



Research Article

Ultrasound-guided thoracic epidural and paravertebral blocks for cholecystectomy in pediatric patients with a cyanotic heart disease: A randomized controlled study



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KEYWORDS

Paravertebral analgesia;
Epidural analgesia;
Open cholecystectomy;
Left to right shunt

Abstract *Background:* Perioperative pain treatment in pediatrics is often insufficient. This study aimed to compare between two different analgesic procedures used for open cholecystectomy in pediatrics with left (LT) to right (RT) shunt.

Methods: 40 patients with age ranging from 2 to 5 years were submitted for elective open cholecystectomy procedures in congenital non-cyanotic heart diseases. After general anesthesia, they were randomized into two groups according to the type of analgesia given, 20 patients in each group. They were either epidural group (group A) or paravertebral group (group B). Hemodynamics including heart rate (HR), mean arterial blood pressure (MAP), and central venous pressure (CVP), were recorded. Pain score, arterial blood gases (ABG), first request for analgesic requirement, and total postoperative consumption of fentanyl ($\mu\text{g}/\text{kg}$) were detected.

Results: Children's Hospital Eastern Ontario Pain Scale (CHEOPS) pain score, total fentanyl requirement and the time for first request of analgesic requirement were comparable in both groups. Hemodynamic parameters (HR–MAP–CVP) and the oxygenation parameters in the form of arterial oxygen tension (PaO_2) and arterial oxygen saturation (SaO_2) were significantly decreased in the epidural group than paravertebral group as $P < 0.05$.

Conclusion: Both blocks have the same analgesic efficacy but the paravertebral block is superior on epidural block in maintaining hemodynamic stability and improving the oxygenation in pediatrics with a cyanotic heart diseases.

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1. Introduction

Pain following surgery is an universal phenomenon which up to now is often underestimated and undertreated especially in pediatrics. Any postoperative analgesic technique should

meet three criteria, which are effectiveness, universal applicability and safety [1].

A cyanotic heart disease, which is a group of congenital heart defects, occurs when shunting (flowing) of blood occurs from the left side of the heart to the right side of the heart due to a structural defect (hole) in the interventricular septum. Patients retain normal levels of ox-hemoglobin saturation in systemic circulation. They include ASD, VSD, PDA and atrioventricular septum defect [2]. The key pathological change is due to the increased pulmonary vascular resistance (PVR) and pressure secondary to increased blood flow from the left to-right shunt. Increasing PVR and pulmonary arterial hypertension (PAH) will lead to reversed direction of blood flow through the cardiac defect (Eisenmenger Syndrome) and heart failure. Cardiac defects with left-to-right shunt generally require surgical or trans-catheter repair at an early age. The balance between pulmonary and systemic circulation will maintain the direction of shunt and any analgesic regimen or block technique will disturb systemic circulation; it will lead to the reversal of shunt [3].

The site of surgery and type of surgery are important factors in determining the degree of pain. Operations involving skin incision without muscle cutting cause a type of pain described as soreness and dull ache, which is very sensitive to low concentration of analgesics, whereas pain following muscle cutting (as occurs in cholecystectomy surgery) is well localized, exaggerated by movement especially deep breathing and coughing and is less responsive to treatment with systemic opioids, so it requires paravertebral or epidural blocks to relieve the pain [4].

Open cholecystectomy with subcostal incision is associated with severe postoperative pain and marked impairment of respiratory function.

Several studies have demonstrated benefits of regional anesthesia in pediatric patients undergoing surgery. Possible regional anesthetic technique for cholecystectomy includes Epidural block, Para-vertebral block, and caudal block [5].

Epidural analgesia is an attractive choice for pediatric surgery. The epidural technique is most commonly used in children either single shot or continuous administration with the usage of many drugs as opioids, local anesthetics, ketamine or $\alpha 2$ agonist as clonidine or dexmedetomidine [6].

Para-vertebral block has undergone a renaissance in last decade. Its use has grown to include breast surgery, renal surgery, cholecystectomy and thoracotomies [7].

The touted benefits in these populations include prolonged and effective analgesia, reduced postoperative nausea and vomiting, with fewer postoperative respiratory complications, shortened recovery, and reduced the stress response to surgical procedures [8].

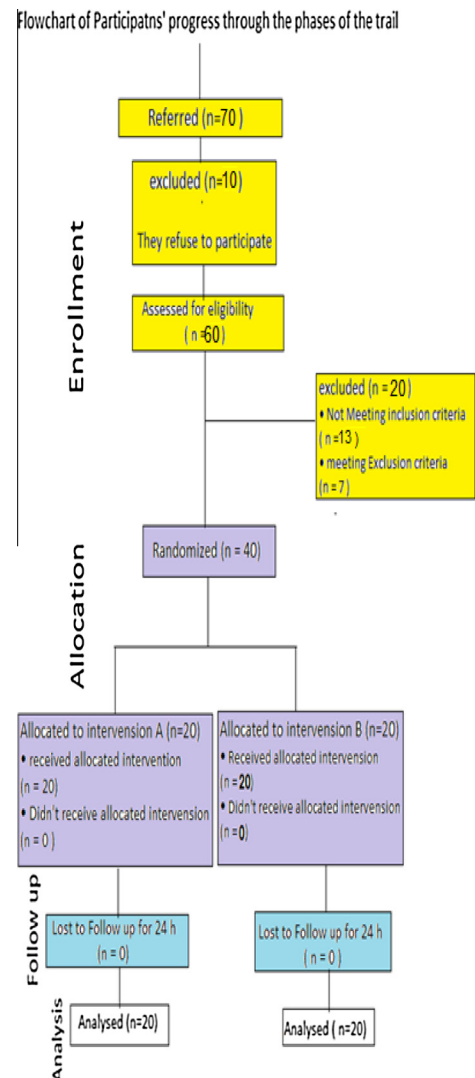
Despite encouraging results in adult, Para-vertebral block has only recently been described in pediatric patients.

The aim of this study was to compare the analgesic, hemodynamic, and oxygenation parameters of single shot thoracic epidural and single shot thoracic paravertebral block after open cholecystectomy in pediatric patients with left to right shunt.

2. Patients and methods

This prospective randomized controlled study was conducted from January 2015 to June 2015 at Mansoura Children

University Hospital on pediatric patients of ASA II and III who had to undergo elective open cholecystectomy. This study was carried out after approval of the Local Ethical Committee and a written informed consent was obtained from all the parents of patients. It was conducted on 40 patients with age group ranging from 2 to 5 years submitted for open cholecystectomy in non-cyanotic heart diseases. Patients with local sepsis, or with history of anaphylaxis to local anesthetics, coagulation disorders, neurological disorders, were excluded from the study.



In the preoperative visit, all patients included in the study were evaluated by clinical, biochemical and radiological investigations. Patients' weight and vital signs were noted down. In the preoperative room all patients were premeditated with intramuscular 0.05-mg/kg midazolam and 0.02-mg/kg atropine sulphate 15 min before induction of general anesthesia. Electrocardiographic (ECG), peripheral oxygen saturation (SpO₂) and noninvasive blood pressure (NIBP) were monitored. Anesthesia was induced by inhalation of sevoflurane at 8% MAC which decreased gradually down to 2% MAC carried by 100% oxygen, with loss of consciousness; a peripheral intra-

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