CASE REPORT

Excellent postoperative analgesia with the addition of hyaluronidase to lignocaine for subcostal TAP block used in conjunction with systemic analgesia for laparoscopic cholecystectomy

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SUMMARY

Subcostal transversus abdominis plane (TAP) blocks provide good postoperative analgesia for laparoscopic cholecystectomies. We hypothesised that adding hyaluronidase may improve the efficacy of this technique by increasing spread of the local anaesthetic (LA). In this case, we performed a bilateral ultrasound-guided subcostal TAP block using lignocaine (40 mL 1%) with hyaluronidase (75 IU/mL) for postoperative analgesia following elective laparoscopic cholecystectomy. It was used in combination with intraoperative morphine, diclofenac and paracetamol. Regular paracetamol was administered postoperatively. We monitored serial serum lignocaine levels and recorded the patient's visual analogue scale (VAS) pain scores postoperatively. We found that the patient experienced excellent analgesia throughout the postoperative period and that the serum lignocaine levels did not exceed the therapeutic range.

BACKGROUND

Subcostal transversus abdominis plane (TAP) blocks provide good postoperative analgesia for upper abdominal procedures. The addition of hyaluronidase to subcostal TAP blocks has not previously been described for upper abdominal surgery. We hypothesised that the addition of hyaluronidase may improve the efficacy of TAP blocks by facilitating the spread of local anaesthetic (LA). We were concerned, however, that hyaluronidase might increase serum lignocaine levels due to increased systemic absorption; for this reason, we monitored serum lignocaine levels and found that they remained well below toxic levels.

CASE PRESENTATION

A 56-year-old woman with no significant medical or surgical history presented for an elective laparoscopic cholecystectomy for symptomatic cholelithiasis.

General anaesthesia was induced with fentanyl 100 µg, propofol 200 mg and rocuronium 50 mg. The airway was secured with an endotracheal tube and mechanical ventilation was initiated. General anaesthesia was maintained with sevoflurane. Analgesia was administered intravenously at the beginning of surgery consisting of paracetamol 1 g, diclofenac 75 mg and morphine 5 mg. No further analgesics were administered intraoperatively.

Following the end of surgery, the skin was prepared with 2% chlorhexidine solution and draped. Bilateral subcostal approach TAP blocks¹ were performed using ultrasound imaging using a Sonosite S-nerve with a linear 5–13 MHz transducer. The neurofascial plane between the internal oblique and TAP was identified. A 60 mm 20G Stimuplex needle was visualised entering the TAP using in-plane technique. Following the demonstration of negative aspiration, 20 mL of 1% lignocaine with 1500 units of hyaluronidase (75 units/mL) was injected bilaterally. Hydrodissection was visualised in the plane. After performing the bilateral TAP blocks, peripheral blood samples were taken at 1, 5, 15, 30 and 60 min and tested for lignocaine levels.

Following completion of the TAP block, neuromuscular blockade was reversed with sugammadex 200 mg and the patient was woken up. The patient was transferred to recovery where she remained for 60 min. Visual analogue scale (VAS) scores were recorded at 10-min intervals in the recovery room for 1 h and at 2 hourly intervals on the surgical ward. To aid with postoperative analgesia, four doses of intravenous paracetamol (1 g every 6 h) was administered regularly until discharge the following morning. Pain scores were 0/10 at all time intervals in the recovery room and in the ward. No breakthrough analgesia was required. The patient was followed-up via telephone interview and reported 0/10 pain scores throughout the 48-h postoperative period.

OUTCOME AND FOLLOW-UP

Bilateral TAP block with hyaluronidase added to lignocaine provided excellent analgesia after laparoscopic cholecystectomy when combined with perioperative paracetamol.

The addition of hyaluronidase to lignocaine for the subcostal TAP block did not lead to elevated serum lignocaine above safe levels. The highest serum lignocaine level observed in this patient was recorded 60 min after performing the block, which was 1.9 mg/L, whereas the therapeutic range for lignocaine as an antiarrhythmic is 2–5 mg/L.²

The patient was closely monitored in the immediate and early postoperative period by anaesthetic staff in the recovery room. VAS scores (0–10) were recorded overnight at 4 hourly intervals until discharge the following morning. VAS scores were

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To cite: Johnson MZ,
O'Connor TC. *BMJ Case Rep*
Published online: [please
include Day Month Year]
doi:10.1136/bcr-2013-
202911

0/10 at all measurements until discharge. The patient was later followed up via telephone interview and reported no pain (VAS score 0/10) at 24 and 48 h.

DISCUSSION

Hyaluronic acid is widely found in the extracellular connective tissue matrix. It is a glycosaminoglycan compound that acts as a lubricant and contributes to cell proliferation and migration.³

Hyaluronidase is an enzyme that hydrolyses hyaluronic acid in the tissue. It has been shown to aid the spread of LA through tissue.⁴ It is postulated that it achieves this by a reversible depolymerising effect on hyaluronic acid.³ It has also been demonstrated that it raises the pH of a LA preparation, thereby contributing to the efficacy of LA blockade.⁴

Hyaluronidase is commonly used as a LA adjunct in ophthalmic anaesthesia and its use was first described in 1949.⁵ A study using ultrasound showed significant improvement in dispersal of sub-tenon lignocaine with addition of hyaluronidase.⁶ A double-blind randomised controlled study found that the addition of hyaluronidase to lignocaine 2% in sub-tenon blocks significantly decreased the volume of LA required to achieve a satisfactory block.⁷

It has also been shown to be effective in improving and prolonging analgesia for inguinal hernia operations.⁸ This study of patients undergoing inguinal hernioplasty under inguinal hernia block (iliohypogastric nerve block, ilioinguinal nerve block, genitofemoral nerve block and local infiltration) using a combination of lignocaine and bupivacaine showed improved intraoperative analgesia and prolonged postoperative analgesia with the addition of hyaluronidase.

While adverse reactions to hyaluronidase are rare, in the ophthalmology setting, there are case reports of allergic reactions including angioedema.⁹ Previous exposure to hyaluronidase was reported in most cases.⁹

There is much debate about the correct concentration of hyaluronidase and no definitive conclusion has been found.⁹ Concentrations used range between 15 and 300 IU/mL when used in ophthalmic regional anaesthesia.¹⁰ In this case, we used a concentration of 75 IU/mL. In a study of ophthalmic blocks comparing LA alone with LA combined with hyaluronidase, the addition of hyaluronidase to LA at a concentration of 75 IU/mL did not significantly increase serum LA levels.¹¹

The TAP block is a regional anaesthesia technique that involves delivering a large bolus of LA into the neurofascial plane between the internal oblique and transversus abdominis muscles. This technique is used to block the neural afferents to the abdominal wall. The TAP block provides analgesia for the skin, subcutaneous tissue and the parietal peritoneum; however, additional analgesia is generally required for visceral pain. TAP blocks are generally used with systemic analgesic agents, usually consisting of paracetamol, NSAIDs and opioids. TAP blocks are generally a safe procedure and can be performed on anaesthetised patients,¹² and in experienced hands the success rate has been quoted as 85%.¹³ It has previously been shown that LA in the TAP may travel paravertebrally providing visceral analgesia,¹⁴ and this mechanism may account for the lack of visceral pain in our patient, for whom VAS score never exceeded 0/10.

As TAP blocks require a high volume of LA, concerns have been raised regarding the potential for elevated systemic levels of LA, with resultant toxicity. A study of 12 patients receiving a TAP block with 40 mL 1% lignocaine showed a peak mean serum concentration of 3.6 mg/L, which occurred 30 min after administering the block.¹⁵ In one patient, however, a concentration of 5.5 mg/L was recorded 15 min after administering the

Figure 1 Serum lignocaine plotted versus time after performance of transversus abdominis plane block.

block, which demonstrates the potentially high systemic absorption with this block. The highest serum lignocaine concentration recorded in our patient was 1.9 mg/L, which is well below the toxic range for this drug (figure 1). The therapeutic range for lignocaine as an antiarrhythmic is 2–5 mg/L, and blood concentrations above 9 mg/L are frequently associated with toxicity.²

Our patient experienced complete postoperative analgesia. The TAP block may explain abdominal wall analgesia; however, visceral analgesia would require further spread of LA. MRI studies have shown that with posterior approach TAP blocks, there can be quite extensive paravertebral spread extending from T5 to L1; however, with subcostal TAP blocks, there was no paravertebral spread observed.¹⁴ We hypothesise that hyaluronidase may facilitate more extensive spread of LA agent, perhaps extending as far as the paravertebral space, thus providing a mechanism for visceral analgesia.

There is debate whether TAP blocks should be performed for postoperative analgesia in laparoscopic cholecystectomies.^{16 17} There is good evidence that TAP blocks provide better analgesia than standard care; however, it has not been shown to be significantly better than infiltration of LA at sites of trocar placement.¹⁸

There are several limitations to our case study. Skin sensation was not tested postoperatively, thus limiting information regarding the level of the block. However, excellent analgesia was achieved for this patient. Laparoscopic cholecystectomies are a moderately painful procedure; the patient received systemic analgesia in addition to the TAP block, which may account in part for the efficacy of the analgesia achieved. However, laparoscopic cholecystectomies are a very common surgical procedure and are frequently carried out as day cases, therefore requiring excellent analgesia without nausea or vomiting—and TAP block with LA and hyaluronidase may contribute significantly to achieve this goal. It may, therefore, present an important alternative to opiate-based analgesia and the potential side effects of this group of drugs, if our findings in this case can be reproduced.

Learning points

- ▶ Hyaluronidase may improve the efficacy of subcostal transversus abdominis plane (TAP) blocks.
- ▶ In this case study, serum lignocaine concentrations were comparable to previous studies of lignocaine levels without hyaluronidase.
- ▶ Addition of hyaluronidase to TAP block may present an important alternative to opiate-based analgesia for postoperative laparoscopic cholecystectomy.

We recommend that randomised controlled studies should be carried out comparing LA alone with LA and hyaluronidase in subcostal TAP blocks, and evaluation of analgesia, level of block, as well as serum levels of LA, should be studied further.

Contributors MJZ carried out this case and wrote case report under the supervision and with the assistance of TCO.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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