ISSN: 3029-0872

Case Report

Journal of Medical and Clinical Nursing Studies

Rectus Sheath and Subcostal Transversus Abdominis Plane Blocks as Main Anesthetic Technique for Open Cholecystectomy: A Case Report

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Received: November 08, 2023; **Accepted:** November 15, 2023; **Published:** November 21, 2023

ABSTRACT
Anesthetic techniques used for open cholecystectomy are traditionally general anesthesia, neuraxial anesthesia, or both due to convenience and safety profile. Peripheral nerve blocks are usually only used for postoperative analgesia for this type of surgery. We report a case of a patient with obstructive jaundice in severe cholangitis and hypovolemic hypernatremia who underwent open cholecystectomy and T-tube drain under right-sided rectus sheath and subcostal transversus abdominis plane blocks.

Introduction

Abdominal field blocks, such as the Rectus Sheath (RS) Block and the Transversus Abdominis Plane (TAP) Block, are being utilized increasingly in modern anesthesia practice because of their effectivity and high success rates [1,2]. The RS block was first described in 1899 by Schleich as a means of providing analgesia for abdominal wall pain in pediatric procedures, as well as to provide muscle wall relaxation in midline laparotomy [3]. The TAP block, a relatively newer regional anesthetic technique, was first described by Rafi in 2001 to provide analgesia to the skin, muscles, and parietal peritoneum [4]. Both techniques are currently used to provide pain control in procedures that involve transection of abdominal wall structures superficial to the peritoneum. In cases where the peritoneal cavity is traversed, dull visceral pain is still expected to be experienced [5].

The use of RS block as the sole anesthetic technique in intraperitoneal surgery has been previously documented in patients with poor hemodynamic status and significant comorbidities, as an alternative to the usage of systemic anesthesia [6,7]. We present a case of an open cholecystectomy performed on a patient classified as American Society of Anesthesiologists (ASA) Class 4E using RS and subcostal TAP block without the use of neuraxial or general anesthesia.

Case Description

Patient was a 59-year-old male who had jaundice and underwent endoscopic retrograde cholangiopancreatography and insertion of biliary stent 7 months prior to admission with findings of common hepatic duct and distal common bile duct strictures with resolution of the condition thereafter. He was apparently well until 3 months prior to admission when he started to have body malaise with recurrence of jaundice. Three weeks prior to admission, he was admitted at a local hospital and was advised for transfer to a higher facility, but was unable to comply due to financial constraints. Three days prior to admission, he was noted to have changes in sensorium and increased sleeping time, hence was transferred to our institution for further management.

Patient was hypotensive upon admission with Glasgow Coma Scale (GCS) 12 (E3V4M5), severely dehydrated, and hypernatremic at 168.6 mmol/L. Hydration and hypernatremia correction was started and was immediately scheduled for tube cholecystostomy. He was received at the operating room GCS 10-11 (E3V2M5-6). Norepinephrine infusion was started for blood pressure support. Consciousness eventually improved to GCS 15 after continuing hypernatremia correction regimen of intravenous D5W 80cc/hour with 200ml of sterile water given through nasogastric tube every 6 hours. After the patient was stabilized, he was placed in supine position. Induction was started under single-shot right-sided rectus sheath and right subcostal transversus abdominis plane (TAP) blocks with ultrasound guidance using a linear transducer. After sterilizing the sites for puncture using 2% chlorhexidine+70% isopropyl alcohol, color Doppler mode was turned on to ensure visualization of blood vessels in the area and the transducer was first placed in the transverse position at the level of the umbilicus and was moved laterally to the right until the rectus abdominis muscle and posterior rectus sheath were delineated. Local anesthetic used was 0.2% ropivacaine. Initially, a Quincke gauge 25, 90-mm needle was used for puncture and deposition of anesthetic, however, there was difficulty in visualizing the needle tip. Hence, the needle was changed to a non-echogenic gauge 22, 50-mm needle and was inserted parallel to the probe in a lateral to medial direction for an in-plane technique with full visualization of the needle. One-ml aliquots of local anesthetic were used to

Citation: Jesher Joshua F Arsenio, Maria Cecilia J Lomboy, Joanne A Remedios, Jude Khalyl C Ramas. Rectus Sheath and Subcostal Transversus Abdominis Plane Blocks as Main Anesthetic Technique for Open Cholecystectomy: A Case Report. J Med Clin Nurs Stud. 2023. 1(1): 1-3. DOI: doi.org/10.61440/JMCNS.2023.v1.18

confirm correct needle tip placement and frequent aspirations done to check for intravascular puncture between the rectus abdominis and posterior rectus sheath by observing separation of these layers upon injection. Twelve ml of 0.2% ropivacaine was injected in this location. The transducer was transferred to the right subcostal area for subcostal TAP block. It was placed transversely initially lateral to the xiphoid process on the lower margin of the right rib cage and was moved laterally until the external oblique, internal oblique, transversus abdominis, and rectus abdominis muscles were clearly identified. The same non-echogenic needle was inserted parallel to the probe in a lateral to medial direction in-plane with complete visualization of the needle. Upon the needle tip reaching the plane between the transversus abdominis and rectus abdominis, 1ml aliquots of local anesthetic were deposited with frequent aspirations to check for correct needle placement and intravascular puncture. A total of 25ml 0.2% ropivacaine was deposited in this plane with separation of transversus abdominis and rectus abdominis muscles. A 25-minute waiting time was given for onset of the drug. Prior to incision, local infiltration of anesthetic on the incision site was done. Additional local infiltration was also done intraoperatively; a total of 20ml of 0.2% ropivacaine with 5ml of 2% lidocaine was given by the surgeon.

After the surgeon did a right subcostal incision, patient did not complain of pain and with no significant increase in heart rate and blood pressure. Intraoperatively, blood loss was 1200ml with episodes of tachycardia of low 100s bpm and hypotension as low as 80s/40s mmHg which were responsive to blood transfusion and titration of norepinephrine. Intraoperative cholangiogram was done and the surgical team decided to do removal of stent and unplanned open cholecystectomy with T-tube placement. Three hours after the first incision, patient was noted to be uncomfortable but without significant changes in vital signs. Midazolam and fentanyl were given in boluses as needed. A total of 3mg midazolam and 100mcg fentanyl were administered. Paracetamol 1gm and tramadol 50mg were also given prior to end of the procedure. Surgery lasted for 6 hours with the surgeon noting that he did not have difficulty in retraction. He was weaned from norepinephrine, was GCS 15 post-procedure, and was started on tramadol 300mg in 500cc D5W at 20cc/hr for 48 hours.

However, during the first postoperative day at the intensive care unit, his sensorium decreased again to GCS 8 (E2V1M5) with hypotensive and febrile episodes; norepinephrine drip was restarted, was intubated and hooked to mechanical ventilator. Only minimal bile was draining from the T-tube. His condition continuously deteriorated until on postoperative day 2, he expired.

Discussion

Biliary obstructive diseases have significant implications on perioperative management. Long-standing biliary obstruction can lead to poor absorption of fat-soluble vitamins, including Vitamin K. A decrease in Vitamin-K dependent clotting factors lead to increased prothrombin time values, which may predispose to complications such as post-epidural hematoma formation [8,9,10]. Bile acids also produce direct cardiodepressive effects which may exacerbate the inhibitory effects of central neuraxial and general anesthesia. Experiments in rat models show a significant negative inotropic effect brought about by the accumulation of cholic acid, inducing vagal stimulation [11]. The reduced hepatic blood flow and hepatic cell damage caused by obstructive jaundice may predispose high-risk patients to poor hepatic clearance of anesthetics, increasing their duration of action, as well as decrease their anesthetic requirements [12.13]. This may necessitate changes in dosing and closer perioperative monitoring when using general or neuraxial anesthesia.

Compared to neuraxial blocks, abdominal field blocks have the advantage of providing effective analgesia while not affecting lower extremity motor function, as is usually seen in epidural blockade. This leads to earlier mobility and a decreased risk for developing complications related to prolonged immobility such as atelectasis and deep vein thromboembolism. Another common adverse effect of neuraxial blocks avoided by the usage of abdominal field blocks is the hypotension and bradycardia that comes with blockade of the cardiosympathetic nerve fibers from T1-T4, causing hemodynamic instability, fluctuations in mean arterial pressure and changes in perfusion to vital organs. In this patient, peripheral nerve block was attempted to avoid the negative effects associated with general or neuraxial anesthesia, considering the patient's long-standing biliary disease, poor preoperative ASA score, and the deteriorating hemodynamic status and vital signs during the time of reception at our institution.

The abdominal field blocks are not without their disadvantages. In theory, these blocks fail to provide analgesia to structures beneath the peritoneum, and so deep, visceral pain is still felt upon intraperitoneal transection. Local anesthetic toxicity may also occur, as these often require large volumes and are done bilaterally [14]. The fascial planes involved are also well-vascularized and may set the stage for high systemic absorption, and differences in anesthetic spread [14]. However, a study done to compare the spread of local anesthetic between different approaches in transversus abdominis plane blocks found out that there was extension of anesthetic coverage towards the layer between the internal and external obliques when using the subcostal approach, spreading the 9th and 10th intercostal spaces cranially and to the level of the iliac crest caudally [15]. In contrast, this phenomenon does not occur when using the landmark-based and posterior approach of the TAP block. Additionally, the local anesthetic deposited may have spread not only within the plane, but also through the vascular and lymphatic systems which richly innervate the transversus abdominis [15]. These mechanisms may explain why the usage of the subcostal TAP in our patient provided definitive anesthesia for the procedure, even when the surgeons decided to convert to an open approach.

While studies regarding the usage of abdominal field blocks as the sole anesthetic technique in intraperitoneal anterior abdominal procedures have yet to proliferate, they may prove to become useful alternatives for general and central neuraxial anesthesia in patient that are hemodynamically unstable and have poor ASA classification scores [16-18].

Financial Disclosures: None

Conflict of Interest: None

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