

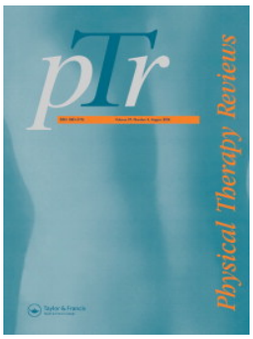
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Physical therapy treatment interventions and the effects thereof on clinical outcomes when addressing intra-pleural abnormalities in patients with trauma: protocol for a systematic review

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ABSTRACT

Background: Patients who sustain chest wall trauma e.g. blunt or penetrating are at increased risk of developing musculoskeletal and pulmonary dysfunction. Physical therapy services are often included during hospital stays to assist with patient outcomes such as lung expansion, increasing oxygenation, pain management, optimization of joint range of motion and early mobility.

Objectives: This protocol describes the proposed systematic review that aims to determine the physical therapy treatment interventions and the effects thereof on clinical outcomes when used in the management of adult patients with intra-pleural abnormalities following chest wall trauma.

Methods: The research team will conduct an effectiveness systematic review using the PICO approach. A three-step search strategy of seven databases will be undertaken: Pubmed, CINAHIL Plus, The Cochrane Library, Physiotherapy Evidence Database (PEDro), Scopus, Science Direct and Google Scholar from conception of the databases. No limitations will be placed on language. The inclusion criteria are publications that focus on adults who sustained chest wall trauma, who had a diagnosis of an intra-pleural abnormality and managed with an intra-pleural drain, and who received physical therapy interventions during their stay in an acute care hospital. If participants had diagnoses that limit ambulation, such publications will not be included in the review. Two independent reviewers will do the critical appraisal and data extraction.

Results: Results are unknown.

Conclusions: This review will contribute to the understanding of physical therapy offered to patients and the clinical outcomes achieved when used in the management of adult patients with intra-pleural abnormalities following chest wall trauma.

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KEYWORDS
Chest trauma; clinical outcomes; intra-pleural abnormalities; physiotherapy or physical therapy; tube thoracostomy

Introduction

Trauma, in the form of road traffic accidents and interpersonal violence, contributes significantly to the global burden of diseases [1]. Road traffic accidents ranked the highest cause of disability-adjusted life-years in adolescents and adults (10 to 24 and 25 to 49 age groups) in the Global Burden of Disease Study [1]. According to Ludwig and Koryllos, approximately two-thirds of patients who sustain a traumatic event will have a degree of chest wall injury [2]. Thoracic trauma can be divided into two categories being that of blunt and penetrating chest wall injuries [2]. Blunt chest trauma is most often managed conservatively with few cases requiring surgical correction [2]. Blunt chest trauma carries a high risk of morbidity and mortality if not treated [3]. Some authors report that penetrating chest wall trauma has a higher mortality rate compared to blunt chest wall trauma due to victims not reaching the hospital in time for emergency care [4].

Chest wall trauma, regardless of the mechanism of injury, has combined physiological effects on the respiratory and cardiovascular functions of the body resulting in hypoxia, hypovolemia and reduced cardiac output. Life-threatening injuries include pneumothoraces and haemothoraces, of which 85% of cases will require chest tube insertion to drain the intra-pleural abnormality [4]. If surgical intervention is not needed, examples of conservative treatment interventions are appropriate airway assessment, adequate oxygen supplementation, insertion of chest tubes, fluid resuscitation, pulmonary hygiene, and effective pain control [5]. Further monitoring of vital signs, review of the mechanism of injury, consideration of patient complaints and general clinical presentation are essential in the first 48 to 72 h post-injury to reduce any risk of complications that

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may arise [5]. Physical therapists play a vital role in assisting with pulmonary hygiene by using techniques that aid in ensuring adequate humidification of the lung airways, mobilizing and removing retained secretions, enhancing cough effort, and improving oxygenation by influencing lung volumes and lung compliance [6].

Patients following chest wall trauma are at risk of developing secondary complications such as pneumonia [7]. Patients often splint their thorax when breathing, in an attempt to lessen pain, thereby making ventilation less optimal [7]. In addition, intercostal muscle strain, leading to pain and muscle spasm, is common in patients with intra-pleural abnormalities following the insertion of a chest tube, further limiting ventilation [8].

Physical therapy, in many parts of the world, is considered integral to effective patient management during admission to an acute care hospital following a traumatic event. In a recent multi-national study physical therapists reported that their practice, when managing a patient who sustained chest wall trauma, includes active coughing, optimal body positioning, deep breathing exercises and early mobilization [6]. In some contexts, rehabilitation activities such as mobilization, advice on deep breathing exercises and education on supported coughing are implemented by other healthcare practitioners, e.g. nurses, respiratory therapists or medical doctors. Said practitioners may also reinforce treatment suggestions following initial treatment by a physical therapist in other contexts.

Physical therapy is an integral part of the management of patients with intra-pleural abnormalities. Interventions including deep breathing exercises, the use of incentive spirometry, upper and lower limb exercises, and walking are supported by the literature [9]. Early interventions can reduce the length of time that chest tube drainage is needed [10]. It lessens the prevalence of temperature spikes in patients and may result in shorter hospital lengths of stay [10]. Early interventions could potentially influence healthcare costs as reported by Senekal and Eales [10]. The benefits of adding 30 min of breathing at a constant positive airway pressure of 15 cm of water with a mask three times a day were highlighted by dos Santos et al. [11]. The authors found that the intervention group had shorter time needed for chest tube drainage, spent less time in the hospital, had less incidence of pneumonia, and less antibiotic use subsequently influencing the cost of care [11]. A rehabilitation program consisting of deep breathing exercises, active shoulder and trunk range of motion exercises (within limits of pain) and walking done three times a day was considered acceptable and tolerable by patients who sustained blunt chest trauma [12].

The purpose of this proposed systematic review is to collate the available published literature regarding the specific physical therapy treatment interventions used during acute care management of adult patients with intra-pleural abnormalities caused by chest trauma and evaluate clinical outcomes. The inclusion of a meta-analysis will be dependent on the findings from the literature review. A search was conducted in the Cochrane Library of Systematic Reviews, JBI Evidence Synthesis, Pubmed, Google Scholar and National Institute for Health Research's International Prospective Register for Systematic Reviews to determine whether a review of the literature related to the topic of interest have been published before. Such a review was not identified during the specific search.

Material and methods

An effectiveness systematic review using the population, intervention, comparator, outcomes (PICO) approach will be conducted [13]. The systematic review will follow the Joanna Briggs Institute's (JBI) methodology for systematic reviews of effectiveness [13]. The protocol was registered on International Prospective Register of Systematic Reviews [PROSPERO] and received the following reference number: CD42022290493.

Inclusion criteria

Population/participants

This review will consider all articles and publications that include adult patients aged 18 years or older. Studies will be considered for inclusion if patients were admitted to an acute care setting (casualty, intensive care unit, high care unit or ward) where they were clinically diagnosed with an intra-pleural abnormality as a result of chest wall trauma (blunt and penetrating), namely pneumothorax, haemothorax or a combination of both.

Studies will be excluded if patients had a medical diagnosis that would limit any physical function such as lower limb fractures, a traumatic brain injury, vertebral fractures, spinal cord injury and patients that are mechanically ventilated. Studies will also be excluded with patients who sustained rib fractures following a traumatic incident, are pregnant, suffer any psychiatric illness or have cranial surgeries.

Intervention(s)

This review will consider all current physiotherapy/physical therapy treatment interventions established

by existing literature for the treatment and management of intra-pleural abnormalities such as, but not limited to incentive spirometry, positive expiratory pressure devices, mobilization, range of motion exercises and respiratory physiotherapy techniques.

Comparator(s)

This review will consider studies with an active comparison (i.e. an alternative intervention group where a different intervention is included).

Outcomes

This review will consider studies that report on the following outcomes:

i. Primary outcomes: pain; respiratory parameters e.g., oxygenation, lung volumes, cough effectiveness etc.; exercise capacity; shoulder and trunk range of motion.
ii. Secondary outcomes: rate of infection e.g., respiratory or surgical site; fluid drainage volume from intra-pleural drain or tube thoracotomy; hospital length of stay.

Types of studies

Quantitative articles that meet the inclusion criteria as stated below will be included in the review, i.e. randomized control trials reported as peer-reviewed manuscripts, quasi-experimental studies, case studies, case-control studies, cohort studies and analytical observational studies will all be considered and reviewed accordingly. The wide range of study designs chosen for this effective systematic review is supported by the JBI Methodology [13].

Search strategy

Using the JBI-approved process the aim will be to collate published and unpublished literature written in all languages. Google Translate will be used to translate articles published in languages other than English. Forward-back translation of articles will be done to review the accuracy of the translation output retrieved from Google Translate. An initial search will be conducted in Pubmed to assess the terms in the titles and abstracts using keywords such as 'Physiotherap* OR Physical Therap*' AND 'Intra-Pleural Abnormalit*' AND 'Chest Wall Trauma', according to the inclusion/exclusion criteria to determine literature available. A wider search will then be conducted in search engines with a specific focus on article titles and keywords. All articles meeting the criteria outlined by the review will then be reviewed and if titles of articles meet the criteria the abstract will then be considered. Should the abstract contain relevant information the article will then be included and reviewed according to the review criteria. Finally, the reference list of sourced articles will be reviewed to identify additional studies for inclusion. The proposed electronic databases are Pubmed, CINAHIL Plus, The Cochrane Library, Physiotherapy Evidence Database (PEDro), Scopus, Science Direct and Google Scholar.

Study selection

Following the search, all identified citations will be collated and uploaded into Mendeley VX.X (Mendeley Ltd., Elsevier, Netherlands) Reference Manager and duplicates removed. Following a pilot test, titles and abstracts will then be screened by two reviewers for assessment against the inclusion criteria for the review. The reviewers will assess the abstracts independently and then meet to discuss their conclusions with regards to whether the full-text articles should be retrieved. Potentially relevant studies will be retrieved in full and their citation details imported into the JBI System for the Unified Management, Assessment, and Review of Information (JBI SUMARI; JBI, Adelaide, Australia) [14]. The full text of selected citations will be assessed in detail against the inclusion criteria by the two reviewers, independently and they will then meet to discuss their decisions following the full-text review. Reasons for exclusion of full-text studies that do not meet the inclusion criteria will be recorded and reported in the systematic review. Any disagreements that arise between the reviewers at each stage of the study selection process will be resolved through discussion or with a third reviewer. The results of the search and study selection and inclusion process will be reported in full in the final systematic review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram [15].

Assessment of methodological quality

Research articles chosen for review in this study will be assessed by two reviewers regarding the methodological quality before they are included using the standardized appraisal instruments from JBI SUMARI [14]. Authors of papers will be contacted to request missing or additional data for clarification, where required. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer.

Data extraction

The study will make use of two reviewers who will independently extract data from the articles that will

be included in the review using the JBI SUMARI tool. A pilot study will be carried out initially for quality assurance purposes. The pilot study will involve the reviewers independently performing data extraction from the first few articles. A meeting to discuss their findings will then take place to determine if their respective extraction findings met the study question and purpose. Data extraction will then continue should the method be deemed effective and efficient. A PRISMA flow diagram will be used to show the number of articles that were reviewed and which met the review inclusion and exclusion criteria [15].

Data synthesis

Quantitative data will be utilized and collated using statistical meta-analysis. Once articles have been reviewed, the results will be pooled according to treatment modalities and impairments established. Effect sizes expressed as odds ratio (for categorical data) and weighted mean differences (continuous data) and their 95% confidence intervals will be calculated for analysis. A random or fixed effects statistical model will be utilized for meta-analysis [16]. Heterogeneity, via forest plots, will be assessed using the results of the I^2 test, Chi-square test and Tau-squared (for random effects model meta-analysis) and will be used to assess and explore subgroup categories that are identified [13]. Articles that are unable to be pooled together for meta-analysis will be provided with a narrative synthesis.

Assessing certainty in the findings

The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach for grading the certainty of evidence will be followed and a Summary of Findings (SoF) will be created using GRADEpro Guideline Development Tool (GDT). This process will be undertaken by the same two reviewers. Authors of papers will be contacted to request missing or additional data for clarification, where required. The SoF will present the following information where appropriate: absolute risks for the treatment and control, estimates of relative risk, and a ranking of the quality of the evidence based on the risk of bias, directness, heterogeneity, precision and risk of publication bias of the review results. It is proposed that the outcomes in the SoF table are: Pain; Respiratory parameters e.g. oxygenation, lung volumes, cough effectiveness etc.; Exercise capacity; Shoulder and trunk range of motion; Rate of infection e.g. respiratory or surgical site; Fluid drainage volume from intra-pleural drain or tube thoracotomy; Hospital length of stay.

Results

The results are still to be determined.

Discussion

Intra-pleural abnormalities following chest wall trauma is common. The occurrence of a pneumothorax or haemothorax is 6.7% in patients who did not sustain rib fractures and the severity of intra-pleural abnormalities increases with the addition of rib fracture injuries [5]. The functional ability of patients can be severely limited due to impairments consisting of insufficient ability to expand the lung, a poor cough effort, impaired gas exchange and poor oxygenation [17]. These patients are therefore at high risk of developing secondary chest complications such as pneumonia in addition to limitations in physical activity. An interdisciplinary team approach is important for optimal management as a means of improving patient outcomes [5]. Physical therapy is important to optimize patients' rehabilitation outcomes [6,17,18]. Including physical therapy as part of the treatment for patients with intra-pleural abnormalities can reduce the length of time that chest drainage is required, lessen the incidence of pneumonia, lessen the need for antibiotic use and reduce hospital length of stay [9–12]. This proposed systematic review will contribute to the understanding of physical therapy services offered to adults with intra-pleural abnormalities who sustained chest wall trauma.

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This systematic review contributes towards an MSc degree.

Author contributions

JKF: conceptualization of systematic review, writing of manuscript. The author will be responsible for data collection and analysis when conducting the review.

RR: conceptualization of systematic review, writing of the manuscript, submission of manuscript. The author will assist with data collection and analysis during the review.

Disclosure statement

The authors have nothing further to declare.

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