoral nerve palsy.

METHODS

This study was performed on two formaline fixed adult male cadavers. In the first part of the work, a comparative model for percutaneous blind ilioinguinal and iliohypogastric nerve block and step-by-step infiltration technique was studied. For blind block, a 20 G / 38 mm needle was inserted 3 cm medial and 1 cm inferior to the ASIS on the right side. As the skin and subcutaneous tissue had previously been lifted, the needle was advanced behind the internal oblique muscle under direct vision. Single click technique was used to inject 10 mL diluted blue dye solution between the internal oblique and transverse abdominal muscles. The tip of the needle was also checked from inside the abdominal wall to protect an inadvertent peritoneal puncture. On the left side of the cadaver, a 5 cm skin incision was made and the subcutaneous tissues were opened to see external oblique aponeurosis. The tip of the needle was inserted under the aponeurosis and 10 mL of the same blue dye solution was given in between external oblique aponeurosis and internal oblique muscle.

Following the injections, the stained areas were investigated superficially and within the deeper tissues.

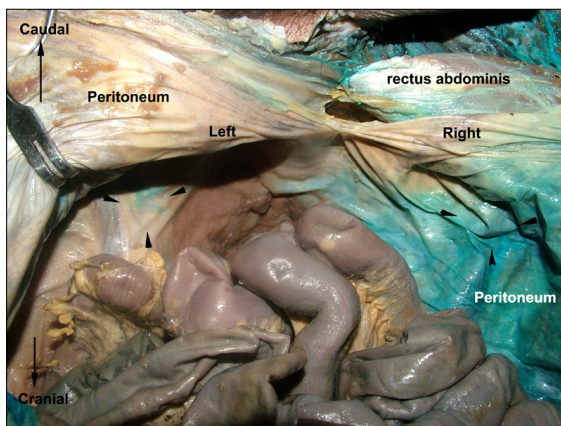


Fig. 1. A view from abdomen shows a wide and intense peritoneal staining at right side, where percutaneous block attempted, while almost no staining is seen at left side.

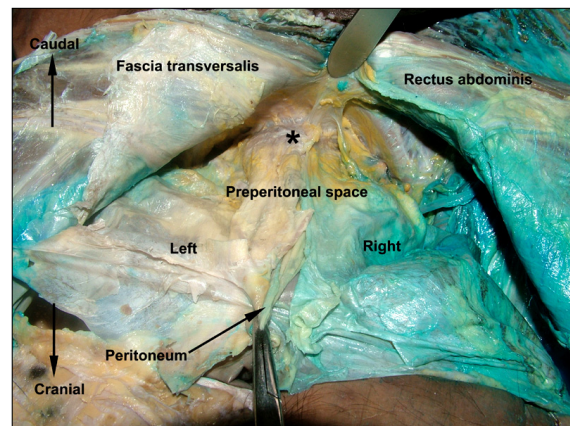


Fig. 2. Preperitoneal dissection displayed a massive staining including testicular vascular pedicle and vas deferens at right side. On the contrary, a very limited staining was seen at left side.

Intraabdominal views were taken, then, a preperitoneal space dissection was performed at both sides until the vicinity of the femoral nerve was exposed.

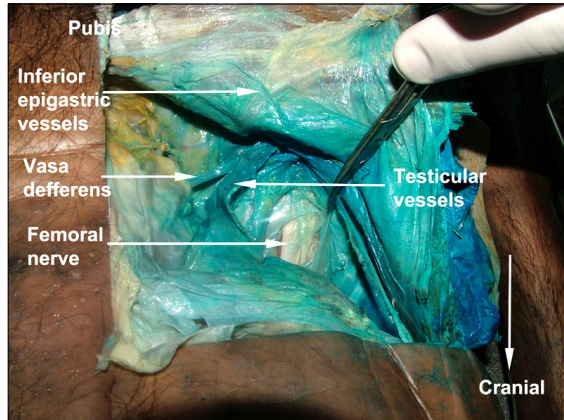


Fig. 3. The dye solution infiltrated the left femoral nerve area prominently at right side after percutaneous block.

At the second part of the work, percutaneous ilioinguinal and iliohypogastric nerve block was simulated by lifting the skin and subcutaneous tissue with dissection first. Red dye was directly given under the external oblique aponeurosis. This model was intended to present a percutaneous block by a highly experienced hand or with the guide of ultrasound.

RESULTS

There was a complete superficial staining covering the iliohypogastric and ilioinguinal nerves in the inguinal floor at both sides. At right side, intraabdominal observation showed a wide and intense peritoneal staining, while almost no staining was seen at left side (Fig. 1). Preperitoneal dissection displayed a massive staining including testicular vascular pedicle and vas deferens at

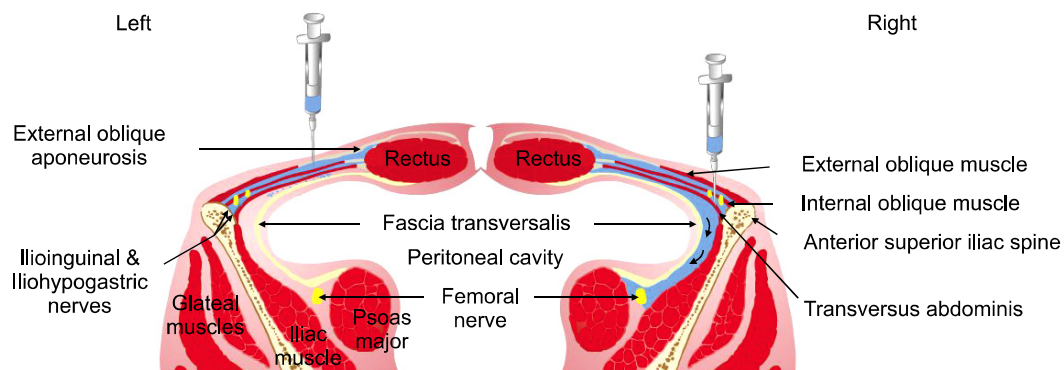


Fig. 4. A cross-sectional diagram shows both sides. Dye solution can infiltrate the tissues down to the femoral nerve after percutaneous injection between the internal oblique muscle and transversus abdominis at right side. The dye travels along with the transversalis fascia. A dye injection under the external oblique aponeurosis seems to be limited with the more superficial tissues.

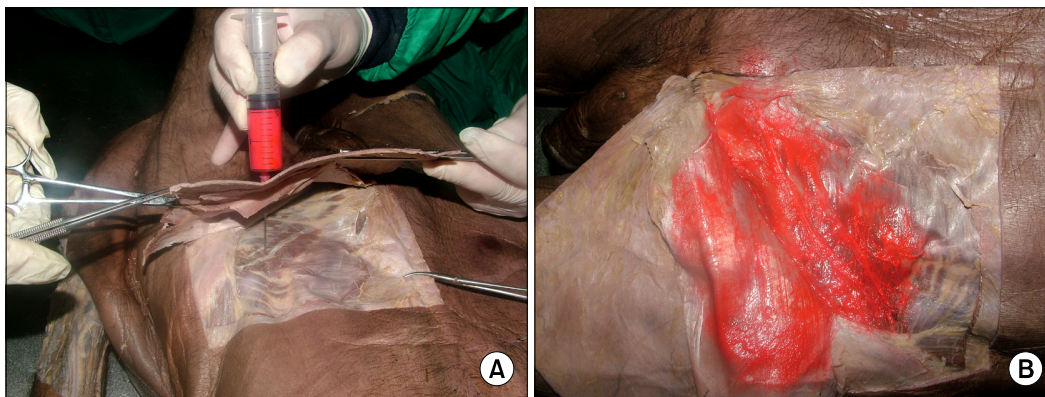


Fig. 5. (A) The red dye was given beneath the external oblique aponeurosis after the skin was lifting. (B) The whole inguinal regions was involved. Both iliohypogastric and ilioinguinal nerves were found to be infiltrated by the red dye.

right side. On the contrary, a very limited staining was seen at left side (Fig. 2). The dye solution infiltrated the right femoral nerve area prominently (Fig. 3). The staining patterns at both sides are also shown in a cross-sectional diagram (Fig. 4).

At the second part of the work, both iliohypogastric and ilioinguinal nerves were found to be infiltrated by the red dye. The whole inguinal floor was also involved (Fig. 5). No deeper penetration as developed by a blind percutaneous block was observed in this occasion.

DISCUSSION

As a blind invasive technique, percutaneous nerve block for inguinal hernia repair has a potential for adverse effects. It requires giving the anesthetic agent between muscles, however it is not always easy to detect the passing of layers of the abdominal wall during the procedure. One can pass and puncture the peritoneum and the major vessels or the given fluid may escape deep into the femoral region unintentionally [10,11]. The first is a major but very uncommon event, whereas the second is a minor complication that can normalize within hours, but not rare. Its incidence has been reported to be 6% in adult hernia patients [20].

Classical complaints of transient femoral nerve palsy are leg weakness and knee buckling (inability to stabilize the knee to stand up and walk). This may last for 8 hours after the operation. Tension-free inguinal hernia repairs with prosthetic material are easily performed as day case procedures today, especially in specific hernia clinics. Patients are generally sent home only 2 hours after the operation. Femoral nerve palsy is obviously an obstacle for early discharge. A step-by-step local infiltration technique under direct vision may be considered to decrease the incidence of this complication.

Rosario et al. [14] have shown by a cadaver study that the needle point is very close to the femoral nerve along the posterior abdominal wall, especially in males. Methylene blue injection -1 mL in the plane superficial to the transversus abdominis and another 1 mL in the plane deep to the transversus abdominis- resulted in a dye tracking medially and slightly cephalad under the iliacus

fascia. Eventually, a dye pooling around the main trunk of the femoral nerve and other branches of the lumbar plexus was seen. They reported that the first superficial plane seemed safe. However, the second plane deep into the transversus was responsible for femoral involvement. Then, the authors suggested that it was better and safer to infiltrate the superficial layers, that is skin, subcutaneous tissues and external oblique aponeurosis first, and continue on the deeper layers under direct vision with surgical exploration.

Our work differs from Rosario's study in some aspects. First, the injected volume of 10 mL in the present study is realistic and matches the clinical application for adult patients, whereas the volume in the earlier study was just 2 mL. Secondly, we compare two different techniques in the same body on two sides. A similar discoloration pattern to that in Rosario's study was observed during the present cadaver dissection after ilioinguinal block. On the other side, step-by-step infiltration with its main step of injecting the agent under the external oblique aponeurosis caused little discoloration in deep tissues and the area around the femoral nerve. This was the case for both intraperitoneal and preperitoneal dissections. The present finding seems to explain why percutaneous inguinal field block causes femoral nerve palsy more frequently than a step-by-step infiltration does.

The superficial discoloration was similar at two sides, indicating that the efficacy of the two methods is similar for inguinal hernia repair. Wide peritoneal discoloration following percutaneous block may be a clue for more comfortable surgical manipulation during hernia sac dissection, however the sac and the root of the spermatic cord is given additional local anesthetic during step-by-step infiltration, by keeping the total number of doses well within safety limits.

The limitation of the present study is that dissection was done on only two cadavers due to an institutional shortage of material. Individual anatomic differences may result in variable findings. Rosario et al. dissected 21 cadavers. Unfortunately, they did not mention how many subjects displayed a prominent dye pooling around the femoral nerve. The pooling appeared in the first and single subject in the present dissection.

Obviously, a difference can be expected between cadavers and living subjects. However, it is not easy to perform this sort of study in surgical patients. One other dissimilarity can arise from the densities of the solutions. Local anesthetic agents and their saline-mixed solutions have a density almost 1.0 g/cm^3 at both room temperature and 37°C , while the blue dye used was about 1.75 g/cm^3 in density. It may be speculated that the dye can be more easily tracked into the deep tissues and spaces. This may explain why femoral nerve involvement is seen in a small percentage of the cases.

Several centers recently reported ultrasound guided ilioinguinal-iliohypogastric nerve block [7,20,21]. Surgeons or anesthetists can see where they administer the local anesthetic during this procedure. In fact, no consensus exists on the correct plane for local anesthetic injection. Many authors consider the plane between the internal oblique muscle and transversus abdominis as safe. It was reported that ultrasound guidance can provide a 100% success rate [21-23]. The second part of the present study also revealed that if ultrasound guidance can indicate the needle is in between the external oblique aponeurosis and internal oblique muscle where two nerves lie the technique may have higher success rates without complications. However, Weintraud et al. [21] wrote that a satisfactory block rate was achieved in only 62% of the patients and accurate placement was accomplished in just 14% of the cases. Eichenberger [24] carried out a cadaver dissection to establish the correct point for the block and suggested that the needle should be targeted to the nerves from 5 cm cranial and posterior to the anterior superior iliac spine, which is not consistent with the classical description of the technique.

In conclusion, the entry point of a blind inguinal nerve block is somewhat uncertain. The exact plane for injection and the success rates are rather changeable. It is not always easy to keep this block within optimum anatomical limits to ease the surgery and to avoid causing adverse events. Previous reports and the present findings suggest that step-by-step infiltration technique under direct surgical vision is safer than percutaneous inguinal block for patients undergoing inguinal hernia repair.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

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