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Original article

Catheter-based serratus anterior plane block vs. continuous wound infiltration for postoperative pain control following minimally invasive atrioventricular valve surgery : a randomized, prospective trial

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Abstract

Background: **Minimally invasive cardiac surgery via mini-thoracotomy reduces surgical trauma compared to full sternotomy. However, thoracotomy can cause severe postoperative pain. Managing postoperative pain is challenging but critical for fast rehabilitation and avoidance of chronic pain. Our objective was to compare the efficacy of analgesia of a bolus in combination with continuous local anaesthetics using a serratus anterior plane block (SAPB) catheter versus a wound infiltration catheter (CWI) in patients after minimally invasive cardiac surgery.**

Design and setting: **We conducted a monocentric, prospective, randomized controlled trial between January 2021 and August 2022. The study was performed at Ghent University Hospital, Belgium.**

Methods: **Patients scheduled for minimally invasive cardiac surgery via thoracoscopy and mini-thoracotomy were randomized to receive either a SABP or a CWI catheter. Postoperatively, continuous ropivacaine 0.2% was started at 10ml/h, and a supplementary bolus of 30ml ropivacaine 0.5% was administered one hour before detubation. The catheter remained in place for at least 24 hours. The primary endpoint was opioid consumption during the first 48 hours postdetubation. Secondary endpoints were anti-emetic consumption, Numerical Analogue Score for 48 hours, length of stay in the Intensive Care Unit and hospital, and incidence of chronic pain. Qualitative data were compared using the Chi – Square test, quantitative data were analyzed with the Student's t-test.**

Results: **During the study period, a total of 21 patients received a SAPB catheter and 26 patients received a CWI catheter. No statistical significant differences were seen in baseline characteristics. In the first 48 hours postdetubation, morphine equivalent consumption was similar in both groups (p= 0.52), with no differences observed in the early, mid- or late postoperative phases. The total morphine equivalent dose was 21.8 mg in the SAPB and 18.6 mg in the CWI group. There were no significant differences in postoperative vomiting and nausea, length of stay in the Intensive Care Unit and in the hospital and chronic thoracic pain (23% and 33% for the SAPB and CWI group, respectively, p=0.54).**

Conclusion: **This prospective study found no significant difference in postoperative opioid consumption between patients who received a serratus anterior plane block catheter and those who received a wound catheter with bolus and continuous ropivacaine, following minimally invasive cardiac surgery via right thoracoscopy and mini-thoracotomy.**

Keywords: **Minimally Invasive Surgical Procedures, Cardiac Surgical Procedures, Serratus Anterior Plane Block, Pain, Postoperative.**

Introduction

Minimally invasive cardiac surgery

Cardiac surgery is associated with moderate to severe postoperative pain in more than a third of patients. Apart from the direct trauma caused by the surgical incision, this pain is mainly driven by tissue damage, inflammation, prolonged sternal retraction, and the use of thoracic and pericardial drains[1,2].

The management of postoperative pain is challenging, but critical to enable a fast rehabilitation. In fact, insufficient pain control leads to higher levels of stress hormones and greater myocardial oxygen consumption. Furthermore, thoracic pain can cause delayed mobilisation and rehabilitation, as well as respiratory complications due to cough and inadequate breathing. Postoperative pain leads to a prolonged stay of patients in the Intensive Care Unit (ICU) or the general hospital ward, and increases the risk for re-admission and chronic pain. With respect to the latter, data show a chronic pain incidence of 17-56% in patients who underwent a sternotomy. Chronic pain is difficult to treat and has a major impact on the quality of life. Interestingly, chronic pain can, at least in part, be prevented by adequate treatment of acute pain[1].

In recent decades, there has been a trend towards minimally invasive cardiac surgery. Minimally invasive cardiac surgery is any surgery performed without a complete sternotomy whether or not in combination with a cardiopulmonary bypass. The smaller surgical trauma associated with this type of surgery reduces the risk of wound infection, sternal instability and inadequate wound healing[3].

Over the years, multiple minimal invasive surgical approaches have been developed for different cardiac procedures (e.g., ministernotomy, parasternal incision, [mini-]thoracotomy). The advantages of minimally invasive cardiac surgery are multiple and include lower risk for postoperative atrial fibrillation, shorter hospitalisation time, earlier mobilisation, lower overall cost, lower number of reoperations and blood transfusions and a more aesthetic scar. On the flipside, however, these approaches also come with some disadvantages. This includes the need for femoral cannulation, difficult conversions to sternotomy when necessary, reduced visualisation, longer bypass and operation times, the need for one lung ventilation, etc[3,4].

Minimally invasive atrio-ventricular surgery is performed at the Ghent University Hospital using a right thoracoscopy and a mini-thoracotomy. Thoracotomy can cause severe pain due to skin incision, retraction of the ribs, damage to muscles, parietal and/or visceral pleurae and intercostal nerves, and due to placement of thoracic drains. After a traditional thoracotomy, up to 50% of patients develop chronic pain[5]. A multimodal approach using locoregional analgesia and multiple groups of pain medications (acetaminophen, non-steroidal anti-inflammatory drugs [NSAID], opioids, adjuvants) can provide better pain relief in this setting. When performing a (mini-)thoracotomy for cardiothoracic surgery, some literature recommends placement of a paravertebral block or a thoracic epidural analgesia for pain relief[5,6].

Serratus Anterior Plane Block

The serratus anterior plane block (SAPB) is a relatively new locoregional block used in breast surgery, thoracic surgery and in the management of rib fractures. It is easy to perform and it avoids some of the major complications associated with thoracic epidural and paravertebral blocks (i.e., haematoma, sympathetic block). A SAPB can be performed in supine position and is safe in patients with coagulopathy. Apart from pneumothorax, complications with SAPB are limited to the known complications of peripheral locoregional techniques (e.g., haemorrhage, block failure, intravascular injection, infection and local anaesthetic toxicity). This easy to perform locoregional block provides analgesia to the hemithorax without autonomic blockade or haemodynamic instability, but it provides less analgesia to the posterior thoracic wall. As such, SAPB has the potential to provide satisfactory pain control while also promoting a faster recovery after thoracic surgery[7,8].

Several techniques for performing a SAPB have been described. One approach is to place the SAPB between the serratus anterior muscle and the latissimus dorsi. Alternatively, it can also be placed deeper, between the serratus anterior muscle and the ribs and intercostal muscles[9]. A study conducted on 64 mastectomies demonstrated a decreased 24-hour opioid consumption when using the deep rather than the superficial block[10].

A SAPB has the potential to reduce pain, opioid consumption and PONV following video-assisted thoracoscopy and cardio-thoracic surgery, in addition to less hemodynamic instability compared to epidural analgesia[7,8,12,13].

However the SAPB provided inadequate pain relief for visceral pain caused by thoracic drains or thoracotomy[14].

In addition to managing pain, the intention of locoregional anesthaesia is to minimise opioid use. While opioids are effective in treating severe pain, they are also associated with increased morbidity, including nausea, vomiting, ileus, respiratory depression and confusion. The use of multimodal pharmacological approaches can help prevent these adverse effects[1].

To our knowledge, only one retrospective study (Berthoud et al.) previously compared a single bolus SAPB to a continuous wound catheter (CWI) in minimally invasive valve surgery via right thoracotomy. This study revealed a significantly lower morphine consumption during the first 48 hours with a lower pain score during the first six

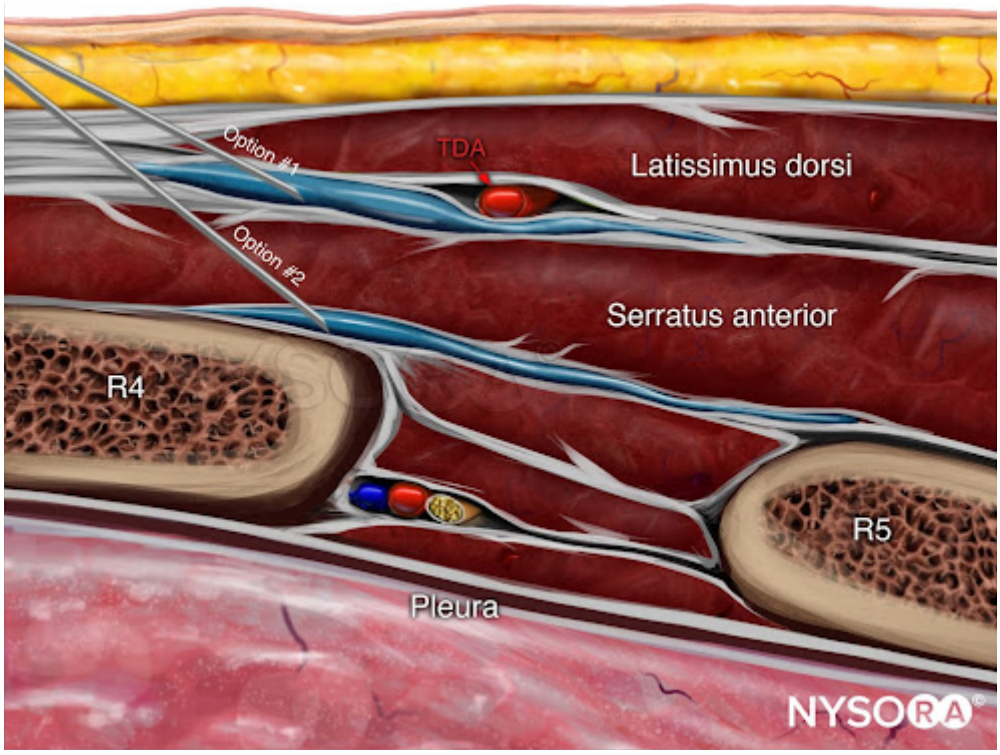

Fig. 1 — Anatomy of serratus anterior plane block. From the Compendium of Regional Anesthesia (NYSORA) : needle insertion in-plane and local anesthetic spread (blue) in option 1, superficial (between the latissimus dorsi and serratus anterior muscles) or option 2, deep (underneath the serratus anterior muscle). TDA, thoracodorsal artery[11].

hours in the SAPB group. The duration of admission to ICU was also significantly lower[15].

Our study aimed to compare the effectiveness of a SAPB catheter versus a CWI catheter for pain management after minimally invasive cardiac surgery via right thoracoscopy and mini-thoracotomy, using a combination of a bolus and continuous administration of local anaesthetics. We hypothesized that administering ropivacaine through either a SAPB catheter or a CWI catheter would result in similar opioid consumption.

Methods

Study Design

We conducted a prospective, randomized, controlled trial with data collection from 01/01/2021 until 01/09/2022. Application to the Ethics Committee of the Ghent University Hospital, C.Heymanslaan 10, Ghent, chairman Prof. Dr. Deron, was made on 17/09/2020 (Project number: BC-08517) with approval on 20/10/2020.

A power calculation was made for an independent t-test, two-sided with a significance level of 0.05, power 0.8, cohen-d of 0.8 (expected effect of morphine consumption calculated from the study by Berthoud et al.)[15]. The intention was to include 25 patients in each arm.

In consultation with the cardiothoracic surgeons and the ICU team, a protocol for placement of the blocks and follow-up of patients was established.

At the end of surgery, either the surgeon left a superficial catheter in the wound (CWI), or the attending anaesthetist inserted a catheter (SAPB). Patients and nurses were blinded during follow-up.

Patients were eligible for the study if they were scheduled for mitral or tricuspid valve surgery, left atrial appendage closure, atrial septal defect closure, or excision of an intracardiac mass, via minimally invasive access. Inclusion of patients was done the day before surgery during the preoperative anaesthesia consultation. Patients were eligible if they were older than 18 years with a body weight between 55 and 100 kg and a height between 155 and 190 cm, to avoid the need for dose or volume adjustments of local anaesthetics and to ensure favourable anatomical conditions for ultrasound placement.

Exclusion criteria were allergy to the local anaesthetics used, mental impairment, end-stage renal or liver failure, preoperative daily opioid use, or not Dutch-, French- or English-speaking. Preoperative lab results (part of standard practice) were used to check the function of the kidneys and liver.

Patients were divided, by simple randomisation, between groups via a randomisation table. The investigators were not blinded.

Minimally invasive cardiac surgery is performed at Ghent University Hospital via right thoracoscopy

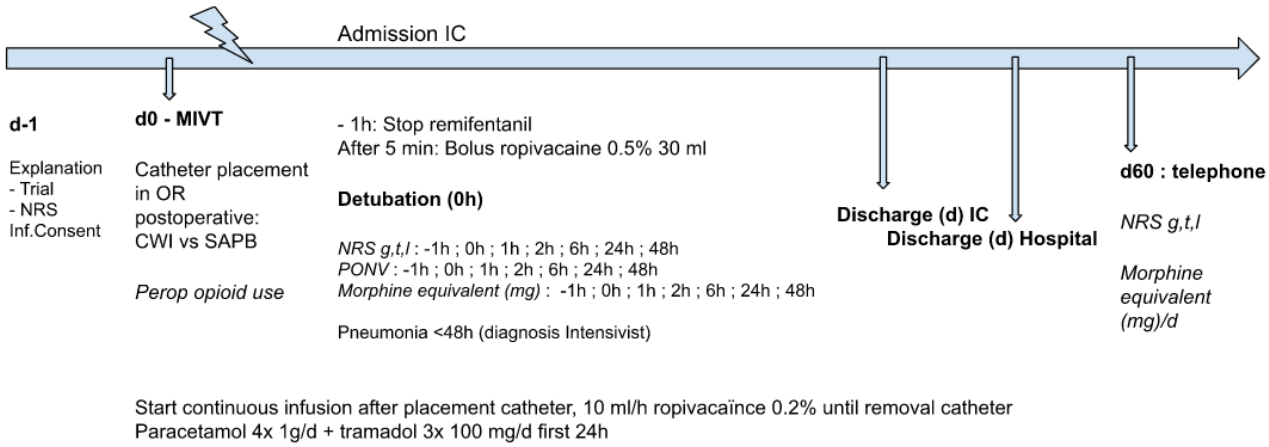

Fig. 2 — Course of the study.

and mini-thoracotomy. Incisions were made at the level of the right thoracic wall, and cannulation for heart-lung support was performed at the right groin. In case of right-sided surgery, cannulation using the right internal jugular vein was also performed.

Placement of the SAPB multiple orifice catheter, in the deep serratus anterior plane, was between the anterior and posterior axillary line and between the two surgical thoracic drains, given the block was performed postoperatively. The placement was carried out under sterile conditions, with monitoring of location, spread and catheter placement through ultrasound. The needle was inserted in an antero-inferior to postero-superior direction, and the tip of the needle was directed towards the 4th to 6th rib. After hydrolocation and dissection, the catheter was advanced.

The CWI multiple orifice catheter was placed by the surgeon by the end of the surgery. It was placed in the intercostal space of the thoracotomy wound, with an average length of 10 to 12 centimeters.

No analgesia was provided preoperatively. Depending on the attending cardiac anaesthetist, a peroperative analgesic dose of dexmedetomidine (0.5mcg/kg/h) was added to the standard dose of fentanyl (approximately 3 mcg/kg at induction and repeat dose if clinically necessary) and sevoflurane anaesthesia[16]. Postoperatively, patients were sedated with a combination of propofol and remifentanil, which were stopped one hour before the planned detubation. According to the ICU protocol, detubation was performed when the patient was normothermic, haemodynamically and biochemically stable, neurologically adequate, and under low ventilatory conditions, with minimal blood loss through the thoracic tubes.

Immediately after placement of the catheter, ropivacaine 0.2% was administered at a rate of 10 ml/hour using an elastomer pump. When the sedatives and opioids were discontinued, one hour before detubation, a bolus of ropivacaine (0.5%, 30 ml) was administered through the catheter. The catheter remained in situ for at least 24 hours. At various time points (T-1h, T0 [detubation], T+1h, T+2h, T+6h, T+12h, T+24h, T+48h), the global pain score (numerical rating scale (NRS)) and the pain scores at the level of the thorax and cannulation site(s) were assessed and recorded by the attending nurse. In addition, the administration and timing of opioids (morphine, tramadol, piritramide or

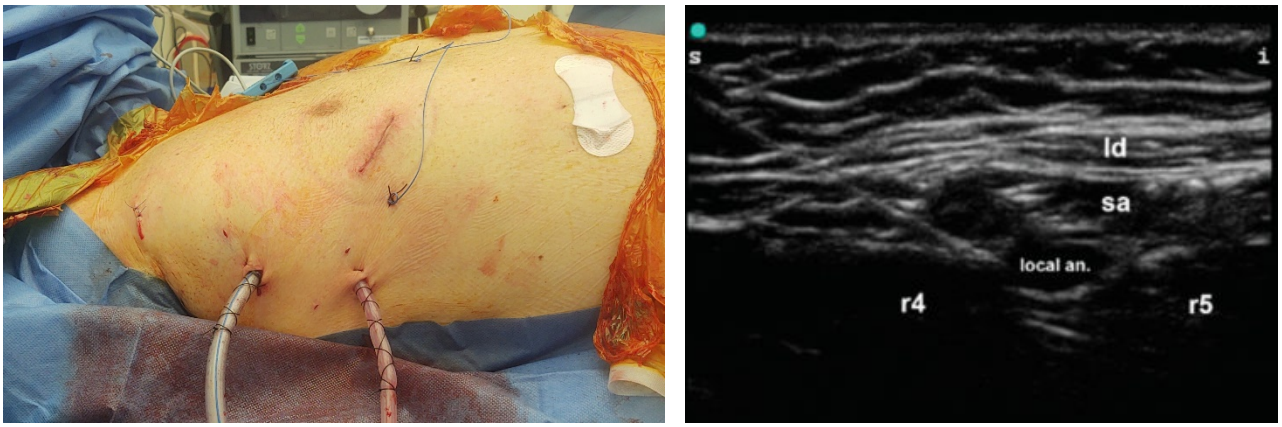

Fig. 3 — Patient positioning on the end of the surgery (left), ultrasound image (right). Ultrasound image from NYSORA.com : needle insertion in-plane and local anesthetic spread : Ld (Latissimus dorsi), sa (serratus anterior muscles), r4 (rib 4), r5 (rib 5)[11].

oxycodon) and anti-emetics during the per- and postoperative phase (up to T+48h) were monitored. All patients were given paracetamol and tramadol during the first 24 hours.

An equipotent table was used to convert the administered opioids to the equivalent dose of morphine analogue (Table II) [17,18]. The administration of opioids was divided into various phases: pre-detubation phase (T-1), early postoperative pain phase (T0; T1; T2; T6), mid postoperative pain phase (T12; T24), and late postoperative pain phase (T48).

Furthermore, the study examined the occurrence of (early) postoperative pneumonia (< 48h) as defined by the attending ICU physician in the ICU charts and the initiation of antibiotics, in addition to the length of stay in the ICU and in the hospital.

Two months after surgery, patients were contacted by telephone and asked to complete a predefined checklist to assess whether they experienced chronic postoperative pain or used opioids.

All personal data collected were pseudonymised and processed using REDCap 'electronic data capture tools' at Ghent University Hospital[19,20].

Statistical analysis

A comparison was made between the SAPB and CWI group. The analysis was carried out using R software[21]. Qualitative data are expressed as numbers and frequencies and were compared using the Chi – Square test. Quantitative data are expressed as means and standard deviations. These are shown in box plots and were compared using the Student's t-test.

A value of $p \leq 0.05$ was considered significant for differences between the two groups.

Results

Baseline characteristics

In total, 47 patients were included in the analysis, 26 in the CWI and 21 in the SAPB group (Figure 3). No major differences were found in the baseline characteristics between the two treatment arms (Table I).

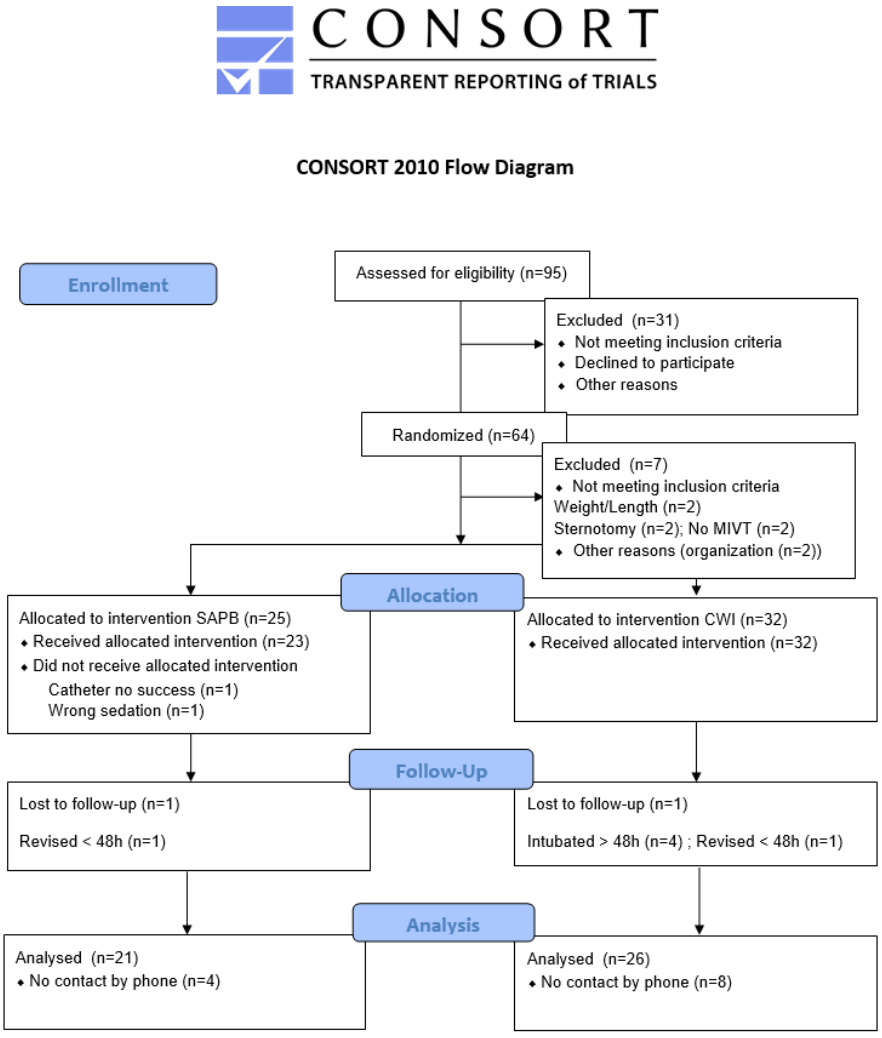

Fig. 4 — Patient Flow Diagram.

Table I. — Patient characteristics and perioperative use of fentanyl and dexmedetomidine.

	SAPB (n=21)	CWI (n=26)	P-value
Gender (male) (n,%)	11 (52%)	9 (34%)	0.35
Age (y), mean ± SD	58.4 ± 21	64.3 ± 17.9	0.31
BMI , mean ± SD	24.7 ± 3.2	26.8 ± 4.1	0.06
Fentanyl peroperative (mcg/kg), mean ± SD	6.2 ± 1.7	5.2 ± 1.6	0.05
Dexmedetomidine peroperative (n, %)	7/21 (33%)	9/24 (38%)	1

Primary outcome results

The mean total dose (up to 48 hours postdetubation) of morphine analogue administered was 21.8 mg in the SAPB and 18.6 mg in the CWI group (p=0.52). No significant difference were noticed in total dose, neither in pre-, mid- or late postoperative phase (Table II).

Other results

Given the low percentage of pain scores (NRS) recorded by the nurses, further analysis of these data was not carried out.

The incidence of postoperative vomiting and nausea, defined as the administration of at least two anti-emetics postdetubation (first 48h), did not differ significantly between the two groups (p=0.73).

The length of stay in the ICU was similar for both the SABP and CWI groups, with a mean of 29.5 and 41.9 hours, respectively. Also, no difference was found in the duration of hospitalisation between the two groups, with a mean of 8.1 and 10.4 days for the SABP and CWI group, respectively.

There were no reported cases of pneumonia during the study. No important harms or unintended effects need to be noted.

The protocol did not define the depth of the SAPB catheter, and this was found to be highly variable, ranging from 8 to 30 cm. When taken the depth of catheter in account (short < 16 cm vs. long > 16 cm, chosen after expert opinion), no difference was found in the dose of morphine analogue (p=0.91).

Two months after the operation, 10 out of 35 patients reported chronic pain during follow-up by phone, with 4 out of 17 in the SAPB group (23%) and 6 out of 18 in the CWI group (33%) (p=0.54).

Discussion

Our prospective trial failed to reject the null hypothesis stating that 'Ropivacaine by a SAPB catheter provides the same consumption of opioids as by a CWI catheter after minimally invasive cardiac surgery via right thoracoscopy and mini-thoracotomy'.

Wound infiltration with local anaesthetics provides less pain relief than thoracic epidurals, paravertebral blocks or erector spinae plane blocks (ESPB), but it has a favourable safety profile with a low incidence of complications. Furthermore, it is easily and quickly performed, and it has shown positive results in thoracotomy and video-assisted thoracoscopy when compared to placebo. Possible complications include local anaesthetic toxicity, haematoma formation or an increased risk of infection, particularly if left in place for more than five days or when placed in the groin region. Wound infiltration is preferably done pre-incision with subsequent placement of a catheter with continuous infusion[22].

Different locoregional techniques exist for analgesia in patients after thoracotomy. The selected deep plane SAPB is an easy to perform

Table II. — Equipotent opioids.

Morfine IV	Oxycodon PO	Tramadol PO	Tramadol IV	Piritramide IV/IM
1 mg	2 mg	15 mg	7.5 mg	1.5 mg

Table III. — Opioid consumption in the first 48 hours postdetubation.

	SAPB (n=21)	CWI (n=26)	P-value
Dose morfine-analogue (mg), mean ± SD	21.8 ± 16.5	18.6 ± 16.9	0.52
Pre-extubation (T-1) (mg), mean ± SD	0.5 ± 1.1	0.6 ± 1.4	0.83
Early postoperative (T0 + T1 + T2 + T6) (mg), mean ± SD	3.4 ± 3.6	1.8 ± 3.2	0.12
Mid postoperative (T12 + T24) (mg), mean ± SD	14.9 ± 13.6	14.8 ± 15	0.98
Late postoperative (T48) (mg), mean ± SD	3 ± 3.6	1.5 ± 1.8	0.09

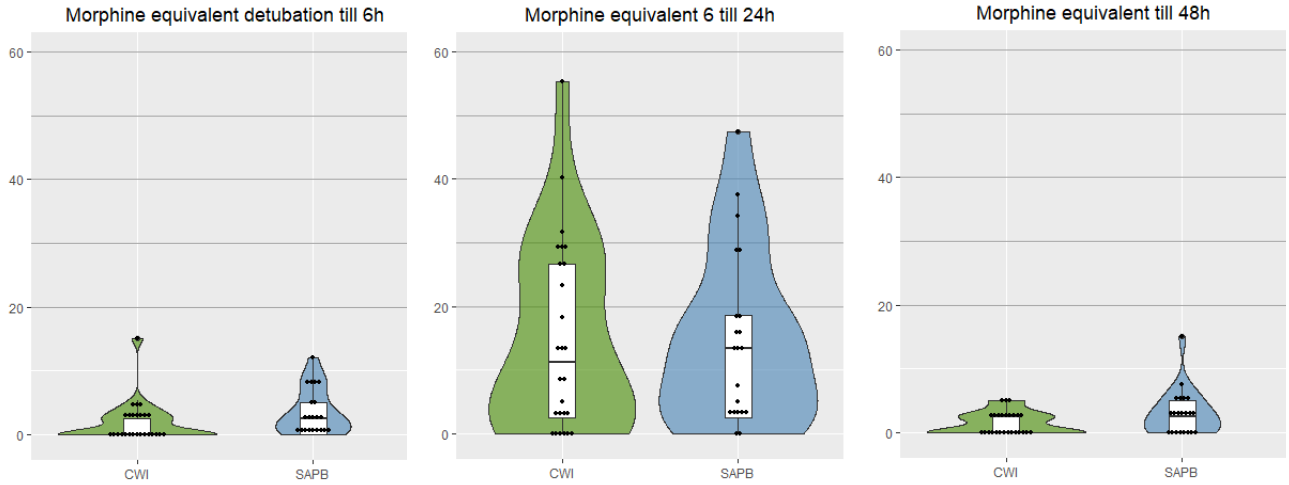

Fig. 5 — Morphine equivalent consumption during study (first 48 hours postdetubation).

plane block of the anterolateral thoracic wall. In our study patients were in the supine position with a small degree of right lateral tilt, no repositioning was done after surgery. Our study was based on the retrospective study by Berthoud et al. which provided a single bolus SAPB with presumably only effect on early pain, compared to a CWI catheter. In our trial a catheter was chosen postoperatively, but no difference could be shown in the dose of opioids postoperatively between the SAPB and the CWI group. The total morphine consumption in the first 48h postdetubation were similar to the consumption of the CWI group of Berthoud et al [15].

No significant difference in opioid administration was observed between the two groups in the early, middle and late postoperative phases. In addition, no difference was seen in terms of PONV, length of stay in ICU and in the total hospitalisation length. The question can be raised to what extent and how long local anaesthetics remain present in the deep serratus anterior space after surgical anatomical disruption and placement of thoracic tubes. Previous research has shown that SAPB provides limited pain relief in the presence of thoracic tubes, which can lead to pronounced postoperative pain, particularly pleural pain[14]. We noticed a difference in the placement of the chest tubes between our and Berthoud et al.'s study, our chest tubes inserted more posterolaterally. This difference may explain the disparity in opioid consumption observed between the two studies, as the SAPB predominantly provides analgesia to the anterolateral area[15]. The current study did not investigate or monitor the distribution of bolus delivery and sensory block, and therefore cannot make any conclusive statements about the block's effectiveness. However, normally, the SAPB covers dermatomes 2 to 9, which should be adequate for surgical incision[9,11].

Chen et al. conducted a study in which a single

Table IV. — Other results.

	SAPB (n=21)	CWI (n=26)	P-value
PONV (n,%)	5 (23%)	4 (15%)	0.73
Time in ICU (h), mean ± SD	29.5 ± 15	41.9 ± 33	0.10
Time in the hospital (d), mean ± SD	8.1 ± 3.9	10.4 ± 8.3	0.24
Pneumonia (n)	0	0	/
Chronic pain (NRS> or >=3 after 2 months) (n,%)	4/17 (24%)	6/18 (33%)	0.54

Table V. — Length of SAPB catheter.

Catheter length (SAPB)	Short (<16cm)	Long (>16cm)	P-value
Dose morfine-analogue (mg), mean	23.1	22.2	0.91
Pre-extubation (T-1) (mg), mean	0.7	0.3	0.35
Early postoperative (T0 + T1 + T2 + T6) (mg), mean	3.8	2.8	0.61
Mid postoperative (T12 + T24) (mg), mean	15.3	16.1	0.92
Late postoperative (T48) (mg), mean	3.2	3	0.89

preoperative bolus of SAPB was administered in video-assisted thoracoscopy, resulting in positive effects on early postoperative pain (at 2 and 8 hours post-surgery)[12]. This suggests that pre-incision SAPB administration may be an effective method for providing analgesia.

Interestingly patients in the SAPB group received 6.2 mcg fentanyl/kg compared to 5.2 in the CWI group, which can indicate a more painful procedure in the SAPB group.

In addition to the acute postoperative pain, thoracotomy can cause chronic pain in up to 50% of patients[5]. We noticed an incidence of 33% in the CWI arm compared to 23% in the SAPB.

In our study, we did not see any cases of pneumonia in the early postdetubation phase (48h). In part, this may be explained by the exclusion of longer (more than 48h postoperative) intubated patients.

Continuous infusion of local anaesthetics via catheter was chosen in combination with a bolus administration one hour before detubation. No studies comparing intermittent bolus administration with continuous administration were found for SAPB. Regarding the transversus abdominis plane block, no difference in the duration and efficacy of analgesia was observed, except for the slightly lower cost of intermittent bolus administration[23].

Additional locoregional options for pain management in thoracoscopy and/or mini-thoracotomy include the paravertebral block, thoracic epidural, and erector spinae plane block (ESPB).

Thoracic epidural analgesia is considered the gold standard for analgesia in thoracoscopy or thoracotomy. It has a limited chance of failure, yet there is some reluctance to use it given the risk for an epidural haematoma with disastrous consequences. It has been shown that this risk is similar in cardiac and non-cardiac surgery (1/12000)[24]. In cardiac surgery, it is recommended to wait at least 60 minutes after puncture and catheter placement before complete heparinization, since symptoms cannot be monitored under anaesthesia. Additionally, hypotension may occur due to bilateral sympathicolysis. A traumatic puncture (either dural tap or bloody) should cause a delay in surgery of at least 24 hours[1]. A Cochrane review in cardiac surgery with and without heart-lung support showed a lower pain score up to 72 hours postoperatively and a shorter duration of intubation with thoracic epidural analgesia vs. general anaesthesia. According to this review, thoracic epidural analgesia was associated with a lower risk of atrial arrhythmia and potentially reduced occurrences of respiratory depression and myocardial infarction when compared to general anaesthesia. However, there was no significant difference observed in terms of mortality or cerebrovascular accidents[25].

A paravertebral block, whether continuous or not, can also provide effective postoperative analgesia, with a higher safety margin compared to thoracic epidural analgesia. Additionally, it has a quick learning curve with a low risk of block failure and a similar effect on analgesia as epidural analgesia[26].

According to a meta-analysis by Chang Xiong et al., a paravertebral block showed better postoperative analgesia in thoracic surgery compared to an ESPB, while an equivalent level of analgesia was observed in mammectomy cases[27].

However, a continuous ESPB has shown superior analgesia in mitral valve surgery via mini-thoracotomy when compared to a continuous SAPB[28].

SAPB can be regarded as a locoregional technique with a low bleeding risk. In fact, in a retrospective study by Toscano et al., no bleeding complications were reported in patients with coagulation disorders undergoing mitral valve surgery via right mini-thoracotomy (INR > 1.4 or plt <80000). In addition, no problems occurred with catheter removal after 48h. Of note, two-thirds of patients in this study were receiving therapeutic anticoagulants[30]. This is confirmed in our study, where no bleeding complications were reported.

Given the surgical approach at our centre (i.e., a right thoracoscopy and mini-thoracotomy), the Prospect guidelines for thoracic surgery of the European Society of Regional Anaesthesia and Pain Therapy are relevant. The guidelines recommend a single bolus or continuous paravertebral block over an ESPB for video-assisted thoracoscopic surgery, with a SAPB as a third option. Given the non-superiority of a thoracic epidural and the higher risk of complications, this technique is no longer recommended. The guidelines also advise using paracetamol and NSAIDs pre-, per- and postoperatively, in combination with peroperative administration of dexmedetomidine[31].

Similar to other surgical fields, guidelines for Enhanced Recovery After Surgery (ERAS) have been established for cardiac surgery, which cover the pre-, per- and postoperative phases. The guidelines recommend an opioid-sparing approach. Acetaminophen and dexmedetomidine are recommended, as well as preoperative education. Unfortunately, these guidelines do not include a statement on locoregional techniques[32].

It is important to consider that analgesic techniques have an acceptable risk profile, promote

rehabilitation and facilitate early discharge from the ICU and from the hospital. Pre- and postoperative patient education is important to counter disinformation about the pros, cons and dangers of postoperative pain and analgesia[1,29].

Limitations

In our study, pain scores were recorded by the nurse in the ICU and at the nursing ward. Unfortunately, one-third of these values were lost in the process. Since the intention in the ICU is to obtain a NRS pain score as low as possible, we opted to focus only on the opioid administration.

The placement of the SAPB was performed by the attending cardio-anaesthetist or assistant-in-training. In this, we should mention that there was little to no previous experience with placing the SAPB in our center (and especially in the cardio-anaesthesia team). Beside this, the depth of the catheter was not defined in the protocol and was highly variable (ranging from 8 to 30 cm).

Conclusion

In this prospective study in patients undergoing minimally invasive cardiac surgery via right thoracoscopy and mini-thoracotomy, no significant difference was found in postoperative opioid use between patients who received a serratus anterior plane block catheter and those who received a wound catheter with bolus and continuous ropivacaine. It is worth noting that in addition to the acute postoperative pain, 29% of patients experienced chronic thoracic pain.

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References

1. Zhang Z, Tang W, Shi C, Huang J. Pain Management in Cardiac Surgery. J Anesth Perioper Med. 2018 Nov 26;5(6):346–54.
2. Guimarães-Pereira L, Reis P, Abelha F, Azevedo LF, Castro-Lopes JM. Persistent postoperative pain after cardiac surgery: A systematic review with meta-analysis regarding incidence and pain intensity. Pain. 2017 Oct 1;158(10):1869–85.
3. Schmitto JD, Mokashi SA, Cohn LH. Minimally-invasive valve surgery. J Am Coll Cardiol . 2010 Aug 3;56(6):455–62.
4. Dieberg G, Smart NA, King N. Minimally invasive cardiac surgery: A systematic review and meta-analysis. Int J Cardiol. 2016 Nov 15;223:554–60.
5. Sherazee EA, Chen SA, Li D, Li D, Frank P, Kiaii B. Pain Management Strategies for Minimally Invasive Cardiothoracic Surgery. Innovations (Phila). 2022 May 1 ;17(3):167–76.
6. Mesbah A, Yeung J, Gao F. Pain after thoracotomy. BJA Educ. 2016 Jan 1;16(1):1–7.
7. Liu X, Song T, Xu HY, Chen X, Yin P, Zhang J. The serratus anterior plane block for analgesia after thoracic surgery: A meta-analysis of randomized controlled trails. Medicine. 2020 May 22;99(21).
8. Jack JM, McLellan E, Versyck B, Englesakis MF, Chin KJ. The role of serratus anterior plane and pectoral nerves blocks in cardiac surgery, thoracic surgery and trauma: a qualitative systematic review. Anaesthesia. 2020 Oct 1;75(10):1372–85.
9. Serratus Plane Block : WFSA - Resources [Internet]. [cited 2023 Feb 9]. Available from: https://resources.wfsahq.org/atotw/9317/
10. Edwards JT, Langridge XT, Cheng GS, McBroom MM, Minhajuddin A, Machi AT. Superficial vs. deep serratus anterior plane block for analgesia in patients undergoing mastectomy: A randomized prospective trial. J Clin Anesth. 2021 Dec 1;75.
11. Blanco R, Barrington M. Pectoralis and Serratus Plane Nerve Blocks - NYSORA | NYSORA [Internet]. [cited 2023 Feb 9]. Available from: https://www.nysora.com/topics/regional-anesthesia-for-specific-surgical-procedures/thorax/pectoralis-serratus-plane-blocks/
12. Chen G, Li Y, Zhang Y, Fang X. Effects of serratus anterior plane block for postoperative analgesia after thoracoscopic surgery compared with local anesthetic infiltration: a randomized clinical trial. J Pain Res. 2019;12:2411–7.
13. Khalil AE, Abdallah NM, Bashandy GM, Kaddah TAH. Ultrasound-Guided Serratus Anterior Plane Block Versus Thoracic Epidural Analgesia for Thoracotomy Pain. J Cardiothorac Vasc Anesth. 2017 Feb 1;31(1):152–8.
14. Sharma R, Louie A, Thai CP, Dizdarevic A. Chest Wall Nerve Blocks for Cardiothoracic, Breast Surgery, and Rib-Related Pain. Curr Pain Headache Rep. 2022 Jan 1;26(1):43–56.
15. Berthoud V, Ellouze O, Nguyen M, Konstantinou M, Aho S, Malapert G, et al. Serratus anterior plane block for minimal invasive heart surgery. BMC Anesthesiol. 2018 Oct 20 ;18(1).
16. Bouchez S. Anesthesie bij Minimally Invasive Valve Technique - richtlijn anesthesie UZ Gent. België: UZ Gent; 2020.
17. De Laat M, Demeulenaere P, Tanghe M, Wouters M. Pijnbestrijding bij palliatieve patiënten - een Richtlijn, Versie: 1.0. September 2013. Available from : www.palialine.be
18. Admiraal M, Hermanns H, Hermanides J, Wensing CGCL, Meinsma SL, Wartenberg HCH, et al. Study protocol for the TRUSt trial: a pragmatic randomised controlled trial comparing the standard of care with a transitional pain service for patients at risk of chronic postsurgical pain undergoing surgery. BMJ Open. 2021;11:49676.
19. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009 Apr;42(2):377–81.
20. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. J Biomed Inform. 2019 Jul 1;95.
21. R core team. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2021.
22. Stamenkovic DM, Bezmarevic M, Bojic S, Unic-stojanovic D, Stojkovic D, Slavkovic DZ, et al. Updates on Wound Infiltration Use for Postoperative Pain Management: A Narrative Review. Journal of Clinical Medicine 2021.10(20):4659.
23. Kadam VR, van Wijk RM, Moran JL, Ganesh S, Kumar A, Sethi R, et al. Continuous transversus abdominis plane block vs intermittent bolus for analgesia after abdominal surgery: a randomized trial. J Pain Res. 2017 Jul 18;10:1705–11.

24. Royse CF. High thoracic epidural anaesthesia for cardiac surgery. Curr Opin Anaesthesiol. 2009 Feb;22(1):84–7.
25. Guay J, Kopp S. Epidural analgesia for adults undergoing cardiac surgery with or without cardiopulmonary bypass. Cochrane Database of Systematic Reviews. 2019 Mar 1;2019(3).
26. White A, Patvardhan C, Falter F. Anesthesia for minimally invasive cardiac surgery. J Thorac Dis. 2021 Mar 1;13(3):1886.
27. Xiong C, Han C, Zhao D, Peng W, Xu D, Lan Z. Postoperative analgesic effects of paravertebral block versus erector spinae plane block for thoracic and breast surgery: A meta-analysis. PLoS One. 2021 Aug 1;16(8).
28. Toscano A, Capuano P, Costamagna A, Canavosio F, Ferrero D, Alessandrini E, et al. Is continuous Erector Spinae Plane Block (ESPB) better than continuous Serratus Anterior Plane Block (SAPB) for mitral valve surgery via mini-thoracotomy? Results from a prospective observational study. Ann Card Anaesth. 2022 Jul 1;25(3):286–92.
29. Cogan J, Ouimette MF, Vargas-Schaffer G, Yegin Z, Deschamps A, Denault A. Patient Attitudes and Beliefs Regarding Pain Medication after Cardiac Surgery: Barriers to Adequate Pain Management. Pain Management Nursing. 2014 Sep 1;15(3):574–9.
30. Toscano A, Capuano P, Galatà M, Tazzi I, Rinaldi M, Brazzi L. Safety of Ultrasound-Guided Serratus Anterior and Erector Spinae Fascial Plane Blocks: A Retrospective Analysis in Patients Undergoing Cardiac Surgery While Receiving Anticoagulant and Antiplatelet Drugs. J Cardiothorac Vasc Anesth. 2022 Feb 1;36(2):483–8.
31. Feray S, Lubach J, Joshi GP, Bonnet F, van de Velde M, Joshi GP, et al. PROSPECT guidelines for video-assisted thoracoscopic surgery: a systematic review and procedure-specific postoperative pain management recommendations. Anaesthesia. 2022 Mar 1;77(3):311–25.
32. Engelman DT, ben Ali W, Williams JB, Perrault LP, Reddy VS, Arora RC, et al. Guidelines for Perioperative Care in Cardiac Surgery: Enhanced Recovery After Surgery Society Recommendations. JAMA Surg. 2019 Aug 1;154(8):755–66.

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