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Factors Affecting Outcome of Infrainguinal Femoropopliteal Bypass in Critical Chronic Lower Limb Ischemia

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ABSTRACT

This prospective trial conducted on 50 patients who underwent infrainguinal femoropopliteal reconstruction as a definitive treatment of critical chronic lower limb ischemia using either great saphenous vein graft, or polytetrafluoroethylene (PTFE) graft. The clinical outcome of graft patency was assessed in relation to graft infection and risk factors which include: female gender, smoking, the American Society of Anesthesiologists (ASA) grade, diabetes mellitus, hypertension, hyperlipidemia, and obesity. Patients were followed up for a median of 18 months. The outcome of surgery (relieve of rest pain, healing of ischemic ulcers, and patency of the graft) was recorded as well as morbidity and mortality. There were thirty two saphenous vein reconstruction and eighteen PTFE grafts. Thirty days and 3 years mortality were one and 6 respectively. Five cases underwent graft removal and another graft reconstruction. Three patients underwent graft excision but no reconstruction with limb survival in 2 cases and amputation in one case. One patient needed angioplasty. Surgical site infection was diagnosed in 5 patients (10%). The three excised grafts were contaminated with Staphylococcus aureus in two cases and Staphylococcus epidermidis in one case. Enterobacteriaceae was cultured either alone or in combination with Staphylococcus epidermidis in two cases. In one case, the bacterial culture was negative. Females had significantly reduced graft patency rates compared with their male counterparts ($p \leq 0.02$) and high ASA grade (III, IV) was predictor of graft failure ($p \leq 0.04$). Among the demographic and operative factors which can predict graft failure, the most important are female gender, the presence of critical ischemia at time of primary surgery, the occurrence of a post-operative complication and high ASA grade. A pre-operative history of smoking was not shown to adversely affect long-term graft patency. These data may be of benefit in pre-operative patient selection, patient counseling and ensuring close patient follow-up.

Key words: Femoropopliteal reconstruction,saphenousgraft, PTFE graft, graft infection

INTRODUCTION

Peripheral Arterial Disease, (PAD) is the most common disease and the infra inguinal arterial reconstruction is one of the most effective treatment in patient remain symptomatic after medical and interventional therapies (Conte *et al*., 2001; Murphy *et al*., 2002).

Treatment of the PAD include: treatment and reduction of the risk factor, medical (pharmacological), interventional, (radiological or surgical by arterial reconstruction). Prosthetic graft material and contraction of distal anastmosis may be the main cause for graft failure (Bell *et al*., 2000). When the distal anastmosis is above knee the prosthetic grafts are a suitable alternative to autologous vein graft (Davies, 2012) graft failure way be the result of continued smoking (Gupta *et al*., 1998). The female gender in several studies have an adverse prognostic

indicator in lower limb bypass surgery but evidence to the contrary else exists (Budd *et al.*, 1990). Fixed roles for conservative, interventional, or surgical by pass treatment of intermittent claudication have not yet been established (Giugliano *et al.*, 2012).

The operative complications are the work important when deciding upon the treatment modality especially since the natural history of being intermittent claudication (Aquino *et al.*, 2001). In lower limbs ischeamia the prosthetic graft are commonly used in the above knee bypass surgery the end result of these surgery is often reported in terms of patency rates. Less frequently complication are reported despite these are well known to vascular surgeons. Graft infections reports in infrainguinal prosthetic bypass operations in PAD are scarce and the rang of graft infection are in range of 0.5% is reported (Zetrenne *et al.*, 2007; Anonymous, 2012). The infected graft management is controversial and difficult (Mertens *et al.*, 1995; Abbott *et al.*, 1997).

Antibiotics or surgical revision or combination of both is the treatment option of the infected graft. Despite antibiotic prophylaxis and the development of more refined surgical techniques, microbial infections of the vascular prostheses are well known, not rare and reported complications. The literature-reported incidence may vary between 0.2 and 5% and it is influenced by: the site of the implant, the underlying disease and the host defense mechanism (Lau and Cheng, 2001; Srivastava *et al.*, 2001; Willigendael *et al.*, 2004). Infection affects especially prosthetic grafts which are implanted during emergency procedures and prostheses anastomosed to the femoral artery or placed into an subcutaneous tunnel.

Graft infections are classified into early infections earlier than 4 months after implantation and late infection (which appear after 4 months). Szilagyi's clinical classifications (Peck *et al.*, 2011) referred to the grades of post operative wound infection as grade I (wound cellulites), grade II (subcutanous tissue infection) and grade III (graft infection).

An early infection correlates with a Szilagyi grade III wound infection. These infections are caused by virulent hospital-acquired bacteria and present with sepsis signs like: fever, leukocytosis, bacteremia and easy-noticeable signs of an infected wound (inflamed tissues around it, pus emerging from it). Late infections are a result of graft colonization by "low-virulence" organisms such as: Staphylococcus epidermidis or Candida spp. They are characterized by the fact that they are indolent and have no signs of sepsis and cultures of the peri graft tissues are not growing any germs.

Adherence of the bacteria to the bio-material surfaces leads to development of bio-film and later colonization that resist antibiotic penetration and host defenses. Bacterial activity and its virulence increased in the presence of foreign body (Sayers *et al.*, 1994). The foreign body risk infection can be predicated by the formula: (dose of bacterial contamination x virulence / Host resistance (Campoccia *et al.*, 2010).

Polyester grafts Bacterial adherence is greater than PTFE grafts 10 to 100 times. Extra cellular glycocalix is the gram-positive bacterial production and it made out of mucin which makes them much more adherent than the gram-negative one. Etiological factors involved in graft colonization include: pre operative contamination, bacterial seeding of bio material; mechanical erosion into bowel genitourinary tract or through the skin (Taylor *et al.*, 1990).

Graft contamination may be due to sterilization defect, emergency surgery, prolonged preoperative stay, extended operative time, simultaneous gastro intestinal procedure, re do operative vascular procedure, remote infection, Seroma, wound infection, skin necrosis, and lymphocele. Local factors leading to altered host defenses include bacterial biofilm, and bio material

foreign body reaction. General factors leading to altered host defence are diabetes mellitus, autoimmune disease, chronic renal failure, corticosteroid therapy, malnutrition leukopenia/lympho-proliferative disorders, and malignancy (Von Eiff *et al*., 2006).

The purpose of this work is to evaluate different risk factors affecting graft failure and outcome of local infections after above-knee femoropopliteal prosthetic graft bypass surgery for lower limb ischemia.

MATERIALS AND METHODS

Fifty patients (35 men and 15 women) underwent femoropopliteal bypass for critical limb ischemia (refractory to medical/interventional therapies) from January, 2010 to December, 2012 and recorded prospectively in a database registry.

Inclusion criteria included all patients who require revascularisation of the lower extremity suitable for above-knee femoro-popliteal bypass surgery as either sex, patients presenting with Fontaine IIB, III, IV ischemia, long (>10 cm) occlusion of the superficial femoral artery with patent popliteal artery and at least 1 patent crural vessel, atherosclerotic disease and written informed consent. Exclusion Criteria: previous operations on the superficial femoral artery, radiation therapy groin/leg region, diameter superficial femoral artery <4 mm, contrast allergy, pregnancy, inability to give informed consent or to complete the follow-up and advanced malignancy and organ failure. Patent and healthy autologous great saphenous vein determine the preferred material of bypass followed by PTFE graft. Reconstructive surgery was only offered to patients who discontinued smoking. A single surgeon will chose the same treatment option for all patients. Critical limb ischaemia was defined as chronic rest pain or the presence of ischaemic skin lesions, either ulcers or gangrene. Eighteen grafts were synthetic (polytetrafluoroethylene-PTFE) and thirty two were saphenous vein grafts.

All patients are seen in an out-patient clinic at 6 weeks, then 3, 6, 9, 12 and 18 months postoperatively. At each appointment patients are examined clinically; palpable pulses in the graft and crural vessels, presenting symptoms and their ankle-branchial pressure indices (ABPIs) measured. In the duplex group only, the results of the scan are monitored. The incidence of radiological and/or surgical interventions throughout the follow-up period are also noted. Quality of life is measured using the SF-36 and EuroQol questionnaires at the 6 and 18 month appointments. Hospital stays and resource use are documented for health economic analysis.The primary endpoint of this study is the time to graft failure (amputation or death from vascular causes. Quality of life and health economic data will be used to determine if there is any benefit in either arm in these outcomes between follow-up strategies. Secondary endpoints included the post-operative complication rate, need for revision surgery, length of hospital stay and overall patient survival.

In all patients' with femoropopliteal bypasses female gender, critical ischaemia, poor run-off and non-venous graft material, the latter even in patients with supragenicular bypasses, will be evaluated as independent risk factors.

Target artery selection varied with indication for surgery and degree of patency as pre-operative angiography. Autologous vein was the preferred conduit for all procedures. Ipsilateral long saphenous vein was the conduit of choice followed by the contralateral long saphenous and upper limb basilic veins respectively. In patients with inadequate autologous vein (varicosed, thrombosed, or found to be non-compliant as determined by absence of response to injection of

papaverine), a prosthetic graft (PTFE) was used with a Miller vein cuff. Suitable veins included those that were not dilated or varicose and veins which were not affected by thrombophlebitis. At the end of the bypass procedure, graft patency was determined by duplex ultrasound.

Post-operatively, the grafts were followed with duplex scanning and ankle-brachial pressure indices 1, 3, 6, and 12 months after surgery and annually thereafter. The mean and median graft follow-up periods were 12 and 18 months (range, 1-36 months, respectively).

Suspected graft occlusion was confirmed angiographically. All patients were commenced on prophylactic aspirin and a statin post-operatively. Patients with concomitant chronic atrial fibrillation were commenced on warfarin therapy.

Prevention of infection:

Simple principles are applied to minimize vascular infections:

- Avoid a prolonged preoperative stay to minimize the development of skin flora resistant to commonly used antibiotics
- Patients have shower with an antibacterial soap and scrub with 10% povidone iodine the night before the operation from the level of the umbilicus to the ankle
- Control the remote infections before an elective operation
- Remove operative site hair immediately before surgery using electric shaver rather than razors, to minimize skin trauma
- Protect vascular grafts from contact with contaminating sources, especially the exposed adjacent skin, using iodine-impregnated plastic drapes or antibiotic-soaked towels
- Avoid simultaneous gastrointestinal procedures during grafting
- Use prophylactic antibiotics whenever a graft is implanted
- Longer duration of peri-operative antibiotics (>48 h) may be considered whenever patients present more than two risk factors for wound infection, including extremes of age, malnutrition, chronic illnesses such as diabetes, remote infections or prior irradiation of the surgical site

Antibiotic prophylaxis protocols for vascular procedures were as follows:

- Available second or third generation cefalosporin 1-2 g IV slowly prior to induction of anesthesia and repeated (1-2 g) each 8-12 h for 24-48 h
- When MRSA (methycillin-resistant Staphylococcus aureus) is cultured from body surfaces or is a known important pathogen in hospitalized patients, clindamycin 900 mg IV over 20-30 min followed by 450-900 mg IV each 8 h for 24 h or vancomycin was added as 1 g infused over 1 h

Prophylactic antibiotics were continued for 3 to 5 days in patients being at high risk for infection from bacteremia, prolonged preoperative hospitalization, immunocompromised, or high hospital wound infection rates (>10%).

Diagnosis of infection: Clinical evaluation includes physical examination and vascular imaging (arteriography, ultarsonography, and contrast-enhanced CT).

Lymphatic complications and local infections were recorded throughout the follow-up period. Lymph fistula was defined as at least 2 days of continuous leakage of clear fluid from the incision.

Lymphocele was diagnosed in cases with a subcutaneous fluid collection in the absence of a hematoma or a surgical site infection. Szilagyi's clinical classification of infection was applied. Surgical site infections were confined to either dermis (grade I) or the subcutaneous tissue without involving the graft material (grade II). Surgical site infection was not recorded in cases of graft infection. Graft infection was diagnosed in cases with a tender, erythematous, pulsatile mass overlying the prosthetic material, and in cases with exposed graft, or if there was persistent drainage from a sinus tract close to the prosthetic material. This definition is equivalent to grade III in Szilagyi's classification (Pedersen *et al.*, 2004).

Therapy of infection: The treatment algorithm of the infected grafts was initiated with an ultrasound scan in cases with clinical signs of local infection. If an abscess was present, needle aspiration was done. In some cases, the graft infection was obvious due to graft exposure. Pus samples from the abscess or the infected graft were obtained and cultured. All infected grafts were treated with antibiotics. Persistent infection warranted surgery. The choice of surgical treatment depended on whether the whole graft was infected or only part of it, and on the clinical response of the antibiotic treatment. Some infections were treated with surgical revision of the tissue surrounding the graft but leaving the graft in situ. Excision of the graft with or without graft replacement was performed in selected cases.

Surgical therapy is mandatory, antibiotic therapy alone not being enough.

General principles of the overall management strategies: determining the extent of graft infection; ± removing the graft; debridement of the peri-graft tissues, and drainage and antibiotic therapy. The therapeutic options are: Graft excision without revascularization; graft preservation; excision+extra anatomical bypass and excision + in-situ replacement (Russu *et al.*, 2011).

Armstrong *et al.* (2007) recommended specific criteria for selective graft preservation:

- Patent graft that is not constructed of polyester Dacron
- Anastomoses are intact and not involved in the infection
- Patient has no clinical signs of sepsis

Maneuvers associated to graft preservation:

- Repeated and aggressive wound debridement in the operating room
- Daily wound dressing change every 8 hours using dilute povidone iodine solution (1% povidone iodine in saline solution)
- If wound is closed between serial wound debridement, antibiotic (vancomycin, tobramycin)-impregnated methylmethacrylate beds are implanted in the subcutaneous tissue
- Administration of culture-specific antibiotics
- Rotational muscle coverage of the exposed prosthetic graft segment (Schutzer *et al.*, 2005)

Referring to revascularization, several randomized controlled trials demonstrated a decrease of morbidity and mortality for staged treatment vs. traditional graft excision associated to extra-anatomical procedures.

If a monophasic Doppler arterial signal is present at the ankle after graft excision or if arterial systolic pressure is greater than 40 mm Hg at the ankle, delayed reconstruction is an option because sufficient collaterals are present to maintain limb viability.

In the presence of critical limb ischemia signs, revascularization shouldn't be delayed. Selection criteria for in-situ reconstruction candidates:

- Clinical criteria (presentation months or years after graft implantation; no systemic signs of infection: a febrile, normal white blood cells count, sterile blood culture.
- Anatomic (inflammation of tissue adjacent to prosthetic graft; peri-graft cavity with absence of graft incorporation, weakening of graft-artery anastomosis (pseudoaneurysm).
- Microbiologic (peri-graft fluid Gram stain: white blood cells, no bacteria; peri-graft fluid culture: no growth; graft biofilm culture: coagulase-negative staphylococci (S. Epidermidis).

Treatment components for these patients are:

- Preoperative and peri-operative administration of clindamycin or vancomycin, beginning 3 days prior to replacement
- Wide debridement of inflamed peri-graft tissue
- Excision of anastomotic sites
- Cleansing/debridement of tissues and retained graft segment with wound irrigation system
- Replace with rifampicin-soaked (60 mg/ml) vascular prosthesis
- Muscle flap coverage of replacement graft segment in groin, if feasible
- Prolonged (6-week) parenteral administration of culture-specific antibiotics

Prophylactic use of antibiotic impregnated grafts in patients at high infection risk does bring benefits.

Statistical analysis was performed using SPSS 12.0 for Windows (SPSS Inc., Chertsey, UK). Univariate analyses were conducted with either the Pearson chi-square/Fisher's exact test or the Student t test for comparing continuous variables. Cumulative graft patency rates were calculated using the Kaplan-Meier method and comparisons between graft survivals were made using the Wilcoxon sign-rank test ($p \leq 0.05$ significant). A Cox proportional hazards model was employed to examine the relationship between graft patency and potential influential variables. Based on this, multivariate models were constructed in order to define which combination of variables best predicted outcome in terms of graft patency. The following variables were entered with graft patency as the outcome variable: age, gender, smoking, diabetes mellitus, hypertension, obesity, hyperlipidemia, ASA grade, graft type, inflow, outflow, and the overall complication rate. A stepwise procedure was used to select the variables that were significant in the model.

RESULTS

Complete data were available in 50 patients who were entered in the study. Table 1 shows demographic data, risk factors, and associated medical conditions. Procedures were classified as femoral-above-knee-popliteal, and femoral-below-knee-popliteal (Table 2).

The 30 day mortality rate was 2% while the 3-year mortality rate was 12%. There were no peri-operative deaths and 1 post-operative death. The mean length of hospital stay was 12.3±2.6 days (range 7 - 63 days). The complication rate was 20% (Table 3).

The post-operative intervention rate was 20% (n = 10). The 5 patients (10%) required further arterial reconstruction, 1 (2%) required graft angioplasty and 3 (6%) needed graft excision without arterial reconstruction. One patient required amputation.

Table 1: Demographic data, comorbidities and risk factors of patient population

Patient characteristics	No. (%)
Demographic data	
Sex:	
Male	35
Female	15
Age median range	62(44-70)
ASA median range	3(2-4)
Comorbidity	
Ischemic heart disease	20(40)
Cerebrovascular disease	8(16)
Chronic pulmonary disease	30(60)
Renal impairment	7(14)
Risk factors	
Smoking	30(60)
Obesity (BMI>30)	8(16)
Diabetes mellitus	20(40)
Hyperlipidemia	10(20)
Hypertension	18(32)

Table 2: Indication for surgery and type of the procedure.

Surgical characteristic	No. (%)
Indication	
Intermittent claudication	5(10)
Critical ischemia	45(90)
With rest pain	9(18)
With tissue loss	36(72)
Anastomosis	
Femoral above knee popliteal	38(76)
Femoral below knee popliteal	12(24)

Table 3: Morbidity and mortality rates

Complications	No. (%)
DVT	3(6)
Thromboembolism	1(2)
Hematoma	3(6)
Seroma	2(4)
Wound infection	5(10)
Pseudoaneurysm	0(0)
30 days mortality	1(2)
3 years mortality	6(12)
30 days amputation	4(8)
3 years amputation	22(44)

Kaplan-Meier curves were constructed in order to calculate patient graft patency rates and curves were compared using the Wilcoxon signed-rank test. Females had significantly reduced graft patency rates compared with their male counterparts ($p \leq 0.02$) (Fig. 1) and high ASA grade (III, IV) was predictor of graft failure ($p \leq 0.04$) (Fig. 2).

However, neither the presence of prior history of smoking ($p \leq 0.35$) (Fig. 3), Obesity (BMI>30), ($p \leq 0.27$) (Fig. 4), diabetes mellitus ($p \leq 0.22$) (Fig. 5), Hyperlipidemia ($p \leq 0.30$) (Fig. 6), nor hypertension ($p \leq 0.29$) (Fig. 7), was significantly associated with graft failure.

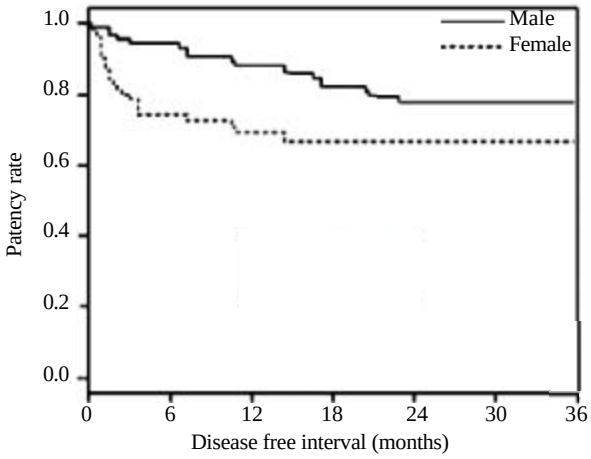

Fig. 1: Graft patency rate in males vs. females

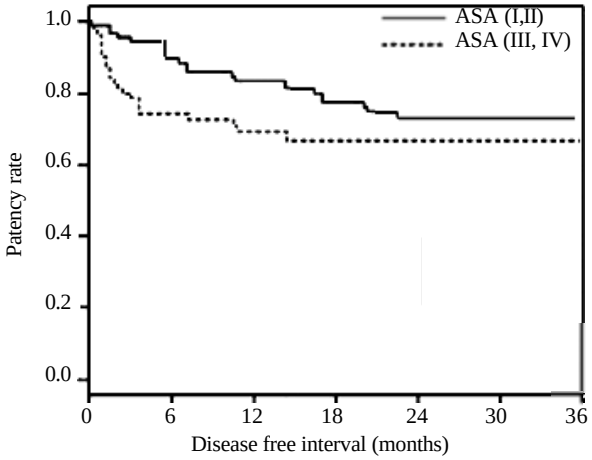

Fig. 2: Graft patency rate in low American Society of Anesthesiologists grades (ASAI, ASAII) vs. high grades (ASAIII, ASAIV)

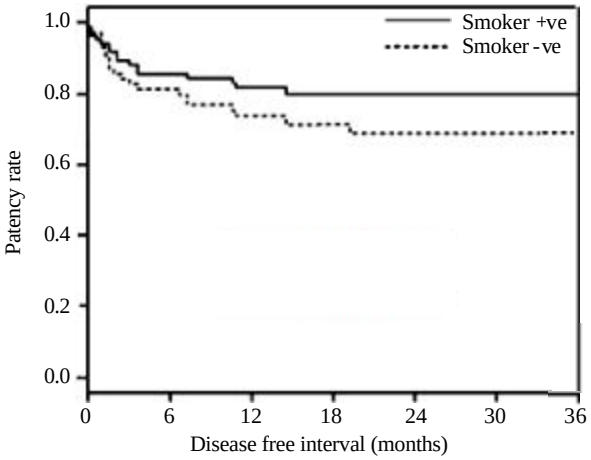

Fig. 3: Graft patency rate in smokers vs. non smokers

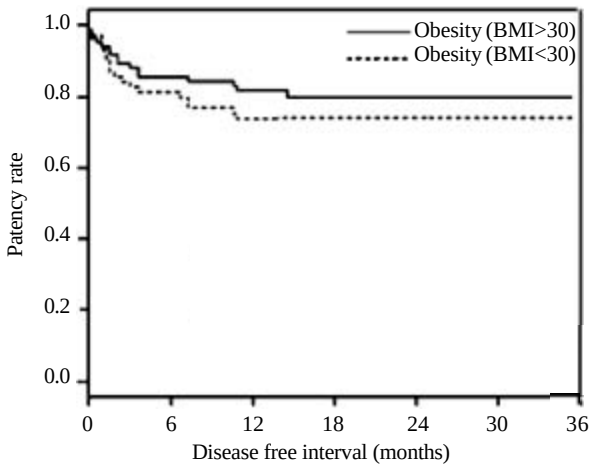

Fig. 4: Graft patency rate in obese patients (body mass index-BMI>30) vs. non obese (BMI<30)

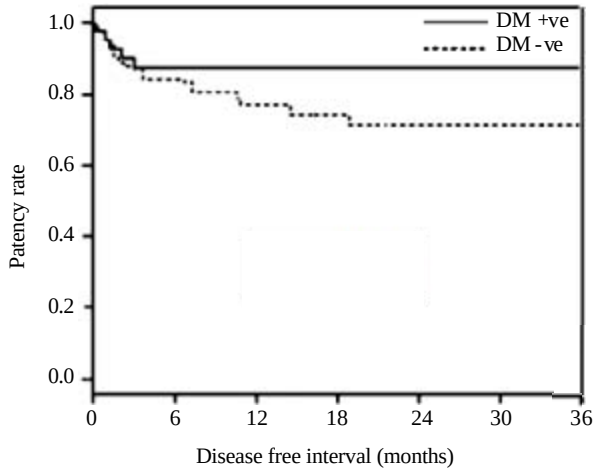

Fig. 5: Graft patency rate in diabetics vs. non diabetics

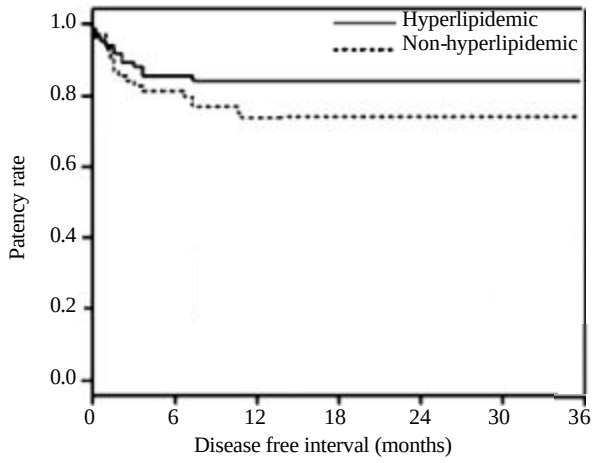

Fig. 6: Graft patency rate in hyperlipidemic patients vs. non hyperlipidemics

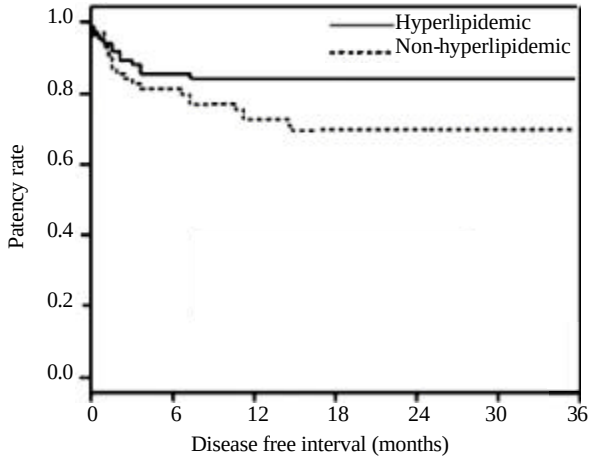

Fig. 7: Graft patency rate in hypertensives vs. non hypertensives

Surgical site infection was diagnosed in 5 patients (10%). Positive bacterial cultures were obtained from all cases. All graft infections occurred within the first few days postoperatively with a mean time of 3 days (range, 1-5 days) after surgery. Five graft infections occurred after primary operations (10%). None of the recorded preoperative risk factors had a significant influence on local infection.

Three infected grafts were excised with reconstruction. Another two patients were treated with a new bypass, whereas three were left with persistent intermittent claudication with one subsequent amputation. The three excised grafts were contaminated with Staphylococcus aureus in two cases and Staphylococcus epidermidis in one case.

Selection criteria for in-situ reconstruction candidates:

- Clinical criteria (presentation after graft implantation; no systemic signs of infection: afebrile, normal white blood cells count, sterile blood culture
- Anatomic (inflammation of tissue adjacent to prostehtic graft; peri-graft cavity with absence of graft incorporation, weakening of graft-artery anastomosis, or pseudoaneurysm)
- Microbiologic (peri-graft fluid Gram stain: white blood cells, no bacteria; peri-graft fluid culture: no growth; graft biofilm culture: coagulase- negative staphylococci (S Epidermidis)

Treatment included: preoperative and peri-operative administration of vancomycin-beginning 3 days prior to replacement, wide debridement of inflamed peri-graft tissue, excision of anastomotic sites, cleansing/debridement of tissues and retained graft segment with wound irrigation system replace with rifampicin-soaked (60 mg mL^{-1}) dressing, muscle flap coverage of replacement graft segment in groin, if feasible, prolonged (6 week) parenteral administration of culture-specific antibiotics.

Three grafts were excised for infrainguinal infections with: removal of the whole graft, radical debridement of peri-graft tissues, closing of the arteriotomies, and antibiotic administration.

If a monophasic Doppler arterial signal is present at the ankle after graft excision or if arterial systolic pressure is greater than 40 mm Hg at the ankle or forearm, delayed reconstruction is an option because sufficient collaterals are present to maintain limb viability.

Three infected grafts were treated in situ (repeated and aggressive wound debridement, wound dressing every 8 h using dilute povidone-iodine solution (1%) with administration of

culture-specific antibiotics), of which two had surgical revision of the infection surrounding the graft and one was treated with antibiotics only. All infected grafts left in situ healed and stayed open throughout the observation period.

None of the three infected grafts treated with antibiotics only were infected with Staphylococcus aureus. In these cases, Enterobacteriaceae was cultured either alone or in combination with Staphylococcus epidermidis in two cases. In one case, the bacterial culture was negative. None of the three graft infections were caused by methicillin-resistant staphylococci.

DISCUSSION

Despite advances in both the medical and endovascular management of peripheral arterial disease, infrainguinal arterial reconstruction remains a necessary and effective treatment in select patients. Identification of predictors of graft failure facilitates appropriate patient selection and follow-up. Here, it was identified that the occurrence of a post-operative complication, is correlated with female gender, and a high ASA grade as predictors of graft failure.

Graft material and the site of anastmosis are the factors correlated with reduced late graft patency in review of 313 femoro popliteal bypass graft (Budd *et al.*, 1990).

The autogenous vein graft is the best for bypass graft and the synthetic or (prosthetic) graft are a suitable alterative to autogenous graft when the distal anastmosis is above knee (El-Sayed, 2012).

Construction of an infra genicular distal anastmosis, an early revision procedure, or continued smoking past operatively are the risk factors for graft occlusion (Thomas *et al.*, 1999; Yuan and Jing, 2011). In the present study, however, even though the uses of a prosthetic graft and the construction of an infragenicular anastomosis (12 cases-24%), results were associated with lower graft patency rates, statistical significance was not reached. The rates of morbidity and mortality, reintervention, length of hospital stay and amputation free survival are comparable to other published data. The autologous and synthetic graft rates are also comparable (Enzler *et al.*, 1996; Huynh and Choi, 2013).

The rate of local infections after above-knee prosthetic femoropopliteal bypass surgery is usually in the range of 5-14%, which is lower than in the present study. This may be due to rather wide definitions of lymphatic and infectious complications and to accumulation over time.

In Burger's disease the graft infection needs long observation time to achieve full overview (Burger *et al.*, 2000).

In graft infection graft contamination usually occurs at the time of surgery (Huynh and Choi, 2013). The clinically apparent infection may be delayed for weeks or months. The course and security of infection is determine by the host defenses, the size of Bacterial column, the nature of involved bacteria (Huynh and Choi, 2013). Alternatively, graft infections may be the result of bacterial episodes during follow up, although no evidence for this etiology exists.

Idophor-impregnated plastic skin draping is used with skin preparation before surgery is some vascular centers:

- Staphylococcus aureus and staphylococcus epidermidis either alone or in combination with entero bacteria are the dominating bacterial species in the early infection there finding agree with previous study (Huynh and Bechara, 2013)
- The present study found that the occurrence of a post-operative complication, female gender, and a high ASA grade significantly reduced the long-term patency of infrainguinal grafts

- Female sex has an adverse effect on graft patency in several study in lower limbs bypass surgery (Luther and Lepantalo, 1997)
- The lower graft patency rate where found to be more in women compared with men. As well as the morbidity and mortality rates where found to be more in the cardiology and cardiac surgery literature (Tan *et al*., 1999; Yang *et al*., 2012)
- Influence of oestrogenic hormones, focal atheromatous disease, smaller vessel size, and older age at presentation in females leads to high failure rate compared to male (Callam and Ruckley, 1996; Raine *et al*., 1999) in contrast, Carlos have shown that female gender does not influence outcome following bypass surgery, but is associated with significantly increased wound complications rate compared with males (Timaran *et al*., 2000)

The females have a higher incidence of grift failure because they have more venous diseasis and smaller long saphenous vein caliber (Cronenwett and Magnant, 1994). In the present study, females had significantly lower graft patency rates on both univariate and multivariate analysis. However, significantly more females underwent bypass with synthetic graft material than males. This may be explained by the fact that females generally have a higher incidence of venous disease than males as well as a smaller caliber long saphenous vein (Cronenwett and Magnant, 1994). In many cases therefore, it may not have been possible to use autologous vein as the conduit of choice for females included in the study. Interestingly, when all of the above variables were entered into a Cox proportional hazards model, female gender was found to be the most powerful predictor of early graft failure.

- One of the methods for classification of low or high risk patients is American. College of anathetists (ASA) (Prause *et al*., 1997; Daabiss, 2011)

In the study In the present study, the median ASA grade was 3-reflecting the multiple co morbidities of this patient population. A high ASA grade was also significantly associated with lower graft patency rates on multivariate analysis. This finding emphasises the importance of pre-operative patient risk stratification and optimization for surgery.

Diabetes Mellites was not associated with time to graft failure on either univariate or multivariate analysis. In recent years, the diabetics and non diabetic patients have a comparable graft patency and limb salvage rate related to eath other is reported (Karacagil *et al*., 1995) some groups have even reported improved graft patency rates and operative mortality in diabetics:

- (Akbari *et al*., 2000; Wolfle *et al*., 2003)
- Gahtan *et al*. (1998) retrospectively reviewed 170 patients undergoing arterial by pass over a 5 year period. They concluded that diabetes mellitus affect the length of the hospital study but did not affect overall survival or operative morbidity or graft patency (Gahtan *et al*., 1998), found that diabetes Mellitus adversely Affects long-term survival and hospital mortality, but not graft patency
- (AhChong *et al*., 2004) in the present study, there was no significant difference between diabetic and non diabetic complication
- Smoking is one of the major risk factors associated with the development and progression of peripheral arterial disease

- Many studies have to explain the relations between the smoking and pathogensis of various diseases and prosthetic graft failure (Wiseman *et al.*, 1989)
- In the present study, pre-operative smoking was not associated with lower graft patency rates, this is incomparison with a large meta-analysis which reported that continued smoking after bypass surgery results in at least 3 fold increase risk of graft failure .cessation of smoking increase graft patency (Willigendael *et al.*, 2005)
- According to this finding cessation of smoking is important steb for patients under went infra inguinal bypass surgery
- In infra inguinal bypass surgery, the decision as to which conduit to use? It based on the site of the planned distal anastmosis and the availability of adequate autologous long saphenous vein. It is universally accepted that autologous saphenous vein is the superior conduit for infra inguinal revascularization, particularly when the vein is of normal size and free of sclerotic segment however, may studies have reported acceptable results with synthetic graft for femoro- politeal bypass grafting, particularly in "claudicants and when the distal anastmosis is supra genicular (AbuRahma *et al.*, 1999)
- The reversed long saphenous vein is the preferred conduit in the present study However, when the different surgical subgroup are examined separated femero -distal bypass with vein graft is associated will increased patency rate than femero distal bypass with synthetic graft
- This finding occurs with many of those described in the punished vascular literature to date (Abdulrahman, 2003)

CONCLUSION

Graft infections after peripheral bypass surgery with implantation of prosthetic material represent immense burdens to the patients as well as to the health care system. Considering the benign natural history of intermittent claudication, complication rates should be surveyed continuously in order to weigh these ill effects against the gain of the treatment. The graft infection rate in the present series is high compared to other reports. This has led to great scrutiny of every process connected to the procedures. A restrictive attitude towards femoropoliteal bypass surgery for intermittent claudication has been advocated for several years and the results of the present study support this policy. Results of the present study conclude that among the demographic and operative factors which can predict graft failure, the most important are female gender, the presence of critical ischemia at time of primary surgery, the occurrence of post-operative complication and high ASA grade. A pre-operative history of smoking was not shown to adversely affect long-term graft patency. Similarly, the presence of diabetes mellitus, hypertension, hyperlipidemia, and obesity were not associated with graft failure, though the number of these factors in this patient population is relatively low and larger series may be required in order to prove this conclusively. In conclusion, these data may be of benefit in pre-operative patient selection, patient counseling, ensuring close patient follow-up and risk stratification.

REFERENCES

Abbott, W.M., R.M. Green, T. Matsumoto, J.R. Wheeler and N. Miller *et al.*, 1997. Prosthetic above-knee femoropopliteal bypass grafting: Results of a multicenter randomized prospective trial. J. Vasc. Surg., 25: 19-28.

Abdulrahman, A., 2003. Polytetrafluoroethylene use for above-knee femoropopliteal bypass in critical limb ischemia. Saudi Med. J., 24: 669-671.

AbuRahma, A.F., P.A. Robinson and S.M. Holt, 1999. Prospective controlled study of polytetrafluoroethylene versus saphenous vein in claudicant patients with bilateral above knee femoropopliteal bypasses. Surgery, 126: 594-602.

AhChong, A.K., K.M. Chiu, M.W. Wong, H.K. Hui and A.W. Yip, 2004. Diabetes and the outcome of infrainguinal bypass for critical limb ischaemia. ANZ J. Surg., 74: 129-133.

Akbari, C.M., F.B. Pomposelli Jr., G.W. Gibbons, D.R. Campbell, M.C. Pulling, D. Mydlarz and F.W. LoGerfo, 2000. Lower extremity revascularization in diabetes: Late observations. Arch. Surg., 135: 452-456.

Anonymous, 2012. Asian society of vascular surgery in 2012-Abstracts from Asia. Ann. Vasc. Dis., 5: 475-510.

Aquino, R., C. Johnnides, M. Makaroun, J.C. Whittle, V.S. Muluk, M.E. Kelley and S.C. Muluk, 2001. Natural history of claudication: Long-term serial follow-up study of 1244 claudicants. J. Vasc. Surg., 34: 962-970.

Armstrong, P.A., M.R. Back, D.F. Bandyk, B.L. Johnson and M.L. Shames, 2007. Selective application of sartorius muscle flaps and aggressive staged surgical debridement can influence long-term outcomes of complex prosthetic graft infections. J. Vasc. Surg., 46: 71-78.

Bell, J., L. Papp and A. Bradbury, 2000. Bypass or Angioplasty for Severe Limb Ischaemia of the Leg: The Basil Trial. In: Vascular and Endovascular Opportunities, Greenhalgh, R.M., J.T.Powell and A.W. Mitchell (Eds.). WB Saunders, London, UK., pp: 485-494.

Budd, J.S., J. Brennan, J.D. Beard, H. Warren, P.R. Burton and P.R.F. Bell, 1990. Infrainguinal bypass surgery: Factors determining late graft patency. Br. J. Surg., 77: 1382-1387.

Burger, D.H., A.P. Kappetein, J.H. van Bockel and P.J. Breslau, 2000. A prospective randomized trial comparing vein with polytetrafluoroethylene in above-knee femoropopliteal bypass grafting. J. Vasc. Surg., 32: 278-283.

Callam, M. and C. Ruckley, 1996. The Epidemiology of Chronic Venous Disease. In: A Textbook of Vascular Medicine, Tooke, J.E. and G.D.O. Lowe (Eds.). Arnold, London, UK., pp: 562-579.

Campoccia, D., L. Montanaro, P. Speziale and C.R. Arciola, 2010. Antibiotic-loaded biomaterials and the risks for the spread of antibiotic resistance following their prophylactic and therapeutic clinical use. Biomaterials, 31: 6363-6377.

Conte, M.S., M. Belkin, G.R. Upchurch, J.A. Mannick, A.D. Whittemore and M.C. Donaldson, 2001. Impact of increasing comorbidity on infrainguinal reconstruction: A 20-year perspective. Ann. Surg., 233: 445-452.

Cronenwett, J. and J. Magnant, 1994. Gender difference in infrainguinal outcome arterial occlusive disease. Curr. Crit. Problems Vasc. Surg., 6: 30-37.

Daabiss, M., 2011. American society of anaesthesiologists physical status classification. Indian J. Anaesthesia, 55: 111-115.

Davies, M.G., 2012. Critical limb ischemia: Reporting outcomes and quality. Methodist Debakey Cardiovasc. J., 8: 15-19.

El-Sayed, H.F., 2012. Bypass surgery for lower extremity limb salvage: Vein bypass. Methodist Debakey Cardiovasc. J., 8: 37-42.

Enzler, M.A., M. Ruoss, B. Seifert and M. Berger, 1996. The influence of gender on the outcome of arterial procedures in the lower extremity. Eur. J. Vasc. Endovasc. Surg., 11: 446-452.

Gahtan, V., M. Harpavat, A.B. Roberts and M.D. Kerstein, 1998. Impact of diabetes mellitus on infrainguinal bypass grafting. J. Diabet. Compl., 12: 197-200.

Giugliano, G., C. Perrino, V. Schiano, L. Brevetti and A. Sannino *et al.*, 2012. Endovascular treatment of lower extremity arteries is associated with an improved outcome in diabetic patients affected by intermittent claudication. BMC Surg., Vol. 12. 10.1186/1471-2482-12-S1-S19

Gupta, S.K., F.J. Veith, E. Ascer, S.A.W. Flores and M.L. Gliedman, 1998. Cost factors in limb-threatening ischaemia due to infrainguinal arteriosclerosis. Eur. J. Vasc. Surg., 2: 151-154.

Huynh, T.T. and C.F. Bechara, 2013. Hybrid interventions in limb salvage. Methodist DeBakey Cardiovas. J., 9: 90-94.

Huynh, T.T. and L. Choi, 2013. Limb salvage in women. Methodist Debakey Cardiovasc. J., 9: 84-89.

Karacagil, S., B. Almgren, S. Bowald and D. Bergqvist, 1995. Comparative analysis of patency, limb salvage and survival in diabetic and non-diabetic patients undergoing infrainguinal bypass surgery. Diabet. Med., 12: 537-541.

Lau, H. and S. Cheng, 2001. Long term prognosis of femoropopliteal bypass: An analysis of 349 consecu-tive revascularisations. ANZ J. Surg., 71: 335-340.

Luther, M. and M. Lepantalo, 1997. Femorotibial reconstructions for chronic critical leg ischaemia: Influence on outcome by diabetes, gender and age. Eur. J. Vasc. Endovasc. Surg., 13: 569-577.

Mertens, R.A., P.J. O'Hara, N.R. Hertzer, L.P. Krajewski and E.G. Beven, 1995. Surgical management of infrainguinal arterial prosthetic graft infections: Review of a thirty-five-year experience. J. Vasc. Surg., 21: 782-791.

Murphy, G.J., D. Kipgen, M.J.S. Dennis and R.D. Sayers, 2002. An aggressive policy of bilateral saphenous vein harvest for infragenicular revascularisation in the era of multidrug resistant bacteria. Postgrad. Med. J., 78: 339-343.

Peck, M., D. Gebhart, N., Dusserre T.N. McAllister and N. L'Heureux, 2011. The evolution of vascular tissue engineering and current state of the art. Cells Tissues Organs, 195: 144-158.

Pedersen, G., E. Laxdal, M. Hagala and S. Aune, 2004. Local infections after above-knee prosthetic femoropopliteal bypass for intermittent claudication. Surg. Infect., 5: 174-179.

Prause, G., B. Ratzenhofer-Comenda, G. Pierer, F. Smolle-Juttner, H. Glanzer and J. Smolle, 1997. Can ASA grade or Goldman's cardiac risk index predict peri-operative mortality? Anaesthesia, 52: 203-206.

Raine, R.A., T.J. Crayford, K.L. Chan and J.B. Chambers, 1999. Gender differences in the treatment of patients with acute myocardial ischemia and infarction in England. Int. J. Technol. Assess. Health Care, 15: 136-146.

Russu, E., A. Muresan and B. Grigorescu, 2011. Vascular graft infections management. Manage. Health, 15: 16-19.

Sayers, R.D., M.M. Thompson, P. Dunlop, N.J.M. London and P.R.F. Bell, 1994. The fate of infrainguinal PTFE grafts and an analysis of factors affecting outcome. Eur. J. Vasc. Surg., 8: 607-610.

Schutzer, R., A. Hingorani, E. Ascher, N. Markevich, S. Kallakuri and T. Jacob, 2005. Early transposition of the sartorius muscle for exposed patent infrainguinal bypass grafts. Vasc. Endovasc. Surg., 39: 159-162.

Srivastava, A.K., J.V. Kothari, A.K. Agarwal, S.K. Agarwal and N.K. Gupta, 2001. Do women carry higher operative risk compared to men while undergoing coronary artery bypass grafting? Indian J. Thor. Cardiovasc. Surg., 17: 146-150.

Tan, E.S., J. van der Meer, P.J. de Kam, P.H.J.M. Dunselman and B.J.M. Mulder *et al.*, 1999. Worse clinical outcome but similar graft patency in women versus men one year after coronary artery bypass graft surgery owing to an excess of exposed risk factors in women. J. Am. College Cardiol., 34: 1760-1768.

Taylor, L.M., J.M. Edwards and J.M. Porter, 1990. Present status of reversed vein bypass grafting: Five-year results of a modern series. J. Vasc. Surg., 11: 193-206.

Thomas, B., H. Lacroix, A. Nevelsteen and R. Suy, 1999. Factors influencing patency of infrainguinal bypasses with polytetrafluoroethylene. Acta Chirurgica Belgica, 99: 236-240.

Timaran,C.H., S.L. Stevens, O.H. Grandas, K.T. Piercy, M.B. Freeman and M.H. Goldman, 2000. Influence of hormone replacement therapy on graft patency after femoropopliteal bypass grafting. J. Vasc. Surg., 32: 506-518.

Von Eiff, C., C.R. Arciola, L. Montanaro, K. Becker and D. Campoccia, 2006. Emerging *Staphylococcus* species as new pathogens in implant infections. Int. J. Artif. Organs, 29: 360-367.

Willigendael, E.M., J.A. Teijink, M.L. Bartelink, B.W. Kuiken and J. Boiten *et al.*, 2004. Influence of smoking on incidence and prevalence of peripheral arterial disease. J. Vasc. Surg., 40: 1158-1165.

Willigendael, E.M., J.A. Teijink, M.L. Bartelink, R.J. Peters, H.R. Buller and M.H. Prins, 2005. Smoking and the patency of lower extremity bypass grafts: A meta-analysis. J. Vasc. Surg., 42: 67-74.

Wiseman S., G. Kenchington, R. Dain, C.E. Marshall, C.N. McCollum, R.M. Greenhalgh and J.T. Powell, 1989. Influence of smoking and plasma factors on patency of femoropopliteal vein grafts. Br. Med. J., 299: 643-646.

Wolfle, K.D., H. Bruijnen, H. Loeprecht, G. Rumenapf and H. Schweiger *et al.*, 2003. Graft patency and clinical outcome of femorodistal arterial reconstruction in diabetic and non-diabetic patients: Results of a multicentre comparative analysis. Eur. J. Vasc. Endovasc. Surg., 25: 229-234.

Yang, H.Y., J.H. Huang, C.Y. Hsu and Y.J. Chen, 2012. Gender differences and the trend in the acute myocardial infarction: A 10-year nationwide population-based analysis. Sci. World J. 10.1100/2012/184075

Yuan, S.M. and H. Jing, 2011. A reappraisal of saphenous vein grafting. Ann. Saudi Med., 31: 62-71.

Zetrenne, E., B.C. McIntosh, M.H. McRae, R. Gusberg, G.R. Evans and D. Narayan, 2007. Prosthetic vascular graft infection: a multi-center review of surgical management. Yale J. Biol. Med., 80: 113-121.