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Research paper

ChIP: An early activation protocol for isolated blunt chest injury improves outcomes, a retrospective cohort study

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ABSTRACT

Background: Blunt chest injuries not treated in a timely manner with sufficient analgesia, physiotherapy and respiratory support are associated with increased morbidity and mortality. The aim of the study was to determine the impact of a blunt chest injury early activation protocol (ChIP) on patient and hospital outcomes.
Methods: In this pre-post cohort study, the outcomes of patients with blunt chest injury who received ChIP were compared against those who did not. Data including injury severity, patient outcomes, hospital treatments and comorbidites were extracted from medical records. The primary outcome was pneumonia. Secondary outcomes evaluated health service delivery. Logistic and multiple regressions were used to adjust for potential confounding variables.
Results: 546 patients were included, 273 in the before-ChIP cohort and 273 in the after-ChIP cohort. The incidence of pneumonia following the introduction of ChIP was reduced by 4.8% (95% CI 0.5–9.2, p = 0.03). In the after-ChIP cohort, more patients received a pain team review (32% vs. 13%, p < 0.001), physiotherapy (93% vs. 86%, p = 0.005) and trauma team review (95% vs. 39%, p < 0.001). There was no difference in length of stay (p = 0.50).
Conclusions: ChIP improved the delivery of healthcare services and reduced the rate of pneumonia among patients with isolated chest trauma.

Introduction

Failure to treat blunt chest injuries in a timely manner with sufficient analgesia, physiotherapy and respiratory support, often results in complications such as pneumonia and respiratory failure. These complications may cause long-term pulmonary impairment or death, delayed recovery and significantly increased resource use [1,2]. Rib fractures are reported to be the most common clinical fracture in older people (≥65 years of age) [3] and this demographic is the most at risk of rib-fracture-related morbidity [1,4–6]. Patients with at least three rib fractures have a significantly increased risk of in-hospital mortality [7], an effect even more pronounced in older patients in whom each additional rib fracture increases the risk of mortality by 19% and of pneumonia by 27% [5]. Even an isolated rib fracture is associated with significant consequences, particularly in the elderly [6]. Inadequate or delayed pain relief may cause anorexia, poor sleep, psychological stress and restricted movement, with inability to participate in normal activities [8]. Isolated blunt chest injury may result from a low energy mechanism (eg fall from standing), thus patients may not receive the rapid multidisciplinary response associated with a trauma team activation. The literature recommends implementing strategies such as clinical practice guidelines (herein pathways) to improve the care and outcomes of these patients [2,7]. However, pathways reported in the literature do not consider patients with less than three rib frac-

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tures, the elderly, or the burden of co-morbid disease, all of which are risk factors for morbidity and mortality [2,9,10].

Despite improvements in pain management strategies in the emergency department, such as nurse-initiated analgesia, patients with moderate to severe pain are often left waiting for pain relief for longer than 60 min [11]. Evidence also shows that patients aged 75 years and older with pain-related Emergency Department (ED) visits are less likely to receive pain medication than younger patients [12]. Given that pain caused by blunt chest injury is associated with restricted pulmonary function which can lead to serious complications, the need for an effective early intervention in this patient group is critical.

To address this evidence-practice gap the trauma and emergency departments in our Level 1 Trauma Centre, in conjunction with the pain, physiotherapy and aged care teams developed and implemented a Chest Injury Protocol (ChIP) consolidating the best evidence available on treatment of blunt chest injury (Fig. 1). Comparable to a trauma team call or "stroke page", [13] which are known to improve patient and health service outcomes, ChIP is an early activation protocol. Early activation enables tailored, targeted patient care, as each patient has individual needs dependent on their pre-morbid condition. The intent was to facilitate multidisciplinary management of blunt chest trauma and effective multimodal analgesia to prevent respiratory compromise.

The aim of this study was to determine if the implementation of ChIP improved clinical outcomes and the delivery of healthcare services. We hypothesised that patients with blunt chest trauma who received a ChIP call would have reduced complications, improved health service delivery and shorter hospital length of stay (LOS) compared to similar patients who did not receive a ChIP call.

Methods

This was a retrospective before-after cohort study undertaken at St George Hospital, a 600-bed Level 1 Trauma Centre in Sydney, Australia, between August 2010 and November 2014. The study adhered to the National Statement on the Conduct of Human Research by the National Health and Medical Research Council of Australia and was approved by the South Eastern Sydney Local Health District Human Research Ethics Committee. In a previous study in patients with blunt thoracic trauma at St George Hospital the complication rate was 24% [14]. With 80% power to detect a minimum clinically important reduction in complications of 10%, at an alpha level of 0.05, a minimum of 240 participants were required in each arm of the study.

The intervention

Each member of the ChIP team (or their after-hours delegate) received a message via their personal pager and was required to respond within 60 min. ChIP could be activated 24 h a day, 7 days a week by emergency nursing or medical staff. Initial intervention included incentive spirometry, high flow nasal prong oxygen (HFNP), multimodal analgesia including patient controlled analgesia (PCA) as indicated. Patients were then admitted to an appropriate acuity ward under the trauma service, or general surgical team after hours with transfer to trauma the following day. The trauma service coordinated the multidisciplinary care, involving specialty teams such as intensive care, cardiothoracic surgery and aged care as required [15]. Following the introduction of ChIP, All patients that received a ChIP call were entered into the trauma registry.

Participants

Patients were eligible for inclusion if they were aged 18 years or older and admitted to the study site with isolated blunt chest trauma, for example rib or sternal fractures, chest wall contusions

Exclusion criteria

Patients who received a trauma call were excluded as they receive the rapid multidisciplinary response associated with trauma team activation. Individuals who were intubated in the emergency department, had an Abbreviated Injury Scale (AIS) score greater than two in the head, neck, pelvis, and/or abdomen, or had extremity trauma requiring operative intervention were also excluded. The outcomes of those patients were likely to be influenced by the other major injuries [16] or the need for operative procedures.

For the before-ChIP cohort (August 2010–April 2012) potential patients were identified by searching the hospital clinical information database using International Classification of Diseases (ICD-10) codes related to thoracic trauma. This was cross-referenced with data from the hospital trauma registry using the thoracic AIS codes. The after-ChIP cohort comprised patients admitted from May 2012 to November 2014. A three week 'run in period', between protocol introduction and study inclusion allowed for implementation training and staff adjustment to the protocol. Patients that received a ChIP call were identified from the trauma registry.

Data collection

Medical records were reviewed for inclusion and exclusion criteria. A standardised template supported by a data dictionary was used for data extraction. Ninety-two records were not located (69 in the before group, 23 in the after group). Demographic information collected included age, gender and smoking habit. Smoking habit was recorded as current smoker or not a current smoker. We could not reliably distinguish smoking habit as current, past or never due to ambiguity of the frequently used term 'non-smoker' which could be valid for either a never or a past smoker. Clinical data collected included Injury Severity Score (ISS), new Injury Severity Score (nISS), AIS score, number of radiological rib fractures, time from injury to arrival, mechanism of injury, radiological evidence of a pneumothorax, haemothorax or pulmonary contusion within 24 h of injury, insertion of a tube thoracostomy, and the Charlson Comorbidity Index [17]. This Index is used to measure the burden of comorbid illness. A score $\geq$5 is considered severe and indicates a high risk of dying from comorbid illness within one year [17]. Radiologic data were obtained from reports in the radiology database. AIS, ISS and nISS were hand scored by a trained AIS coder. A list of all included patients was provided to the hospital Casemix (finance) department to obtain hospital LOS data.

Outcome measures

The primary outcome was pneumonia. This was defined as radiological evidence of pulmonary air-space opacification, together with medical record documentation of a clinical diagnosis of pneumonia and treatment with antibiotics [2]. When radiological evidence of pulmonary air-space opacification developed within 24 h of hospital arrival, these changes were considered to represent contusion rather than infection. Secondary outcomes were divided into clinical and health service categories. Clinical outcomes were all-cause mortality, deep vein thrombosis, pulmonary embolism and the need for ventilatory support following admission (continuous or bi-level positive airway pressure, or endotracheal intubation). Health service outcome measures were hospital LOS,