Journal of
Pulmonary & Respiratory Medicine

Woo et al., J Pulm Respir Med 2018, 8:3
DOI: 10.4172/2161-105X.1000461

Case Report Open Access

Case Study: Traumatic Pneumothorax after Parachute Landing

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Abstract

Introduction: Pneumothorax during military airborne operations is an uncommon injury among paratroopers. More common injuries are fractures or sprains to the lower extremities, as this is where most of the impact is absorbed during parachute landings. Classically, a pneumothorax will present with sudden onset severe chest pain and dyspnea warranting immediate medical evaluation. Among military service members, pneumothorax is more likely to occur because of traumatic injuries such as from motor vehicle accidents.

Case presentation: This case highlights an otherwise healthy male paratrooper, who presented 24 hours following routine airborne training.

Conclusion: Symptoms of even mild dyspnea or chest pain in military paratroopers following airborne operations should prompt immediate evaluation for pneumothorax.

Keywords: Pneumothorax; Military; Army; Parachute injuries

Introduction

Pneumothorax is defined as air that has entered the pleural space, either spontaneously or as a result of traumatic tears in the lung pleura induced by chest injury or invasive procedures [1]. The classic clinical presentation for pneumothorax is one of sudden onset dyspnea, diminished breath sounds, decreased chest excursion, and hyper-resonance to percussion [1-5]. In some instances, the lung continues to leak air into the chest cavity and results in compression of the chest structures, including vessels that return blood to the heart. This clinical presentation to as a tension pneumothorax and can be fatal if not treated immediately [6].

Spontaneous pneumothorax is classified as being primary or secondary. Primary spontaneous pneumothorax (PSP) is defined as a pneumothorax of an unclear etiology [2,4]. Most individuals with PSP have unrecognized lung disease with the pneumothorax resulting from rupture of a subpleural bleb. Primary spontaneous pneumothorax usually develops when the patient is at rest [7]. Patients are typically in their early 20s, with PSP being rare after age 40. Secondary spontaneous pneumothorax is caused by organic etiologies such as chronic obstructive pulmonary disease, cystic fibrosis or lung malignancy. Patients with the connective tissue disorder, Marfan syndrome, may also be predisposed to developing spontaneous pneumothorax.

A traumatic pneumothorax can result from either penetrating or non-penetrating chest trauma. Some cases of pneumothorax observed in emergency departments have been induced by blunt trauma from motor vehicle crashes or contact sports injuries.

Paratroopers exit out of aircrafts on static line parachutes in order to maintain airborne training requirements. These soldiers perform a specialized landing called a parachute landing fall (PLF) upon contacting the ground to minimize injuries. Paratroopers perform a parachute landing fall by making contact with the balls of the feet, the side of the calf, the side of the thigh, the side of the buttocks, and the side of the back. Although dated, one study identified an increased risk for developing pneumothorax in paratrooper populations, especially those with a tall and slender body habitus [8]. We report a case of an active duty male soldier who developed a traumatic pneumothorax after a parachute landing during an airborne training exercise, without sustaining other significant chest trauma, such as a rib fracture, and without any identifiable underlying lung disease.

Case Presentation

A tall (185 cm) 29-year-old male paratrooper in good physical condition with a slender body habitus (body mass index (BMI)=19.2) and no history of smoking presented to his battalion aid station complaining of an on-going right-sided chest pain lasting over 24 hours after his last parachute jump. The jump occurred during unfavorable wind conditions and a suboptimal parachute landing fall that caused direct contusion to the right side of his chest. After the initial landing, he was able to move off the drop zone with no acute symptoms. The following morning during strenuous physical fitness training the patient experienced chest tightness and pain which prompted a brief medical evaluation at the battalion aid station and a chest radiograph to rule out a pneumothorax. Radiography showed a small, right-sided apical pleural line suspicious for pneumothorax (Figure 1).

The patient was subsequently transported to the emergency department of the nearest military hospital for further evaluation. A non-contrast chest computed tomography scan was ordered and confirmed the diagnosis of pneumothorax (Figure 2).

At the emergency department, the patient was found to be afebrile with a blood pressure of 147/80 mmHg, heart rate of 66 bpm, respiration rate of 16, and an oxygen saturation of 100% on room air. On physical examination, the patient was found to have equally clear lung sounds with slightly diminished air movement on the anterior side of the upper lobe of the right lung. The patient was placed on 15 L of supplemental oxygen and evaluated by general surgery for evacuation of the pneumothorax.

After the subsequent examination by general surgery, a thoracostomy with a pigtail catheter was performed to assist in the

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Received June 25, 2018; **Accepted** July 02, 2018; **Published** July 10, 2018

Citation: Woo CH, Berry-Cabán CS, Norland SP, Skinner DJ, Motyka TM, et al. (2018) Case Study: Traumatic Pneumothorax after Parachute Landing. J Pulm Respir Med 8: 461. doi: 10.4172/2161-105X.1000461

Figure 1: Baseline chest radiography shows a right-sided apical pleural line, concerning for a right-sided pneumothorax.

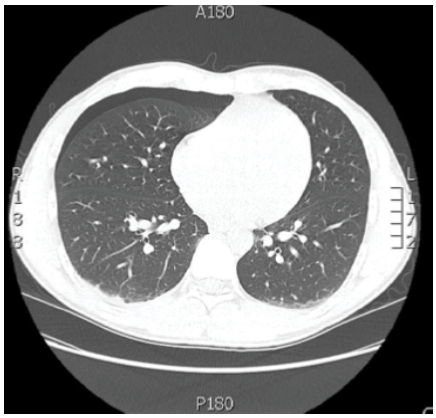

Figure 2: Axial view of the non-contrast chest computed tomography scan is shown to have a small to moderate size pneumothorax, confirming the findings from the initial chest radiograph.

Figure 3: Post-evacuation chest radiograph showing a right-sided pneumothorax and pig-tail chest tube.

evacuation (Figure 3). The evacuation was successful, and the patient was discharged the following day. The patient was followed up at an outpatient evaluation 10 days later with a routine chest radiograph

Figure 4: Outpatient follow-up chest radiograph 10 days post evacuation showing no acute abnormalities or residual pneumothorax.

that showed no acute abnormalities (Figure 4). Although the patient is described as "tall and slender", the chest radiograph did not show features consistent with Marfan Syndrome such as hyperinflation or bullous changes that could have predisposed him to a pneumothorax.

Discussion

While ruptured blebs have been determined as an etiology of pneumothorax in otherwise healthy young male military service members, a more common etiology of pneumothorax among service members results from blunt trauma, usually secondary to a rib fracture as a result of injuries sustained during motor vehicle crashes or blast injuries [8-10].

A pneumothorax is a rare injury associated with military parachute jumps. In a 1999 literature review of military parachute injuries, chest and abdominal wall injuries accounted for only 3% of total injuries (pneumothorax was not a specifically recorded injury) [11]. According to a prospective study conducted by Elkland, the majority of parachuting injuries involved the lower extremities, most commonly the ankle, as a result of impact during landing [12]. The most classic injuries include fracture of the tibia, fracture or dislocation of the humerus, collateral knee ligament injuries, vertebral compression fractures, fractures and strains of the fibula, or dislocation of the acromioclavicular joint [11-14]. Although, the parachute landing fall is designed to distribute the force of landing across various body parts, most of the impact is absorbed through the ankles and knees rather than through the thorax. The amount of force can be compared to that of jumping off a 9 to12 foot wall [11,15]. The mechanism of parachute landing fall could account for the low incidence of pneumothorax among paratroopers [16].

A systematic review and meta-analysis conducted by Knapik reviewed risk factors associated with injuries involving static line military parachutists. The frequency of parachute injuries, most commonly fractures or sprains to the lower extremities, was found more commonly among women or males with heavier body weight [15]. Increased body weight and female gender may be risk factors for more common parachute injuries, however these characteristics are not shown to be a risk for a pneumothorax during military parachute operations. Among civilian personnel, male gender has been shown to have an increased incidence of pneumothorax with a peak of PSP occurring much earlier than that of women [13]. The peak incidence of PSP in males is observed at 20 years of age when compared to women whose peak incidence is delayed up to 40 years of age [17]. Body mass

index of patients with PSP also tends to be lower than the BMI of the average patient, which may increase susceptibility for development of PSP [18]. In paratroopers with a slender body habitus, trauma sustained during an airborne operation may be a contributing factor to a pneumothorax following a hard landing on the flank.

While typical characteristics of pneumothorax generally include sudden onset dyspnea and sharp pain, the presentation can be variable. Pain may mimic angina pectoris, perforated ulcers, or acute cholecystitis. Dyspnea is surprisingly reported in only 60% of PSP cases [7]. Additional physical exam findings such as decreased breath sounds on lung auscultation or hyper-resonance to percussion may also vary depending on the size of the pneumothorax [7]. Pneumothorax resulting from blunt trauma such as sports injuries or motor vehicle accidents presenting to the emergency department commonly have substantially decreased oxygen saturation [5]. However, the clinical findings in this case did not have the typical presentation of a sudden onset of dyspnea or decreased oxygen saturation [5]. Although an uncommon injury, this case warrants a greater clinical index of suspicion for a pneumothorax in paratroopers experiencing chest pain and dyspnea during airborne training operations or on the battlefield after a hard landing.

Military personnel undergoing parachute landings withstand significant impact. Notably, increased combat loads during jump operations could also predispose the individual to pneumothorax development because heavier loads increase the descent velocity and impact upon landing [10,16,19]. This case highlights a unique presentation of pneumothorax in a healthy young individual. While the majority of injuries from airborne operations are not to the chest, clinicians should maintain a high index of suspicion for pneumothorax in patients presenting with dyspnea or chest pain following airborne operations.

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