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A Report on Emergent Pulmonary Embolectomy

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ABSTRACT

Introduction: Pulmonary embolism is one of the leading causes of mortality in patients.The mortality rate of this disease can be significantly reduced with appropriate treatment. Surgical intervention can be highly effective for the treatment of acute massive pulmonary embolism. This article presents a report on the experience of acute pulmonary embolectomy.

Materials and Methods: Demographic data, rate of mortality, as well as surgical and post-operative complications were recorded and analyzed.

Results: In general, 12 patients with mean age of 60±13.39 year were included in the study. None of the patients had significant arrhythmia during the surgery, but 25% suffered from post-operative arrhythmia. Moreover, electrical cardioversion was administered to 8% of the patients, 8% received pharmaceutical interventions, and the rest of the patients sustaining arrhythmia (9%) survived with specific metabolic correction.

The diagnosis of acute pulmonary embolism was correct in 100% of the patients, with 33.3% of the cases suffering from this disease due to recent surgeries. In 41.6% of the patients, blood clots were observed in the pulmonary artery, right atrium, and right ventricle. The three-month follow-up of the patients showed that 83.3% of the cases were alive. There were two cases of mortality, one of which occurred at the end of surgical procedure and the other one happened in the intensive care unit.

The results of independent t-test did not indicate any significant relation between mortality and ejection fraction of the patients (P=0.189). Moreover, there were not any significant differences between the patients' pre- and post-operative laboratory tests (P>0.05). Nonetheless, hemoglobin and hematocrit levels were significantly different pre- and post-operation (P=0.0001).

Conclusion: Our data suggest that acute pulmonary embolism can be treated successfully with favorable outcome and a mortality rate of approximately 16.6%, if evaluation and diagnosis are done as soon as possible in patients who require surgical intervention.

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Introduction

Pulmonary embolism is one of the most critical cardiovascular diseases (1). In this regard, the massive pulmonary embolism is assumed as a life-threatening disorder with significant mortality rate. (2,3,4) A review shows that the age-adjusted death rate for PE was 94 per 1,000,000 individuals. (5) Massive pulmonary embolism is generally characterized by a 50% or greater obstruction in the pulmonary artery or a blockage of two or more lobar arteries (6). The mortality

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rate in these patients is 31-38% in the absence of clinical shock (7) and 70% in the presence of shock. (8) Patients usually die as a result of right ventricular failure and collapse of the circulatory system, which often occurs hours after admission. About 65% of deaths occur in the first hour and 92.9% in two and a half hours of admission. (9)

Pulmonary embolectomy is one of the most effective treatments of acute massive pulmonary embolism, and considering the paucity of literature on this procedure, the current study attempts to describe the treatment experience of 12 cases of acute pulmonary embolectomy.

Materials and Methods

In this descriptive study, from the patients presenting to Ghaem hospital due to acute pulmonary embolism, 12 patients were referred to one of our cardiac surgen for surgical intervention from November 2012-2014. Following the routine monitoring and intravenous access, arterial line was established. Then, after pre-oxygenation, prep, and drape, anesthetic induction was performed using etomidate and fentanil .The patients received cisatracurium as muscle relaxant. Three patients had severe hypotension after induction, but all of them responded to fluid and inotrope administration. For all the patients, standard median sternotomy was carried out, and after heparinization aorta, superior vena cava, and inferior vena cava were cannulated, and then cardio pulmonary bypass (CPB) was initiated. Pulmonary artery was opened and clots were removed.

The average duration of the surgery was 91-190 minutes with a mean on-pump and cross-clamping time of 72 and 50 minutes, respectively. In more than 58% of the patients, weaning of CPB pump was performed without any adverse events; however, in the rest of the cases, it was accompanied with high doses of inotropic infusion and some other problems.

The three-month mortality rate, duration of hospital and intensive care unit stay, rate of co-morbidities, and underlying hemodynamic parameters of patients were recorded from medical records of the patients. Thereafter, descriptive analysis, paired t-test and independent t-test were performed to assess variations in laboratory parameters pre- and post-operation. It should be noted that all the patients were under the supervision of one cardiac surgeon throughout the treatment period.

Results

In general, 12 (six females and six males) patients, with mean age of 60±13.39 year were included in the study. The demographics and clinical status of the patients with emergent pulmonary embolectomy are demonstrated in Table 1.

In more than 83% of the patients, blood transfusion was carried out in the operating room, with 66% of the patients requiring post-operative blood transfusion. None of the patients had significant arrhythmia during the surgery, but 25% suffered from post-operative arrhythmia. Moreover, electrical cardioversion was administered to 8% of the patients, 8% received pharmaceutical interventions and the rest of the patients sustaining arrhythmia (9%) survived with specific metabolic correction. In addition, drainage occurred in 16.6% (n=2) of the patients. No gastro-intestinal symptoms were reported.

The diagnosis of acute pulmonary embolism was correct in 100% of the patients, with 33.3% of the cases suffering from this disease due to recent surgeries. In 41.6% of the patients, blood

Table 1. The demographics and clinical status of the patients with emergent pulmonary embolectomy

Patient	Age(y)	Gender	Recent surgery	Comorbidities
1	68	F	No	RF
2	75	M	No	DM(diabete mellitus)-HTN(Hypertention)
3	73	F	Yes	HTN
4	57	M	No	Addiction
5	50	F	No	None
6	40	F	No	None
7	74	F	No	HTN
8	65	M	No	None
9	33	M	Yes	None
10	64	M	Yes	None
11	65	M	Yes	Addiction
12	56	F	No	RF(Renal Failure)

Table 2. Results of paired- t-test about comparing patients' lab tests before and after surgery

Results of lab test	PLT	PT	PTT	NA	K	BS	BUN	CR	PH	PACO2	HCO3	BE
p-value	0.265	0.101	0.377	0.562	0.367	0.324	0.28	1	0.054	0.592	0.459	0.183

clots were observed in the pulmonary artery, right atrium, and right ventricle. The three-month follow-up of the patients showed that 83.3% of the cases were alive. There were two cases of mortality, one of which occurred at the end of surgical procedure due to right ventricle failure, and the other one happened in the intensive care unit on the first post-operative day due to low cardiac output state.

The results of independent t-test did not indicate any significant relation between mortality and ejection fraction of the patients (P=0.189). Moreover, there were not significant differences between the patients' pre- and post-operative laboratory tests (PLT, PT, PTT, NA, K, BS, BUN, CR, PH, $PACO_2$, PAO_2, HCO_3, BE, LACTAT, and GLU) (P>0.05) as show in table 2. Nonetheless, hemoglobin and hematocrit levels were significantly different pre- and post-operation (P=0.0001).

Discussion

A literature review revealed that most studies on pulmonary embolism in Iran had been concentrated on detecting risk factors and their preferred diagnostic methods, whereas the present study presents a clinical experience of surgical treatment of these patients.

In this study, recent surgeries were one of the known cause of acute pulmonary embolism in patients, which is consistent with the findings of Qasemieh et al (10) and other study (11,12).

The study of Anderson in 2003 indicated that thromboembolism was primarily associated with hypertension (50%), a finding which was 25% in the patients in our study. (13)

It should be noted that a mortality rate of 8 to 9% has been reported for pulmonary embolism in different studies (10). Despite the recent advances, the mortality rate of patients with massive pulmonary emboli that underwent surgical embolectomy is still between 30- 50%. In the United States, the reported mortality rate in pulmonary embolism patients was 27.2% (14), whereas in our report, there were only two cases of deaths (16.6%), with the rest of patients surviving in a three-month follow-up.

Some studies have shown that the mortality rate of acute pulmonary embolism can be reduced as much as 6 to 12% in patients with preoperative stable hemodynamic status (14, 15).

Conclusion

Given the favorable outcomes and low mortality rates of surgical intervention for pulmonary embolism, it is recommended as the treatment of choice.

Conflict of Interest

The authors declare no conflict of interest.

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