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Pulmonary embolism as a complication of fracture of the proximal end of the humerus - literature review

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Abstract

Introduction and purpose: Pulmonary embolism (PE) is one of the leading causes of death worldwide. There are many factors that increase the risk of its occurence. High costs of treatment, non-specific symptoms and high mortality of the disease determine the further search for new methods of treatment and diagnostics. The aim of the study is to determine the incidence of PE in patients after fracture of the proximal end of the humerus.

Materials and methods: A literature search was conducted in the PubMed MEDLINE database of medical publications using the following keywords: pulmonary embolism, deep vein thrombosis, proximal humerus fracture.

Results: Among the found articles, 4 original papers describing the problems of pulmonary embolism after fractures of the proximal end of the humerus were qualified for further analysis. The incidence of PE after this type of fracture is rare and ranges from 1.3% to 5.1%. Moreover, PE was not the cause of death of any patient in the analyzed literature.

Conclusion: The need for further randomized controlled trials on a large group of patients operated with the same technique was demonstrated, including subgroups with and without antithrombotic chemoprophylaxis.

Key words: pulmonary embolism, deep vein thrombosis, proximal humerus fracture.

Introduction:

Venous thromboembolism (VTE) is one of the leading causes of mortality worldwide. The most common manifestation of VTE is pulmonary embolism (PE), which is estimated to occur in 100-200 patients per 100,000 people. [1,3] The disease is characterized by pulmonary embolism (PE) or deep vein thrombosis (DVT). The most common manifestation of VTE is pulmonary embolism, which is estimated to occur in 100-200 patients per 100,000 people [1-3]. Conversely, in the United States of America, more than 2,000,000 people develop deep vein thrombosis (DVT) each year, of which 500,000-600,000 develop symptoms of PE and 100,000 die. [4-6] The cause of PE is the blockage of blood flow by a clot that closes the lumen of the pulmonary arteries. The severity of the disease symptoms and the prognosis depend, amongst other things, on the diameter of the closed vessel and the time elapsed from blocking it to reperfusion. Patients hospitalized for PE at admission most often report dyspnoea, chest pain, cough, haemoptysis, malaise and fainting. Physical examination reveals tachycardia and tachypnea. Due to the nonspecificity of symptoms, PE may be mistaken for an exacerbation of chronic obstructive pulmonary disease (COPD), pneumonia or other cardiovascular conditions. [7,8] Studies have shown that 80% of it is undiagnosed on admission and only postmortem examinations show PE as the actual cause of death. [9] Clinical trials have confirmed many factors that predispose to VTE and have been divided into congenital and acquired. Congenital factors are more likely to cause DVT or PE in young people, while acquired factors are more likely to cause disease in the elderly. [7] An extremely important aspect related to VTE (including PE) is the cost incurred by health care systems related to the diagnostic and therapeutic process. According to analyzes in the

European Union, they can reach up to EUR 8,500,000,000 and hospitalization of one patient may be associated with an expense of USD 30,000. [10,11] Such high costs result from a wide and comprehensive diagnosis, treatment and a large number of involved medical personnel during hospitalization and subsequent rehabilitation of patients. The high risk of PE after orthopedic procedures in the area of the lower limb is known and widely described, while the relationship of PE with injuries of the upper limb is less of interest to scientists and clinicians. [12-18] This issue is important from the point of view of patients and healthcare professionals, as prognostic models assume that in the US the number of upper limb operations is expected to increase by 700% over the next ten years. [19]

The aim of this study was to check the incidence of PE in patients with fracture of the proximal end of the humerus based on the available literature. The authors decided to look at upper limb injuries and immobilization as potential causes of PE.

Materials and method:

An attempt was made to find all publications available in English on the incidence of PE in patients after fractures of the proximal humerus, before June 1, 2021. An electronic search was performed in the PubMed MEDLINE search engine using the following keywords: pulmonary embolism, deep vein thrombosis, proximal humerus fracture.

Results:

21 articles were found after applying keywords. Among them, only original works were selected, describing in a direct way the relationship between fractures of the proximal end of the humerus and the occurrence of PE. After an in-depth analysis of the literature, the authors' assumptions were met by 4 papers, the results of which are presented in the table (Tab. 1).

Tab. 1. The results of the literature analysis

(**VTE** – venous thromboembolism; **DVT** – deep vein thrombosis; **PE** – pulmonary embolism; **ORIF** - open reduction–internal fixation procedures; **RTSA** - reverse total shoulder arthroplasty; **ORW**F - open reduction without fixation; **CRPP** - closed reduction percutaneous pinning; **FWPO** - fixation with plate osteosynthesis **HA** – hemiarthroplasty; **IMN** - intramedullary nail; **PSF** - plate-screw fixation; PR- Protesis; **CM** - combination)

Author	Year	Place of fracture	Amount of patients	PE		Treatment method	Antithrombotic prophylaxis after surgery
				n	%		
Heyer, J. H. et al. [20]	2020	Proximal part of the humerus	92	2	2,2	76 - ORIF, 8 - RTSA, 4- HA, 3 - CRPP, 1 - ORWF	None received chemoprophylaxis (5 patients were taking 81 mg aspirin before the procedure)
Janssen, S. J et al. [21]	2016	134 (45%) proximal fractures, 131 (44%) shaft fractures 30 (10%) distal fractures	295	4	1,3	Treatment: (treatment of proximal fractures only): Proximal lesions were treated by IMN - 57, PR - 46, PSF - 30 CM - 1	No data available
Widmer, B. J et al. [22]	2011	Proximal part of the humerus	50	0	0	40 – FWPO 10 - HA	Two daily doses of aspirin: (2x Aspirin 325mg) for 6 weeks Pneumatic calf compression pumps
Hoxie, S. C. et al.[23]	2007	Proximal part of the humerus	137	7	5,1	102 - ORIF 37 - HA	Thrombo-Embolic Deterrent (TED) hose and sequential compression devices preoperatively and postoperatively. None received chemoprophylaxis

Discussion:

Due to the aging of the population, the frequency of fractures of the proximal end of the humerus is increasing. This causes the need for an in-depth analysis of the occurrence of VTE incidents, including DVT and PE, which are still one of the dominant causes of death. [22] Due to the small number of reports dealing only with fractures of the proximal humerus, and also on small groups of patients, the authors of this publication decided to analyze this problem globally. As a result, it will be possible to make more accurate decisions during hospitalization of patients with fractures of the humerus. [18, 21-23] Only one of the three studies found no PE in any patient. However, the study was conducted on a small group of 50 patients. [22] The authors of the remaining analyzes had larger groups of patients and their results may be binding. In all three studies, the proportion of patients diagnosed with PE was similar, ranging from 1.3 to 5.1%. [18,21,23] No PE deaths were reported in any of the studies. Undoubtedly, an important role, apart from the risk factors that the patients were burdened with, is played by the method of treatment and thromboprophylaxis.

In all four publications, the subgroups of patients treated with different treatments are not proportional, which may affect the results of individual studies. Additionally, most of them are retrospective studies. The role of thromboprophylaxis is recognized and widely used in the immobilization and surgical treatment of the lower limb and pelvis. Its use reduces the likelihood of thromboembolic events in these patients. [12-16] Antithrombotic prophylaxis is associated not only with the reduction of thromboembolic events. It can cause other difficulties, such as bleeding, especially during reoperation, and the formation of local hematomas. [22]

From the point of view of healthcare professionals, it is important not to underestimate non-specific and often subtle symptoms, such as cough, dyspnoea and chest pain, or a decrease in saturation after an injury and surgery. Ignoring them may have fateful consequences for the patient's life and health.

Conclusions:

Diagnostic and therapeutic protocols require continuous improvement in order to reduce the number of underdiagnosed pulmonary embolisms and thus reduce patient mortality. The incidence of pulmonary embolism following fractures of the proximal humerus is relatively low. The incidence of pulmonary embolism following fractures of the proximal humerus is relatively low. It seems appropriate to conduct extensive randomized controlled trials aimed at

checking the occurrence of PE in patients undergoing various treatments, distinguishing between the group of patients using and not using anticoagulant chemoprophylaxis.

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