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Factors Affecting the Long-term Patency of Crossover Femorofemoral Bypass Graft

Y.W. Kim,[1]* J.-H. Lee,[2] H.G. Kim[2] and S. Huh[2]

Divisions of Vascular Surgery, Departments of Surgery, [1]Samsung Medical Center (SMC), Sungkyunkwan University School of Medicine, Seoul, and [2]Kyungpook National University Hospital (KNUH), Daegu, South Korea

Objectives. *To determine the factors affecting long-term patency of crossover femorofemoral bypass (FFB) graft.*
Design. *A retrospective clinical study of a prospectively registered database.*
Materials. *Two hundred and sixteen FFBs performed for 192 patients with atherosclerotic iliac occlusive disease.*
Methods. *The clinical and surgical variables influencing graft patency were assessed with log-rank test and Cox's proportional hazard analysis.*
Results. *The primary patency rates of all FFB grafts at 3 and 5 years were 73±4 and 65±5%, respectively. By multivariate analysis, hypertension (Odds ratio 2.8, P=0.002) and critical ischemia (Odds ratio 0.42, P=0.01) significantly (P<.05) influenced long-term patency of FFB grafts.*
Conclusion. *The long-term patency of FFB grafts was not affected by procedural modifications. Graft patency was inferior in patients with severe lower limb ischemia but superior in patients with hypertension. Further study is required to clarify the mechanism of an unexpected beneficial effect of hypertension on FFB graft patency.*

Keywords: Atherosclerosis; Iliac artery; Vascular graft occlusion; Risk factors.

Introduction

Crossover femorofemoral bypass (FFB) has been used for about 40 years as an extra-anatomic bypass for patients with unilateral iliac artery occlusion. In the early days after its introduction, FFB was reserved for patients with unilateral iliac occlusion who were at higher surgical risk for aortofemoral bypass (AFB). Currently the majority of patients with iliac artery stenosis are treated by endovascular intervention. However, open surgical treatment is still recommended for a long iliac occlusion. Over the past 13 years, there have been changes in the indications for FFBs and also procedural modifications. In this study, we investigate how clinical and surgical factors affect femorofemoral graft patency in a modern series of patients.

*Corresponding author. Young-Wook Kim, MD, FACS, Division of Vascular Surgery, Department of Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, 50, Irwon-Dong, Gangnam-Gu, Seoul 135-710, South Korea.
E-mail address: ywkim@smc.samsung.co.kr

Patients

During a period of 13 years and 7 months from January 1990 through August 2003, 230 FFB operations were performed or supervised by one surgeon (YWK) in a tertiary referral center of university hospital. Two hundred and sixteen FFBs in 192 patients (male 91%, mean age±SD: 66±9 years) were included in this study. Fourteen FFBs for non-atherosclerotic iliac occlusions (trauma 5, Buerger's disease 4, and unilateral graft limb occlusion after AFB bypasses 5) were excluded from the study. The demographic and clinical features of the patients are demonstrated in Table 1.

Methods

Our indications for FFB were long segment unilateral iliac disease corresponding to type C or D lesions according to TASC classification[1] and acute unilateral iliac artery thrombosis when catheter-directed thrombolytic therapy was unavailable or contraindicated. Selection of FFB over AFB was favoured for patients of

Table 1. The demographic and clinical features of patients

Feature	No (%)
Age (years), mean ± SD (range)	66 ± 9 (46–91)
Male (%)	196 (91)
Indications for FFB	
Disabling claudication	105 (49)
Critical ischemia*	111 (51)
Coexisting morbidities	
Hypertension†	111 (51)
Diabetes mellitus‡	55 (25)
Ischemic heart disease§	61 (28)
Cerebrovascular disease with neurologic deficit	38 (18)
Moderate or severe COPD	34 (16)
Renal insufficiency (serum creatinin > 2.0 mg/L)	17 (8)

SD, standard deviation; FFB, femorofemoral bypass; COPD, chronic obstructive pulmonary disease.
* Critical ischemia denotes rest pain or ischemic tissue loss regardless the mode of onset.
† Hypertension was defined as systolic blood pressure > 150 mmHg or diastolic blood pressure > 95 mmHg on casual blood pressure measurement or by history of patients taking antihypertensive agents.
‡ Diabetes was defined as fasting blood sugar > 125 mg/dL or by a history of patients using hypoglycaemic agents or insulin.
§ Ischemic heart disease was defined as fixed or reversible perfusion defect on myocardial perfusion scan or electrocardiographic findings of myocardial infarction.

older age (> 75 years), those with significant coexisting morbidity, and according to patient's preference. When a thick, ulcerated or dissected intimal plaque was found during FFB operation, femoral endarterectomy was concomitantly performed in 31% of patients. We used 7 or 8 mm diameter-sized e-polytetrafluoroethylene (e-PTFE, Gore-Tex®) grafts in all patients according to the size of the femoral artery. Among the patients showing recipient-side SFA occlusion ($n = 95$ limbs, 44%), concomitant leg bypass was performed in 63 patients (66%). Donor-side SFA occlusion was not a contraindication for FFB grafting in our institution.

The frequencies of surgical variables are demonstrated in Table 2. Postoperatively, all patients were prescribed 100–300 mg of oral aspirin daily. FFB graft patency was assessed by duplex ultrasonography every 3 months. Data were retrieved from the pre-registered vascular database at KNUH. SPSS for Windows (version 10.0; SPSS Inc., Chicago, Ill) was employed for statistical analyses. Cumulative patency rates were calculated with the Kaplan–Meier method. To determine the factors influencing the long-term patency of FFB graft, four clinical variables (hypertension, diabetes mellitus, critical ischemia, and recipient-side SFA occlusion) and six surgical variables (urgent operation, second FFB bypass, donor iliac artery intervention, FFB graft diameter, femoral endarterectomy, and anastomosis at distal deep femoral artery (DFA) were tested with univariate and multivariate analysis. After univariate analysis with the log-rank test, variables with P value < 0.2 were applied into a Cox's proportional hazard model for multivariate analysis. The Odds ratio and 95% confidence intervals (95% CI) for the different variables were also estimated. $P < 0.05$ was considered significant.

Results

After 216 FFB operations on 192 patients, one operative death occurred in a patient with oxygen-dependent, COPD who required an emergency FFB for limb-threatening acute iliac artery thrombosis. During the follow-up period (mean 35 ± 32 months; range 1–170 months), we have observed 20 FFB graft failures (9%) including two graft infections, 73 patients deaths (38%), and 46 losses to follow-up (21%). Overall primary cumulative patency rates of FFB grafts at 1, 3, and 5 years were 90 ± 2, 73 ± 4, and 65 ± 5%,

Table 2. Surgical variables of femorofemoral bypasses (FFBs)

FFB procedure ($N = 216$)	No (%)
Urgent operation (< 24 h after symptom onset)	37 (17)
Second operation with new graft	24* (11)
Donor-side iliac artery intervention	34† (16)
Preoperative PTA or stenting	25
Ilio-femoral prosthetic graft interposition	11
Concomitant recipient-side leg bypass	73 (34)
Femoral endarterectomy	67 (31)
Anastomosis at distal DFA‡	24 (11)
Diameter of e-PTFE graft	
7 mm	103 (48)
8 mm	113 (52)

PTA, percutaneous transluminal angioplasty; e-PTFE, expanded-polytetrafluoroethylene.
* Performed for 23 graft occlusions and one graft revealing tight stenosis of both anastomotic sites. Among 23 graft occlusions, three patients were transferred from other hospitals with graft occluded or removed due to graft infection.
† Two patients underwent concomitant ilio-femoral interposition due to suboptimal results of preoperative iliac PTA.
‡ Distal DFA denotes segment of deep femoral artery distal to the lateral circumflex branch.