Original Article

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USG Guided Quadaratus Lumburoum Block and Low Dose Spinal Anesthesia in Abdominal Surgeries

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ABSTRACT

Background: The postoperative analgesic efficacy of trans-muscular quadratus lumborum block in abdominal surgeries is well established; however, its intraoperative safety and efficacy as an anesthetic is still being explored. This retrospective case review was conducted to investigate the efficacy and safety of combined quadaratus lumburoum block and low-dose subarachnoid block for anesthesia in complex abdominal operations.

Methods: Perioperative data of 29 patients, who underwent abdominal operations during the period of June/2019 to October/2019 under the combined technique, was analyzed. The primary outcome was intra and postoperative pain scores with the conox as qnox and numeric rating scale respectively at different time points. The secondary outcomes were intraoperative sedation scores with conox as qcon and perioperative dosage of fentanyl, changes in mean arterial pressure and the incidence of adverse events.

Results: The mean qnox scores at incision, viscera dissection, closure and before transport to the post anesthesia care unit were between 44.66 and 55.79. The mean numeric rating scale scores before bed on the operation day, at 8 am on the first postoperative day, before bed on the first postoperative day and at 8 am on the second postoperative day were between 3.41 and 3.86. The mean qcon scores during the operations were between 61.31 and 65.82 while it was 85.66 following the stoppage of all sedations. The mean total perioperative consumption of fentanyl was 38.7mcg. The proportion of patients having MAP changes of less than 20% from baseline was 85.72%. The incidence of peri-operative adverse events was low.

Conclusions: For complex abdominal operations, a combination of ultrasound-guided QLB-TM and low dose spinal anesthesia achieves adequate analgesia and is a safe technique.

Keywords: Conox; continuous transmuscular quadratus lumborum block; high risk patients; laparotomy; low dose spinal anesthesia

INTRODUCTION

Abdominal operations are typically performed under general anesthesia. However, in underdeveloped countries like Nepal, patients present for operations in pretty advanced stages.[1] Additionally, the patient may have unoptimized co-morbidities. General anesthesia in these patients could lead to delayed recovery, respiratory inhibition, cognitive dysfunction and fluid and circulatory derangements.[2]

Neuraxial and Regional anesthesia are valid and reliable alternatives to general anesthesia in many situations.[3] Neuraxial anesthesia is successfully used for orthopedic, obstetric and urological operations in high risk patients. However higher anesthetic doses during spinal and epidural anesthesia may cause exaggerated hemodynamic responses. Additionally, although a range of variables affect the spread of local anesthetics during neuraxial blockade, there is no reliable technique to trace the spread of drugs. Spinal anesthesia is also limited by duration of effective blockade of less than 2-3 hours.

Exploring better anesthesia techniques to avoid GA and high dose neuraxial blockade in these circumstances is still a major concern.

Low-dose spinal anesthesia could be combined with a new anesthetic approach called continuous quadratus lumborum block (QLB) to achieve both the rapid and a sustained abdomen and groin dermatome (T4-L1) blockade, required for abdominal operations. This retrospective, observational study was conducted to examine the safety and efficacy of the combined technique.

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METHODS

This is a single cohort retrospective observational study conducted at Civil service hospital of Nepal. The inclusion criteria were the patients who received the combined anesthetic technique for a midline incision requiring abdominal operations between June 1 and October 31 of 2019, ASA I to IV and patients who had complete perioperative records. The exclusion criteria was patient denial, known coagulation disorder, pregnancy, chronic analgesic use and high(>35) or low (<18.5) body mass index. The anesthetic management forms were retrieved from the Records department. Informed consent was taken by telephone as physical interview was restricted due to ongoing pandemic. A unique sequence number was assigned to each patient as per the date of operation in chronological order over the time of the study. To protect patient health information, this number was the only direct identifier used throughout the rest of the study. Data analysis was performed using *SPSS* Version 17.0 for *Windows*, and presented as mean±SD for quantitative data and frequency and percentage for categorical data.

The primary outcomes were intra-operative and postoperative pain values. The former was measured with the presence of movement and changes in heart rate and mean arterial pressure and the conox monitor[4,5] (Fresinus Kabi, Germany) which displayed qnox scores. The postoperative pain values were measured with the Numeric rating scale (NRS) scores. The secondary outcomes were changes in mean arterial pressure, total opiate consumption and intraoperative sedation scores. The latter was measured with conox monitor as qcon scores. The observations times for the study were labeled T0 to T8. (Table 2) Conox score recordings were performed at times T1 to T4; NRS scores at times T5 to T8 and mean arterial pressure measurements were done at times T0-T3, T6 and T8.

Table 1. Observation time points.

Observation Point	Label
Baseline	T0
At surgical incision	T1
First Visceral organ dissection	T2
Beginning of Closure	T3
Before leaving the operating room	T4
Before bed (Operation day)	T5
8 am (Post Op Day 1)	T6
Before bed (Post Op Day 1)	T7
8 am (Post Op Day 2)	T8

Incidence of complications such as tachycardia, hypoxemia, time to anesthetic recovery, post-operative nausea and vomiting, pruritus, local anesthetic systemic toxicity, internal organ injury, conversion to general anesthesia and duration of ICU stay were also recorded. Tachycardia was defined as more than 20% increase in the heart rate from baseline. Standard definitions were used to define each of the complications and their incidence recorded accordingly.

During preoperative visit, information regarding the anesthetic technique and the perioperative issues was provided and an informed consent was taken. Premedication was done with gabapentin 300mg orally before bed on the day prior to surgery, followed by gabapentin 200mg and 25ml of 50% dextrose orally and metoclopramide 10mg and paracetamol 1g intravenously in the morning before surgery.

At the theatre, ASA standard monitors were connected. Additionally, Conox® sensors were attached. The vital sign, sedation and pain values were recorded as baseline first then at every five minutes during anesthesia and at every 15 minutes intervals during postoperative recovery.

Procedural sedation was provided with pethidine 25 mg and midazolam 1 mg. Patient was placed on a lateral decubitus position. With aseptic and antiseptic precautions, a Convex transducer of 2-5 HZ (Mindray, Shenzhen China) was initially placed transversely in the midline on the fifth lumbar spinous process. It was then slid in a cephalo-lateral direction away from the table until the 5th lumbar transverse process, the anterior layer of thoracolumbar fascia (TLF) and the Q.L. and the Erector spinae muscles were identified. Without losing the view of these structures, the transducer was then rotated such that it lied on the parasagittal plane. The transducer was fixed at this position and a small area of skin at the caudal end of the transducer was infiltrated with 2-3 ml of 1% lignocaine with adrenaline (1:100000). An epidural needle (Perifix B Braun Germany) was then advanced in-plane to the transducer in a caudo cranial direction such that the tip was directed towards the QL muscle. Hydro-dissection confirmed the tip at the intermuscular QL space behind the TLF. A total of 20 ml of 0.33% ropivacaine was injected in this space in 5ml aliquots and with repeated aspirations. The spread of the injectate cranially was visualized in real time. Catheterization with an 18G catheter (Perifix, B Braun Germany) was then done. Hydro-dissection was done again to confirm cranial spread of the drug at least two vertebrae level cranially from the tip of the catheter.

The procedure was repeated on the contra-lateral side. Tunneling and fixation was done with tape on the either side.

Throughout the surgery, 10 ml of 0.3% bupivacaine was injected through both these catheters every hour while during the postoperative period, continuous infusion was maintained with 0.125% bupivacaine at 5ml per hour. Additionally, 10ml of the same concentration of the drug was given thrice a day through each catheter.

With aseptic and antiseptic precautions, a 27G Whitacre needle was inserted in the inter spinous space between 3rd and 4th lumbar vertebrae. On free flow of cerebrospinal fluid, 1.2ml of 0.5% heavy bupivacaine was injected over 3 seconds. The level of spinal anesthesia was checked with pinprick test after 5 minutes.

Sedation for surgery was induced with intravenous bolus of 2ml of 1% propofol and maintained with 0.4 to 0.7 mcg kg hour of Dexmeditomide and 20-30 mcg/kg/min of 1% propofol. Target qcon for sedation was a score between 60 and 80. Inadequacy in sedation was managed with bolus of propofol 0.3mg per kg. General anesthesia was induced on patients whose qcon scores remained high even after use of a total of 2 mg per kg of propofol or if there was any significant movement of the limbs.

Intravenous ketorolac 30mg was given to all the patients as part of multimodal analgesic regimen. Intraoperatively, the target pain score (qnox) was a value between 40 and 60. Inadequate intraoperative analgesia was managed firstly with intravenous ketamine 0.5mg per kg. Fentanyl 0.5 mcg per kg aliquots were subsequently added if the former had failed to control pain. General anesthesia was induced on patients whose qnox values remained more than 60 for 10 minutes even after the use of a total of 2 mcg per kg of Fentanyl.

All sedative infusions were stopped at the completion of skin closure of the surgical wound. Patients were then transferred to the post anesthesia care unit, where a recovery nurse assessed patients with the modified ALDRETE scoring system.[6] Time taken to achieve a score of ≥9 was noted and the patient transferred to the ICU. At the ICU bilateral QL infusion was started at 6-8 ml per hour of 0.125% bupivacaine to target a NRS value of less than 4 points.

Any analgesic inadequacy (NRS>4) was managed with fentanyl 0.5 mcg per kg as intravenous boluses. Twice daily intravenous dosing of 1g of paracetamol and 30mg of ketorolac was given to all the patients.

RESULTS

All 29 patients met the inclusion criteria and did not have any exclusion criteria. The female to male ratio was 3.14:1 The patients' ages ranged between 19 years and 80 years with a mean age of 52.3. Most common diagnosis was Ca Ovary (44.8%) followed by Ca Colon (27.6%). Most frequent ASA physical status class was III (79.3%), followed by II(13.79%) The mean operating time for the patients was 206 minutes and the mean blood loss was 756.90 ml.

Table 2. Demographic data.

Demographic variable	Mean ±SD, frequency
Age	52.31 ± 14.65 years
BMI	
ASA	
I	0
II	4(13.79%)
III	23(79.3%)
IV	2(6.89%)
Altered Preop Chest Xray	7(24.1%)
Mean Operating time	206.48 ±53.45 minutes
Maximum Level of loss of pin prick sensation five minutes after spinal anesthesia	T6±1.4
Intraoperative events	Frequency
Mean blood loss	756.90±396.8
Conversion to General Anesthetics	6(20.6%)
Due to qnox>60	4(13.79%)
Due to limb movements	2(6.89%)

Intraoperative pain scores (qNOX) ranged between 26 and 80 with a peak mean of 55.79 at the time just before patient left the operation theatre. Postoperatively, mean NRS ranged between 1 and 6 with a mean peak of 4.86 at 8am on the first postoperative day.

Table 3. Intraoperative (Qnox) and postoperative(NRS) pain scores.

Observation Time	Intraoperaive Qnox values Mean±SD	95% CI
T1	51.24±15.60	45.29-57.19
T2	53.59±16.33	47.37-59.80
T3	44.66±15.82	38.63-50.68
T4	55.79±14.06	50.44-61.14
	Postoperative NRS values Mean±SD	
T5	3.41±1.65	2.78-4.04

T6	3.86±1.94	3.12-4.60
T7	3.55±2.01	2.79-4.32
T8	3.8±1.70	2.83-4.13

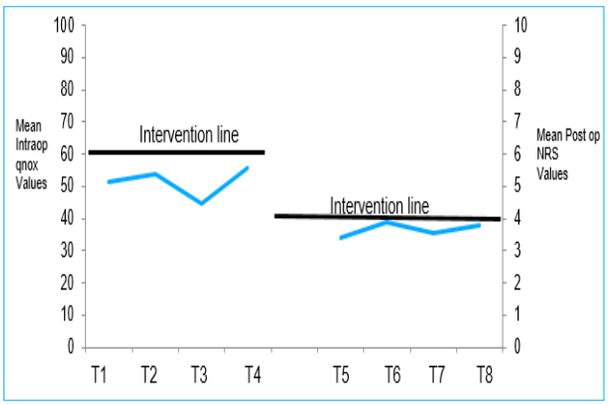

Figure 1. Mean pain scores at different observation times.

Fourteen (48.2%) of the patients did not require any rescue analgesic while seven (24.1%) required intravenous ketamine and further 8 (27.58%) required intravenous fentanyl in addition to ketamine.

Table 4. Use of adjuvant analgesics.

Use of Rescue Analgesics	N (percentage)
None	14(48.2%)
Ketamine	7(24.1%)
ketamine-Fentanyl	8(27.58%)
Conversion to GA due to qnox>60	4(13.7%)
Conversion to GA due to significant limb movement	2(6.8%)
Mean Rescue Fentanyl use (Intraop and Postop)	38.7mcg(0-200mcg)

Sedation scores (qcon) during the operation ranged between 30 and 70 with a peak mean of 55.62 at the beginning of abdomen closure. There were 2 patients who required general anesthesia due to significant limb movement.

When the patients were ready to leave the operating room the qcon values ranged from 70 to 98 with a mean of 85.41. The mean time to a modified aldrete score of ≥9 after cessation of all sedatives was 40.33 minutes.

The changes in mean arterial pressure values with respect to the baseline values ranged from 0 to 34.48%. The peak mean change was 11.95% at time T1. The number of patients who had clinically significant (>20%) changes in mean arterial pressure was four(14.28%). Three of the patients had those changes at three different occasions i.e. at incision, during closure and on the first postoperative day. However, the fourth patient recorded those changes at incision only. All other blood pressure changes were clinically insignificant.

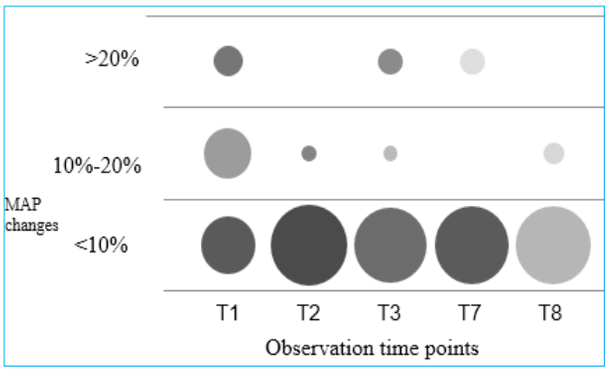

Figure 2. Proportion of patients with different MAP changes at different time points.

Six patients required general anesthesia of which four had high qnox values and two had significant limb movements despite all rescue measures.

After surgery, there were 4 cases of tachycardia, 4 cases of hypoxemia, 2 cases of PONV, nil cases of pruritus, a case of shivering, nil cases of local anesthetic systemic toxicity and nil cases of internal organ injury.

DISCUSSION

Given the complexity of the operations and the patient comorbidities, we elected to perform low dose spinal anesthesia with continuous bilateral posterior QLB.

Low dose spinal anesthesia has advantages of rapid onset, profound sensory and motor block, reduced drug dosage, absence of exaggerated physiological effects and avoidance of tracheal intubation and has been utilized to perform urgent laparotomy in high risk patients.[7] Similarly, Quadratus lumborum block has clear advantages over other trunk blocks.[8] In addition to immediate perioperative pain control, reduced opioid consumption, reduced sympathetic activation, relaxation of the anterior abdominal wall, enhanced postoperative recovery and discharge, the block is safe as the target location is away from major organs and peritoneal cavity.[9]

QLB involves injection of local anesthetics in the thoracolumbar fascia adjacent to the quadratus lumborum muscle and results in the spread of the drug medially and cranially under the crura and arcuate ligaments of the diaphragm and further onto the thoracic

paravertebral space (PVS).[10] An intramuscular QL block at L2 transverse processes could achieve blockade of T4 to L1 to cover both the visceral and somatic components of a laparotomy.[8]

Balogh et al utilized Bilateral QL2 blocks as the sole anesthetic technique for open umbilical hernia repairs in multi-morbid patients. [11] Tanaka et al achieved good pain control with anterior QLB and Erector spinae plane block (ESPB) in patients undergoing robot-assisted partial nephrectomy. [12] Tulgar et al achieved adequate and effective surgical anaesthesia when they combined transmuscular quadratus lumborum block with lumbar ESPB in hip operations. [13] Yayik et al[14] achieved similar efficacy in hip operations when he combined low dose spinal anesthetic with QLB.

Similarly, QLB has been used to control postoperative pain in abdominoplasty[15], open cholecystectomy,[16] cesarean sections,[17] and hysterectomy.[18]

We observed that the combined technique was consistently associated with desirable and predictable pain scores based on physiologic responses, qnox and NRS at each observation points during anesthesia and recovery. The mean qnox scores during inscision, visceral dissection and closure were around 50. Additionally, the analgesic efficacy sustained subsequently during the recovery period with mean NRS scores consistently around 3 at each postoperative observation points. Our use of standardized multimodal analgesic technique that included QLB, SAB, paracetamol, ketorolac and pethidine may have attributed to the effect.[19]

Our primary outcome is consistent with that of Kadam et al who included 10 patients undergoing major abdominal operations in their case series and found analgesic benefits of QLB.[20]

Average consumption of fentanyl during the postoperative recovery in our patients was 38mcg which may be due to continuous infusion of local anesthetics via QL catheters.[21]

The stable qcon values of around 60 throughout the operation period indicate a high level of patient satisfaction.[22] However, six (20.6%) of the patients required conversion to general anesthesia. Two of the latter were found to have blocked QL catheters during later inspection. Catheter blockage have been reported on several occasions.[23] The failure of the technique in the four remaining patients could be due to catheter tip dislodgement.

Hemodynamic parameters grossly remained stable throughout the peri-operative period. This may be attributable to the low dosage of spinal anesthetic at the start of the surgery and subsequent activation of QLB. Both of the techniques have been shown to lack major systemic effects.[24,9]

The low incidence of hypertension, agitation, delayed recovery, hypoxemia and nausea and vomiting in our study is primarily attributable to the avoidance of general anesthesia and standardized and judicious use of anesthetics, analgesics and antiemetics. There were no block related complications in any patient as all the appropriate precautions were taken.

The measurement of intraoperative anti-nociception was based on changes in physiologic parameters and a commercially available monitor. As there was no established validity study available for any anti-nociception measuring monitor during the time of our study, this is one of the limitations of any study that tends to measure anti-nociception.

We plan to conduct prospective studies to explore the comprehensive influence of the combined technique in similar patient cohort. Although our frequency of parameter measurement was very high, we included data recorded at specific time points only; this may not provide a comprehensive clinical detail. Level of muscle relaxation in the surgical field was not measured and therefore surgical difficulty was not assessed.

CONCLUSIONS

A combination of single shot low dose spinal anesthesia and continuous QL block can be safely utilized as a primary anesthetic technique in patients requiring laparotomy with midline incision. The technique is also valuable as analgesia can be extended into the postoperative period.

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Competing interests: None declared

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