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Research Article

Erector Spinae Nerve Block for the Management of Rib Fractures: A Retrospective Propensity Matched Cohort Study Protocol

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Abstract

Introduction: Rib fractures are the most common thoracic blunt trauma injury and constitute up to 55% of all thoracic blunt trauma injuries. They are a common cause of hospital admission and are associated with significant morbidity and mortality. Immediate causes of comorbidities and mortality that stem from complications of rib fractures include pneumothorax, haemothorax, pulmonary contusions, flail chest and acute respiratory distress syndrome; whilst more delayed complications include atelectasis, pneumonia, pulmonary embolism, empyema and respiratory failure. The higher the number of rib fractures, the higher the incidence of pulmonary morbidity and mortality. A fundamental contributor to delayed complications is hypoventilation secondary to pain from the facture(s) and thus, a key element in the prevention of post-fracture complications is optimal analgesia. Several neuraxial and regional techniques have been described in relation to systemic opioid analgesia with varying levels of evidence. One such strategy is the use of the Erector Spinae Block (ESB). This technique has never been described in relation to any other technique. The aim of this study will be to compare the ESB to systemic opioid analgesia with the hypothesis that patients receiving Erector Spinae Blocks will have a lower incidence of respiratory complications and thus a shorter length of stay in hospital and reduced mortality rates.

Methods and Analysis: A retrospective cohort study with propensity matching will be performed. A retrospective analysis of patients with rib fractures managed by the Sunshine Coast Hospital and Health Service (SCHHS) Acute Pain Service (APS). Each patient's electronic medical record (EMR) from their hospital admission will be reviewed

for age, number of rib fractures, presence of a flail segment, comorbidities at the time of admission, type of management used (oral medications alone vs. ketamine infusion vs. patient controlled analgesia vs. regional block), complications (haemothorax/pneumothorax, pneumonia, pulmonary embolism, respiratory failure, requirement of ventilatory support or ICU, number of days of ventilatory support, regional block failure or local anaesthetic catheter related adverse effects), length of stay, discharge destination and mortality during admission.

Ethics and Dissemination: Ethics approval for the study protocol and data collection has been approved (HREC: LNR/2018/QPCH/45155). The study findings will be submitted for publication in a peer reviewed journal.

Conclusion: There is currently no available literature to support the use of an ESB over other analgesic options and this cohort study will provide initial exploratory results to guide further randomised controlled trials.

Keywords: Rib fractures; Haemothorax; Pneumothorax; Anaesthetic

1. Background

Rib fractures from blunt trauma to the thoracic cage poses a significant burden on the healthcare system, with over 10% requiring hospital admission [1, 2] and constituting approximately 10% of admissions to trauma centers [3-5]. Of the proportion admitted to hospital, there is a significant risk of morbidity and mortality [6, 7]. The morbidity and mortality secondary to rib fracture related admissions are predominantly a result of pulmonary complications [6, 7]. In order to minimize these pulmonary complications adequate pain control is required [8, 9].

The most common analgesic methods include the use of patient controlled intravenous analgesia (PCA) and thoracic epidurals. Both of which have been associated with worsened outcomes in certain circumstances [8]. Even the safest of opioids are associated with respiratory depression [9] and provide poor analgesia for rib fractures. In addition to this, the use of NOACs (a common medication in the elderly), precludes the use of thoracic epidurals and paravertebral blocks. There has recently been a vast number of new regional techniques developed for both operative and trauma related pain. As with many other regions of the body there is little evidence available to guide the choice between different blocks [7]. The Erector Spinae Block (ESB) has been well publicised in a number of recent case reports [8, 9] and unlike thoracic epidurals and paravertebral blocks, is safe to be performed with a NOAC on board. However, to date there are no studies comparing the ESB to other techniques.

At the Sunshine Coast University Hospital (SCUH), Australia it has become common practice to utilize ESB catheters for analgesia during the initial recovery period. ESB catheters have been proven to provide high quality analgesia in the setting of thoracic surgery [9]. However, given the paucity of literature on the ESB for management of rib fractures, we propose to undertake a retrospective cohort study. This study will investigate the morbidity and mortality associated with the use of ESBs compared to systemic opioid analgesia. Systemic opioid analgesia will be used as the control group given that it's efficacy is well described in the literature.

1.1 Primary hypothesis

Patients receiving erector spinae blocks will have a lower incidence of respiratory complications.

1.2 Secondary hypothesis

Patients receiving erector spinae blocks will have a shorter length of stay and reduced mortality as a result of less respiratory complications.

2. Methodology

2.1 Data Collection and Storage

A retrospective analysis of patients with rib fractures managed by the SCHHS acute pain service (APS). Patients for inclusion will be initially be identified through the APS registrar handover database between December 2017 and October 2018. If there is an insufficient number of patients, the inclusion dates may span back to January 2014. Each patients' electronic medical record (EMR) from the stay will be reviewed for age, co-morbidities at the time of admission, discharge destination, complications and mortality during admission (Table 1). The search of patient records will be performed independently by two investigators. This information will be entered into a password protected file.

Patient Variable	**Procedure Variables**	**Outcome Measure**
Age Sex Number and location of rib fractures Presence of flail segment Requirement of chest drain Other injuries Medical Co-morbidities Living location prior to admission: - House independent - House services - Low Care Facility - High Care Facility	Day of stay inserted Oxygen saturation before and after insertion Test local anaesthetic and dose Local anaesthetic protocol Time to rescue	Respiratory Complication - Pneumonia (CXR consolidation + positive sputum or blood culture) - Pulmonary embolism - Respiratory failure - Ventilatory support ICU admission Length of stay Mortality during stay (up to 30 days) Block failure or local anaesthetic catheter related adverse effects. Oral Morphine equivalent analgesia use during stay (using the FPM - Faculty of Pain Management - Opioid Calculator) Discharge destination - House independent - House services - Low Care Facility - High Care Facility

Table 1: Patient, procedure and outcome variables for collection.

2.2 Data Analysis

This study will be performed utilizing a quasi-experimental design using propensity matching. The matching will be performed by Dr Leigh White prior to the performance of any statistical analyses to prevent investigator related bias. The matching will be performed on a one to one basis. The matching variables included age, sex, number of rib fractures, chest drain insertion and pulmonary contusion.

The statistical analysis will include a two-tailed student's t-test for continuous variables and a chi-square test will be ultilised for categorical variables for both the matched and unmatched cohorts. Subgroup analyses will be performed looking at patients receiving either a PCA or oral analgesia. If the propensity matching design is determined to be unfeasible then an unmatched retrospective analysis will be performed utilizing the statistical methods as mentioned above. In addition, a logistic regression analysis will be performed to adjust for confounding variables.

2.3 Ethics

This study protocol and data collection process has received ethics approval (HREC: LNR/2018/QPCH/45155). This was submitted to the Metro-North HREC subcommittee as per the Sunshine Coast Hospital and Health Service ethics process.

3. Conflicts of Interest

The authors of this study have no conflicts of interest to declare.

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