SURGICAL IMPLICATIONS OF LONG SAPHENOUS VEIN HARVESTING IN CORONARY ARTERY BYPASS GRAFTING SURGERY

Essay

Submitted for partial fulfillment of Master Degree in
General Surgery

By

Mohamed Eraqi Moussa
M.B.,B.Ch.

Under supervision of

Prof. Dr. Mohamed Abdel Moniem Ibrahim
Professor of General Surgery and Endolaparoscopic Surgery
Faculty of Medicine-Ain Shams University

Prof. Dr. Walaa Ahmed Saber
Professor of Cardiothoracic surgery
Faculty of Medicine-Ain Shams University

Dr. Ahmed Mohamed Awad
Fellow of General Surgery and Endolaparoscopic Surgery
Ain Shams University Hospitals

Ain Shams University
Faculty of Medicine
٢٠٠٨


بسم الله الرحمن الرحيم
نَرْفَعُ دَرَجَاتٍ مَّن نَّشَاءُ
وَفَوْقَ كُلِّ ذِي عِلْمٍ

Acknowledgements

All thanks are due to GOD

To Professor Dr. Mohamed Abdel Moniem Ibrahim, *I would like to express my sincere gratitude and my deepest appreciation, for his trust in my humble abilities and allowing me to choose this subject which is a true link between vascular and cardiac surgery.*

Special acknowledgement is directed to Professor Dr. Walaa Ahmed Saber, *for his kind help, care, valuable advice, and unlimited attention offered to me during accomplishment of this work.*

My gratitude and appreciation to Dr. Ahmed Mohamed Awad, *for his special care and time directed towards fulfillment of this work in the proper way it deserves.*

Special gratitude is directed towards my colleagues, and friends for their help and support offered to me during my whole residency and my whole life so that I was able to proceed in all the projects in my life.

Dedication

This work is dedicated to:

My grandmother: for her continuous pray that supported me through my whole life

My parents for their continuous support and standing behind me in time of weakness

My brothers for their holding up and sympathy that was a true guide to fulfill many duties in my work

Little cute Mariam my niece who is the true candle that lights my last year in residency

CONTENTS

	Page
Introduction	١
Aim of Work	٤
Anatomy of Long Saphenous Vein	٥
Physiology of Long Saphenous Vein	١٣
Pharmacology of CABG and Long Saphenous Vein	٢٠
Methods of Harvesting the Long Saphenous Vein	٣٨
Complications of the Long Saphenous Vein Harvesting	٥٣
Alternatives to Long Saphenous Vein as a Conduit	٧٤
Comparison between Patency Rates of Venous and Arterial Conduit	١١١
Methods of Reducing Vein Graft Failure	١٢٦
Summary and Conclusion	١٤١
References	١٤٤

كلية الطب
جامعة عين شمس
٢٠٠٨

LIST OF ABBREVIATION

٥-HT	٥-hydroxy tryptamine
ASVs	Accessory saphenous veins
ATP	Adenosine tri phosphate
bFGF	Basic firboplast growth factor
BITA	Bilateral internal thoracic artery
CA	Coronary artery
Ca^{++}	Calcium
CABG	Coronary artery bypass graft
cGMP	Cyclic guanylate monophosphate
CX	Circumflex artery
ECM	Extracellular matrix
EDGFs	Endothelium derived growth factors
EDHF	Endothelium derived hyperpolarizing factor
EDRFs	Endothelium derived relaxing factors
eNOS	Endothelial nitric oxide synthase
ET-١	Endothelin-١
EVH	Endoscopic vein harvest
GEA	Gastroepiploic artery
GSV	Great saphenous vein

GTN	Glyceryl nitrate
GV	Glyceryl nitrate and verpamil
IEA	Inferior epigastric artery
IMA	Internal mammary artery
IMV	Internal mammary vein
iNOS	Inducible nitric oxide synthase
ITA	Internal thoracic artery
K^+	Potassium
LAD	Left anterior descending artery
LIMA	Left internal mammary artery
LITA	Left internal thoracic artery
MMP	Matrix degrading metalloproteinases
NE	Norepinephrine
nNOS	Neuronal nitric oxide synthase
NO	Nitric oxide
NOS	Nitric oxide synthase
NR-IMA	No react bovine internal mammary artery
NT	No touch
ODN	Oligo deoxy nucleotide
OM	Obtuse marginal
OPCAB	Off pump coronary artery bypass
OVH	Open vein harvest
PAD	Peripheral arterial disease
PDA	Posterior descending artery

PDGF	Platelets derived growth factor
PGs	Prostaglandins
PTFE	Polytetrafluoroethylene
RA	Radial artery
Rb	Retinoblastoma
RCA	Right coronary artery
RGEA	Right gastroepiploic artery
RIMA	Right internal mammary artery
RITA	Right internal thoracic artery
SITA	Single internal thoracic artery
SKT-ITA	Skeletonized internal thoracic artery
SNP	Sodium nitroprusside
SV	Saphenous vein
TIMPs	Tissue inhibitors of metalloproteinases
tPa	Tissue plasminogen activator
TXA۲	Thromboxane A۲
VEGF	Vascular endothelial growth factor
VOCC	Voltage operated Ca^{++} channels
VPF	Vascular permeability factor

Arabic Summary ....

LIST OF TABLES

Table No.	Title	Page
١	Patency rates of venous graft	١١٢
٢	Patency rates of IMA grafts	١١٤
٣	Comparison between IMA and vein graft	١١٦

LIST OF FIGURES

Figure No.	Title	Page
١	The great saphenous vein and its tributaries	٨
٢	Saphenous vein used to bypass blockage	١٠
٣	Schematic representation of the fibrinolytic system	١٤
٤	Nitric oxide formation	١٦
٥	The pathways of blood coagulation	١٧
٦	Positioning of the lower limb for harvesting the GSV	٣٨
٧	The Leg incision over the vein	٤٠
٨	Conventional harvesting technique of the long saphenous vein	٤١
٩	Ligating branches of the vein	٤٢
١٠	Control of avulsed branches with a fine suture placed longitudinally to produce the least distortion	٤٥

١١ Skin incision in EVH ٤٨

LIST OF FIGURES (CONT..)

Figure No.	Title	Page
١٢	EVH technique	٥٠
١٣	Adventitial Constriction	٥٥
١٤	Non healing wound of leg after SVG harvesting	٦٦
١٥	Saphnous vein "in situ" together with the pedicle of adipose tissue, after dissection from the bed	٦٨
١٦	Course of the ITA from inside the chest	٧٦
١٧	Arteries of the forearm	٨٥
١٨	Relations of Radial Artery	٨٨
١٩	Different types of conduits for CABG	٩٠

Introduction

The long Saphenous Vein is the most frequently used conduit for coronary artery bypass. Saphenous vein bypass grafting was first successfully used by Edward Garrett in November ١٩٦٤. Who then working under the Tutelage of Michael De-Bakey, found it is necessary to interpose such a graft to wean a patient from cardiopulmonary bypass. The saphenous vein bypass constructed in this patient was still open seven years after operation(١).

Patients undergoing coronary artery bypass grafting frequently complain more about postoperative discomfort from the site of leg vein harvesting than about their sternotomy wound. The traditional method of harvesting the greater saphenous vein, a groin-to-ankle incision, involves the longest incision used in surgical practice and may cause minor complications in up to ٣١ percent of patients. Major complications are believed to be rare, but the morbidity and costs of minor complications from vein harvesting comprise an area of surgical practice that requires further study. Horvath and colleagues used a prospective, nonrandomized, case-matched study that

compared two new, less invasive techniques of harvesting the saphenous vein that were designed to minimize trauma and complications[٢].

Traditional longitudinal saphenectomy is a multivariable risk factor for development of leg wound complications. Endoscopic saphenectomy modifies the risk factor profile for wound complications and should be the standard of care, particularly for obese and/or diabetic patients who require venous conduit during coronary artery bypass grafting[٣].

Minimally invasive direct vision harvesting the great saphenous vein is an attractive alternative to the traditional open-harvesting technique. This procedure resulted in fewer wound complications and showed a much better cosmetic outcome. The total operation time was not increased by using the minimally invasive technique[٤].

Wound complications identified were dehiscence, drainage for greater than ٢ weeks postoperatively, cellulitis, hematoma, and seroma/lymphocele[٥].

Several techniques are available for minimal invasive vein harvesting, but all necessitate traction on the vein to maximize surgical visibility and enable

side branch ligation. Excessive surgical manipulation of saphenous vein impairs endothelial cell function and reduces the bioavailability of nitric oxide. This endothelial injury promotes platelet and leukocyte adhesion that in turn can result in smooth muscle cell proliferation that exacerbates the intimal hyperplasia that is a common cause of vein graft occlusion. Thus, functional integrity of the harvested and prepared saphenous vein has important implications for immediate and long-term graft patency.

Modern management of CABG surgery patients emphasizes an early return to normal activities. In this regard early mobilization after surgery plays an important part in the process of recovery. In turn, any reduction in morbidity from the saphenous vein harvest procedure will promote early mobilization and speed rehabilitation[٦].