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ORIGINAL ARTICLE

The Effect of Ultrasound Guided Pecto-Intercostal Fascial Plane Block with Levobupivacaine on Extubation Time after on Pump Coronary Artery Bypass Grafting Surgery: A Randomised Controlled Trial

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Background To assess the effect of pecto-intercostal fascial plane block (PIFB) with Levobupivacaine after on-pump coronary artery bypass grafting (CABG) surgery on post-operative recovery.

Methods This randomised, double-blinded, parallel group, controlled, clinical trial enrolled 60 patients scheduled for elective on-pump CABG with PIFB. The patients were randomly allocated to either levobupivacaine local anaesthesia (LA) group receiving 30ml of 0.25% levobupivacaine on two divided doses (15ml for each side of the sternal border) or a placebo (P) group receiving 30ml of saline in the same manner.

Results The primary outcome was time to extubation. Secondary outcomes included visual analog scale (VAS) scores at 0, 2, 4, 6, and 12 hours, total fentanyl consumption during intensive care unit (ICU) stay, and ICU and hospital length of stay (LOS). Time to extubation was significantly shorter in the LA group than in the control group (p= 0.027). VAS scores were significantly lower in the LA group at 0 and 2 hours post-extubation (p= 0.002 and p= 0.006, respectively). Total fentanyl consumption was lower in the LA group (p<0.001). ICU stay was shorter in the LA group (p= 0.035), as was hospital LOS (p= 0.013).

Conclusions PIFB significantly reduced extubation time, opioid consumption, and ICU/hospital LOS in patients undergoing on-pump CABG surgery.

Keywords Airway Extubation, Coronary Artery Bypass, Levobupivacaine, Opioid Analgesics, Postoperative Pain.
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INTRODUCTION

Coronary artery bypass grafting (CABG) is still considered the gold standard procedure for coronary arteries revascularization [1]. Isolated CABG remains the most commonly performed cardiac procedure within the previous 3 years in USA and UK [2, 3].

Preventive measures for postoperative pain are always being sought to avoid its adverse consequences, most critical are respiratory complications in form of atelectasis, hypoxemia and pneumonia [4-8]. It was also found that the worst pain after cardiac surgery is being experienced within the first 4 postoperative days being moderate at rest, and severe during coughing or movement [9]. The chest wall sensory innervation , which is inevitably deranged during sternotomy in cardiac surgery causing the consequences of nerve injury pain, comes from the perforating branches of the intercostal nerves [10].

Acute postoperative pain is also a predictive risk for chronic pain [11-13] and peripheral and central pain

sensitization often follow tissue injury [14]. It was also found that the risk for chronic post surgical pain CPSP directly proportionate to length of time being in severe pain postoperatively [15].

Mechanical ventilation time was proved a risk factor for ventilator-associated complications like; pneumonia, pulmonary edema, atelectasis, bronchitis and acute respiratory distress syndrome (ARDS), with subsequent increase in morbidity and mortality, hospital LOS and the overall costs [16,17].

Also patients who required ICU stay more than 48 hours after cardiac surgery had higher in-hospital mortality, lower survival rate on the long term and higher risk of hospital readmission for cardiac events [18].

So, recently many protocols of enhanced recovery after surgery (ERAS) are being applied in cardiac surgery, and apart from pain control, they include early extubation approach and obviously are making good success in decreasing time to extubation, ICU LOS, hospital LOS and so the overall costs [19-24], they include using multimodal analgesia approach to decrease the side effects of using opioids as a solo agent and so preventing the so-called opioid-related adverse drug events (ORADEs) [25-27].

In previous studies [28-32], the effect of pecto-intercostal fascial plane block on post-operative pain in cardiac surgery population had been studied as the primary outcome and found to decrease pain scores and total postoperative opioid doses, but its effect on extubation time was not their primary outcome and so were not powered enough to correlate between the block and extubation time. A study tried to correlate between the block and extubation time, but with small sample size [33].

The aim of our study was to assess the effect of pecto-intercostal fascial plane block (PIFB) using levobupivacaine on enhancing recovery and early extubation after On Pump Coronary Artery Bypass surgery. Our objectives were to assess the effect of PIFB on recovery after On Pump CABG by assessing the extubation time, visual analogue scale (VAS) score assessed after extubation, total opioid consumption, ICU length of stay, and hospital length of stay. We hypothesized that PIFB could enhance recovery regarding decreasing extubation time, total opioid consumption, ICU length of stay and hospital length of stay.

METHODS

The study was approved by the Ethics Committee of the Faculty of Medicine, Cairo University, Egypt (Code: MD-278-2021, Date: 20/10/2021). Written informed consents were obtained from all subjects participating in the trial. The trial was registered at the Pan African Clinical Trial Registry (PACTR202405467152740). The investigators were responsible for maintaining the confidentiality of the data. Collection of data started from 21/10/2021 to 31/10/2022. Informed written and verbal consents were taken before inclusion of any patient.

This randomized clinical trial was conducted on patients older than 18 year-old with weight ≥50kg candidates for On-Pump CABG through median sternotomy. Criteria for exclusion from our study were as follows: Patients refused the intervention, patients undergoing emergency CABG, morbidly obese patients BMI ≥40, patients suffering from systolic dysfunction defined as having ejection fraction (EF) less than 50%, patients having associated valve lesions, patients suffering from chronic obstructive pulmonary disease or moderate to severe asthma (% predicted FEV1 moderate 69-60, mod-sev 59-50, severe 49-35, very sev. <35), patients on Adrenaline support >50ng/kg/min, and patients giving history of substance abuse.

Our study was double blinded, two of the investigating anesthesiologists performed the block in the operating room one scrubbed in and locating the point of injection with the needle and the other was helping with the sonar device and injecting the drug, a random anesthiologist outside the study was preparing the syringes (Drug or placebo), the intensivists were in charge of collecting patients data in the ICU and handed them over to the investigator in charge of collecting data and the rest of investigators were supervising the scientific content. For complete blinding surgeons were blinded of whom would be injected with saline and whom with the local anesthetic solution.

Patients enrolled were randomly allocated using computer-generated number tables to be classified into two equal groups (30 in each group) in opaque closed envelopes with instructions for drug preparation and divided into two groups: a (LA) group who received bilateral PIFB with Levobupivacaine and a Control Placebo (P) group who received bilateral PIFB with saline. Only patients, who satisfied the eligibility criteria and successfully CPB weaned entered the randomization.

Upon arrival of the patient to preinduction preparation room, all patients were instructed of the use of the VAS score night before surgery and w. A large bore IV access and an arterial line were inserted, under local anesthesia in the non-dominant hand unless there was a need to spare it for arterial grafting, and 0.05mg midazolam iv was given to a maximum of 5mg.

In the operating room, the 5 lead-ECG and pulse oximetry was attached, the arterial line was connected to the monitor and baseline haemodynamic readings

was documented. Anesthesia was induced using fentanyl 5µgkg, propofol titration to the effect 1-2mg/kg (may be titrated to reach much lower total dose according to the verbal response and to what balanced anesthesia situation dictates with preservation of hemodynamics), and atracurium 0.5mg/kg as an intubating dose.

After intubation, mechanical ventilation was instituted, volume control mode, with tidal volume of 8ml/kg-predicted body weight and respiratory rate of 14/min, with target PaO2 of 130-150 mmHg and PaCO2 of 35-45mmHg, all was adjusted to a target end tidal CO2 of 30-40mmHg.

Maintenance of anesthesia was accomplished with; inhalational isoflurane to MAC, and maintenance of muscle relaxation with atracurium infusion 5mcg/kg/min. If pain induced hypertension happened intraoperatively, patients received intravenous fentanyl in a titration dose to the effect for analgesia and total dose will be measured for both groups.

Triple lumen central venous catheter was inserted in the right internal jugular vein, with the guidance of ultrasound according to the hospital protocol. Full heparin-induced anticoagulation was done, with initial dose 400IU/kg, and targeting to maintain an activated coagulation time ACT ≥450 seconds.

After placement of an ascending aortic cannula and a 2-stage right atrial cannula, CPB was instituted, with a roller pump according to the hospital protocol. CPB was conducted according to a standardized institutional protocol, with normal drifting of temperature down to approximately 33°C, intermittent warm blood cardioplegia, and mean flow rate of 2.2L.min-1.m-2, maintaining perfusion pressure between 50–70mmHg. After aortic cross-clamping, warm oxygenated blood cardioplegic solution generally was delivered antegrade via the aortic root, unless there was an exceptional situation. All patients received a left internal mammary artery LIMA graft to the left anterior descending LAD artery.

Patients entered randomization, only if, they were successfully weaned from CPB (optimum arterial blood gases ph 7.35-7.45mmHg,pCO2 35-45, P/F ratio ≥ to 300, optimum electrolytes K+ 4.5-5.0, good urine output 0.5-1ml/kg/hr, minimal inotropic support adrenaline ≤50 nano/kg/min with good cardiac output, contractility and central venous pressure), and randomization was computer-generated, with equal randomization into either; saline placebo (*P*) or treatment local anesthetic (LA) group, and the investigators were blinded all through.

The pecto-intercostal fascial block includes anesthetizing the anterior cutaneous branches of the intercostals nerves close to the sternal border. To achieve this, after complete closure of the sternotomy wound, with the patient in the supine position; 1- the anterior chest wall was completely sterilized using betadine, 2- using linear ultrasound probe, a few centimeters lateral to the upper half of sternal border (beginning with any side of chest wall right or left being sectioned by the sternotomy wound) identification of rib shadows was approached and in between them, from upwards to downwards; skin, subcutaneous tissue, pectoralis major muscle, intercostal muscles and pleura, 3- in plane with the probe technique, the block needle was placed in the plane between the pectoralis major muscle and external intercostal muscles in a caudad to cephalad direction, 4- to confirm the place of the needle tip, hydrodissection of the fascial plane with the block solution infiltration will be done after aspiration test and after applying color Doppler to identify internal mammary artery branches to avoid intra-arterial injection or injury of internal mammary, 5- then 7.5ml injection of the block solution will be done at $2^{nd}/3^{rd}$ intercostal space ICS and will be recurred at the lower half of the same sternal border at $4^{th}/5^{th}$ ICS, choice between spaces according to best sono-anatomical view specially in obese patients and then the same was done on the other sternal border side, 6- group (LA) will receive local infiltration with 30mL of 0.25% levobupivacaine on two divided doses (15ml for each side of the sternal border) (with maximum total dose 2mg/kg on the ideal body weight for safety), and group (*P*) with 30mL of saline in the same manner.

Precautions were taken as follows; 1) aspiration of the needle before each injection, 2) 30 sec between each injection, 3) availability of Lipid emulsion (Intralipid 20%) in the theatre and ICU was regularly checked every time before study conduction, 4) great vigilance was always there for anticipating any local anesthetic systemic toxicity (LAST), and 5) immediate management was implemented according to American Society of Regional Anesthesia and Pain Medicine (ASRA) practice, which is in our point of view is a well instructed evidence based and frequently updated management advisory [34,35].

After transfer to the ICU, all patients received paracetamol IV 1 gram Q 8 for 3 days, and before extubation any signs of sympathetic overactivity in relation to pain, in the form of tachycardia >90/min and/or hypertension >140/90mmHg not explained by any other cause, was managed by nurse controlled analgesia after informing the Intensivist.

After fulfilling criteria for successful extubation; patient being fully conscious and obeying commands, not

on high inotropic support (adrenaline ≤50 nano/kg/min), within normal arterial blood gases and electrolytes, and respiratory rate <30/min and with no moderate or severe hypoxia (P/F ratio >200).

After extubation, pain scoring was done using Visual Analogue Scale (VAS), (to cope with all patients different educational levels), at 0-hour immediately post-extubation, 2, 4, 6 and 12-hour time. Pain score according to VAS scale ≥4, in both groups, was managed by intravenous fentanyl PCA as required, and the total dose will also be documented for each group. Balloon pump disposable PCA 100ml was used with concentration of fentanyl 5mic/ml, basal rate 2ml/hr, bolus volume 2ml and lockout time 15min and Ondansetron 8mg as additive.

The primary outcome was the effect on extubation time defined as time since complete closure of the chest wall. Secondary outcome included VAS score at 0-hour immediate post-extubation, 2, 4, 6, and 12-hour time, postoperative total dose of PCA fentanyl consumption during ICU stay, ICU length of stay, since patients admission to ICU, and Hospital length of stay, since patients admission to the cardiothoracic department ward.

The sample size was calculated based on our primary outcome (the time to extubation). In a previous study [31], the time to extubation in the control (non-intervention) group was 6.3±1.49 hours. We calculated a sample size that could detect a mean difference of at least 1.26 hours between study groups. Using MedCalc Software version 14 (MedCalc Software bvba, Ostend, Belgium), a sample size of 60 patients will be needed to have a study power of 90% and alpha error of 0.05. The number was increased to be 66 envelopes (33 envelopes per group) to compensate for possible dropouts.

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 28 (IBM Corp., Armonk, NY, USA). Data was summarized using mean and standard deviation for quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables. Comparisons between groups were done using unpaired *t* test. For comparing categorical data, Chi square (χ^2) test was performed. Exact test was used instead when the expected frequency is less than 5. *P*-values less than 0.05 were considered as statistically significant.

RESULTS

A total of 70 patients were screened; 60 (mean age: 53 years; 37 men and 23 women) were randomized (30 in each group) (Figure 1). The only type of surgery included was coronary artery bypass graft (CABG) in the 60 patients and the surgery was conducted under cardiopulmonary bypass (CPB) in all the patients. The demographic and baseline characteristics of participants are shown in Table (1).

Intubation and extubation were successful in the first attempt in all 60 patients. The time to extubation was 238.00±57.32min in the Block group vs. 297.00±115.08min in the control group (*P*= 0.027). Total fentanyl dose till 12h post extubation in the ICU was 138.33±80.60µg in the Block group vs. 276.67±117.25µg in the control group (*P*<0.001) (Table 2).

Table 1: Demographic and baseline characteristics:

Variables Count		Block group		Control group		*P* value
		%	Count	%		
Gender	Male	22	73.3%	22	73.3%	1
	Female	8	26.7%	8	26.7%	
Diabetes mellitus	Yes	12	40.0%	16	53.3%	0.301
	No	18	60.0%	14	46.7%	
Hypertension	Yes	23	76.7%	18	60.0%	0.165
	No	7	23.3%	12	40.0%	
Smoking	Yes	19	63.3%	15	50.0%	0.297
	No	11	36.7%	15	50.0%	
		Mean	**SD**	**Mean**	**SD**	**P value**
Age		58.73	7.97	58.27	9.15	0.834
Body mass index		27	5.15	26.03	4.93	0.460
Cross clamp time (min)		107.67	33.50	100.60	19.89	0.325
Bypass time (min)		141.00	34.18	136.50	23.65	0.555
Total operative time (min)		299.33	70.46	291.33	51.78	0.618
Grafts number		3.2	0.76	3.05	0.68	0.672

SD: Standard deviation.

Total length of stay (LOS) in ICU was (3.13±0.82 day in the Block group vs. 3.77±1.38 day, *P*= 0.035) and hospital LOS (8.10±1.79 vs. 9.23±1.63 days, *P*= 0.013) (Table 3).

The Visual Analogue Scale (VAS) was statistically significant between the two groups at 0 and 2 hour post extubation, VAS 0 was in the Block group 3.77±1.28 vs

Table 2: Extubation time and total fentanyl patient controlled analgesia dose:

Variables	Block group		Control group		*P* value
	Mean	SD	Mean	SD	
Extubation time (min)	238.00	57.32	297.00	115.08	0.027*
fentanyl patient controlled analgesia dose (µg)	138.33	80.60	276.67	117.25	<0.001*

SD: Standard deviation; *: Significant when *P* value ≤0.05.

Table 3: Intensive care unit and hospital length of stay:

Variables	Block group		Control group		*P* value
	Mean	SD	Mean	SD	
Intensive care unit length of stay (day)	3.13	0.82	3.77	1.38	0.035*
Hospital length of stay (day)	8.10	1.79	9.23	1.63	0.013*

SD: Standard deviation; *: Significant when *P* value ≤0.05.

Table 4: Visual analog scale scores at 0, 2, 4, 6, and 12 hours:

Variables	Block group		Control group		*P* value
	Mean	SD	Mean	SD	
VAS 0	3.77	1.28	5.13	1.57	0.002*
VAS 2	3.60	1.10	4.63	1.52	0.006*
VAS 4	3.67	1.30	4.03	1.00	0.223
VAS 6	3.47	1.63	3.17	0.75	0.125
VAS 12	2.53	1.78	2.97	1.03	0.591

SD: Standard deviation; VAS: Visual analog scale; *: Significant when *P* value ≤0.0.

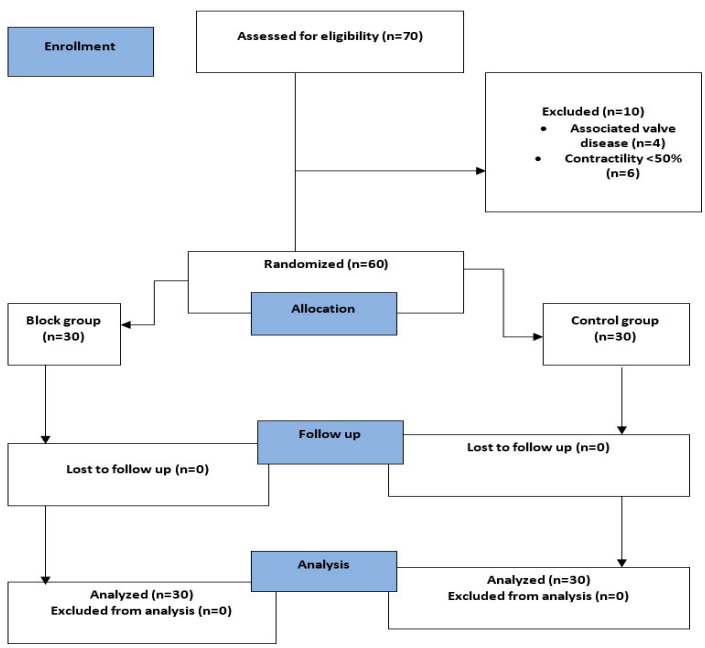

Figure 1: The trial flow diagram.

5.13±1.57 in the Control group (*P*= 0.002) and VAS 2 was (3.60±1.10 vs 4.63±1.52, *P*= 0.006), while VAS 4, 6, 12 differences were not statistically significant between the groups (Table 4).

DISCUSSION

Acute postoperative pain is a predictive risk for chronic pain [11-13]. Post-surgical pain is not only a result of an inflammatory response or isolated nerve injuries but it is often a combination of both, even if pain is after a surgery that does not involve direct nerve damage as it may be the result of central sensitization after peripheral inflammatory processes [36]. The tissue injury resultant pain varies in intensity according to two principles. The first is the intensity of nociceptive inputs resulted from the incision. The second is the mechanisms of peripheral and central sensitization that influence the post-incisional pain sensation [37].

Tissue damage, like surgical incision, induces inflammatory response that produce great changes in nociceptor responsiveness, it evokes a complex cascade of events, many of them facilitate peripheral nociceptor activity [38,39]. Post-ganglionic sympathetic neuronal activity directly enhances peripheral inflammation [40] and is also required to produce some of the effects of pro-inflammatory mediators. Nociceptor activity contributes to the neurogenic component of inflammation, which further facilitates nociception [41].

Spinal dorsal horn neurons, and especially WDR neurons, demonstrate remarkable plasticity in response to nociceptor input [42]. At low rates of C-fiber stimulation, spinal neurons generally have a fixed stimulus dependent response, however, at higher rates of stimulation, some neurons (especially WDR neurons) respond with huge bursts of activity, which lasts longer after the end of the afferent input. This exaggerated or so called “wind-up” response extensively studied in animal and human models was found to correlate with the oversensitivity to a noxious stimulus (hyperalgesia) presents after tissue injury [43].

Pecto-intercostal block one of the two known parasternal intercostal blocks, the other one transeversus thoracis block, de la Torre *et al*., 2014 [44] was first to describe it for pain management post-breast surgery [20]. It have been used primarily to provide peri-operative analgesia and opioid sparing effect for midline sternotomy and are an attractive option, as the risk of bleeding complications is low and it targets the anterior cutaneous branches of the thoracic intercostal nerves, covering T2 to T6, which innervate the sternum and anteromedial thorax [45,46].

Various local anesthetics were used to perform the block, we chose levobupivacaine as it demonstrated relatively lower cardiotoxicity profile in-*vitro* and in-*vivo* animal studies [47]. The estimated mean fatal dose through severe arrhythmias after intravenous administration of levobupivacaine was significantly larger than the fatal dose of bupivacaine [48].

The aim of our study was to investigate the potential benefit of performing ultrasound guided US pecto-intercostal fascial plane block (PIFB) in patient undergoing CABG on-pump with median sternotomy in decreasing extubation time, total opioid dose and ICU and hospital length of stay (LOS).

Our study showed there was a significant decrease in extubation time which was approximately one hour with *p*= 0.027. It also showed a significant decrease in opioid consumption (in the form of fentanyl boluses in the ICU till 12 hours post-extubation) with approximately 50% reduction in total dose required with *p*= 0.001.

Pain score assessed by VAS was significantly lower at 0 & 2 h post extubation in the PIFB group vs Control, with *p*= 0.002 at 0hr and *p*= 0.006 at 2h. Length of stay LOS in ICU and Hospital has been decreased significantly in the PIFB group (with *p*= 0.035 for ICU LOS) and (*p*= 0.013 for Hospital LOS).

Five randomized control trials were conducted on cardiac surgical patients with median sternotomy, where PIFB was used as an adjunct to the analgesic regimen to assess its efficacy in different parameters of enhanced recovery [31,49-52].

Previous research [51] studied 98 patients undergoing open cardiac surgery for valve replacement only for the study, PIFB group 49 and Control (Saline) group 49, they conducted the block bilaterally only one time after induction of anesthesia with 20ml Ropivacaine 0.4% on each side, they used Sufentanil IV boluses during surgery, and Sufentanil PCA + IV Parecoxib 20mg at 6h intervals as analgesic rescue in ICU postoperative.

They found a decrease in total consumption of Sufentanil intra- and post-operative and total Parecoxib consumption postoperative, a decrease in extubation time, a decrease in pain scores and a decrease in ICU and Hospital LOS in PIFB group vs Control group, which is consistent with our study.

Another study [50] was conducted on 50 patients undergoing open cardiac surgery whether on-or off-pump for intervention, PIFB group 25 and Control (saline) group 25, they performed the block bilaterally only one time after induction of anesthesia with 30ml ropivacaine 0.3% with 2.5mg dexamethasone on each side, they used Sufentanil

IV boluses during surgery and hydromorphone patient controlled analgesia PCA + polypill (oxycodone 5mg + acetaminophen 325mg) as a rescue analgesia in ICU postoperative as the analgesic regimen.

They found a decrease in total Sufentanil consumption and a decrease in extubation time in PIFB group vs Control group, but insignificant results for hydromorphone consumption in the ICU, pain scores and ICU and Hospital LOS.

Compared to the previous similar study the insignificant results may be possibly due to the difference in surgery type, as in this study they chose all open cardiac surgeries not only valve surgeries, and it was found that internal mammary harvest done in almost all CABG surgeries is associated with greater percentage of brachial plexus injuries and subsequent increase in postoperative acute and chronic pain [53,54].

In comparison with our study, which also included on-pump CABG, our study showed superior results in postoperative opioid consumption and ICU and Hospital LOS may be due to anesthetic solution drug selection, where ropivacaine is shorter acting and in addition to that they performed the block much earlier (after induction of anesthesia).

A recent study [52] on 110 patients undergoing open cardiac surgery whether on-pump or off-pump for the study, PIFB group 55 and Control (Saline) group 55, PIFB was performed in OR before induction of anesthesia with local anesthetic skin infiltration before injection, it was done bilaterally with 20mL 0.33% ropivacaine on each side, after the injections, a multi-orifice catheter was inserted on each side, infusion in the catheters used in the next 3 days postoperative, with ropivacaine 0.1% or saline at a rate of 8–10mL/h into each catheter and catheter removed on the 3rd day postoperative, they used Sufentanil boluses intraoperative and Sufentanil PCA postoperative + flurbiprofen axetil 50mg upon patient request but the total <200mg a day as analgesic rescue postoperative.

They found a decrease in total consumption of Sufentanyl intra- and post-operative and total Flurbiprofen consumption, a decrease in extubation time, a decrease in pain scores and a decrease in ICU and Hospital LOS in PIFB group vs. Control group.

We think that these better results despite using the same relatively short acting Ropivacaine was the continuous infusion of the block postoperatively.

An earlier study [31] on 40 patients undergoing open cardiac surgery on-pump only for the study, PIFB group 20 and Control (non-intervention) group 20, they conducted the block bilaterally only one time before transfer to the ICU with 30ml Ropivacaine 0.25% on each side, they used IV paracetamol 1g, tramadol 50mg, repeated every 6h and IV Fentanyl boluses as analgesic rescue in ICU postoperative.

They found a decrease in total Fentanyl consumption and a decrease in pain scores at 6 and 12h in PIFB group vs Control group but insignificant results for Time of extubation.

Possibly due to the inadequate analgesia in the first 6 hours that is reflected by insignificant results of pain scores till 6 hours postoperatively which may be related to the type of anesthetic solution drug used (Ropivacaine). They did not put ICU and Hospital LOS as one of the supposed to be measured outcomes.

Another study [49] assessed 80 patients undergoing open cardiac surgery whether on-or off-pump for intervention, PIFB group 40 and Control (saline) group 40, they conducted the block bilaterally with 20ml Bupivacaine 0.25% on each side two times, one time within 2 hours of admission to the cardiovascular ICU postoperatively and the other one on postoperative day POD 1 between 9-11 am, they used multimodal postoperative analgesia (i.e. tramadol) and measured them as morphine equivalents, and they found that only pain scores were lower significantly in PIFB group vs Control group but without significant reduction in morphine equivalents consumption or ICU and Hospital LOS and they did not put extubation time as one of the supposed to be measured outcomes, which is way too inconsistent with our study.

We concluded that, PIFB using Levobupivacaine decreased the time to extubation, total opioid consumption, and ICU length of stay and hospital length of stay in patients undergoing on-pump CABG.

Our study showed some limitations. It did not measure or follow up chronic neuropathic pain to study the effect of PIFB management of acute pain which suggest decreases risk of chronic pain. The VAS is subjective, and healthcare provider (nurse/intensivist) operated analgesic regimen rather than patient-controlled regimen in some points before extubation, could have affected the opioid consumption. PIFB has no effect on other areas of postoperative pain arising from the shoulder due to retractors, chest drain site or the graft site, which could contribute to the overall consumption of opioids. We did not assess time to drain removal and to ambulation. We did not use objective parameters for pain as pain stressors and inflammatory mediators (Interleukins, TNF α, ….).

CONFLICT OF INTERESTS

There are conflicts of interests.

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