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Case report

Pulmonary embolism in burns, is there an evidence based prophylactic recommendation? Case report and review of literature

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ARTICLE INFO

Article history:
Accepted 30 June 2014

Keywords:
Pulmonary embolism
Deep venous thrombosis
Venous thromboembolism
Blood clot
Burn wounds
Acquired hypercoagulopathy

ABSTRACT

Burn patients exhibit an acquired hypercoagulable state with increased risk of venous thromboembolism. Currently, no randomized control study assessing the efficacy of chemical venous thromboembolism (VTE) prophylaxis in burn patients has been performed. We present a case of a morbidly (body mass index > 54 kg/m^2) obese patient with 18% total body surface area (TBSA) burn who developed a VTE and a non-fatal submassive pulmonary embolus (PE). We will be reviewing the current consensus of venous thrombosis prophylaxis in burn patients and briefly discuss the treatment of PE in this population.

1. Introduction

Hypercoagulability is one of the many physiological changes that occur in burn patients. There is not only an increase in prothrombotic factors including factors V and VIII, but also a dramatic rise in platelet count and fibrinogen levels [1–4]. Conversely, the levels of antithrombotic factors including antithrombin III, protein C and protein S are decreased [1,5]. The systemic inflammatory state and the concomitant mechanical vascular trauma such as central venous catheter insertion are potential causes for endothelial injury in burn patients. Sedation and analgesia needed for the care of complex burns, mechanical ventilation and multiple successive operations prolong the immobilized state and thus the risk of stasis. Burn patients exhibit all the components of Virchow's triad.

Despite this acquired hypercoagulable state in burn patients, thrombotic complications including venous thromboembolism (VTE) and pulmonary embolism (PE) have a low incidence and relatively low impact in this population [6]. Hence, no major prospective randomized studies have been developed in this area, consequently, some burn centers do not routinely use deep venous thrombosis (DVT) prophylaxis in every burn patient. Others recommend the use of selective chemical DVT prophylaxis in patients at high risk of thrombotic complications, however, this point remains controversial and not fully defined by the American Burn

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http://dx.doi.org/10.1016/j.burns.2014.06.018
0305-4179/

Association (ABA). We present a case of a morbidly obese patient with 18% total body surface area (TBSA) burn. Although the patient was receiving chemical prophylactic measures, she developed a VTE and a non-fatal submassive PE. We will be reviewing the current consensus of venous thrombosis prophylaxis in burn patients and briefly discuss the treatment of PE in this particular patient group.

2. Case report

A 43-year-old morbidly (BMI 54.6 kg/m^2) obese female with no previous history of DVT sustained an 18% TBSA flame burn. The burn was mostly superficial involving parts of the face, left shoulder, bilateral forearms, dorsum of bilateral hands, bilateral anterior legs, the lower back and the buttock area. Standard burn care was initiated and the patient received maintenance intravenous fluids, remained nothing per orifice (NPO) and adequately resuscitated as monitored by her urine output. Her wounds were initially managed non-operatively with topical ointments as the majority of the burn wounds were thought to heal. She also received *Enoxaparin* for venous thrombosis prophylaxis.

During her stay, the partial thickness burns of the buttocks evolved to full thickness burns likely secondary to edematous changes and pressure related to her obesity requiring excision. Unfortunately, for personal reasons (family emergency), the patient requested to be discharged home and her excision and grafting were postponed. During this period, skilled nurses were contracted to perform home dressing changes.

Almost 3 weeks later after the initial injury, the patient returned for excision of her buttock and left lower extremity wounds with autografting. The patient, again, received *Enoxaparin* for DVT prophylaxis but serial compression devices were not placed due to her lower extremity grafts. No immediate peri-operative complications were noted and the patient was transferred post operatively to the burn ward. On post-operative day one, patient complained of respiratory symptoms including shortness of breath, hoarseness, and blood tinged sputum. Given the constellation of symptoms, she underwent bilateral lower extremity duplex which revealed a chronic right posterior tibial vein thrombosis and an acute left popliteal vein thrombus extending to the common femoral vein. A computed tomography angiogram of the chest revealed multiple pulmonary emboli with a large central embolus in the right main pulmonary artery and left lower pulmonary artery extending into the segmental branches (Fig. 1). Right heart strain and left lower lobe pulmonary infarct were noted. A standard dose *heparin* infusion was initiated and an inferior vena cava (IVC) filter was placed the following day. She remained hemodynamically stable and was discharged home the following week on Coumadin anticoagulation therapy.

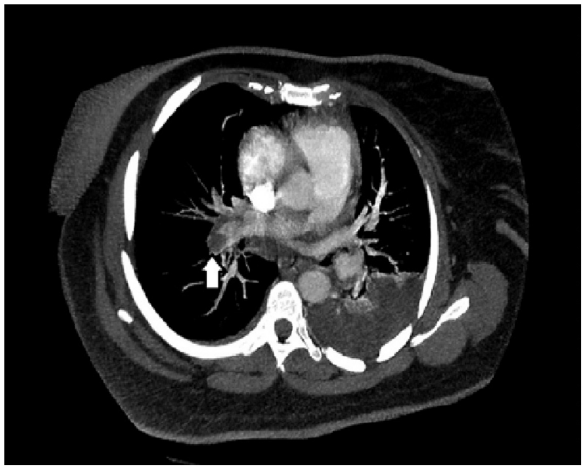

Fig. 1 – A computed tomography angiogram of the chest showing a large central embolus in the right main pulmonary artery and extending into the segmental branches.

3. Discussion

Limited research in the field of burn DVT prophylaxis is noted to date and presently there are no prospective or randomized control trials to study the efficacy of chemical venous thromboembolism (VTE) prophylaxis. Additionally, prospective studies categorizing the risk factors for VTE in this setting have not been published likely secondary to the low incidence of clinical DVT and PE in burn patients although having a physiologic tendency to develop such events. Using the National Burn Repository database in 2010, Pannucci et al. [7] found a 0.61% incidence of VTE in burn patients, while others found an even lower incidence: 0.25% for DVT and 0.05% for PE [8]. This data has led some burn centers to defer the use of chemical prophylaxis in all patients. A survey of 84 burn centers in the United States revealed that 23.9% of these centers neither used chemical nor mechanical DVT prophylaxis [9]. This is in opposition to the guidelines put forth in 2008 by the American College of Chest Physicians who recommend routine chemical VTE prophylaxis in burn patients with specific risk factors [10]. These risk factors are as follows: older age, lower extremity burns, morbid obesity, associated trauma, the use of femoral central venous catheters or prolonged immobilization [10]. Of note, these recommendations did not take into account other important factors such as the nature of the burn, its size and depth, or the presence of a concomitant inhalational injury.

For several years, studies have tried to determine conclusive risk factors for the use of chemical VTE prophylaxis in burn patients. Pannucci et al. utilized the National Burn Repository (NBR) database to retrospectively assess all VTE events in this patient population to formulate a VTE risk score. The score was generated by taking into account both the size of the burn and the presence of inhalational injury [7,11]. The matched case–control retrospective study also assessed acquired inpatient risk factors and concluded that the number of operations, pneumonia and the use of central venous catheters were directly related to the development of VTE [7,11]. Another study established that lower extremity burns and/or infected burns were significant risk factors for DVT formation and thus justified venous duplex for DVT screening in these patients [12]. Additionally, Harrington et al. [13]