

Surgical Embolectomy In Massive Acute Pulmonary Embolism: Our Experience

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Abstract

Background and Aims: Pulmonary embolism (PE) is the leading cause of hospital deaths among the non-surgical patients. Our aim was to evaluate the efficacy of surgical embolectomy in massive acute PE.

Methods: It was a single centre, prospective study conducted between January 2007 and August 2013 in Specialized Cardiovascular Surgical Hospital of Nizhny Nizhny Novgorod State Medical Academy Nizhny Novgorod, Russia.

One hundred and seventy five patients were diagnosed as PE. Only 77 patients were diagnosed as massive pulmonary embolism and were included in this study. Surgical embolectomy was performed without cardiopulmonary bypass through thoracotomy approach only in the involved pulmonary artery. Right atriotomy and evacuation of embolus was done, in cases of right ventricle thrombus.

Results: Seventy-seven patients with acute massive PE underwent surgical embolectomy. Four (5.1%) patients died before discharge. Mean time of ICU stay was 70.1 ± 11.0 hours. During six months of follow up after the embolotomy. Eleven (14%) patients had deep vein thrombosis, two had sub-massive PE. During 6 months of follow up 62 patients (81%) had no further episode of venous thromboembolism.

Conclusions: Our study showed surgical embolectomy can be done with good clinical outcome with acceptable mortality rate.

Key words: pulmonary embolism; surgical embolectomy.

Introduction

Problem of pulmonary embolism (PE) has become significant to specialists of different profile due to its prevalence and severe fatal complications. PE is the leading reason of mortality in surgical hospitals.^{1,2,3} Approximately 25% of patients with massive PE die within the first year of diagnosis.^{4,5}

Two most important steps in the management of “massive” PE are restoration of blood flow to the lungs and the relief of right ventricular strain and failure. Inadequate restoration of pulmonary blood flow leads to right ventricular dysfunction and chronic post embolic pulmonary hypertension (CPEPH), which occurs in 0.5-5% patients after thrombolytic therapy.^{6,7,8}

Pulmonary embolectomy is a mode of treatment in acute massive pulmonary embolism. The aim of our study was to evaluate the efficacy of surgical embolectomy in acute PE.

Methods

This was a single center, prospective study conducted in Specialized Cardiovascular Surgical Hospital, Nizhny

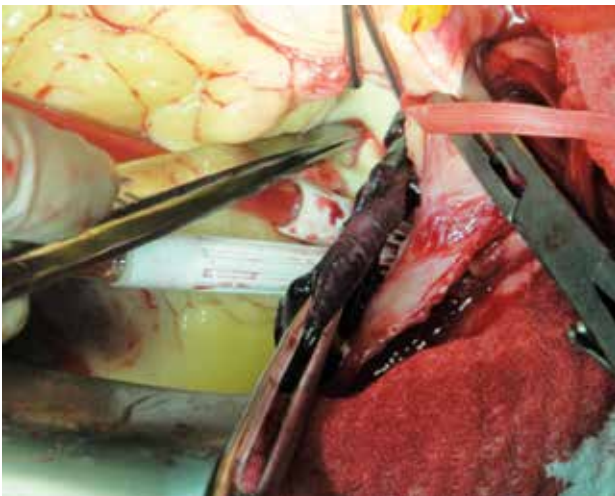
Novgorod, Russia. One hundred seventy five patients were diagnosed as PE. Among them 77 were diagnosed as massive PE and were included in this study. Massive PE was defined as PE with sustained hypotension (systolic blood pressure <90 mmHg for at least 15 minutes or requiring inotropic support). Institutional approval by the Ethics Committee of the Specialized Cardiovascular Surgical Hospital was taken. Informed consent was taken with the patient party before the surgical pulmonary embolectomy. Investigations including clinical and laboratory tests such as, ultrasonography, duplex/triplex ultrasonic scanning of veins, CT scan and/or pulmonary angiography were performed in all patients for the localization of the embolus.

Thoracotomy through 4th – 5th intercostal space was performed for unilateral pulmonary artery embolism without cardiopulmonary bypass. Sternotomy with cardiopulmonary bypass was done in the cases of bilateral pulmonary embolism. Right atriotomy and evacuation of embolus was done for RV thrombus. Embolectomy from the pulmonary artery was performed by direct method using Fogarty catheter (2F-5F size) and with active aspiration. Selective retrograde pulmonary perfusion via

pulmonary veins was done in cases of peripheral pulmonary embolus. All the variables were entered into the Statistical Package for Social Sciences software, version 18 (SPSS Inc) for data analysis. Descriptive statistics were computed and presented as means and standard deviations for continuous variables categorical variables were reported in percentage. P values of less than 0.05 were considered statistically significant.

Results

Surgical embolectomy was performed in 77 patients. Mean age was 62.3 ± 9.2 years. The duration of intervention from the onset of symptom was 5.3 ± 1.7 days. All patients had signs of pulmonary hypertension and right ventricular overload with dilatation and severe tricuspid regurgitation. Pulmonary artery systolic pressure was 49.7 ± 7.3 mm Hg.



Pulmonary embolectomy was performed through a thoracotomy without cardiopulmonary bypass for unilateral PE in 12 patients. Pulmonary embolectomy through sternotomy with cardiopulmonary bypass for bilateral PE was done in 65 patients. Mean cardiopulmonary bypass time was 52.3 ± 8.7 min and mean aortic cross clamp time was 29.4 ± 7.8 min. Selective retrograde pulmonary perfusion (via pulmonary veins) was done in 6 cases.

Mean ICU stay was 70.1 ± 11.0 hours. Early postoperative complications included reperfusion syndrome in 2 patients (2.6%), acute respiratory failure required prolonged ventilation in 4 patients (5.19%). Hypoxic damage of central nervous system was diagnosed in 28 patients (37.5%), acute renal failure in 10 patients (13.3%) and multiorgan failure syndrome in 23 patients (30.0%).

After embolectomy 4 patients underwent IVC filters implantation due to contraindication to anticoagulant therapy.

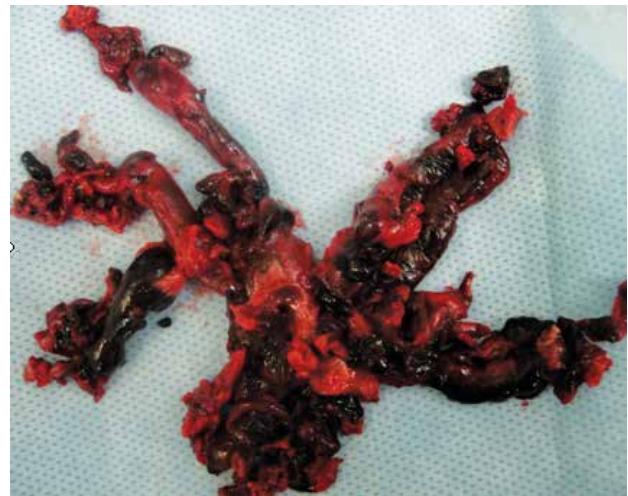


Fig 1: Pulmonary embolectomy with cardiopulmonary bypass: the moment of the operation (a) and extracted emboli (b)

Unilateral PE was diagnosed in 12 patients. Thirteen patients were referred to us following ineffective thrombolysis therapy. Contraindications for thrombolytic therapy were present in 22 patients. Embolus in the right ventricle and in pulmonary artery was present in 5 patients. Three patients underwent embolectomy after cardio-pulmonary resuscitation.

In-hospital mortality rate was 4 (5.19%). Among the patients who expired 3 patients were more than 75 years old with the severe right ventricular dysfunction and multiorgan failure, one patient developed recurrent PE and acute gastric bleeding. Among the 73 (94.8%) survived patient pulmonary artery pressure decreased from 49.7 ± 7.3 mm Hg to 23.8 ± 7.0 mm Hg before discharge. All the patients were treated with anticoagulants.

Table 1 Demographic features

No.	Parameters	Mean±σ	%
1.	Mean age	62.3±9.2 years	
2.	Male	30	38.96
3.	Female	47	61.04
4.	Pulmonary artery involvement		
	Unilateral	15	19.48
	Bilateral	62	80.52
5.	RV thrombus	5	6.5
6.	Time of presentation	5.3±1.7 days	
7.	Total ICU stay	70.1±11.0 hours	
8.	PA pressure		
	Pre-operative	49.7±7.3 mm Hg	
	Post-operative	23.8±7.0 mm Hg	
9.	Aortic cross-clamp time	29.4±7.8 min	
10.	Total bypass time	52.3±8.7 min	
11.	In hospital mortality	4	5.16

Discussion

The first successful surgical pulmonary embolectomy was performed in 1924, several decades before the introduction of medical treatment for PE. Multidisciplinary teams enjoying the early and active involvement of cardiac surgeons have recently reintroduced the concept of surgical embolectomy for high-risk PE, and also for selected patients with intermediate-high-risk PE, particularly if thrombolysis is contraindicated or has failed. Surgical embolectomy has also been successfully performed in patients with right heart thrombi straddling the interatrial septum through a patent foramen ovale.^{9,10}

The site of surgical care does not appear to have a significant effect on operative outcomes, and thus patients need not be transferred to a specialized cardiothoracic centre if on-site embolectomy using extracorporeal circulation is possible.¹¹ In our study 12 patients were operated in General Surgical Hospital due to unilateral involvement of pulmonary artery and due to lack of cardiopulmonary bypass, 65 patients were transferred to Specialized Cardiac Surgical Hospital for operative management.

Perioperative mortality rates of 6% or less have been reported with a rapid multidisciplinary approach and individualized indications for embolectomy before haemodynamic collapse.^{12,13,14,15} Our perioperative mortality of 5.1% is comparable to international standard.

In our study 37 patients, who primarily presented in our centre due to acute massive PE were directly treated with surgical embolectomy. Though surgical embolectomy is not the Class I indication in international guidelines.

The limitations of this study are small number of cohort group, lack of control group and absence of long-term study.

Conclusion

Surgical embolectomy is preferred treatment option when thrombolytic therapy is contraindicated or ineffective. Our study showed surgical embolectomy can be done with good clinical outcome with acceptable mortality rate.

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