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Pulmonary endarterectomy combined with cardiac surgery: A 7-year retrospective analysis



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ABSTRACT

Background: Pulmonary artery endarterectomy (PEA) is established as a successful method for the treatment of chronic thromboembolic pulmonary hypertension (CTEPH). A significant fraction of patients indicated for the pulmonary endarterectomy has other severe comorbidities that generally increase the risk of cardiac surgery. The aim of our study is to analyze the process of indications and therapeutic procedures at our Cardio-Centre, as well as comparing hemodynamic parameters and long-term results in order to determine the continuation of the treatment. **Method:** From September 2004 to August 2012, 192 patients underwent PEA for CTEPH. We carried out a retrospective analysis of patients' data. Patients were divided into two groups: A and B. The group A included patients with PEA only (128 patients), group B consisted of patients with PEA and other cardiac procedure (64 patients, i.e. 33.3% of which 72 cardiac procedures were carried out). Group B was further subdivided into group B1-patients with PEA + CABG, which included 25 patients, and group B2-PEA + suture of PFO, which consisted of 29 patients for more detailed analysis.

Results: Five-year survival rate is 83% in group A, 79.3% in group B, and 63.1% in group B1. Group B1 is statistically significantly different from group A ($P = 0.031$). The cumulative survival rate is comparable for groups A and B2. Cumulative survival rate is very good with annual survival in group A – 94%, group B2 – 90% and group B1 – 82.6%.

Conclusion: Results of combined interventions are comparable with isolated pulmonary endarterectomy. We did not find any differences in hemodynamic effects. All patients indicated for the PEA should be screened for the most common comorbidities regardless of their age. We recommend implementation CryoMAZE for the treatment of atrial fibrillation or atrial flutter.

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Introduction

Pulmonary artery endarterectomy (PEA) is established as a successful method for the treatment of chronic thromboembolic pulmonary hypertension (CTEPH). In a selected group of patients, it can lead to the cure of this disease, which if left untreated has an otherwise very poor prognosis as showed by a number of studies. A significant fraction of patients indicated for the pulmonary endarterectomy have other severe comorbidities that generally increase the risk of cardiac surgery. As a standard, the risk of cardiac surgery is calculated using scoring systems such as the EuroSCORE II, STS score [1,2]. In order to estimate the risk of PEA and PEA combined with other cardiac procedures, we cannot use current scoring systems as they do not take into account the risk factors for CTEPH and PEA. The main risk factors for these procedures are the severity of PH, heart failure, and the significance of deterioration of other organs functions [3]. Nearly 30% of our patients have renal insufficiency, 29% ischemic heart disease, 10% atrial flutter or fibrillation, 12% diabetes mellitus and 5% stroke. Patients with CTEPH combined with cardiac disease account for different portions in various published reports. In the latest report published by the UCSD, PEA combined with CABG, suture of the foramen ovale and valve surgeries is similar to our group of patients, accounting for 30% [3]. Our group of patients contains in addition procedures for atrial fibrillation; all these procedures in our group were performed in 33.3% of patients [4]. Data analysis by the UCSD shows excellent results and comparable mortality in combined procedures as well as in PEA only. However, CABG surgery combined with lung transplantation or resections has significantly worse results [5].

In our report, we will concentrate mainly on the cardiac diseases that can be solved simultaneously with pulmonary hypertension. They are predominantly coronary artery disease, valvular defects, atrial septal defects, and atrial fibrillation. The aim of our study is to analyze the process of indications and therapeutic procedures at our Cardio-Centre, as well as comparing hemodynamic parameters and long-term results in order to determine the continuation of the treatment.

Materials and methods

From September 2004 to August 2012, 192 patients underwent PEA for CTEPH at 2nd Surgical Clinic of Cardiovascular Surgery, General Faculty Hospital and 1st Faculty of Medicine after a complex diagnostic examination at the 2nd Clinic of Internal Medicine – Cardiology and Angiology, General University Hospital and 1st Faculty of Medicine. All operations were performed by one surgeon. Post-operative care was carried out by doctors of both clinics with the addition of The Clinic of Anesthesia, Resuscitation and Intensive Care (KARIM), General Faculty Hospital and 1st Faculty of Medicine.

Indications for pulmonary endarterectomy included:

1. Symptomatic patients usually NYHA III or IV.
2. PVR greater than 320 dyn (4 Wj).

3. Pulmonary lesion manifested on angiography or CT-AG.
4. Effective anticoagulation for at least 3 weeks.

Patients where combined etiology of PH was not dominant to the CTEPH were contraindicated. Furthermore, we contraindicated patients with severe disease that significantly limited patient's survival (malignancy) and patients with irreversible multi-organ dysfunction. We did not indicated any uncooperative patients and patients in which a psychiatrist or neurologist did not recommend the procedure.

We carried out a retrospective analysis of patient data. Patients were divided into two groups: A and B. These groups of patients were mutually analyzed. The group A included patients with PEA only (128 patients), group B consisted of patients with PEA and other cardiac procedure (64 patients, i.e. 33.3% of which 72 cardiac procedures were carried out). Table 1 shows the number of individual procedures in group B.

For detailed analysis of this group, we have dedicated group B1-patients with PEA + CABG, which included 25 patients, group B2-PEA + suture of PFO, which consisted of 29 patients. The remaining 10 patients with combined procedure were not subjected to a separate analysis due to its statistical insignificance. The overall mortality was 5.2%, 3.9% in group A and 7.8% in group B.

Statistical analysis

All continuous variables were tested for normality using Kolmogorov–Smirnov test. All normal variables were expressed as mean \pm standard error of mean (SEM) and the differences between groups were assessed by the one-way ANOVA (for 3 groups) or independent samples t-test (for 2 groups). Analogically, all non-normal variables were represented by median (Min – Max) and the between-group comparisons were performed using Kruskal–Wallis test or Mann–Whitney test. Chi-square test was used for comparisons of frequencies between groups in the case of categorical variables. The variables measured pre- and post-operation were analyzed using one-way ANCOVA with repeated measures. Survival distribution was estimated by the Kaplan–Meier method. Significant differences in the probability of surviving between the groups were evaluated by the Gehan–Wilcoxon test. Cox proportional hazard models were used to identify risk factors for survival. All tests were performed in Statistica 12 (StatSoft, Inc, Tulsa, OK, USA).

Operating procedures

All operations were performed through median sternotomy. After cannulation, extracorporeal circulation was started.

Table 1 – Overview of cardiac procedures carried out simultaneously with the PEA.

Suture DSS (PFO)	29
Coronary artery bypass graft	25
MAZE	13
AVR	2
MVP	1
Pacemaker	2

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