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The Final thesis

Place of Peripheral Nerve Blocks for Pain Management after Major Gynecological Surgeries

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SUMMARY

Postoperative pain after major gynaecological surgeries is a common problem that can significantly affect a patient's recovery and overall quality of life. Peripheral nerve blocks offer a promising alternative with fewer side effects in comparison with traditional pain management options. This thesis aims to provide a comprehensive overview of the various techniques and locations for performing peripheral nerve blocks after different gynaecological surgeries. The thesis includes a review of relevant literature on peripheral nerve blocks and their application in pain management, as well as an analysis of the benefits and drawbacks of each technique.

KEYWORDS

Peripheral nerve blocks, fascial plane blocks, post-operative pain management, major gynaecological surgeries, fascial plane blocks, regional anaesthesia.

1. INTRODUCTION

Post-operative pain management remains a major medical challenge despite many advances in the understanding of pain mechanisms, pain physiology and the pharmacology of analgesically active substances. Insufficiently treated postoperative pain affects postoperative convalescence in many ways. Although progress has been made in the treatment of postoperative pain in some areas in recent years, the overall quality of postoperative pain management remains unsatisfactory in both Europe and the United States (1). Post-operative pain after major gynaecological surgeries is a common problem that can have a significant impact on patients' quality of life and recovery. Despite the use of various traditional methods of pain control, such as opioids, many patients still experience significant pain, which can lead to longer hospital stays, delayed recovery, and increased healthcare costs. As a result, there is a growing interest in alternative methods of pain control, such as peripheral nerve blocks, which have been shown to be safe and effective in reducing post-operative pain after major gynaecological surgeries (2).

Peripheral nerve blocks are a type of regional anaesthesia that involves injecting a local anaesthetic (such as lidocaine, bupivacaine, or ropivacaine) around or near a specific peripheral nerve or group of nerves to block pain sensation in the area of the body that the nerve or nerves supply. They are used to provide pain relief during surgical procedures, as well as to manage chronic pain conditions and post-operative pain. They can be delivered in different ways, including single-injection techniques, continuous techniques, and plexus blocks (3).

Postoperative pain control and recommendations differ between different European countries. Traditional pain management methods such as opioid analgesics can have significant side effects, including nausea, constipation, and the risk of addiction. In contrast, peripheral nerve blocks can provide targeted pain relief, reduce opioid use, and lead to better patient satisfaction and shorter hospital stays (4).

Peripheral nerve blocks have shown promising results as safe and effective alternatives to traditional pain management methods in major gynaecological surgeries. More research is needed to determine the optimal use of these techniques, as well as the long-term effects and the most appropriate patients for these interventions.

2. LITERATURE REVIEW

A literature search was conducted on relevant databases including PubMed, Medline, Google Scholar. The search was limited to studies published in English and German languages from 2012 to 2023. Keywords used in the search included "peripheral nerve blocks," "postoperative pain management," "major gynaecological surgeries," and other related terms.

The existing studies on peripheral nerve blocks (PNBs) for postoperative pain management after major gynaecological surgeries have several strengths. One of the main strengths is that they have been conducted as randomized controlled trials, which is considered the gold standard in terms of study design. This allows for a high level of evidence that PNBs are effective in reducing postoperative pain. Most of the studies have used validated pain scales and patient satisfaction questionnaires, which allows for a more accurate assessment of the effectiveness of PNBs.

However, the studies also have some limitations. One limitation is that the studies have been conducted on a specific populations of patients, which limits the generalizability of the findings to other patient populations. Another limitation is that most of the studies have been conducted in a single center or a small number of centers, which limits the generalizability of the findings to other centers or countries. The studies also have some limitations in terms of the duration of follow up, which is short. One gap in the current knowledge is that there is limited information on the long-term effects of PNBs, such as the risk of chronic pain or nerve damage.

In summary, the existing studies on PNBs for postoperative pain management after major gynaecological surgeries provide a high level of evidence for the effectiveness of PNBs, but there are also limitations and gaps in the current knowledge that should be considered in future research.

3. POST-OPERATIVE PAIN IN GYNAECOLOGY

Acute pain arises as a result of tissue damage after surgery and should resolve during the healing phase. This can take up to three months, after which the pain is deemed chronic or persistent. Pain is a complex sensation that is unique to each patient. Pain perception is determined by biological reaction, psychological state and qualities, and social situation. Acute postoperative pain has a complex etiology.

The surgical damage causes a wide range of pain-related reactions, including sensitization of peripheral and central pain pathways as well as feelings of dread, anxiety, and frustration. Although pain reduces in the majority of patients in the first few days following surgery, some individuals suffer a static or increasing trajectory in pain and analgesic doses (5).

Despite tremendous advances in our understanding of pain causes, pain physiology, and the pharmacology of effective analgesic drugs, postoperative pain management continues to be a major issue in medicine. Inadequately managed postoperative pain hampers postoperative convalescence in a variety of ways, including perioperative morbidity, increased risk of persistent postoperative pain, impaired rehabilitation, increased length of stay and/or hospital readmission, and adverse events related to excessive analgesic use, such as oversedation. Despite advances in some areas of postoperative pain therapy, the quality of postoperative pain management is typically substandard in both Europe and the United States (6,7).

Postoperative pain management in obstetrics and gynaecology also must be greatly improved. This is evident in the fact that pain scores in obstetrics and gynaecology departments in German hospitals are higher than in all other surgical departments. Open uterine surgeries, in particular, are linked with significant pain, which is equivalent to pain ratings after spondylodesis. Consequently, open uterine surgeries had the highest pain scores in Germany. Complex surgeries in the female breast, as well as seemingly modest laparoscopic treatments such as adenectomies, are linked with severe postoperative pain too. Pain levels in the mentioned scenarios are higher than those reported following major procedures in the upper abdomen (such as partial liver resection) (8).

4. PERIPHERAL NERVE BLOCK IN PAIN MANAGEMENT AND ITS TECHNIQUES

Peripheral nerve blocks (PNBs) are a type of regional anaesthesia that involve injecting a local anaesthetic around or near a specific peripheral nerve or group of nerves to block afferent nociceptive pathways. In addition to potent analgesia, regional anaesthesia may lead to reductions in the stress response, systemic analgesic requirements, opioid-related side effects, and, possibly, the development of chronic postoperative pain (9).

Benefits of PNBs as a component of multimodal post-operative analgesia regimen:

• Improvement in postoperative pain control and reduction in the use of opioids;

• Reduction in hospital length of stay;

• Prevention of hospital readmissions;

• Reduction in postoperative nausea and vomiting;

• Faster movement to phase 2 recovery and/or postanaesthetic care unit bypass;

• Earlier participation in physical therapy;

• Improved patient satisfaction (10).

There are 2 main types of PNBs according to the amount and regime of anaesthetic injected:

1. Single-shot PNB (sPNB): The limited duration of action of the majority of local anaesthetics is the primary limitation of sPNB. Hence, sPNB is most appropriate for surgical procedures when postoperative pain is not anticipated to last more than 12 to 24 hours; otherwise, patients run the risk of experiencing substantial rebound pain after discharge. Larger doses or higher concentrations of local anaesthetics can lengthen a block's duration while simultaneously raising the risk of motor block and local anaesthetic systemic toxicity. Other strategies are thus needed to get around these restrictions for surgical operations when pain lasts longer than the first postoperative day (10).

2. Continuous PNBs (cPNB), also known as perineural local anaesthetic infusion, involve the insertion of a percutaneous catheter next to a peripheral nerve, followed by the administration of local anaesthetic to lengthen a nerve block. Long-acting local anaesthetics (ropivacaine or bupivacaine) are nearly exclusively used for infusions. The local anaesthetic may be administered exclusively as bolus doses (patient controlled or automated) or a basal infusion, and a combination of these methods is frequently utilized (9).

Blockades are also classified according to the end point where the anaesthetic is injected: to a particular nerve or to the fascial space where a group of nerves is located (fascial plane blocks).

Fascial plane blocks have gained popularity over the past ten years. These blocks work by injecting a significant amount of local anaesthetic into the fascial planes that house the target nerves. Comparing facial plane blocks to their traditional nerve block equivalents, there are benefits and drawbacks. In many cases, a single injection to a fascial plane can anesthetize several nerves or dermatomes, whereas traditional nerve blocks call for multiple injections to cover each nerve or dermatome. Moreover, compared to traditional nerve or epidural blocks, facial plane blocks are typically more superficial. Both of these elements help to make fascial plane blocks possibly safer. Also, compared to directly injecting local anaesthetic around a nerve, fascial plane blocks have a lower chance of properly blocking the target nerve since they do not target specific nerves (9).

There are also differences in how the block is administered depending on how the target nerve is located. There are 2 main methods used, as well as a combination of both.

The first method is ultrasound-guided blocks. In recent years, ultrasound imaging has decisively become the primary modality taught for nerve location and needle guiding. Another technique is nerve stimulation. An insulated needle focuses electrical current at the needle tip for this procedure, while a wire linked to the needle hub links to a nerve stimulator—a battery-powered gadget that generates a modest quantity (0-5 mA) of electric current at a specified frequency (usually 1 or 2 Hz). Certain muscle contractions are elicited and local anaesthesia is given when the insulated needle tip is positioned near a nerve (9).

5. COMPLICATIONS AND CONTRAINDICATIONS

Peripheral nerve blocks are an integral part of modern pain management techniques. However, certain factors such as patient cooperation, bleeding disorders, pharmacological anticoagulation, and the risk of infection must be carefully considered before performing the block. Patients who cannot remain still during the procedure, such as paediatric or developmentally delayed patients, may be at increased risk (9).

PNBs, regardless of technique or block location, carry potential risks such as vascular puncture and bleeding, nerve damage, and local anaesthetic systemic toxicity (10). The use of ultrasound guidance for PNB placement has been shown to reduce the incidence of vascular puncture and nerve damage (11). While all neurologic complications are a concern, such as tingling, pain on pressure, or pins and needles, can extend for weeks or months after surgery. Nerve injury is always a possibility and certain patients, such as those with pre-existing nerve conditions, may be at higher risk. Site-specific risks should be assessed for each patient to minimize potential complications (12).

Systemic local anaesthetic toxicity is a potential risk that must be promptly addressed if it occurs. Symptoms of it are dose-dependent and can range from metallic taste, tinnitus, and perioral numbness to seizure, cardiac arrest, and death (13). Several registry-based studies that focused exclusively or primarily on PNB reported seizure incidence ranging from 0.08 to 0.28 cases per 1000 blocks (12). Ultrasound guidance might decrease the incidence of local anaesthetics systemic toxicity for many peripheral nerve blocks compared with nerve stimulator guidance (14).

Patients with local infection, particularly around the site of the block, should be carefully evaluated to determine the potential risks of performing the block. The presence of local infection is a relative contraindication to performing a peripheral nerve block (9). Although there have been case reports of serious infectious complications after peripheral RA, the incidence after single shot PNB is extremely low. Continuous nerve block catheters are higher risk for infection – approximately 0–3% (15). Indwelling perineural catheters can serve as a nidus of infection, and the bacterial colonization rate of these catheters increases with the duration of therapy. Catheter bacterial colonisation is common but does not necessarily translate into local or systemic infection. Patients with systemic infections must be monitored for signs and symptoms of infection, but there is no specific time point when a catheter should be removed if it continues to provide benefit and no infection concerns are present (16).

The incidence of cPNB complications is highly dependent on the insertion technique and block location, and thus, it is difficult to make generalizations across studies. For example, posterior lumbar plexus and paravertebral blocks carry a higher risk due to their proximity to the retroperitoneal space and neuraxis, respectively. Similarly, paravertebral blocks, intercostal nerve blocks, and supraclavicular brachial plexus blocks carry a risk of pneumothorax (9,10).

PNBs offer targeted and effective pain relief for surgical procedures, but careful evaluation of patient factors and potential risks is necessary to ensure safety and success. Close communication with the surgical team, patient reassurance, and intermittent follow-up are important to manage any complications that may arise.

6. PLACES OF PERIPHERAL NERVE BLOCKS AFTER GYNECOLOGICAL SURGERIES

In this thesis, I review peripheral nerve blocks based on the division of gynaecological surgery into 3 groups according to the anatomical location of the operating field. There are three main categories of gynaecological surgeries: breast surgeries, abdominal surgeries, and perineum surgeries.

1. Breast surgeries: These surgeries are performed on the breasts and may involve removing a lump or tumour (lumpectomy), removing the entire breast (mastectomy), or reconstructing the breast after surgery.

2. Abdominal surgeries: These surgeries involve the abdominal organs, including the uterus, ovaries, fallopian tubes, and cervix. Examples of abdominal surgeries include hysterectomy, myomectomy, oophorectomy, and salpingectomy.

3. Perineum surgeries: These surgeries are focused on the area between the vagina and the anus. Some perineal surgeries, such as vaginal hysterectomy, can also involve accessing abdominal organs through the vagina. However, these operations are considered minor, so I will not consider them in this thesis.

6.1 POST-OPERATIVE PAIN MANAGEMENT AFTER BREAST SURGERIES

Despite the most recent advancements in breast cancer surgery, this operation is commonly accompanied with postoperative pain, nausea, and vomiting, which not only prolongs hospital stays and associated costs but also increases patient suffering (17).

The following peripheral nerve blocks are used after major breast surgeries: paravertebral, pectoral nerves block I/II, serratus anterior plane block and erector spinae plane block.

6.1.1 PARAVERTEBRAL BLOCK

Paravertebral block is a useful and standard technique for postoperative pain control in patients undergoing breast surgery. Paravertebral block is associated with lower opioid consumption, postoperative pain scores, a reduced pain score at the time of hospital discharge following breast surgery and overall quality of recovery (18).

Thoracic paravertebral block is a regional anaesthetic technique that consists in the injection of a local anaesthetic in the paravertebral space, nearby the point where the thoracic spinal nerves emerge from the intervertebral foramina. The thoracic paravertebral space is a space that has a wedge-like shape, with its broadest part located towards the lateral sides of the vertebral bodies and the spaces between them, while its narrowest part is connected to the spaces between the ribs. The posterior border of the space is defined by the superior costotransverse ligament, while the pleura forms its anterolateral boundary. The vertebrae and intervertebral foramina form the medial border, and the ribs define the superior and inferior boundaries (19).

Several meta-analyses have reported on the effectiveness of paravertebral blocks in breast cancer surgery. Compared to a control group receiving systemic analgesia alone, the administration of thoracic paravertebral blocks resulted in significantly lower postoperative pain scores ($p < 0.001$), lower opioid consumption, and a reduced incidence of postoperative nausea and vomiting (20). One of the meta-analyses indicated that patients who received paravertebral blocks had a slightly shorter hospital stay on average, but the difference was not considered clinically significant (21).

In comparing single-shot blocks to multiple injections, it was found that multiple injections resulted in a reduced need for postoperative pain medication, but no notable difference in the occurrence of postoperative nausea and vomiting was observed (22). Different studies have investigated the use of continuous paravertebral blocks following mastectomy, with or without axillary clearance. Results from these studies indicate that continuous paravertebral block leads to reduced pain scores for up to five days postoperatively (23).

Additionally, administering a continuous paravertebral infusion on an ambulatory basis was found to be associated with lower pain scores and better functional outcomes for three postoperative days (24).

In another study, patients who received a continuous paravertebral block exhibited a similar incidence of chronic pain when compared to those who did not, but paravertebral block was linked to less severe chronic pain symptoms (25). Studies on reducing the risk of chronic pain after paravertebral block give somewhat contradictory results. In one study, compared to the control, the paravertebral block group showed significantly reduced risk of developing chronic post-surgical pain at six months (26). On the other hand, another meta-analysis found that paravertebral block did not significantly prevent chronic postsurgical pain after breast conserving surgery, but it could prevent chronic postsurgical neuropathic pain by affecting the transition from acute to chronic pain (27).

In terms of analgesia consumption during the first 24 hours, continuous paravertebral blockade was found to be as effective as local anaesthetic infiltration in a study comparing the two methods (28). Another study demonstrated that ultrasound-guided erector spinae plane block and paravertebral block were effective in providing sufficient analgesia during breast surgery and also helped in reducing morphine consumption by having an opioid-sparing effect (29).

While the occurrence of severe negative effects linked to paravertebral block is very uncommon, they may include pleural puncture, pneumothorax, vascular puncture, central and peripheral nerve damage, organ harm, toxicity due to local anaesthesia, adverse reaction to ancillary medication, headache caused by post-dural puncture, and abnormal propagation of local anaesthesia both centrally and peripherally (19,30).

Paravertebral block is recommended (Grade A) by PROSPECT guidelines as the first-choice regional analgesic technique for major breast surgery (e.g. mastectomy with or without axillary node dissection) (20).

6.1.2 PECTORAL NERVES BLOCK (PECS I/II)

The pectoral fascia block was introduced as an alternative to paravertebral block in 2011, and since then, the procedure has been modified in various ways. Currently, a commonly used technique involves combining fascia blocks between the pectoralis major and pectoralis minor muscles (PECS I block) with blocks between the pectoralis minor and serratus anterior muscles (PECS II block) at the fourth rib level (31). The combination of PECS I and PECS II blocks has been found to be similarly effective as paravertebral block, while also having a low risk of complications, even when administered in a supine position after induction of general anaesthesia (32).

Intraoperative opioid requirements were significantly reduced after a PECS II block compared to no block (33), and patients who received PECS II blocks reported lower pain scores and consumed less postoperative opioids compared to those who did not receive any block or received a placebo (34–36).

Several meta-analyses have reported similar efficacy between PECS and paravertebral blocks in terms of pain relief and analgesia consumption (37,38), while other study has shown that PECS blocks can effectively reduce pain and opioid consumption during the post-anaesthesia care unit stay compared to no block or placebo (39). In some studies, it was found that patients who received a PECS II block had lower pain scores during the initial two hours following the surgery, in comparison to those who received a paravertebral block. Although there was no significant difference in pain scores between the paravertebral block and the PECS block groups during the 2 to 18-hour postoperative period, the paravertebral block group experienced lower pain scores after 18 hours (32,40,41).

The addition of a PECS I block to multimodal analgesia did not reduce postoperative pain scores, but the sub-group of patients undergoing major breast surgery experienced lower pain scores after a PECS block (42). In comparing PECS blocks to erector spinae plane blocks, initial pain scores were similar but became lower in the PECS block group, with less postoperative tramadol consumption (43).

Numerous studies and meta-analyses have reached a consensus that a two-level PECS block is a safe, reliable, and effective method to reduce morphine consumption, enhance postoperative pain relief, and increase patient satisfaction in breast cancer surgery. Compared to general anaesthesia with systemic opioids, the PECS block has demonstrated significantly better postoperative pain control, and this finding is unlikely to alter with additional clinical trials (44,45).

Based on the PROSPECT guidelines, the use of PECS block is recommended for significant breast surgeries where axillary node dissection is not carried out or when paravertebral block (PVB) cannot be used due to medical reasons (Grade A). However, there is a lack of information on this method, and it may not offer sufficient pain relief to the axilla from an anatomical standpoint (20).

6.1.3 SERRATUS ANTERIOR PLANE BLOCK

The Serratus Anterior Plane Block (SAPB) offers localized pain relief on the front and side of the chest wall by blocking the T2-9 intercostal nerves that run through the intercostal and serratus anterior muscles, along with the long thoracic and dorsal thoracic nerves. The fascial space known as the serratus anterior plane is the target of the SAPB technique, which involves injecting local anaesthetic between the latissimus dorsi and the serratus anterior muscles along the midaxillary line or on the deep surface of the serratus anterior with the assistance of ultrasound (46).

Information on the use of this method in breast surgery is quite contradictory and limited. However, this method has been increasingly investigated in recent years because it is relatively easy to use and has good potential.

The administration of the superficial SAPB in mastectomy entails injection of the local anaesthetic close to the surgical site, thereby increasing the risk of muscle oedema or hematoma, which may interfere with the operation. Additionally, the local anaesthetic may be washed away or suctioned, leading to diminished effectiveness of the block. Conversely, the deep serratus anterior block remains unaffected by the surgical procedure (47). Research findings indicate that deep serratus anterior block is more effective in providing postoperative pain relief and reducing opioid consumption compared to superficial serratus anterior block specifically in mastectomy patients (48). Several consecutive clinical investigations have demonstrated that administering SAPB prior to breast cancer surgery can decrease postoperative pain scores, the incidence of rescue analgesia, and the requirement for opioids during the perioperative period. These findings indicate that SAPB can be an effective method for providing postoperative analgesia for breast cancer patients (49–52).

A comprehensive analysis of regional block methods for postoperative pain management in breast tumour patients revealed that both paravertebral block and SAPB have a strong likelihood of reducing pain levels up to 24 hours following major oncologic breast surgeries (53). Reports indicate that although patients in the classic thoracic paravertebral block and serratus anterior block groups had comparable intraoperative fentanyl requirements and postoperative visual analogue scale scores, both providing effective analgesia, the serratus anterior block group had a shorter duration of muscle blockade and analgesia (245.6 ± 58 min vs. 346 ± 57 min). Due to the challenges and complications associated with thoracic paravertebral block, SAPB can serve as an alternative for postoperative analgesia in breast cancer surgery (54). In a different study, the efficacy of SAPB was compared with paravertebral block, and it was found to be less effective. Patients who received SAPB had a significantly higher total morphine consumption for rescue analgesia, and their pain scores were higher at 8 hours, 16 hours, and 24 hours postoperatively, compared to those who received paravertebral block (55).

According to a prospective controlled study investigating the effects of SAPB, the incidence of chronic pain syndrome three months after the surgery was significantly lower in the SAPB group (22/99, 25.6%) than in the control group (46/89, 51.7%). These results suggest that preoperative SAPB may reduce the likelihood of developing postoperative chronic pain syndrome in patients undergoing breast cancer surgery (56).

Based on the PROSPECT guidelines, SAPB is not recommended as data are limited and inconsistent (20).

6.1.4 ERECTOR SPINAE PLANE BLOCK

The erector spinae muscle is a combination of several muscles, including the spinalis, longissimus thoracis, and iliocostalis muscles, that run vertically along the back. To perform an erector spinae plane (ESP) block, the local anaesthetic is injected deeper than the erector spinae muscle into the fascial plane at the tip of the vertebra's transverse process. This allows the anaesthetic to be distributed in the cranio-caudal fascial plane, diffuse into the paravertebral and epidural spaces anteriorly, and spread to the intercostal space at various levels laterally (57).

The erector spinae plane block is a relatively new technique that was first described by Forero et al. in 2016. The increasing clinical interest in ESP blocks has led to the need for future trials to compare ESP blocks with robust multimodal analgesic regimens and other truncal blocks (58). Although ESP block has gained popularity as a treatment for perioperative pain, there is still debate surrounding its benefits. While several meta-analyses have demonstrated the efficacy of ESP block in providing adequate analgesia and decreasing postoperative opioid consumption (59,60), the results are not yet conclusive due to the limited sample size and significant heterogeneity among the studies. More research is needed to fully understand the potential benefits and limitations of ESP block in pain management (61).

The ESP block has several advantages over thoracic epidural and paravertebral injections. Unlike these techniques, the ESPB targets a plane that is distant from the pleura and neuraxial structures, which significantly reduces the risk of complications such as local anaesthetic systemic toxicity and pleural puncture (62,63). In terms of reducing pain scores and 24-hour opioid consumption, the pectoralis nerve block was found to be more effective than the ESP block (64–66). When comparing ESP block and paravertebral block, no significant differences were found in the requirements for oral morphine equivalent consumption 24 hours after surgery (29,67–69). However, in few trials that compared immediate postoperative pain scores (0-2 hours), the mean pain scores were significantly lower in the paravertebral block group (29,69).

According to PROSPECT recommendations, there is limited procedure-specific evidence supporting the use of interfascial plane blocks, such as erector spinae plane block. Conflicting findings indicate that more studies are necessary to evaluate their effectiveness when compared to other techniques like paravertebral blocks and pectoralis blocks in breast surgery (20).

6.2 POST-OPERATIVE PAIN MANAGEMENT AFTER ABDOMINAL SURGERIES

Abdominal surgery can cause significant pain due to both the incision in the abdominal wall and trauma to the internal organs. However, this pain is often not well-managed. Peripheral nerve blockade is a viable option for providing effective pain relief with selective analgesia in a variety of surgical procedures. It also avoids the side effects that come with central blockade, including hypotension, urinary retention, and epidural abscesses (70).

The following peripheral nerve blocks are used after major abdominal gynaecological surgeries: transversus abdominis plane (TAP) block, erector spinae plane block and quadratum lumborum block.

Although thoracic paravertebral block has been shown to be effective in providing postoperative analgesia in patients undergoing abdominal and thoracic surgery, its efficacy in major gynaecological surgery has not been extensively studied. Therefore, the use of paravertebral block for postoperative analgesia in major gynaecological surgery is not common (71).

Rectus sheath block is commonly used for analgesia after midline surgical incisions. The procedure involves the blockade of the final branches of T9-T11, which pass between the internal oblique and transversus abdominis muscles and infiltrate the rear wall of the rectus abdominis muscle before terminating in an anterior cutaneous branch that supplies the umbilical region's skin (72). This is a long-used method that is not widely used in gynaecological practice (despite the existence of several studies with a small sample of patients (73,74)) because it is known for vascular damage and intraperitoneal injection, and because new methods have emerged that provide more adequate analgesia and also block visceral pain (75).

6.2.1 TRANSVERSUS ABDOMINIS PLANE BLOCK

In 2001, Rafi introduced the TAP block as a technique guided by landmarks through the triangle of Petit to perform a field block. This involves injecting a solution of local anaesthetic into the plane between the internal oblique and transversus abdominis muscles. The TAP block provides analgesia by blocking the seventh to 11th intercostal nerves (T7–T11), the subcostal nerve (T12), and the ilioinguinal and iliohypogastric nerves (L1–L2) (5). The nerves originating from the T6 to L1 spinal roots that run into this plane supply sensory nerves to the anterolateral abdominal wall. Therefore, the spread of local anaesthetic in this plane can block the neural afferents and provide analgesia to the anterolateral abdominal wall (76).

The effectiveness of TAP blocks is still unclear due to conflicting evidence. While some studies have demonstrated a reduction in opioid consumption only in the first 2 hours postoperatively (70,77), others have reported a decrease in opioid use up to 24 hours after surgery.

Several meta-analyses have assessed the efficacy of TAP blocks for open hysterectomy. The results consistently suggest that posterior/lateral TAP blocks lead to reduced 24-hour morphine consumption, lower pain scores both at rest and during movement, lower incidences of nausea and vomiting, and longer duration of analgesia when compared to placebo or no block (78,79).

On the other hand, in another study in patients undergoing open resection for gynecologic malignancy, TAP blocks did not show a significant difference in median 24-hour opioid consumption or length of stay, raising doubts about their efficacy in cases with large laparotomy incisions (80).

Direct comparisons between epidural analgesia and TAP blocks have been conducted, with results indicating that the epidural group had superior pain scores compared to the TAP group. However, patients in the epidural group also had a higher incidence of side effects such as hypotension, postoperative nausea and vomiting, urinary retention, inability to ambulate, and a longer length of hospital stay (81).

Research has suggested that the effectiveness of TAP blocks may be influenced by the operator's experience, as some studies have reported comparable results between laparoscopic delivery of liposomal bupivacaine and ultrasound-guided TAP blocks, while others have demonstrated poor outcomes when TAP blocks were performed without ultrasound guidance (82,83). This variability in efficacy may explain why TAP blocks have demonstrated little to no benefit when compared to placebo or wound infiltration in some studies (84), while others have shown significant improvements, even compared to epidural analgesia. For instance, the trial, which involved 498 patients undergoing major abdominal surgery, compared TAP blocks with liposomal bupivacaine to continuous epidural analgesia. The pain scores at rest for the first three days after major abdominal surgery showed no significant difference between patients receiving TAP blocks and those receiving epidural analgesia. However, the TAP block group required a higher amount of opioids compared to the epidural group, while experiencing less hypotension (85).

Although ultrasound TAP block is an easy technique, decreases postoperative pain, and opioid consumption, it lacks visceral pain relief and limits the spread of local anaesthetics (86).

According to Enhanced recovery after surgery (ERAS) society guidelines for gynaecologic oncology, due to the possible complications and side effects associated with epidural anaesthesia, techniques like TAP block are favoured (87).

6.2.2 ERECTOR SPINAE PLANE BLOCK

The use of ultrasound-guided ESP block has become increasingly popular due to its efficacy and safety in providing regional analgesia, as well as its ability to provide relief from visceral pain (88). ESP block improves the somatic and visceral pain by affecting the ventral ramus and rami communicates that contain sympathetic nerve fibers when local anaesthetic spreads through the paravertebral space (89). ESP block can be performed at T4–5 levels for breast and thoracic surgeries and T7–8 levels for abdominal surgeries (90).

Ultrasound-guided ESP block is considered a simpler and safer alternative to epidural anaesthesia. This is because the ultrasound target, which is the transverse process, is easily visible, the injection site is located far from the neuroaxis, pleura, and major blood vessels. Also, a single injection can provide extensive coverage due to the wide craniocaudal diffusion of the anaesthetic (91).

There is growing interest in this method in the application to gynaecological surgeries, most studies compare ESP block with the TAP block. According to the results of studies, ultrasound-guided bilateral single-shot ESP block was more effective than TAP block in reducing visual analogue scale (VAS) pain scores at various postoperative times, including 30 minutes, 2, 12, 16, 20, and 24 hours (86).

Similarly, it was reported that significantly higher VAS pain scores were in the control group for the first 12 hours postoperative, which were comparable to ESP block after total abdominal hysterectomy. Bilateral ESP block also significantly reduced fentanyl consumption 24 hours postoperatively compared to the control group after total abdominal hysterectomy (91). Another study found that patients who received ESP block had significantly reduced pain scores at all postoperative time intervals up to 24 hours and consumed less tramadol than those who received lateral TAP block after open total abdominal hysterectomy (92).

Therefore, bilateral ultrasound-guided ESP block appears to provide more potent and longer-lasting postoperative analgesia than TAP block. While more research is needed to fully understand the potential benefits and limitations of ESP block, the existing studies suggest it is a promising option for pain management in major gynaecological surgeries.

6.2.3 QUADRATUS LUMBORUM BLOCK

The quadratus lumborum (QL) block was first described in 2007 as a variant of the TAP block and targets the same fascial plane. It is thought to provide somatic and visceral pain relief through local anaesthetic spread to the thoracic sympathetic trunk at T7–L1 depending on the site of injection (93). The transversalis fascia, which lines the transverse abdominal muscle and QL, is continuous with the endothoracic fascia in the thoracic cage, and therefore local anaesthetic can spread posterior to the transversalis fascia and into the thoracic paravertebral space, providing additional pain relief (75).

Since the first study on QL block by Blanco et al. most of the studies have been performed in patients undergoing Caesarean section (94). Several recent studies have compared the QL block and TAP block, with a meta-analysis of eight randomized controlled trials involving 564 patients revealing lower pain scores, lower postoperative morphine consumption, and longer duration of postoperative analgesia in the QL group compared to the TAP group (95). Another meta-analysis compared postoperative pain relief and opiate requirements after caesarean section and found that both QL block and TAP block provided equivalent pain relief compared to inactive controls, but there was insufficient data to directly compare the two techniques (96).

No significant difference was found in the analgesia efficacy of ESP block and QL block after hysterectomy (97), but also there was found no difference between QL block group and placebo group regarding opioid consumption (98).

A trial conducted on patients undergoing hysterectomy found that bilateral QLB provided more effective intraoperative and postoperative analgesia compared to bilateral TAP block. The QLB group had less intraoperative fentanyl consumption, lower VAS for postoperative pain, fewer patients requiring analgesia after surgery, and lower postoperative morphine consumption compared to the TAP block group. However, the TAP block group had a shorter duration of postoperative analgesia (99).

There is currently growing interest in the potential for QL block in gynaecology, but it is too early to make any recommendations for its use due to the limited research.

CONCLUSIONS

In conclusion, peripheral nerve blocks offer a promising option for postoperative pain management after major gynaecological surgeries. Compared to traditional analgesic methods, peripheral nerve blocks have been shown to provide superior pain relief, reduce opioid consumption, and minimize adverse effects.

Paravertebral blocks and pectoralis blocks have been found to be the most effective for pain management in breast surgeries. Among the various types of peripheral nerve blocks, evidence suggests that the transversus abdominis plane block and erector spinae plane block are particularly effective for managing postoperative pain after abdominal gynaecological surgeries. In addition, studies have shown the potential of quadratus lumborum block for pain management after abdominal surgeries.

There are currently no unified recommendations for the use of peripheral nerve blocks for post-operative pain relief in gynaecology, but they are universally used due to their simplicity, level of analgesia and minimal complications.

Overall, the use of peripheral nerve blocks in pain management after major gynaecological surgeries has shown great promise, and future research could help further refine the optimal techniques and parameters for these procedures.

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