CLINICAL MEETING SUMMARIES ON 10TH MAY 2018

Iatrogenic chest injury from thoracocentesis

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Introduction

Bedside pleural intervention is one of the most commonly performed procedures in clinical practice nowadays. It aims at evacuating air and/or fluid from the thoracic cavity and obtaining biopsy from pleura, whether in emergency or elective, life-saving or palliative settings [1]. These include pleural tapping, pleural biopsy, and chest drain insertion.

Common indications for above procedures include pneumothorax, pleural effusion, haemothorax (iatrogenic or traumatic), blunt or penetrating traumatic injury, chylothorax, etc [2]. The average complication rate is quoted from 5% to 10% [1, 3]. Complications are usually classified into early/acute presentation (within the first 24-48 hours), and late/delayed presentation (beyond this initial period) [4]. Cumulative rates of 'early' and 'late' complications are 3–5% and 8–10%, respectively [1]. The commonest complications are pneumothorax, procedure failure, pain and haemorrhage [5]. In a meta-analysis including 24 studies and 6605 thoracocenteses, the incidence of post-procedural pneumothorax is found to be around 6% [6]. The risk of haemothorax is lower with an overall estimated incidence of 1% to 2% [7,8].

In subsequent sections of this article, we review cases which underwent surgical interventions for iatrogenic haemothorax after pleural procedures including pleural tapping, pleural biopsy and chest tube insertion. We also look into guidelines and advices for safer procedure in order to reduce the incidence of potential complications.

Method

This is a single-center retrospective cohort study, from year 1999 to 2018, in which we aimed to review patients who underwent surgical interventions for iatrogenic haemothorax following pleural procedures. Case records with operative diagnosis of 'haemothorax' were identified and retrieved from operative record listing function in Clinical Management System. Causes for haemothorax in identified cases were further studied, and those with iatrogenic haemothorax following pleural procedures were included in the study; while those with any other causes such as traumatic haemothorax or spontaneous haemopneumothorax were excluded. Data such as demographic information, indications and modalities of pleural procedures, modes and symptoms of presentation, drain output, intraoperative blood loss and outcome, etc. were also collected and studied.

Results

From 1999 to 2018, there were a total of 22 patients identified who underwent surgical

interventions for iatrogenic haemothorax following pleural procedures. Pleural procedures included pleural tapping in 5 patients, pleural tapping and biopsy in 9 patients, pigtail/small-bore catheter insertion in 2 patients, and chest drain insertion in 6 patients. Indications for pleural procedures included pleural effusion/empyema in 19 patients (86.3%) and pneumothorax in 3 patients (13.7%). Among these 22 patients, 14 of them are male (63.6%) and 8 are female (36.4%). Age ranged from 50 to 89 years old.

Their mode of presentation could be classified into early presentation (within 24 to 48 hours) in 13 patients (59.1%) and late presentation (beyond this initial period) in 9 patients (40.9%). Presenting signs and symptoms included shortness of breath, hypotension and even cardiac arrest in acute setting.

The mean output from pigtail or chest drain before surgical intervention was 1846ml (ranged from 900 to 2200ml). Intraoperative mean blood loss was 4500ml (ranged from 900 to 11500ml). 6 patients (27.3%) had bleeding source identified from lacerated intercostal artery, 1 (4.5%) from great vessel, 2 (9.1%) from diaphragmatic laceration, 2 (9.1%) from lung parenchymal laceration and 5 (22.7%) from chest wall muscles. Generalized diffuse oozing without specific single bleeding site was found in 6 patients (27.3%) who were already in condition of diffuse intravascular coagulopathy.

Predisposing factors for potential post-pleural procedural haemothorax were identified in 15 patients (68.2%), including coagulopathy (thrombocytopenia or INR more than 2) in 3 patients (6.8%), antiplatelet therapy in 6 patients (27.3%), end stage renal failure in 2 patients (9.1%), mechanical ventilation in 3 patients (13.7%), and previous pulmonary surgery in 1 patient (4.5%).

In-hospital mortality rate of entire cohort was 50%. Causes of death were acute renal failure, pneumonia, myocardial infarction and other complications secondary to massive blood transfusion. Mortality rate among early presentation group was 61.5% (8 out of 13 patients), and was 33.3% (3 out of 9 patients) among late presentation group.

Discussion

Pleural interventions from simple pleural tapping to chest drain insertion are commonly performed in clinical practice by practitioners from different specialties. Possible complications, haemothorax and visceral injury for example, could be potentially fatal and should be made aware of. Close monitoring with vital parameters and chest X-ray are mandatory after the procedures. Although post-procedural haemothorax is rare, suspicion should be raised especially there is clinical deterioration or radiological evidence of increasing effusion.

Safety techniques and advices to reduce the incidence of complications are described in the *British Thoracic Society guideline 2010* and *Society of Interventional Radiology and Cardiovascular & Interventional Radiological Society of Europe* [5, 11]. Non urgent procedures should be avoided in anticoagulated patients until INR <1.5, and those with anti-platelet drugs. Use of thoracic ultrasound guidance for marking the site of procedure is strongly recommended especially when pathology is loculated or is away from triangle of safety. With the use of ultrasound, the incidence of post-procedural pneumothorax could be significantly reduced, by as high as six-fold [6, 9]. In a review of 19,339 thoracocenteses performed in 414 hospitals, there was a 38.7% reduction in incidence of haemorrhage, with ultrasound guidance [10].

The preferred site for insertion of the needle should be inside the *triangle of safety* except loculated pathology outside the triangle. The triangle is bordered anteriorly by the lateral edge of pectoralis major, laterally by the lateral edge of latissimus dorsi, inferiorly by the fifth intercostal space and superiorly by the base of axilla [5]. The advantages are less muscular dissection, far away from diaphragm and invariable position of intercostal artery within the groove. The needle should be inserted just above a rib so as to avoid damaging the neurovascular bundle which runs in a groove in the inferior aspect [5]. The patient may take a semi-reclined position with arm raised and hand behind head, or may sit up and lean over a table with padding support the arms [5]. Measures to secure and manage the drainage system and to monitor the patient are also explained in the guideline.

However there were several limitations in this study. Firstly this was a single-center retrospective study. Secondly patients who had self-limited post-procedural haemothorax without surgical intervention or succumbed before surgical intervention were excluded. In addition details of procedures were absent including technique, site of intervention and experience of operating staff. To overcome above limitations, a multi-center prospective cohort study is necessary.

With better knowledge and greater awareness of the potential complications, preventive strategies and safety techniques, we hope that bedside pleural intervention could serve its purpose at its best and unnecessary iatrogenic injuries could be avoided.

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