

ULTRASOUND GUIDED THORACIC PARAVERTEBRAL BLOCK IN THORACIC SURGERY: -OBSERVATIONAL STUDY-

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ABSTRACT:

Introduction: The paravertebral block (PVB) is a unilateral anesthesia of the trunk which showed its effectiveness in many surgical indications. The aim of this our study is to evaluate the interest of the PVB in the analgesia after thoracotomy. **Methodology:** All patients were older than 12 years old, and were to benefit from PVB for any thoracic surgery by thoracotomy. Data concerning the ultrasound locating of the paravertebral space, the puncture, the analgesics data according to the visual analogue scale (VAS), and complications of the technique were collected. **Results:** Sixteen patients, with a median age of 36 years old, were prospectively included over 8 months. The anatomical structures identified through ultrasound guidance were: the transverse process (100% of cases), the costo-transverse ligament (44%) and the parietal pleura (100%). The needle was displayed throughout his trajectory in 81% of patients. The extremity of the needle is displayed in 93% of cases. The anterior displacement of the pleura was noted in 94% of cases. The mean VAS during the rest was [3, 73-0] for 48 hours and during effort has varied VAS average of [5.6 to 0.5]. The dose of morphine received during the 48hours was 13mg. No complications were recorded. After extubation the mean VAS was 5 and the dose of morphine received in the post-operative room was 3.5 mg. **Conclusion:** The paravertebral block is a simplified technique allowing analgesia after major surgery of the thorax. This technique can thus advantageously replace thoracic epidural analgesia with fewer major complications.

Keywords: Analgesia; Chest pain; Pulmonary resection; Thoracic para-vertebral block; Thoracotomy.

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INTRODUCTION

Postoperative follow-up after thoracic surgical procedure, especially thoracotomy, are marked by the existence of painful phenomena which is described intense for three to five days. The treatment of this postsurgical thoracic pain is an integral part of the management of patients, and therefore allows limiting postoperative morbidity and mortality [1]. The failure of usual painkillers and the need for early and effective respiratory physiotherapy have led to the search for more appropriate therapeutic modalities. In this context, loco-regional anesthesia techniques occupy a prominent place. In fact, they also make it possible to reduce or even substitute for morphine analgesia which is not very effective in the effort and its administration is not recommended in patients

suffering from respiratory failure. Thoracic epidural anesthesia (TEA) is usually considered to be the most effective and reliable technique for analgesia in cardiothoracic and upper abdominal surgery [2]. Recent data in the literature suggest comparable analgesic efficacy between TEA and para-vertebral block (PVB) in thoracic surgery [3].

We carried out a single-center prospective observational study whose main objectives were to evaluate the effectiveness of the association of a PVB with an intravenous multimodal analgesia in the management of the postoperative pain after thoracotomy based on simple criteria for the evaluation of analgesia, namely the visual analogical scale (VAS) at rest and during incentive spirometry, and the evaluation of postoperative consumption or demand for morphine.

MATERIAL & METHODS

This is a descriptive prospective study carried out in the department of general intensive care A4 in the Hospital Center Hassan II Fez, over a period of 8 months (from September 2015 to April 2016). Were included in this study all patients aged over 12 years, admitted to the operating room for performing a thoracotomy, the indications are varied: pneumonectomy, lobectomy, atypical pulmonary resections or other for neoplastic or infectious pathologies. This analgesia technique is explained during the anesthesia consultation and accepted by the patient as part of the multimodal analgesia during the postoperative period. We excluded from the study patients who refused the technique, having had a thoracotomy with pleurectomy decortications, or patients with systemic infection or infection at the puncture point, or cases with hemostasis disorder (thrombocytopenia $\leq 100\ 000$ platelets/ mm^3 , lengthening of activated partial thromboplastin time ≥ 1.5 , prothrombin time $\leq 70\%$), or cases having an atrio-ventricular block grade II or III unaided, severe liver failure and also patients allergic to spaces aminoamides-type anesthetics.

Materials:

The ultrasound system used for this study is of the general Electric LOGIQ-e type dedicated to the practice of ALR and equipped with a 12 MHz linear ultrasound probe. The needle used for producing the PVB is a hyper echoic Tuohy18G x10cm needle, in accordance with the recommendations for producing the PVB. The anesthetic product used was bupivacaine with 0.125% dilution. The catheters used were of the multi-perforated type. The evaluation of the pain was done by VAS.

Description of the procedure:

All patients underwent general anesthesia with a standard anesthetic protocol based on propofol, fentanyl and rocuronium. After ultrasonographic tracing of the para-vetrebral space elements and introduction of the Tuohy needle into the ultrasound plane, the loco- regional analgesia catheter is introduced into this para-vertebral space over a variable length depending on the Body Max Index (BMI). A first 8-10 ml bolus of 0.125% bupivacaine is injected after an aspiration test and a maintenance dose of 0.125% bupivacaine is initiated at the electric

syringe pump (ESP) at a variable rate depending on the patient's weight over a total duration of 48 hours after surgery:

- 50 <Weight <65 kg: flow rate at 5 ml / h
- 65 <Weight <75 kg: flow rate at 6 ml / h
- Weight > 75 kg: 7 ml / h

Immediately after surgery, we have evaluated the quality of the awakening, the VAS and the dose of morphine received immediately postoperatively in the post anesthesia care unit (PACU). Patients were subsequently admitted to the intensive care unit, where the evaluation of the VAS at H4, H8, H24, H36 and H48 was done, with also the cumulative morphine monitored during the first 48 hours postoperatively.

RESULTS

Sixteen patients benefited from an ultrasound- guided paravertebral block, it was 10 men (62%) and 6 women (38%) with an average age of 34 years old, and extremes ranging from 12 to 72 years. The BMI ranged from 16.42kg/m² to 31.5 kg / m² with an average of 22.6 kg/m². The types of surgery performed were: resection of hydatid cysts of the lung in 5 cases, wedge resection in 5 cases, lobectomy for lung cancer in 5 cases and clotted hemothorax in one case. The approach was a postero-lateral thoracotomy in all cases. Mean operative time was 130 min with extremes of 117 min at 245 min. The visualization of the necessary anatomical structures of the paravertebral space (transverse process, parietal pleura, and pulmonary parenchyma) for the realization of a PVB under ultrasound was complete in all cases (**Fig. 1**).

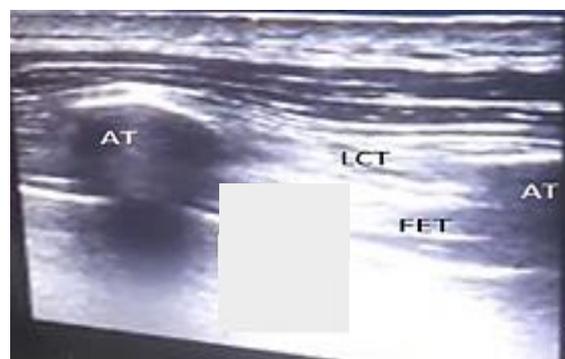


Fig. 1. Ultrasound image showing the structures of a thoracic paravertebral space. **EPV:** Paravertebral space; **AT:** Transverse process; **LCT:** Costo-transverse ligament; **FET:** Endo-thoracic fascia.

As for the costo-vertebral ligament, it was only visualized in 44% of cases. The visualization of the needle was complete in 13 cases (81%) (**Fig. 2**), partial in one case (7%) and invisible in two cases (13%).

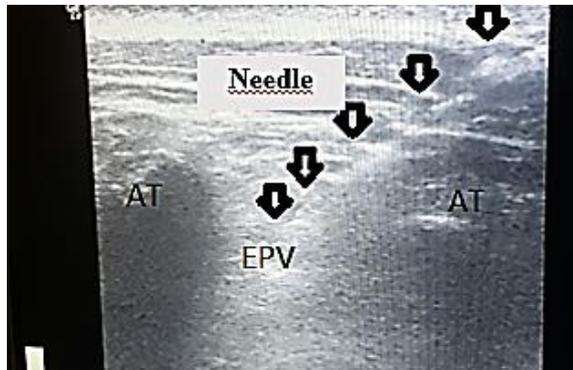


Fig. 2: Ultrasound images showing the visualization of Tuohy's needle and its progression, in the ultrasound plane, towards the para vertebral space.

The visualization of the tip of the needle was direct in 14 cases (86%), indirect in one case (7%) and invisible in one case (6%). Hydro-dissection or anterior displacement of the parietal pleura secondary to bolus injection of loco- regional anesthesia was observed in 15 patients (94%) (Figure 3).

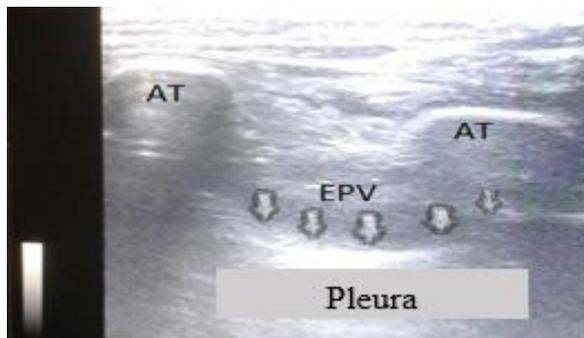


Figure 3: Ultrasound image showing the anterior displacement of the pleura after injection of serum physiology (hydro-dissection).

This anterior displacement of the pleura was not visible in one case (6%). The catheterization was successful in all our patients. The distance between the tip of the catheter and the skin was on average 9.4 cm with extremes between 5 cm and 12 cm. The average dose of local anesthetic (bupivacaine 0.25%) administered during puncture of the paravertebral space was 9.8 ml with extremes of 6 ml and 12 ml. In

the context of multimodal analgesia, our patients received a continuous infusion of bupivacaine at a concentration of 0.125% with an average flow rate of 5.8 ml/h, and extremes of 8 ml/h and 3 ml/h. paracetamol was administered in all patients. nefopam was administered in 14 patients (86%), and non-steroidal anti-inflammatory drugs in 13 patients (80%). Morphine were only used in 7 patients (46%). The awakening was calm in 11 cases (69%), agitated in 4 cases (25%) and painful in a single case (6%). The VAS at the time of extubation was with a median of 5 with extremes at 2 and 8 (**Table I**). The average dose of morphine received in PACU was 3.5 mg with extremes of 0 to 8 mg.

Table I: VAS value after extubation in all patients

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16
5	7	4	3	4	5	6	4	7	5	3	6	2	7	4	8

Figure 4 shows the mean pain scores of EVA for rest and exercise for the first 48 hours.

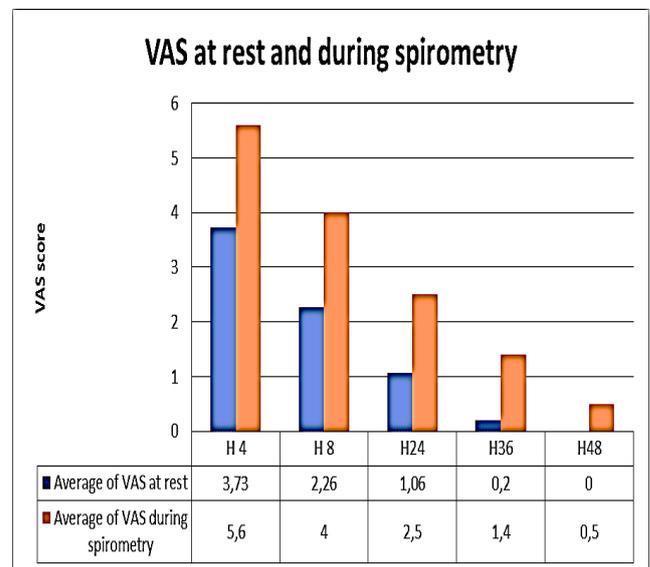
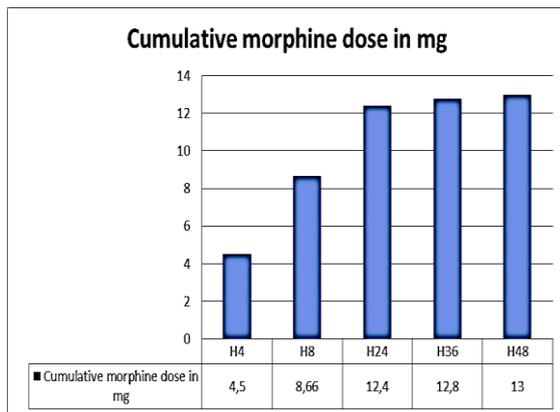


Fig. 4: The average VAS at rest and effort during respiratory physiotherapy

The evolution of morphine consumption during the first 48 hours of the postoperative period has been illustrated in **figure 5**.



No case of motor or sensory neurological complication was noted. No case of hypotension or systemic passage was observed, and no case of respiratory depression or urinary retention related to the use of morphine has been observed. In one patient, nausea with vomiting was noted with good progression under symptomatic treatment during the first 24 hours.

DISCUSSION

The paravertebral block (PVB) is one of the first techniques of locoregional anesthesia and analgesia. It was described in the book of Pauchet, published by Doin in 1914 [4, 5]. The principle of PVB is based on the injection of a local anesthetic near the roots of the spinal nerves, at their emergence of the medullary canal, when they are in contact with the transverse processes. Due to the development of more and more reliable techniques of general anesthesia and intravenous analgesia, the practice of thoracic PVB for thoracic surgery has experienced a long-lasting eclipse. The search for a peripheral locoregional anesthesia technique for postoperative analgesia after thoracic surgery has restored interest to this block under the impetus of authors such as Richardson et al [6]. This block offers the possibility of a continuous unilateral analgesia of quality thanks to the placement of a catheter in the paravertebral space. Thus, it currently presents an alternative to epidural analgesia [6]. The paravertebral space is an open space: an injection at the level of a single paravertebral space diffuses to the above and underlying spaces. A bolus of 15 ml of 0.5% bupivacaine creates a unilateral block of 5 to 6 dermatomes [7]. PVB was first compared to systemic analgesic techniques. Several studies have demonstrated the benefit of PVB in postoperative pain management. Indeed, in 1988,

Sabanathan demonstrated the efficacy of PVB with catheter, placed by intercostals approach in the extrapleural compartment with continuous administration of 0.5% bupivacaine at a flow rate between 5 and 7 ml / h [8]. In 1990, Berrisford demonstrated that paravertebral analgesia (5 to 10 ml of 0.5% bupivacaine) prevented the use of opioids immediately after surgery in 59% of patients with average of VAS at rest less than 2/10 [9]. In another study conducted by Marret and al [10] in 2005 in order to compare analgesia with PCA morphine to PVB, in 2 groups with identical epidemiological data (age, sex, smoking, exposure, and ASA score) as well as technical data (operative indications, types of surgery, duration operative, approaches, anesthetic protocol), Patients in the PVB group were randomly selected. The realization of the PVB in this study was performed after the end of the surgery by the responsible anesthesiologist using the technique of loss of resistance. A bolus of 1.5% lidocaine associated to epinephrine was administered, followed by a continuous dose of 0.5% lidocaine at a dose of 0.1 ml/ kg / h. The second group received morphine titrations up to a VAS less than or equal to 3, then a PCA morphine was instituted with boluses of 1 mg and a refractory period of 7min. Both groups also received multimodal analgesia based on paracetamol and anti-inflammatory. The results were largely in favor of the PVB group, whether for EVA scores or for postoperative respiratory complications.

In 2008, Burns et al [11] studied the efficacy of PVB obtained by 0.2% ropivacaine infusion on an intercostal catheter posed by an anesthesiologist prior to surgery. The mean VAS values during the first 24 hours postoperatively were 2 and the cumulative dose of morphine during the same period was 1.69 mg. This allows highlighting the interest of the early infusion of the local anesthetic in the preoperative and postoperative periods in order to reduce the nociceptive afferences. Some authors propose performing loco-regional anesthesia before the surgical incision, aiming to reduce the chronic pain that is present in nearly 70% of patients [12].

This is the concept of preventive or preemptive analgesia: the effectiveness of an analgesic method seems superior when it is applied before painful stimulation. The goal is to oppose the development of a real memory of stimuli, by blocking the phenomena of temporal amplification of nociceptive stimulation at the level of the posterior horn of the spinal cord

(Wind up phenomenon). PVB was later compared to epidural analgesia. Until recently the standard technique was TEA using local anesthetic solutions with or without opioids. The use of the PVB, a technique known for a long time, has developed over the past ten years. A survey carried out among French centers in 2004 showed that 67% of them used TEA and only 9% the PVB [13]. In contrast, 7 years later, a similar survey carried out in United Kingdom (UK) hospitals showed that analgesia was provided by an epidural in 61% of centers and by a PVB in 31% of centers [14]. Increasingly, teams have since turned to the PVB [15]. This diversion is the result of several studies that have demonstrated BPV efficacy comparable to TEA. Davies et al [16] on a meta-analysis of 10 randomized and performed studies in thoracic surgery argues for an analgesic efficacy of PVB and TEA. The results of this meta-analysis also showed superiority of PVB in limiting side effects and in the number of failures of the technique. The authors concluded that postoperative pain management was simpler and recommended PVB in major thoracic surgery. It has also been shown that there is a tendency for better pain control when PVB is compared to TEA using only local anesthetic solution, whereas when an opioid is associated with local anesthetic epidural, the advantage is rather in TEA [17].

On the other hand, the comparison of the incidence of side effects is to the advantage of the PVB, particularly with regard to hypotension and retentions of urine [17- 20]. Finally, the meta-analysis of Davies and al found, regarding to the prevention of respiratory complications a greater efficacy of the PVB [20]. The PROSPECT group recommends the use of PVB as a preferred analgesic technique after thoracic surgery based on comparable analgesic efficacy and lower incidence of side effects or complications [17]. Recently, an observational, multicenter cohort study was conducted in the UK on all centers performing thoracic surgery. This study, which concerned the outcome of pneumonectomies, was the subject of two publications, one in the surgical literature [21] and another in the anesthetic literature [14]. This study, which did not randomize the two analgesia techniques, showed that TEA was an independent risk factor for the occurrence of complications (hypotension, atrial fibrillation, arrhythmia, respiratory complications) even though patients receiving one or the other technique were

comparable. Mortality (6.4% in the TEA group versus 4.2% in the PVB group) was not significantly different between the two groups. Finally, another study carried out from a cohort of 1592 patients operated between May 2000 and April 2008, from which 122 pairs were extracted at 488 epidural, found to the advantage of patients who had benefited from PVB a reduction in the duration of hospitalization while the mortality was not modified by the use of the block [22]. Studies comparing PVB and TEA provide some conclusions, but do not definitively lead to a decision. It seems that the two techniques are comparable in terms of pain control and must be supplemented by systemic analgesia to allow good control of the pain. Epidural analgesia may have an advantage when opiates are associated with local anesthetics, but this may have disadvantages in terms of side effects. The paravertebral block causes fewer side effects and is thus a technique easier to implement and monitor. Only one study found paravertebral block superiority over the continuous cicatricial infiltration catheter for the control of postoperative pain and morphine use [23]. In our study, the administration of a continuous perfusion of 0.1ml / kg / h of bupivacaine by a paravertebral catheter placed using the ultrasound technique, combined with multimodal analgesia, showed a great benefit in terms of post thoracotomy analgesia, a decrease in rest and exercise pain scores during the first 48 hours postoperatively.

CONCLUSION

Our study was not comparative with any other means of postoperative analgesia, such as thoracic epidural, PCA mode morphine, or scar infiltration catheters. The strength of our series is small. The evaluation of a subjective and personal data namely the VAS. Indeed, this scale can be met with the misunderstanding of some patients.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest with this manuscript.

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