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ANALYSIS OF RISK FACTORS FOR THE DEVELOPMENT OF FEMOROPOPLITEAL BYPASS GRAFT OCCLUSIONS

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ABSTRACT

To identify significant risk factors for femoropopliteal bypass graft occlusions.A retrospective case-control study included patients who had undergone femoropopliteal bypass due to lower extremity arterial disease at the Clinical Centre Kragujevac, Serbia, between 2008. and 2011. The cases (n = 35) were patients with femoropopliteal bypass graft occlusion which required surgical intervention. The control group (n = 70) consisted of patients without graft occlusion. The cases and controls were age and sex matched. Significant impact on graft occlusion was found for the form of femoropopliteal bypass($OR_{adjusted}$ *115.34; 95%CI 4.02,3306.55;), type of graft(*$OR_{adjusted}$ *81.62; 95%CI 1.03,6486.32), cardiovascular disease(*$OR_{adjusted}$ *55.64; 95%CI 2.63,1176.94), previous vascular procedures(*$OR_{adjusted}$ *51.61; 95%CI 1.10,2425.14), preoperative disease stage according to Rutherford(*$OR_{adjusted}$ *22.21; 95%CI 2.62,188.39), and preoperative hematocrit levels (*$OR_{adjusted}$ *0.34; 95%CI 0.13,0.89). A significant synergistic effect on graft occlusion was observed for the combination of form of bypass and type of graft, combination of type of graft and previous vascular procedures, combination of form of bypass and cardiovascular diseases, combination of type of graft and cardiovascular diseases, combination of type of graft and preoperative disease stage, and combination of form of bypass and preoperative disease stage.The results of our study suggest that previous and concomitant cardiovascular diseases and severity of the vascular disease itself should always be taken into account together with type of the graft and type of the operative procedure when planning femoropopliteal bypass in a patient with lower extremity vascular disease.*

***Keywords**: Femoropopliteal bypass, graft occlusion, risk factors.*

INTRODUCTION

Femoropopliteal bypass (FP) is relatively safe and effective technique of limb revascularization surgery for Chronic Critical Limb Ischaemia (CCLI) and disabling intermittent claudication (IC) in patients with peripheral arterial occlusive disease (PAOD). The initial outcome of this procedure is mostly good graft patency and limb preservation[1]. Although this surgical technique initially prolongs limb salvage, long-term graft patency is one of the major issues facing vascular surgeons[1] .

The most significant complication of FP bypass is graft occlusion, with frequency of 25 – 35% over a two-year postoperative period[1]. Graft occlusions are classified in three categories: early (<30 days), intermediate (<2 years) and late (>2 years)[2] . Limb salvage rate after the graft occlusion is poor, about 50% ± 5% over a two-year postoperative period [2].

According to the literature, FP bypass graft occlusion is associated with age[3], sex[4,5], race[3], preoperative hematocrit and hemoglobin values[3], clinical stage of disease [2,4,6,7], form of FP bypass[2,6], type of graft[4,8,9], number of crural recipient arteries patent at angiography[6,8,10,11], previous vascular intervention and progression of vascular disease[7,12-14], and type of anticoagulant (AC) and antiaggregant therapy (AA)[6,8,11]. On the other hand, there are conflicting published data about relevance of the following factors for the graft occlusion: associated chronic diseases in patients[3,15-17], drug therapy[3,13,15], perioperative blood transfusion, coagulation parameters (aPTT and INR)[18] , preoperative ankle systolic pressure index (ASPI)[19-23], alcohol and nicotine[3,7], Finnvastic score[24,25], lipid levels and statin therapy [15,26].

The aim of this study was to analyse insufficiently examined potential risk factors and risk factors with conflicting relevance according to prior studies, as well as their mutual interaction (possible synergistic effect of potential risk factors) and determination of their relative importance for FP bypass graft occlusions.

MATERIALS AND METHODS

Study design

The study design was of retrospective case-control type. It was conducted in patients with FP bypass graft occlusions which required surgical intervention, while the control group consisted of patients without such outcomes. Data were collected from the medical records of the patients. Risk factors for the occurrence of graft occlusion in patients with FP bypass were analyzed.

Study population

The study population consisted of the patients experiencing FP bypass surgery for advanced lower limb PAOD at Vascular Surgery Unit of the Clinical Centre Kragujevac, from January 2008. to December 2011. The cases were patients with FP bypass graft occlusions which required surgical intervention. The controls were patients without FP bypass graft occlusion after PAOD who were sex and age matched. The allocation ratio of the patients among groups was 1:2 in favor of controls. On the basis of the medical records of both groups it was observed to what extent they were exposed to the observed risk factors. This study did not include patients with incomplete medical records. The study was approved by the Ethics Committee of the Clinical Centre Kragujevac. The data were collected from the medical records of the patients.

The variables measured in the study

The main outcome of the study were FP bypass graft occlusions. The following potential risk factors for the graft occlusion were followed: age, sex, preoperative levels of hematocrit, hemoglobin, activated partial thromboplastin time (aPTT) and prothrombine time (PT/INR), clinical stage of disease according to Rutherford, number of angiographically patent crural recipient arteries, form of the FP bypass, type of the graft, previous vascular intervention, other patient's diseases (cardiovascular diseases, diabetes mellitus, chronic renal insufficiency, peptic ulcer disease, malignancy), drug therapy (angiotensin converting enzyme (ACE) inhibitors, alpha and beta blockers, calcium channel blockers, diuretics, metformin, insulin, anticoagulant and antiplatelet therapy), perioperative blood transfusion, smoking, alcohol consumption, and Finnvastic score.

Statistical analysis

In statistical data analysis continuous variables are presented as mean ± standard deviation (SD) in the text and tables, and categorical variables are presented as proportion of examined subjects with a particular outcome. Student's t-test was used for comparison of the mean values of continuous variables for small independent samples, and alternative non-parametric tests were used if the results did not follow normal distribution, based on the Kolmogorov-Smirnov test. Chi-squared (χ^2) test was used to compare differences in the frequencies of categorical variables, and Fisher's exact test was used if the frequency of categories was low. The influence of a number of variables on the examined dichotomous outcome (graft occlusions after FP bypass surgery), as well as the mutual interaction of potential predictor variables, were examined using binary logistic regression, and the results were presented as Adjusted Odds Ratio with corresponding 95% confidence intervals. All results where the probability of the null hypothesis being true was less than 5% ($p < 0.05$) were considered statistically significant. Statistical analysis was performed using a standard statistical software package (SPSS software V.18.0).

RESULTS

Basic characteristics of cases and controls and the differences between them are shown in Table I. There were no significant differences between cases and controls in terms of: sex, age, preoperative values of aPTT and INR, perioperative blood transfusion, ACE inhibitors, alpha and beta blockers, diuretics, calcium-channel blockers, metformin, insulin, diabetes, chronic renal insufficiency, peptic ulcer, malignancies, aorto-iliac occlusive disease, number of angiographically patent crural recipient arteries, the administration and type of antiaggregants and anticoagulants, alcohol consumption, duration of nicotine consumption, and Finnvastic score.

Statistically significant effects for the occurrence of FP bypass graft occlusion were found in the form of FP bypass (below-knee vs above-knee) ($OR_{adjusted}$ 115.34; 95% confidence interval 4.02,3306.55; p=0.006), graft type (artificial vs venous) ($OR_{adjusted}$ 81.62; 95% confidence interval 1.03,6486.32; p=0.049), associated cardiovascular diseases ($OR_{adjusted}$ 55.64; 95% confidence Interval 2.63,1176.94; p=0.010), previous vascular procedures ($OR_{adjusted}$ 51.61; 95% confidence interval 1.10,2425.14; p= 0.045), pre-operative disease stage according to Rutherford ($OR_{adjusted}$ 22.21; 95% confidence interval 2.62,188.39; p= 0.004), preoperative haemoglobin levels ($OR_{adjusted}$ 1.33; 95% confidence interval 1.01,1.74; p= 0.040) and preoperative hematocrit levels ($OR_{adjusted}$ 0.34; 95% confidence interval 0.13,0.89; p=0.028).

The results of logistic regression analysis (Coh & Snell R square 0.534, Nagelkerke R square 0.740, Hosmer-Lemeshow Chi-squared 4.713, df=8, p = 0.788) with adjustment for potential confounders are shown in Table II.

After examination of interaction between risk factors a significant synergistic effect was found for the combination of form of FP bypass and type of the graft ($OR_{adjusted}$ 140.95; 95%Confidence Interval 5.47,3632.14; p=0.003), type of the graft and previous vascular procedures ($OR_{adjusted}$ 75.96; 95%Confidence Interval 1.14, 5060.94; p=0.043), form of FP bypass and associated cardiovascular diseases ($OR_{adjusted}$ 68.03; 95% confidence interval 3.14,1472.69; p=0.007), type of graft and associated cardiovascular disease ($OR_{adjusted}$ 25.71; 95%Confidence Interval 1.69,391.30; p=0.019), type of graft and preoperative clinical stage of the disease according to Rutherford ($OR_{adjusted}$ 2.83; 95% Confidence Interval 1.28,6.24; p=0.010), form of FP bypass and preoperative clinical stage of the disease according to Rutherford ($OR_{adjusted}$ 2.58; 95 % confidence interval 1.47,4.51; p=0.001) (Table III).

Table I. Baseline characteristics of cases and controls

Variable		Cases (n=35)	Controls (n=70)	Test value and significance of null hypothesis	Crude odds ratios with confidence intervals (1.96*SE)
Sex(M/F)		27/8 (77%/23%)	53/17 (76%/24%)	$\chi^2 = 0.26$ p = 0.871	1.08 (0.41, 2.83)
Age (years, mean ± SD)		65.00 ± 7.92	63.79 ± 10.02	T = 0.626 p = 0.533	1.01 (0.97, 1.06)
Clinical stage of disease according to Rutherford	I	0 0%	7 10%	$\chi^2 = 25.848$	2.82 (1.77, 4.48)
	II	0 0%	16 22%	p < 0.001*	
	III	6 17%	21 30%		
	IV	11 31%	13 19%		
	V	15 43%	13 19%		
	VI	3 9%	0 0%		
Duration of smoking (years, mean ± SD)		28.03 ± 16.08	26.51 ± 17.03	U=1213,000 p = 0.934	1.01 (0.98, 1.03)
Alcohol consumption		8/27 (23%/77%)	18/52 (26%/74%)	$\chi^2 = 0.102$ p = 0.749	0.86 (0.33, 2.22)
Form of femoropopliteal bypass(below-knee vs above-knee)		25/10	22/48	$\chi^2 = 15.099$	5.45 (2.24, 13.28)

Variable	Cases (n=35)	Controls (n=70)	Test value and significance of null hypothesis	Crude odds ratios with confidence intervals (1.96*SE)
	(71%,29%)	(31%, 69%)	p < 0.001*	
Anticoagulant(AC) and Antiaggregant (AA) therapy	AC+AA 23 66% AC 11 31% AA 0 0% without AA/AC 3 3%	AC+AA 34 49% AC 29 41% AA 4 6% without AA I AC 3 4%	χ^2 =4.001 p = 0.261	0.58 (0.31, 1.11)
Type of heparin	SH 28 80% LMWH 5 14% S+LMWH 2 6%	S 54 77% LMWH 10 14% S+LMWH 6 9%	χ^2 = 0.274 p = 0.872	0.85 (0.42, 1.71)
Preoperative levels of haemoglobin	128.91 ± 20.85	133.67 ± 19.98	T = -1.134 p = 0.260	0.99 (0.97, 1.01)
Preoperative levels of aPTT	28.12 ± 5.11	27.92 ± 6.27	U = 1157.500 p = 0.646	1.01 (0.94, 1.08)
Preoperative levels of INR	1.14 ± 0.30	1.08 ± 0.38	U = 1067.000 p = 0.283	1.57 (0.51, 4.89)
Preoperative levels of hematocrit	38.57 ± 6.36	40.18 ± 5.67	T = -1.323 p = 0.189	0.95 (0.891, 1.023)
Aortoiliac stenosis	6/29 (17%/83%)	18/52 (26%/74%)	χ^2 = 0.972 p = 0.324	0.60 (0.21, 1.67)
Previous vascular intervention	9/26 (26%/74%)	13/57 (19%/81%)	χ^2 = 0.719 p = 0.397	1.52 (0.58, 4.00)
Angiotensin converting enzyme (ACE) inhibitors	24/11 (69%/31%)	50/19 (71%/29%)	χ^2 = 0.677 p = 0.713	0.80 (0.33, 1.94)
Beta blockers	16/19 (46%/54%)	28/42 (40%/60%)	χ^2 = 0.313 p = 0.576	1.26 (0.56, 2.86)
Diuretics	11/24 (31%/69%)	24/46 (34%/66%)	χ^2 = 0.086 p = 0.770	0.88 (0.37, 2.09)
Calcium channel blockers	6/29 (17%/83%)	17/53 (24%/76%)	χ^2 = 0.696 p = 0.404	0.64 (0.23, 1.82)
Metformin	2/33 (6%/94%)	14/56 (20%/80%)	χ^2 = 3.687 p = 0.055	0.24 (0.05, 1.13)
Insulin	5/30 (14%/86%)	9/61 (13%/87%)	χ^2 = 0.041 p = 0.839	1.13 (0.35, 3.67)
Type of graft (artificially vs venous)	32/3 (91%/9%)	61/9 (87%/13%)	χ^2 = 0.423 p = 0.515	1.57 (0.40, 6.22)
Finnvastic score	5/30 (14%/86%)	5/65 (7%/93%)	χ^2 = 1.382 p = 0.295	2.17 (0.58, 8.05)
Cardiovascular diseases	20/15 57%/43%	26/44 37%/63%	χ^2 = 3.791 p = 0.052	2.26 (0.98, 5.16)
Chronic renal insufficiency	5/30 14%/86%	4/66 6%/94%	χ^2 = 2.188 p = 0.156	2.75 (0.69, 10.97)
Peptic ulcer disease	5/30 14%/86%	5/65 7%/93%	χ^2 = 1.382 p = 0.295	2.17 (0.58, 8.05)
Number of angiographically passable crural recipient arteries 1/2/3	16/9/8 48,5%/27,3%/24,2%	15/28/21 32,8%/43,8%/23,4%	χ^2 = 6.359 p = 0.042*	1.75 (1.01, 3.06)

Variable	Cases (n=35)	Controls (n=70)	Test value and significance of null hypothesis	Crude odds ratios with confidence intervals (1.96*SE)
Diabetes	11/24 31%/69%	23/47 33%/67%	$\chi^2 = 0.022$ $p = 0.883$	0.94(0.39, 2.24)
Malignancy	0/35 0%/100%	5/65 7%/93%	$\chi^2 = 2.625$ $p = 0.167$	0.00
Perioperative blood transfusion	6/29 17%/83%	9/61 13%/87%	$\chi^2 = 0.350$ $p = 0.554$	1.40 (0.46, 4.31)
Alpha blockers	2/33 6%/94%	2/68 3%/97%	$\chi^2 = 0.520$ $p = 0.471$	2.06 (0.28, 15.28)

* Significant difference
SD= Standard Deviation
AC =Anticoagulants
AA = Antiaggregant
SH = Standard heparin
LMWH = Low molecular weight heparin
aPTT = Activated Partial Thromboplastin Time;
INR = international Normalized Ratio;
ACE = Angiotensin Converting Enzyme;

Table II. Crude and adjusted odds ratios of the risk factors for femoropopliteal bypass graft occlusions*

Risk factors	Crude OR (95% CI)	Adjusted OR (95% CI)
Form of femoropopliteal bypass(below-knee vs above-knee)	5.45(2.24, 13.28)	115.34(4.02, 3306.55)
Type of graft (artificially vs venous)	1.57(0.40, 6.22)	81.62(1.03, 6486.32)
Cardiovascular diseases	2.26(0.98, 5.16)	55.64(2.63, 1176.94)
Previous vascular intervention	1.52(0.58, 4.00)	51.61(1.10, 2425.14)
Clinical stage of disease according to Rutherford	2.82(1.77, 4.48)	22.21(2.62, 188.39)
Preoperative levels of haemoglobin	0.99(0.97, 1.01)	1.33(1.01, 1.74)
Preoperative levels of hematocrit	0.95(0.89, 1.02)	0.34 (0.13, 0.98)

* For the sake of clarity only significant associations are shown in the table (95% CI of adjusted OR does not include value of 1)
OR = Odds Ratio;
CI = onfidence Intervals

Table III. Synergistic effects of risk factors for the femoropopliteal bypass graft occlusions

Risk factors	Crude OR (95% CI)	Adjusted OR (95% CI)
Form of femoropopliteal bypass (below-knee vs above-knee)	5.45(2.24, 13.28)	115.34(4.02, 3306.55)
Type of graft (artificially vs venous)	1.57(0.40, 6.22)	81.62(1.03, 6486.32)
Cardiovascular diseases	2.26(0.98, 5.16)	55.64(2.63, 1176.94)
Previous vascular intervention	1.52(0.58, 4.00)	51.61(1.10, 2425.14)
Clinical stage of disease according to Rutherford	2.82(1.77, 4.48)	22.21(2.62,188.39)
Preoperative levels of haemoglobin	0.99(0.97, 1.01)	1.33(1.01, 1.74)
Preoperative levels of hematocrit	0.95 (0.89, 1.02)	0.34 (0.13, 0.98)

Risk factors	Crude OR (95% CI)	Adjusted OR (95% CI)
Form of femoropopliteal bypass(below-knee vs above-knee) by Type of graft (artificially vs venous)	5.54(2.30,13.35)	140.95(5.47, 3632.14)* p=0.003
Type of graft (artificially vs venous) by Previous vascular intervention	1.50(0.52,4.35)	75.96(1.14, 5060.94)* p=0.043
Cardiovascular diseases by Form of femoropopliteal bypass(below-knee vs above-knee)	4.50(1.75,11.60)	68.03(3.14, 1472.69)* p=0.007
Type of graft (artificially vs venous) by Cardiovascular diseases	2.03(0.89,4.64)	25.71(1.69, 391.30)* p=0.019
Previous vascular intervention by Form of femoropopliteal bypass(below-knee vs above-knee)	2.70(0.76,9.53)	4.22(0.20, 90.46) p=0.357
Type of graft (artificially vs venous) by Clinical stage of disease according to Rutherford	1.86(1.39,2.61)	2.83 (1.28, 6.24)* p=0.010
Clinical stage of disease according to Rutherford by Form of femoropopliteal bypass(below-knee vs above-knee)	1.65(1.32,2.05)	2.58(1.47, 4.51)* p=0.001
Preoperative levels of haemoglobin by Form of femoropopliteal bypass(below-knee vs above-knee)	1.01(1.01,1.02)	1.02(1.01,1.04) p=0.008
Preoperative levels of hematocrit by Form of femoropopliteal bypass(below-knee vs above-knee)	1.04(1.02,1.06)	1.06(1.02,1.12) p=0.009
Preoperative levels of haemoglobin by Preoperative levels of hematocrit	1.00(1.00-1.00)	1.00(0.99,1.00) p=0.381

* Clinically significant interaction
OR = Odds Ratio
CI = Confidence Interval

DISCUSSION

Each year about 220 new cases of CCLI per million are reported worldwide[16]. Revascularization procedures are necessary in approximately 50% of patients and FP bypass is usually performed[16] . A major complication after FP bypass surgery is graft occlusion with a frequency of 25 – 35% over a two-year postoperative period[1].

Since previous studies demonstrated the impact of gender[4,5,7] and age[3] on the occurrence of graft occlusions, we matched our patients by sex and age in order to discover influences of other variables. According to our research main risk factors for graft occlusion are the form of FP bypass, type of graft, associated cardiovascular disease, previous vascular procedures and preoperative clinical stage of the disease according to Rutherford.

Below-knee FP bypass was a significant risk factor for graft occlusion in our study, and these results are consistent with other studies[3,7]. In addition, below-knee FP bypass is a significant factor affecting the limb salvage duration[2].

Type of graft, i.e. synthetic graft, is an important risk factor for graft occlusion according to the results of our study, which corresponds with the literature explaining a clear benefit for autologous vein when compared to synthetic materials[4,7-9,13,27]. Also, limb ischaemia resulting from graft occlusion seemed to cause more severe effects in artificial graft compared with venous graft[8,27]. Autogenous saphenous vein is considered to be the best material for FP bypass. A synthetic graft is considered only as an acceptable alternative. There is a significantly increased rate of occlusion in artificial graft compared to venous graft (48% versus 18% ; p =0.005)[8] .

Interaction between the type of graft and form of bypass showed highly significant association with graft occlusion and these results also correspond to previous research[3]. According to these results synthetic peripheral FP bypass seemed to have the highest rate of graft occlusion, as shown in other studies, where early graft occlusion was around 8.2% in artificial graft and 4.7% in vein graft[3] .

However, according to previous studies impact of patients' chronic diseases on graft occlusion is a conflicting issue[15,28]. We found a significant impact of associated cardiovascular diseases on graft occlusion. It is logical, since coronary artery disease and cerebrovascular disease often appear along with PAOD as a manifestation of generalized atherosclerosis. Approximately 40-60% of patients with PAOD also have associated cardiovascular disease[16]. In patients with cardiovascular disease peripheral perfusion is reduced due to heart failure and left ventricular relaxation. Consequently, in patients with PAOD and related cardiovascular diseases graft occlusions occur more frequently. On the contrary, in some studies patients with diabetes have a lower incidence of graft occlusion, and better results after FP bypass procedures if compared with patients without diabetes[3]. There is also an inverse association between diabetes and graft occlusion after FP bypass, but without statistical significance[3]. The rate of early occlusion in non-diabetic patients was 5.5%, in insulin-dependent diabetic patients 4.4%, and in patients with insulin-independent diabetes 4.0%[3]. The occurrence of early occlusion was 28% less likely in patients who take insulin than in those who take oral antidiabetics[3]. However, in our study we did not find significant effect of diabetes and type of antidiabetic drug on graft occlusion. This is not surprising, since in patients with diabetic PAOD is more aggressive, with early major blood vessels involvement and more rapid disease progression.

There is also controversy over significance of the impact of chronic renal insufficiency (HRI) in patients with PAOD on graft occlusion after FP bypass. Some authors state that HRI has no effect on graft occlusion, which corresponds to our results[17]. There are also dissenting opinions[13]. Since the mortality rate of these patients is already high, it is important to identify the subset of patients who demonstrate benefit and improve the quality of life after revascularization.

Our results also showed statistical significance of previous vascular and endovascular intervention in relation with graft occlusion. They indicate generalized atherosclerosis and more advanced stages of the disease. According to some studies previous aortobifemoral bypass, contralateral amputation, ipsilateral FP bypass, grafting revision, and endovascular procedures are significant risk factors for graft occlusion[13,14] .

Advanced clinical stage of disease according to Rutherford as a manifestation of advanced limb atherosclerosis and advanced vascular ischaemia, according to our results, significantly affect the occurrence of graft occlusion, which corresponds with the results of other studies[2,6,7]. In patients who underwent FP bypass for claudication, pain at rest or tissue loss, we found significantly lower limb preservation rates[2] .

According to the literature average hematocrit level in the examined patients is 38%. In patients with higher hematocrit level the risk of graft occlusion is lower if compared to those with lower hematocrit levels[3]. The decrease by 1% below 38% hematocrit level increases the rate of occlusion for 2%[3]. Our results indicate that hematocrit levels are inversely proportional to occurrence of occlusion, which corresponds to the results of other authors[3]. However, although statistically significant, hematocrit level may not be clinically relevant.

According to most authors number of patent crural recipient arteries significantly affects the occlusion[1.10]. We did not find a number of patent crural recipient arteries to be statistically significant factor, which was also found by some authors[22] .

Nicotine consumption is an influential factor. A number of authors emphasize that smoking is significant factor in the development of graft occlusion[7] , while others dispute it as a statistically significant effect[3]. We did not find that duration of nicotine consumption influences graft occlusion.

The results obtained in our study did not show significant impact of AA and AC therapy on the occurrence of graft occlusion, which corresponds to previous results[8]. The prevention of postoperative graft occlusion by AC and AA, or by combination therapy (AA and AC) is a routine measure. In prevention of polytetrafluoroethylene (PTFE) graft occlusion there was a slight but not statistically significant decrease in the frequency of occlusion using AC and AA therapy if compared to AA (39.3% versus 47.2%; $p = 0.62$)[8]. Two-fold increase in risk of severe ischemia without the use of AC vitamin K antagonist (VKA) indicated that, even not statistically significant, AC VKA and AA therapy was useful in PTFE graft[8]. Given the increased risk of bleeding and costly treatment, PTFE graft may be considered inappropriate for FP bypass, if great saphenous vein is available[8] .

Some authors state that AC VKA may be useful for FP bypass with low graft flow (midgraft velocity $\leq$ 45 cm/s). Given the low incidence of high-flow bypass occlusion, the use of AC therapy was not significant for either popliteal or femoral bypass[6]. Although not statistically significant, AC therapy is justified considering the two-fold lower risk of severe limb ischaemia[8]. Aspirin has a slight effect on the patency of the graft, but such effect was significantly lower in venous graft when compared to artificial graft[11] .

Curi and associates show reduced long-term graft patency in patients with hypercoagulable states[18]. They are usually at young age. We have not found a significant effect of preoperative coagulation factors on graft occlusion.

The main drawback of this study were its limitation to one centre and its retrospective design. Although we used some of the useful strategies for minimizing potential subjectivity in sampling and measuring the outcomes, such as matching of cases with controls, a lot of patients were not included due to incomplete patient files, and true randomization of matched controls was not possible. These circumstances hampered our ability to analyze the impact of some potentially important factors on the occurrence of graft occlusion after FP bypass, such as body mass index , blood lipid parameters and hypolipemic therapy, primarily statins, and color duplex scan verified postoperative graft blood flow velocity.

CONCLUSIONS

The results of our study suggest that previous and concomitant cardiovascular diseases and severity of the vascular disease itself should always be taken into account together with type of the graft and type of the operative procedure when planning femoropopliteal bypass in a patient with lower extremity vascular disease. Adequate indications for surgery, preoperative assessment and preparation of patients with chronic conditions, selecting the form of bypass and type of graft and dealing with preventable risk factors significantly should reduce the rate of graft occlusions, limb amputations and disabled patients. This study may also suggest some hypotheses for future research, in which well known risk factors of graft occlusion after femoropopliteal bypass may be combined with the certain factors identified in this survey as significant predictors of the graft occlusion.

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