

Investigating the success rate and complications of hybrid revascularization surgical technique in treating multi-level critical limb ischemia

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Abstract

Peripheral artery disease is a disease that leads to obstruction of blood flow in arteries, especially coronary arteries. Hybrid Revascularization Surgery Technique is one of the methods in the treatment of critical limb ischemia in people with peripheral arterial disease. In a case series study of patients who had peripheral vascular occlusion from 2016 to 2021 and referred to Razi Medical Center in Rasht and were treated with a hybrid procedure by CFA arterial endarterectomy and simultaneous Inflow & Outflow angioplasty, a checklist included Age, sex, local complications, exacerbation of ischemia, inflow artery involvement, outflow artery involvement, blood flow success rate, symptom success rate, and wound healing rate were collected. Sixteen patients were studied during this period, of which 13 were male and 3 were female. Their mean age was 67.75 ± 10.55 years and the youngest person was 47 years old and the oldest person was 86 years old. 2 patients had only Inflow involvement, 8 patients had only Outflow involvement and 6 patients had both Inflow and Outflow involvement. Of the 16 patients studied, 1 patient did not present after surgery and the information on the success or failure of their surgery is not known, but of the other 15 patients, 13 patients (87%) had their wounds healed and their surgery was successful. In our study, the majority of patients (13 out of 15 patients) had technically successful vascular surgery, which is a significant success in terms of mortality and morbidity compared to open surgery according to other studies. In aortic and lower extremity stenosis, with this procedure, the mortality and morbidity rates are low and the success rate is high. It is also an acceptable method due to shortening the duration of surgery and the time of hospitalization of the patient and not opening the abdomen.

Keywords: Peripheral artery disease, Critical Limb Ischemia, Hybrid Vascularization

Introduction

Peripheral artery disease (PAD) is considered a chronic atherosclerotic occlusive disease of limbs and is a major global health problem which is secondary to global population aging with increased incidence of risk factors such as diabetes, smoking, hypertension, and dyslipidemia [1-6].

PAD causes mortality, morbidity, and increased public healthcare costs in countries. Epidemiological investigations have evaluated that more than 200 million people are affected by PAD worldwide, with about 20% of it occurring in the recent decade [7-10].

Development of PAD is observed in both wealthy as well as low- and middle-income countries (LMICs); it indicates the largest growth rate in LMICs plus southeast Asia and Pacific margin [10-13].

Gender- and age-associated PAD prevalence is slightly different across the world. In wealthy countries, men and women are afflicted by PAD equally, and in less than 5% it occurs in ages younger than 50 years which grows to about 20% in individuals older than 80 years. In LMICs, it is observed more in women than in men, whose reason is unclear [14-17].

In a group of patients, PAD develops as multilevel atherosclerotic disease in lower limb arteries, which is

often associated with numerous medical comorbidities, making these patients high risk for open surgical procedures [17-21].

Hybrid surgical technique has been introduced as an alternative in the treatment of this group of patients. It enjoys a combination of the benefits of open surgery and endovascular surgery as less invasive, providing a safe and efficient solution in the treatment of these patients [21-25].

With development and usage of static imaging systems in operation for vascular surgery as well as the development of endovascular skills of vascular surgeons, patients benefit from this type of all-in-one hybrid procedures, part of which is in the form of open vascular surgery and another as catheter-based intervention. Also, the cost saving effect differs up to 50% in comparison with staged techniques at different locations [26-30].

Based on studies [28, 31-35], the current status of the therapeutic evidence for hybrid technique in PAD treatment is still limited and further studies are required in order to achieve real outcomes. Given the importance of this issue, the present study investigates the efficiency of hybrid revascularization technique in treating patients with peripheral artery disease (PAD).

Materials and Methods

In a case series studies, after acquiring permission from the ethics committee of research at the university, the information of patients suffering from peripheral artery occlusion from 2016 to 2021 was taken who had referred to Razi educational healthcare center in Rasht for whom hybrid procedure had been performed as CFA endarterectomy plus inflow and outflow angioplasty concurrently. The patients' information was extracted from their file at hospital, and collected in a checklist capturing age, gender, local complications (hematoma, seroma, and pseudo-aneurysm), aggravation of ischemia, inflow artery involvement, outflow artery involvement, success rate in perfusion, success rate in improving the symptoms, and success rate in wound healing. Data collected data were then inputted into SPSS 22.

Ethical considerations

Receiving introduction letter from the relevant authorities

Observing ethics in data collection, analysis, presentation of the report, as well as presentation of results based on reality

Anonymous checklists with no address or phone number, with information being confidential.

Conducting this research had no costs for the authorities

The method of presenting the report or providing the research results guarantees respecting the material and spiritual rights of the relevant entities (subjects, researcher, research, and related organization)

All individuals' information remained confidential and the results were reported in general. Further, the ethics code of the thesis has been IR.GUMS.REC.1400.270.

Results

In this section, we will analyze the data based on the specific goals of the study. The information collected for this study is about the research of hybrid (coronary) revascularization (HCR) surgery technique in treating critical limb ischemia (CLI) and multi-level ischemia in patients who visited Razi University Hospital of Rasht together with the success rate and side effects (Complication) from 1395 to 1400.

Out of 16 patients studied, 2 (12.5%) patients in 1395, 1 (6.25%) patient in 1396, 6 (37.5%) patients in 1397, 6 (37.5%) patients in 1399, and 1 (6.25%) patient in 1400 visited Razi University Hospital in Rasht and went under hybrid revascularization surgery.

Out of 16 patients studied, 13 (81.2%) patients were male, and 3 (18.8%) patients were female. Also, their average age was 67.75 ± 10.55 years, the youngest patient was 47 years old, and the oldest patient was 86 years old.

Out of 16 patients studied, 5 (31%) patients smoked only cigarettes, 2 (12%) patients smoked only opium, 2 (13%) patients smoked both cigarettes and opium, and 7 (44%) patients smoked neither cigarettes nor opium.

In the studied patients, 13 (81.25%) patients had early complaints about left peripheral artery disease (PAD), and 3 (18.75%) patients had early complaints about right PAD. Two (12%) patients had only inflow PAD, 7 (44%) patients had only Outflow PAD, and 7 (44%) patients had both Inflow and Outflow PAD.

Out of 16 patients, 3 (18.75%) patients had right common femoral artery (CFA) endarterectomy, and 13 (81.25%) patients had left CFA endarterectomy. One

Table 1: Frequency distribution of various types of angioplasty in the studied patients

Various types of angioplasty patients	number
EIA and PFA angioplasty	1 patient
SFA angioplasty	2 patients
SFA angioplasty and femoral popliteal	6 patients
SFA angioplasty, femoral popliteal, and tibial arteries	6 patients

(6.25%) patient with CFA endarterectomy went under stenting procedure, 9 (56.25%) patients with CFA endarterectomy went under angioplasty, and 6 (37.5%) patients with CFA endarterectomy had both angioplasty and stenting.

Table 1 indicated the frequency of various types of angioplasty in the studied patients. Also, 7 (43.75%) patients had stenting procedure, the types of which are listed in Table 2. Out of 16 patients studied, 1 (6.25%) patient did not visit after the surgery, and there is no information about the success or failure of his surgery. But out of the other 15 patients, 13 (87%) patients had their wounds healed, and their surgery was successful, and 2 (13%) patients did not have a successful surgery, in a way that both of them visited the hospital with a complaint about lower limb rest pain and went under left CFA artery endarterectomy and angioplasty procedure. Both of them went under open surgery again at the next visit.

Discussion

We reviewed the information on the success rate and side effects of the hybrid revascularization surgery method in treating multi-level critical ischemia of the lower limb of patients who visited Razi University Hospital of Rasht from 2016 to 2021.

The hybrid surgery method has been presented as an alternative in treating this type of patient, which has a combination of the benefits of open surgery and Less-invasive endovascular surgery and represents a safe and effective solution in the treatment of these patients. In this review, the average age of the studied patients was 67.75 ± 10.55 years, and the youngest

Table 2: Frequency distribution of stenting types of patients

Various types of stenting patients	Number
left CIA and EIA Stenting	2 patients
Left CIA stenting	4 patients
Right EIA stenting	1 patient

patient was 47 years old, and the oldest patient was 86 years old. And 75% of patients had at least one underlying condition. Previous studies have indicated the patency of a low-mortality hybrid technique in treating critical limb ischemia. In the present study, comorbidity factors including a history of ischemic heart disorder, diabetes, and high blood pressure (hypertension), as well as arterial outflow or inflow disease in the targeted limb was identified and evaluated. All available variables were evaluated and identified before the hybrid method procedure, providing us the opportunity to predict the side effects, prevention method, and the next treatment. The validity of the hybrid revascularization surgery method in treating multi-level critical limb ischemia has been validated in other studies [20, 34, 35].

By creating and utilizing modern fixed imaging systems in the vascular surgery room and also developing the endovascular skills of vascular surgeons, patients benefit from this type of All-In-One hybrid procedure, part of which is done in open vascular surgery and the other part is done in a catheter-based intervention procedure and also has a cost-saving effect of up to 50 percent compared to the staged techniques in various locations.

Matsagkas et al. studied the short-term and medium-term results of the hybrid technique in treating patients that suffer from critical limb ischemia (CLI) and explained that the hybrid technique can be used to treat critical limb ischemia with low post-operative mortality and suitable patency [34].

The mentioned findings are consistent with the results of our study.

In the present study, it was indicated that only two out of fifteen patients had unsuccessful surgery. Although hybrid surgery is a procedure to treat patients who suffer from peripheral arterial disease (PAD), consider that side effects can emerge. In the

study by Matsagkas et al., Three patients developed superficial femoral artery (SFA) thrombosis in the early six months after surgery, and two had their limbs amputated [34]. Also, in the study of Cotroneo et al., 3 out of 44 patients (8.6%) required further intervention [35].

In the study of Nishibe et al., during the 357 days' follow-up period, the primary patency was 94%, 70%, and 70% at 6, 12, and 24 months, respectively [35].

In the study of Cotroneo et al., the 2-year patency rate was 79.1%, with only two mortality in 44 patients. According to this study and previous reports, we have indicated that the hybrid surgery technique in patients with peripheral artery disease (PAD) due to its high patency is an efficient method in treating multi-level critical limb ischemia.

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Author contribution

All authors contributed equally in all parts of article and approving the final version of the manuscript before submission

Conflict of Interest

Authors declare no conflicts of interest.

Ethical declaration

Ethical number for this study was taken from Guilan University of Medical Sciences by this code: IR.GUMS.REC.1400.270.

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