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PULMONARY THROMBO-ENDARTERECTOMY: A STUDY OF 39 CASES OPERATED AT OUR INSTITUTION

Surgery

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ABSTRACT

Pulmonary thrombo-endarterectomy (PTE) is the treatment of choice to relieve pulmonary artery obstruction in patients with chronic thrombo-embolic pulmonary hypertension (CTEPH). It is a complex surgical procedure with a simple principle: removal of obstructive thrombo-embolic material from the pulmonary arteries in order to reduce pulmonary vascular resistance, relieve pulmonary hypertension (PH) and alleviate right ventricular dysfunction. Operability assessment is not always easy, being largely subjective and based on experience. The most common reason for inoperability is distal vasculopathy accounting for a high proportion of the vascular resistance. Surgery requires cardiopulmonary bypass with or without arresting the heart. Complications include reperfusion lung injury and persistent PH. However, with careful patient selection, surgical technique and post-operative management, PTE is a highly effective treatment with mortality rates <5% at experienced centres. Patients who are unsuitable for surgery may be candidates for medical therapy.

KEYWORDS

INTRODUCTION

Chronic thromboembolic obstruction of the major pulmonary arteries is a potential long term consequence of acute pulmonary embolism[1]. The actual prevalence of chronic thromboembolic pulmonary hypertension (CTEPH) is almost certainly underestimated[2]. It is the only type of pulmonary hypertension that can be successfully treated with surgery—that is, pulmonary thromboendarterectomy (PTE)—in selected patients.

The PTE operation, as first performed at the University of California, San Diego[3]. PTE can be successfully performed in selected centres with a multidisciplinary approach involving the specialities of surgery, pulmonary medicine, critical care, cardiology, anaesthesiology, and radiology[4,5]. PTE promptly reduces pulmonary hypertension and restores cardiac output, producing an excellent symptomatic improvement in almost all patients, even those who were very compromised[6].

The selection criteria for surgery are currently well standardised. Briefly, the selection is based on a combination of clinical (only patients in New York Heart Association (NYHA) functional class III or IV), anatomical (lesions at the level of the main, lobar and segmental pulmonary branches), and haemodynamic (moderate to severe pulmonary hypertension or pulmonary vascular resistance (PVR) > 300 dynes/sec/cm^{-5}) characteristics. PTE is postponed for patients with a fair clinical status (NYHA class II) and an acceptable haemodynamic profile (mild pulmonary hypertension or PVR < 300 dynes/sec/cm^{-5} caused by a still elevated cardiac output), while patients with exclusively distal lesions (distal segmental or subsegmental pulmonary branches) are excluded and are candidates for double lung transplantation.[7]

The location and extent of the proximal thromboembolic obstruction are the most critical determinants of operability. In terms of the extent of obstruction, the anatomical and haemodynamic findings must be interpreted in concert. This determination is crucial: if the haemodynamic impairment derives from mainly surgically inaccessible disease or from the resistance conferred by a secondary, small vessel arteriopathy, then pulmonary hypertension will persist postoperatively and may have adverse short term and long term effects[3].

In our institute, we operated 39 patients of chronic pulmonary thrombo-embolism after the criteria for operability was met. All patients were symptomatic with NYHA Class III dyspnoea and had radiological evidence of thrombus in right and left pulmonary arteries extending into lobar branches upto proximal segmental branches. 2D Echocardiography revealed severe tricuspid regurgitation, with right ventricular dysfunction, moderate to severe pulmonary hypertension.

PRE – OP Findings -

Baseline Pre-operative clinical characterstics	No.
Age	22 – 63
Male/ Female	31/ 8
Functional Class NYHA – II III IV	14 22 3
DVT	7
PH – Mild Moderate Severe	6 11 22
TR – Mild Moderate Severe	6 17 16

PULMONARY ARTERY BRANCH INVOLVEMENT

Branch Involved	Total	Partial
MPA	0	4
RPA	11	12
LPA	9	14
Lobar	12	5
Segmental	8	3
Sub-segmental	2	4

7 patients had concommitant lower limb Deep Vein Thrombosis, as confirmed by lower limb doppler studies. 37 out of 39 patients were operated on cardio-pulmonary bypass without arresting the heart. Two patient also had an associated Right ventricular mass, which was operated on arrested heart. Plane of dissection was identified and established. Thrombo-endarterectomy done and content was removed from main pulmonary branch, till the segmental branches. Postoperatively patients were started on anti-platelets, anticoagulants, lipid lowering agents and sildenafil, which was continued till 3-6months depending on the condition of the patients.

Careful postoperative management is essential to the success of the operation. Besides the problems encountered in the postoperative period that are shared by patients undergoing other forms of cardiac surgery, the postoperative care of patients undergoing PTE is further complicated by a dramatic redistribution of pulmonary blood flow accompanied by an equally dramatic reduction in right ventricular afterload. The severity of reperfusion pulmonary oedema is highly variable, ranging from a mild form resulting in postoperative hypoxaemia in most affected patients to profound alveolar haemorrhage that may be fatal. In our experience no patient died of reperfusion pulmonary oedema. Careful management of ventilation

and fluid balance will minimise alveolar capillary leak.

POST OP -

Post – op clinical characterstics	No.
Functional Class NYHA – II	30
III	6
IV	1
Mortality	2
PH – Mild	26
Moderate	11
Severe	0
TR – Mild	27
Moderate	10
Severe	0

RESULTS :

Out of 39 patients, 8 were female and 31 were male. CTEPH can involve patients of all age groups most of them being in 5th decade. Age of patients ranging from 22 to 63years. Mean age being 44.38. Most common symptom being dyspnoea on exertion. Most of the patients pre-operatively had severe Pulmonary hypertension along with moderate to severe Tricuspid Regurgitation. 36 out of 39 patients had an uneventful postoperative course. One patient had pulmonary haemorrhage which settled on conservative management. One patient had pulmonary edema and patient succumbed to it and one patient developed recurrent thrombus and succumbed due to acute RV failure. 2D Echocardiography done in the postoperative period showed reduction in pulmonary hypertension. Improved right ventricular function. Reduction in tricuspid regurgitation status. CT Pulmonary angiography revealed clearance of main, lobar and segmental pulmonary arteries of the thrombus, while few remnants in some subsegmental branches. One patient also underwent IVC filter placement. Symptomatically it was found that patient had dramatic improvement[8].

Patients were discharged and followed up after 3months. 2D echocardiography revealed decrease in PH, good RV function, mild to moderate tricuspid regurgitation. CT pulmonary angiography showed residual thrombus in only few subsegmental branches.

SUMMARY :

The success of PTE has now been confirmed, particularly by the recent results on long term effects, and it remains the primary treatment for CTEPH[9, 10]. Although PTE is so successful that alternative approaches to CTEPH may seem heretical, other interventional strategies such as balloon pulmonary angioplasty should be implemented for selected patients—that is, those with surgically inaccessible disease or co-morbid illness.

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