BRJ BASIC RESEARCH JOURNALS

Basic Research Journal of Medicine and Clinical Sciences ISSN 2315-6864 Vol. 5(7) pp. 127-133 September 2016
Available online http//www.basicresearchjournals.org

Review

The enigma of regional anesthesia in enhanced recovery after anesthesia protocols

Tariq Alzahrani and *Abdelazeem Eldawlatly

Department of Anesthesia, College of Medicine, King Saud University, Riyadh, KSA

*Corresponding author email: dawlatly@ksu.edu.sa

Accepted 30 September, 2016

ABSTRACT

Enhanced recovery after surgery (ERAS) protocols is considered a new era in anesthesia and surgery practices. Those protocols are now well developed and published by the ERAS society for different surgical procedures. In this report we are going to focus on the role of regional anesthesia in improving patient outcome and achieving enhanced recovery after surgery guidelines. In particular we are going to report our experience with ultrasound guided regional anesthetic techniques and the role they play to enhance recovery of the patients.

Keywords: Transversus abdominis plane block; Ultrasound; Laparoscopy

INTRODUCTION

Enhanced recovery after surgery (ERAS) protocols for perioperative care has proven of value in minimizing postoperative complications (Varadhan et al., 2010). Updated and evidence-based guidelines have been developed by the ERAS study group and are now available for colonic and rectal resections and pancreaticoduodenectomies (Gustafsson et al., 2012). Recently, there have been many published articles on implementing the ERAS (www.erassociety.org) protocols with special reference to gastrointestinal surgery (Feldheiser et al., 2016; Lassen et al., 2009). In implementing enhanced recovery after bariatric surgery (ERABS) protocol, it was found that the use of ERABS ensured the highest safety standards (Pedziwiatr et al., 2015). ERAS guidelines for the postoperative management were successfully implemented in gynecologic/oncology surgery (Nelson et al., 2016). Looking in depth to the ERAS protocols, you will find that anesthesia plays an important role in many aspects, including patient education, preoperative evaluation and optimization, anesthesia choice and medication, fluid therapy, temperature monitoring, and postoperative analgesia. Therefore, the term enhanced recovery after anesthesia (ERAA) is accurately describes ERAS protocols. The ERAA ladder summarizes all aspects of ERAS protocols including the background, preoperative, intraoperative as well as postoperative management [Figure 1] (Eldawlatly, 2016). Briefly, if you look into the background section, you will find the most important three pillars of the protocol including the risk assessment, optimization of preexisting organ function, and education. Furthermore, a brief note is given on insulin resistance in terms of long fasting hours and the trend nowadays of giving preoperative carbohydrates to reduce surgical stress. In the preoperative section, you will find the most important risk stratification tools commonly used in clinical practice with strong recommendation grade. Of note the Lee index which grades the patient as high risk if

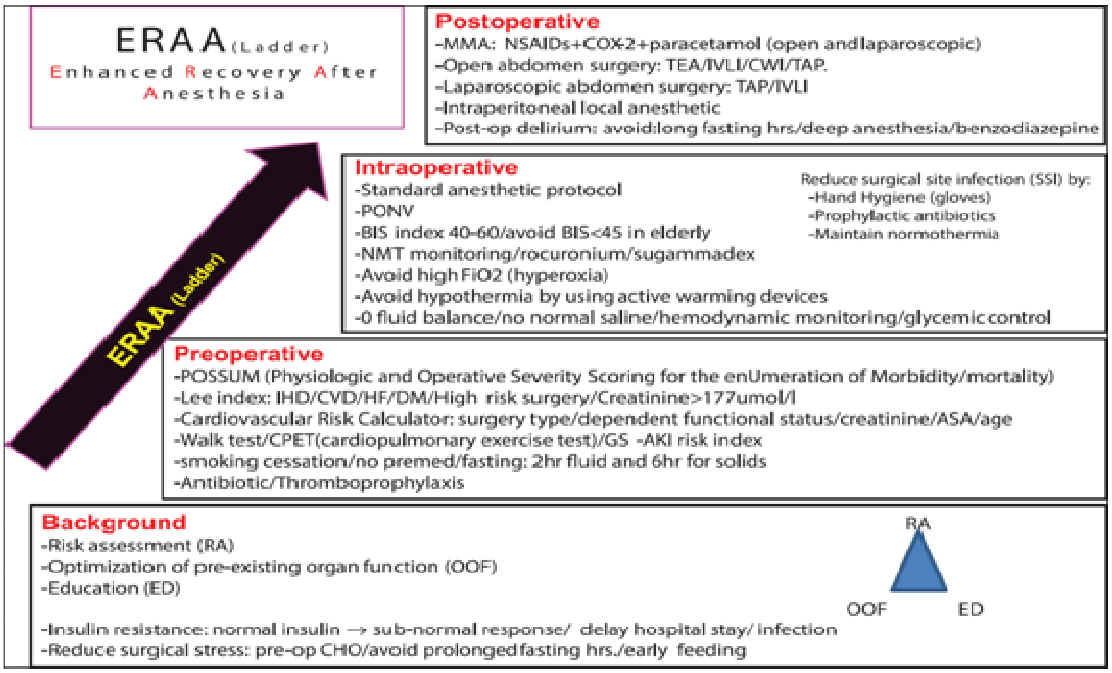

Figure 1. Enhanced Recovery After Anesthesia (ERAA) (Eldawlatly, 2016).

he/she has a history of ischemic heart disease and or cerebrovascular disease, heart failure, diabetes mellitus who is undergoing high-risk surgery with a creatinine level >177 mmol/l (Archan et al., 2010). Smoking cessation for at least 4 weeks before surgery is highly recommended. In the intraoperative section, standard anesthetic protocol should be adhered with where the anesthetic depth guided with bispectral index monitoring between 40 and 60 to prevent awareness and to minimize anesthetic side effects with rapid recovery. The standard anesthetic protocol is strongly recommended in the ERAS protocol. Neuromuscular transmission monitoring and reversal of neuromuscular blockade are strongly recommended. We believe that sugammadex which is specific reversal agent for rocuronium has ensured the adequate return of muscle function and nearly eliminates the problem of residual paralysis during the recovery period. Looking into the postoperative section, you will find opioid sparing techniques including regional techniques are strongly recommended as multimodal analgesia strategy for open and laparoscopic abdominal surgical procedures. Thoracic epidural analgesia is strongly recommended in open and weakly recommended in laparoscopic abdominal surgery. Intravenous lidocaine infusion is moderately recommended for both surgical techniques (Khan et al., 2016). Continuous wound infiltration of local anesthetic is weekly recommended in open abdominal surgery technique (Hughes et al., 2015). On the contrary transversus abdominis plane (TAP) block is strongly recommended in laparoscopic abdominal surgery (Gao et al., 2016).

Regional anaesthesia (RA) techniques, including neuraxial and peripheral nerve block, can provide many benefits for patients in the perioperative period. These benefits include a decrease in postoperative pain, decrease in nausea and vomiting, improvement in mobilization and decrease in length of stay (LOS), reduction in surgical stress response, and reduction in morbidity and mortality (Choi et al., 2013; Berwick et al., 2008). Enhanced recovery protocols (ERPs) are bundled interventions that are used to improve recovery and outcomes after surgery (Kehlet, 2015). ERPs include interventions spanning the perioperative period and have been widely researched in colorectal surgery. More recently, ERPs have also been studied in other surgeries. A meta-analysis of the impact of ERPs on outcomes after elective surgery demonstrated that ERPs were beneficial in decreasing LOS and total complications. RA interventions are often included in ERPs. However, consistent evidence that the specific elements included within ERPs affect patient outcome is lacking. Although bundling allows patients to benefit from a variety of evidence-based interventions targeted at a shared objective, quantification of the impact of each component on outcomes is challenging (Nicholson et al., 2014).

Therefore, understanding the added benefit of RA within an ERP is of key importance to patients and clinicians. To date, the impact of RA on patient outcomes in an ERP has been systematically described only in the

setting of open colorectal surgery. In a review of seven trials, epidural analgesia (EA) was associated with improved pain scores and faster return of gut function than i.v patient-controlled analgesia (IVPCA). However, complications were more common in the EA group, and no difference in LOS between intervention groups was identified (Nix et al., 2013; Hughes et al., 2014).

RA techniques in ERPs

Interscalene analgesia

Shoulder surgery results in significant postoperative pain which warrants effective postoperative analgesia. Ultrasound-guided interscalene brachial plexus block (ISBPB) has gained wide acceptance as a preferred method of postoperative analgesia following shoulder surgery (Neville et al., 2014). Local anesthetic administration via patient-controlled pump was found to decrease the postoperative pain and the need for rescue analgesics (Tariq and Abdulaziz, 2011). Commonly local anesthetics are administered into the interscalene brachial plexus (ISBP) continuously in the postoperative period followed by removal of the perineural catheter (Byeon et al., 2015). Infusion methods exert influence on the course of the operation or the occurrence of adverse effects, as prolonged contact of surrounding tissues with local anesthetic may cause changes in those tissues and may lead to the development of toxicity in the surrounding tissues (Tuominen et al., 1987). Even with proper procedural technique, ISBPB could lead to postoperative neurological complications in certain cases (Haasio et al., 1990). Perineural catheters located precisely at the targeted nerves can supply sufficient analgesia with small volume of local anesthetics. Current literature suggests a reduction of the volume of local anesthetics used for ultrasound-guided upper extremity blockades (Dhir et al., 2007). In one study it was found that single-shot interscalene block with less than 10ml of ropivacaine in arthroscopic rotator cuff reconstruction reduced postoperative pain for several hours after the operation (Koscielniak-Nielsen and Dahl, 2012). In another study the authors recommended the use of single-shot interscalene plexus block in combination with patient controlled catheter system under ultrasound (US) guidance only for the first 24 h after major open-shoulder surgery (Taninishi et al., 2011). In an unpublished data we have found that there was no differences in the quality of pain relief following bolus injections of bupivacaine at different time intervals in shoulder surgery patients received ISBPB via catheter technique. Continuous interscalene brachial plexus block has been shown to be the most effective analgesic technique following shoulder surgery; however, its use is uncommon due to logistical and safety concerns related to ambulatory administration. In another study on 1505 consecutive patients undergoing shoulder surgery who received continuous interscalene analgesia at home. Catheter removal was by the patient between postoperative days two and five. There were no major complications although 27% of patients reported mild dyspnea, 13% hoarseness and 7% dysphagia. Twelve percent sought medical advice and 2% reported technical issues with the pump or tubing. Complications and technical issues were associated with patient age; weight; use of ultrasound or concomitant nerve stimulation as the endpoint for final needle tip position; local anaesthetic placement via the catheter or needle; whether a catheter related intervention for pain relief was required in the recovery area; and the type of ambulatory pump (Goebel et al., 2010).

IIa. Conventional transversus abdominis plane (TAP) block (external)

Although laparoscopic surgery procedures is considered to be a minimally invasive surgical procedure with lower perioperative pain scores compared with open procedures, it is associated with significant levels of postoperative pain. Usually, standard general anaesthetic is given to patients undergoing laparoscopic surgery. However, the use of neuraxial anaesthesia or of intraperitoneal local anaesthesia has been shown to increase the efficacy of perioperative pain therapy and reduce the consumption of opioid drugs. Peripheral regional anaesthetic techniques could be considered as an attractive alternative to central blocks or high-dose intraperitoneal anaesthesia. The TAP block (external) involves the sensory nerve supply of the anterior –lateral abdominal wall, where the T7– 12 intercostal nerves, the ilioinguinal and iliohypogastric nerves, and the lateral from cutaneous branches of the dorsal rami of L1– 3 are blocked with an injection of local anaesthetic between the internal oblique abdominal muscle (IOAM) and the transverse abdominal muscle (TAM) after visualizing the external oblique abdominal muscle (EOAM) via ultrasound device. TAP blocks are performed for indications such as Caesarean delivery, bowel surgery, or retropubic prostatectomy. Direct ultrasonographic visualization of the anatomy involved and the spread of local anaesthetic could serve as the best technique to perform a TAP block (Figure 2) (El-Dawlatly et al., 2009). In the ERAA protocol TAP block is considered an essential part of the multimodal postoperative analgesic techniques following laparoscopic or open abdominal surgery.

IIb. Inside-out TAP block (internal)

Although TAP block is considered simple, safe, and

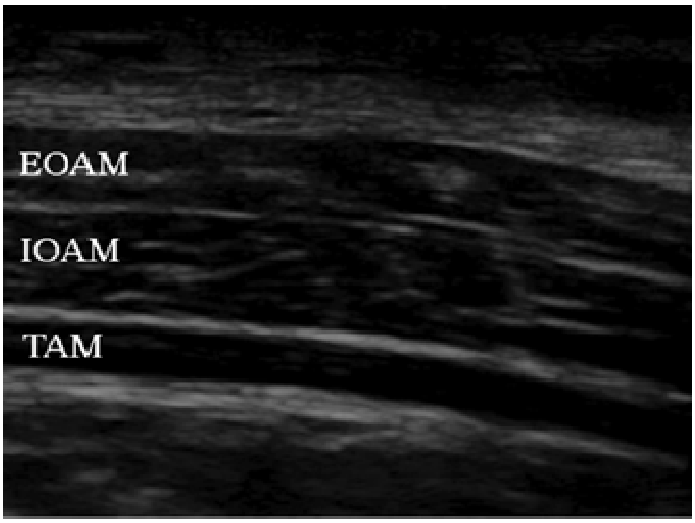

Figure 2. Transverse ultrasound view of the EOAM, IOAM, and TAM . (El-Dawlatly et al., 2009)

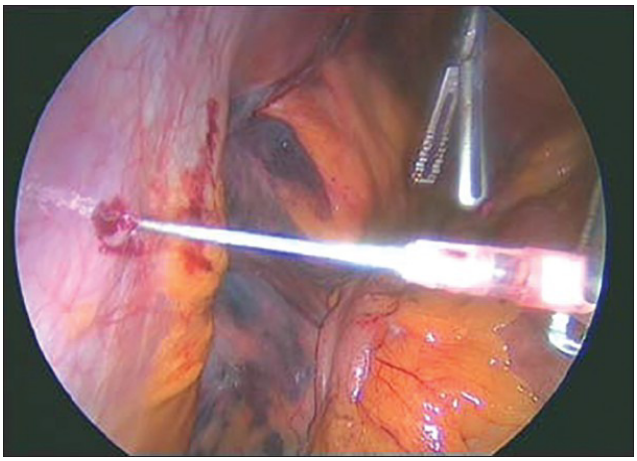

Figure 3. Needle insertion (El-Dawlatly and Al-Dohayan, 2014)

effective, there are two reports of significant morbidity resulting from damage to viscera, namely liver trauma, even when using US-guidance (Lancaster and Chadwick, 2010; Farooq and Carey, 2008). In an attempt to avoid visceral injury during TAP block, Owen *et al*., have described a much simpler technique in which the obstetric surgeon, during open surgery, was able to introduce the TAP block via an intra-abdominal approach, which was technically easier and also obviates the risks associated with the conventional TAP procedure. Owen *et al*. (2011) have reported their series in open surgery; we sought of doing TAP block during laparoscopic surgery with retrograde approach or in other words "inside-out" TAP block approach (Owen et al., 2011). Theoretically "inside-out TAP" (internal) approach will avoid any possible visceral or vascular trauma compared with the conventional TAP (external) technique. In our case, TAP block was performed under US-guidance with a SonoSite M-Turbo transportable US device (SonoSite ^{TM} Inc., Bothell, WA, USA) and a linear 6-13 MHz US transducer. The edge of the probe was covered by a sterile plastic transducer sheath (Intercoverw, Microtek Medical, USA) and a sterile gel (Asept Inmed, Quint Fonsegrives, France) was applied on the skin. Once the abdominal wall muscles were visualized at the level of the anterior axillary line between the 12 th rib and the iliac crest then, the surgeon introduced a 50-mm, 19-gauge needle (Nanoline; Pajunk, Geisingen, Germany) through one of the laparoscopic ports [Figure 3] (Owen et al., 2011). Once the tip of the needle was placed within the TAP, negative aspiration was performed followed by injection of 15 mL

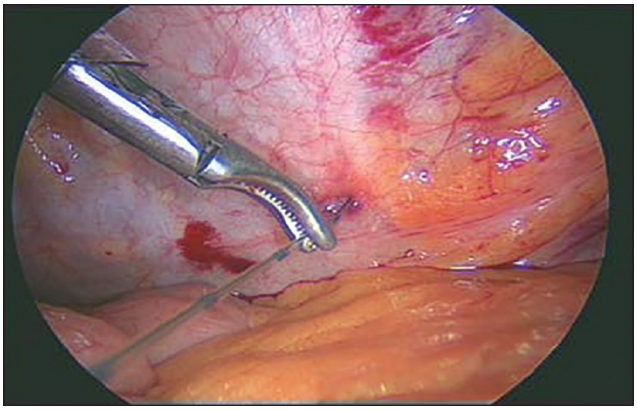

Figure 4. Catheter insertion (El-Dawlatly and Al-Dohayan, 2014)

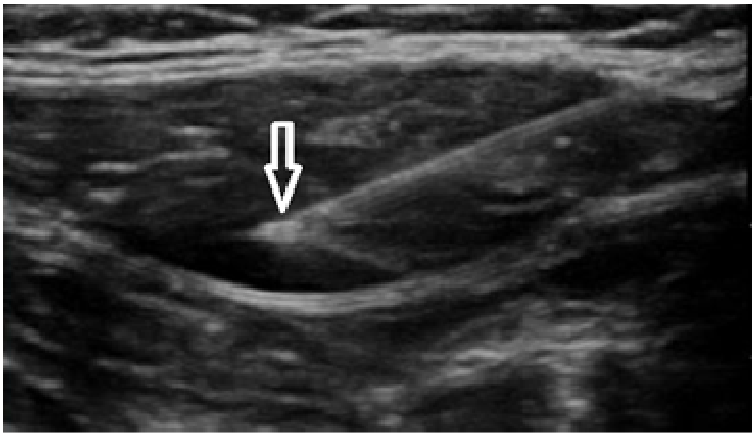

Figure 5. Arrow point at the needle tip visualized in the posterior rectus sheath with tissue plane dissection from local anesthetic spread.

bupivacaine 5 mg/mL with local anesthetic spread appeared on the US screen. Following needle insertion a 21-gauge catheter was introduced through the needle and fixed to the abdominal wall for continuous TAP block [Figure 4] (El-Dawlatly A, Al-Dohayan, 2014).

We have described this novel approach of “inside-out” TAP (internal) technique which we think it’s safer than the conventional TAP (external) approach for laparoscopic surgery in terms of avoiding visceral or vascular trauma. Furthermore, we believe that continuous “inside-out” TAP block (internal) approach is feasible and may provide more asepsis than the classic TAP (external) approach.

III. Rectus sheath block (RSB)

The rectus sheath block (RSB) is an old technique that gained new clinical interest. It was first introduced into clinical practice in 1899 (Schleich, 1899). By then it was used to achieve operative muscle relaxation and analgesia. RSB is assumed to suite midline incisions. Like other central non-neuraxial regional anesthesia, blocks of the abdomen RSB only provides analgesia for somatic pain, not pain of visceral origin. The anterior branches of the lower six thoracic and first lumbar sensory nerves travel in the TAP and enter medially into the rectus sheath, passing between rectus muscle and the posterior sheath. They penetrate anteriorly through rectus muscle ending by supplying the skin from the midline to approximately the anterior superior iliac spine. The local anesthetic (LA) can be deposited between the muscle and the posterior rectus sheath as anterior insertions of the arcuate lines limit the spread of LA solution anteriorly. Because, the lower abdomen nerves have a progressively shorter course, too medially deposited local anesthetic in the rectus sheath plane may miss all the nerves. In one study it was concluded that Ultrasound-guided rectus sheath block is an easy

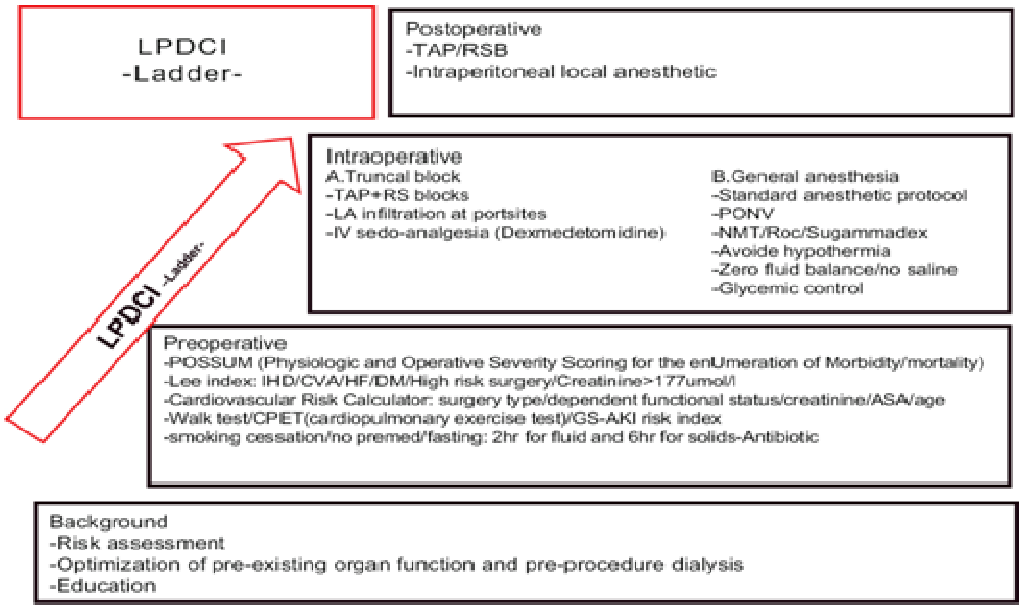

Figure 6. Laparoscopic peritoneal dialysis catheter insertion (LPDCI) ladder (Eldawlatly and Aldohayan, 2016)

technique to learn. This technique, when used with general anesthesia, was found effective in reducing pain scores and opioid consumption compared to general anesthesia alone (figure 5) (Bashandy and Elkholy, 2014).

III. Combined TAP and RS blocks

End-stage renal disease (ESRD) patients undergoing laparoscopic peritoneal dialysis catheter insertion (LPDCI) presents a real challenge to the anesthesiologists due to the associated comorbidities. ESRD patient can be labeled as a syndromic patient due to the involvement of many other body systems in the disease. Usually, those patients are suffering from all side effects of chronic longstanding diabetes mellitus as well as cardiorespiratory diseases. Anesthesia for LPDCI includes understanding the background of ESRD and the associated co-morbidities. The background includes risk assessment, optimization of preexisting diseases, and education which we have discussed in details in this review. Anesthesia for LPDCI can be either general or regional anesthesia. The choice of the anesthetic technique depends on the risk stratification performed preoperatively. In our practice, we perform general anesthesia (GA) if the patient tolerates it with low-risk. GA includes the use of rocuronium to facilitate tracheal intubation and sugammadex to reverse its effect with continuous neuromuscular transmission monitoring. Ultrasound guided (USG) truncal blockade is our technique of choice in the case of high risk for GA encountered. In our practice, we have noticed that those patients tolerate the procedure very well with the combination of transverses abdominis plane (TAP) and rectus sheath (RS) blocks. Usually, the three ports inserted one on each hypochondrium and the third port sub umbilical in the midline. Furthermore, the patient receives an intravenous continuous infusion of dexmedetomidine 4 µg/ml at a dose of 0.5-1 µg/ kg/h for intraoperative sedation. Postoperative pain relief is achieved by the truncal blocks performed intraoperatively and by local anesthetic instillation within the intraperitoneal cavity. We have introduced the LPDCI ladder which summarizes the perioperative management of those patients [Figure 6]. We believe that the combination of TAP and RS blocks provides safe and effective anesthetic technique for high-risk ESRD patients undergoing LPDCI (Eldawlatly and Aldohayan, 2016).

In summary regional anesthesia techniques are commonly included in ERAA because of their positive effect in improving recovery after anesthesia. Our review suggests that RA interventions improve pain, organ function, and mobility, and the decreased nausea and vomiting and LOS. We have introduced the ladder series which we believe will help anesthesiologists in a simple manner to memorize what they should do to achieve ERAA for their patients and hence improving the outcome.

REFERENCES

Archan S, Roscher CR, Fairman RM, Fleisher LA (2010). Revised

Cardiac Risk Index (Lee) and perioperative cardiac events as predictors of long-term mortality in patients undergoing endovascular abdominal aortic aneurysm repair. J. Cardiothorac. Vasc. Anesth. 24: 84-90.
Bashandy G, Elkholy A (2014). Reducing Postoperative Opioid Consumption by Adding an Ultrasound-Guided Rectus Sheath Block to Multimodal Analgesia for Abdominal Cancer Surgery with Midline Incision. Anesth Pain Med. 4: 18263
Berwick DM, Nolan TW, Whittington J (2008). The Triple Aim: care, health, and cost. Health Aff 3: 759–69.
Byeon GJ, Shin SW, YoonJU, Kim EJ, Baek SH, Ri HS (2015). Infusion Methods for Continuous Interscalene Brachial Plexus Block for Postoperative Pain Control after Arthroscopic Rotator Cuff Repair. Korean J. Pain. 28: 210-6.
Choi S, Trang A, McCartney CJ (2013). Reporting functional outcome after knee arthroplasty and regional anesthesia: a methodological primer. Reg Anesth Pain Med 38: 340–9.
Dhir S, Ganapathy S, Lindsay P, Ahwal GS (2007). Case report: ropivacaine neurotoxicity at clinical doses in interscalene brachia plexus block. Can. J. Anaesth. 54: 912-6.
Eldawlatly A (2016). Is enhanced recovery after anesthesia a synonym to enhanced recovery after surgery? Saudi J Anesth 10: 119-20
El-Dawlatly A, Al-Dohayan A (2014). “Inside-out” transversus abdominis plane block. Saudi J Anaesth 8: 315-6.
Eldawlatly AA, Aldohayan A (2016). Combined transversus abdominis plane block and rectus sheath block in laparoscopic peritoneal dialysis catheter insertion. Saudi J Anaesth 10: 251-2.
El-Dawlatly AA, Turkistani A, Kettner SC, Machata AM, Delvi MB, Thallaj A, Kapral S, Marhofer P (2009). Ultrasound-guided transversus abdominis plane block: description of a new technique and comparison with conventional systemic analgesia during laparoscopic cholecystectomy. Br. J. Anaesth. 102: 763–7
Farooq M, Carey M (2008). A case of liver trauma with a blunt regional anesthesia needle while performing transversus abdominis plane block. Reg Anesth Pain Med 33: 274-5.
Feldheiser A, Aziz O, Baldini G, Cox BP, Fearon KC, Feldman LS (2016). Enhanced Recovery After Surgery (ERAS) for gastrointestinal surgery, part 2: Consensus statement for anesthesia practice. Acta Anaesthesiol Scand 60: 289-334.
Gao T, Zhang JJ, Xi FC, Shi JL, Lu Y, Tan SJ, Wen-Kui Y (2016). Evaluation of Transversus Abdominis Plane (TAP) Block in Hernia Surgery: A Meta-analysis. Clin. J. Pain.
Goebel S, Stehle J, Schwemmer U, Reppenhangen S, Rath B, Gohlke F (2010). Interscalene brachial plexus block for open-shoulder surgery: a randomized, double-blind, placebo controlled trial between single-shot anesthesia and patient-controlled catheter system. Arch Orthop Trauma Surg 130: 533-540
Gustafsson UO, Scott MJ, Schwenk W, Demartines N, Roulin D, Francis N (2012). Enhanced Recovery After Surgery Society. Guidelines for perioperative care in elective colonic surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations. Clin Nutr 31: 783–800.
Haasio J, Tuominen M, Rosenberg PH (1990). Continuous interscalene brachial plexus block during and after shoulder surgery. Ann Chir Gynaecol 79: 103–107.
Hughes MJ, Harrison EM, Peel NJ, Stutchfield B, McNally S, Beattie C (2015). Randomized clinical trial of perioperative nerve block and continuous local anaesthetic infiltration via wound catheter versus epidural analgesia in open liver resection (LIVER 2 trial). Br. J. Surg. 102: 1619-28.
Hughes MJ, McNally S, Wigmore SJ (2014). Enhanced recovery following liver surgery: a systematic review and meta-analysis. HPB (Oxford) 16: 699–706.
Kehlet H (2015). Enhanced Recovery After Surgery (ERAS): good for now, but what about the future? Can. J. Anaesth. 62: 99–104.
Khan JS, Yousuf M, Victor JC, Sharma A, Siddiqui N (2016). An estimation for an appropriate end time for an intraoperative intravenous lidocaine infusion in bowel surgery: A comparative meta-analysis. J. Clin. Anesth. 28: 95-104.
Koscielniak-Nielsen ZJ, Dahl JB (2012). Ultrasound-guided peripheral nerve blockade of the upper extremity. Curr Opin Anaesthesiol. 25: 253-9.
Lancaster P, Chadwick M (2010). Liver trauma secondary to ultrasound-guided transversus abdominis plane block. Br. J. Anaesth. 104: 509-10.
Lassen K, Soop M, Nygren J, Cox PB, Hendry PO, Spies C (2009). Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations. Arch Surg 144: 961-9.
Nelson G, Altman AD, Nick A, Meyer LA, Ramirez PT, Achtari C (2016). Guidelines for postoperative care in gynecologic/oncology surgery: Enhanced Recovery After Surgery (ERAS®) Society recommendations – Part II. Gynecol Oncol 140: 323-32.
Neville A, Lee L, Antonescu I (2014). Systematic review of outcomes used to evaluate enhanced recovery after surgery. Br. J. Surg. 101: 159–70.
Nicholson A, Lowe MC, Parker J, Lewis SR, Alderson P, Smith AF (2014). Systematic review and meta-analysis of enhanced recovery programmes in surgical patients. Br. J. Surg. 101: 172–88.
Nix CM, Margarido CB, Awad IT (2013). A Scoping Review of the Evidence for Teaching Ultrasound-Guided Regional Anesthesia. Reg Anesth Pain Med 38: 471–80.
Owen DJ, Harrod I, Ford J, Luckas M, Gudimetla V (2011). The surgical transversus abdominis plane block — A novel approach for performing an established technique. BJOG 118: 24-7.
Pedziwiatr M, Kisialeuski M, Wierdak M, Stanek M, Natkaniec M, Matlok M (2015). Early implementation of Enhanced Recovery after Surgery (ERAS®) protocol – Compliance improves outcomes: A prospective cohort study. Int. J. Surg. 21: 75-81.
Schleich DL. 4th ed. Berlin: Springer Verlag; 1899. Schmerzlose Operationen; pp. 240–58.
Taninishi H, Takehisa S, Sato K, Morita K (2011). Effect of single-shot interscalene block with less than 10ml of local anesthetics on postoperative pain relief after arthroscopic rotator cuff reconstruction. Masui 60: 1073-7
Tariq A, Abdulaziz AA (2011). Effect of bupivacaine concentration on the efficacy of Ultrasound guided interscalene brachial plexus block. Saudi J. Anaesth. 5: 190-4.
Tuominen M, Pitka¨nen M, Rosenberg PH (1987). Postoperative pain relief and bupivacaine plasma levels during continuous interscalene brachial plexus block. Acta Anaesthesiol Scand 31:276–278.
Varadhan KK, Neal KR, Dejong CH, Fearon KC, Ljungqvist O, Lobo DN (2010). The enhanced recovery after surgery (ERAS) pathway for patients undergoing major elective open colorectal surgery: a meta-analysis of randomized controlled trials. Clin Nutr 29: 434–440.