Evaluation of the flow diffuser technique: A new modification of brachioaxillary graft for hemodialysis

Thesis

Submitted for partial fulfillment of the MD degree in general surgery

By

Amr El-Sayed Mohammed

Supervised by

Prof. Dr: Tarek Ahmed Adel Abdel-Azim (MD)

Professor of General and Vascular Surgery

Faculty of Medicine - Ain Shams University

Prof. Dr: Gamal Eldeen Saad Abbas (MD)

Professor of General Surgery

Faculty of Medicine - Ain Shams University

Dr: Magdy Mohammed Saeed El-Sharkawy (MD)

Assistant Professor of General and Nephrology Medicine

Faculty of Medicine - Ain Shams University

Dr: Wagih Fawzy Abdel-Malek Fahmey (MD)

Lecturer of General and Vascular Surgery

Faculty of Medicine - Ain Shams University

Ain Shams University

٢٠٠٧

تقييم الطريقة الإنتشارية : تقنية جديده لتركيب الوصلات الصناعية بين الشريان الساعدي و الوريد الإبطي للغسيل الكلوي

دراسة

توطئه للحصول علي درجة الدكتوراه في الجراحة العامة

بواسطة

عمرو السيد محمد

تحت إشراف

الأستاذ الدكتور/ طارق أحمد عادل عبد العظيم

أستاذ الجراحة العامة و الأوعية الدموية

كليه الطب - جامعه عين شمس

الأستاذ الدكتور/ جمال الدين سعدعباس

أستاذ الجراحة العامة

كليه الطب - جامعه عين شمس

الدكتور/ مجدي محمد سعيد الشرقاوي

أستاذ مساعد أمراض الباطنة و الكلي

كليه الطب - جامعه عين شمس

الدكتور/ وجيه فوزي عبد الملك فهمي

مدرس الجراحة العامة و الأوعية الدموية

كليه الطب - جامعه عين شمس

جامعه عين شمس

٢٠٠٧

AKNOWLEDGEMENT

*Above all and first of all thanks to **Allah.***

*I would like to express my spincere thanks and deepest gratitude to Prof. Dr. **Tarek Ahmad Adel Abd El-Azim** professor of vascular and general surgery faculty of medicine, Ain-Shams university, who suggested the topics and offered me the useful guidance and kind criticism.*

*I am deeply grateful to Prof. Dr. **Gamal Saad Abbas** professor of general surgery faculty of medicine, Ain-Shams university, for his great help and cooperation.*

*A lot of thanks to Dr. **Magdey Mohammed El-Sharkawy** assistant professor of nephrology faculty of medicine –Ain Shams university for his generous help and kind assistance*

*A special note of gratitude goes to Dr. **Wageeh Fahmy Abdel-Malek** lecturer of general and vascular surgery faculty of medicine, Ain-Shams university for his guidance and valuable supervision of this work.*

*Finally, my deepest thanks to **my family** that gives me a lot and get a little.*

Amr El-Sayed Mohammed

Contents

List of abbreviations

Academy ,Academic	***Acad***
American	***A- Am***
Advanced	***Adv***
American journal of medicine	***AJM***
American journal of surgery	***AJS***
Annual	***Ann***
Archive	***Arch***
Artificial	***Artif***
Arteriosclerosis	***Arterioscl***
Arteriovenous	***AV***
Acetyl salicylic acid	***ASA***
Asian strategy	***ASAIO***
Arteriovenous graft (s)	***AVG (s)***
Basic fibroblast growth factor	***bFGF***
Biochemistry	***Biochem***
Biology	***Biol***
British journal of medicine	***BJM***
British journal of surgery	***BJS***
Cardiac	***Card***
Cardiology	***Cardiol***
Cardiovascular	***Cardiovasc***
Centimeter	***cm***
Circulation	***Circ***
Clinical	***Clin***
Coagulation	***Coagul***
College	***Colleg***
Companey	***Com***
Current	***Curr***
Deep venous thrombosis	***DVT***
Desoxy ribonucleic acid	***DNA***
Disease (s)	***Dis***
Distal revascularization with interval ligation	***DRIL***
Distal venous segments	***DVS***
Dipyridamole	***dip***

Dialyses outcome quality improvement	***DOQI***
Three dimensions	***٣D***
Electro cardiogram	***ECG***
Experience	***Exp***
Endothelial progenitor cells	
Endovascular	***Endovasc***
European	***Eur***
Food and drug administration	***FDA***
Figure	***Fig***
Glomerular filtration rate	***GFR***
Geiger per yard	***G/y***
Gynecology	***Gynecol***
Hypertension	***Hyperten***
Inferior vena cava	***IVC***
Infection	***Infec***
Internal	***Intern***
Intervention	***Interv***
International	***Int***
Internist	***Inst***
Investigation	***Inv.***
Journal	***J***
Journal of American medical association	***JAMA***
Kidney	***Kid***
Laboratory	***Lab***
Medicine, Medical	***Med***
Minute	***Min***
Milliliter	***ml***
Mille-par per second	***Mpa.s***
New York	***NY***
Nephrology	***Nephrol***
National	***Natl***
National institute of health consensus	***NIHC***
National kidney foundation- department of quality improvement	***NKF-DOQI***
New intimal hyperplasia	***NIH***
North england journal of medicine	***N. Eng. J. Med***
Opinions	***Opin***

Obstetric	***Obestet***
Pathology	***Path***
Platelet-derived growth factor	***PDGF***
Polytetrafloroethylene	***PTFE***
Particular page	***PP***
Proximal vein segment	***PVS***
Procedures	***Proc***
Prognosis	***Prog***
Expanded polytetrafloroethylene	***ePTFE***
Quoted from	***Q***
Radiology	***Radiol - R***
Renal	***Ren***
Research	***Res***
Scientific	***Scien***
Seminar	***Semin***
Smooth muscle cell (s)	***SMC (s)***
Surgery	***Surg, S***
Shear stress	***SS***
Society	***Soc***
Thoracic	***Th***
Thrombosis	***Thromb***
Laser Doppler vibrometry	***LDV***
Tumor necrotizing factor	***TNF***
Transplantation	***Trans***
Ultrasound	***U/s***
United state	***USRDS***
United kingdom	***Uk***
Vascular	***Vasc***
Venous neointimal hyperplasia	***VNH***
Vascular endothelial growth factor	***VEGF***
Warner brothers	***WB***

List of pictures

List of tables

INTRODUCTION

The number of dialysis dependant patients with chronic renal failure is growing constantly. The discovery and evolution of hemodialysis techniques have prolonged and improved the quality of life of patients with chronic renal failure. Hemodialysis accesses are surgically created communications between the native artery and the vein in an extremity. The direct communications are called native arteriovenous fistula. Polytetrafloroethylene (PTFE), and other materials are termed prosthetic hemodialysis access (arteriovenous graft). The access that is created is routinely used for hemodialysis for ٢-٥ times per week. Many patients who are not candidate for renal transplantation or those for whom a compatible donor cannot be secured are dependent on the hemodialysis for their lifetime. Preservation of patient's well functioning dialysis access is one of the most difficult clinical problems in long-term treatment of patients on dialysis. ***(Hakaim and Scott, ١٩٩٧)***

Historically native graft thrombectomy and revision resulting in the eventual exhaustion of the vein thus shortening its lifespan and the need to create a new access is mandatory. Less than ١٥٪ of dialysis access remains patent and can functioning without problem during the entire life of patient. In best records fistula takes about ٣ years while PTFE graft lasts ١-٢ years before failure and thrombosis are noted. The problem after creation of arteriovenous graft results from progressive narrowing of the venous anastomosis which identified in more than ٩٠٪ of grafts, the primary underlying in outflow vein obstruction is pathophysiologic mechanism responsible for causing intimal hyperplasia at the anastomosis site. In ١٩٨٠s percutaneous techniques such as balloon dilatation,

thrombolysis and mechanical thrombectomy allow the treatment of thrombosis and stenosis nonsurgically; but with high rate of recurrence and high cost. ***(Wijesinghe et al., ١٩٩٨)***

By using an in-vitro model of arteriovenous graft anastomosis at the venous site we noticed that, the traditional graft to vein anastomosis for arteriovenous grafts that created end to side fails because of myointimal hyperplasia at the anastomosis site. Rather than the conventional venous anastomosis we created a new modified end to side anastomosis. The modified end to side anastomosis (diffuser type) allows decreasing the flow velocity and increasing the pressure thus inhibiting the boundary layer separation. That is because diffusers are used to accommodate the mismatch between two dissimilar areas by interposing an approximately ١٦٪ increase in cross sectional area at the point of insertion. This method has a significant increase in patency of the prosthetic graft with no deaths, wound infections or hemorrhagic complications. ***(Hakaim et al., ٢٠٠٣)***

Aim of the work

The aim of this work is to evaluate the technical feasibility, complications and long-term patency of the arteriovenous grafts using the new technique of flow diffuser between the brachial artery and the axillary vein for hemodialysis vascular access.