Anesthetic Management of End stage Renal Disease Planned for Renal Transplantation

An Essay

Submitted for Partial Fulfillment of Master Degree in ***Anesthesia***

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بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

Acknowledgement

Thanks first and last to **ALLAH** as we owe him for his great care, support and guidance in every step in our life.

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Finally, I dedicate this effort to **my husband,** who helped me in every moment of my life. Also I dedicate this work to my family.

Contents

List of Figures

List of Tables

List of Abbreviations

Abb.	Full term
ACC/AHA	The American Heart Association/American Collegue of Cardiology
ADH	Antidiuretic Hormone
AHS	American Heart Society
AKI	Acute Kidney Injury
ANP	Atrial Naturetic Peptide
AT	Anastmosis Time
ATP	Adenosine Triphosphate
ATG	Antithymocyte Globulin
AVF	Arterio-Venous Fistula
CAD	Coronary Artery Disease
CBC	Complete Blood Count
CKD	Chronic Kidney Disease
Cl	Chloride
CVP	Central Venous Pressure
DBD	Donation after Brain Death
DCD	Donation after Cardiac Death
EA	Epidural Anesthesia
ECG	Electrocardiography
e GFR	estimated Glomerular Filtration Rate
ESRD	End Stage Renal Disease
ESRF	End Stage Renal Failure
FiO2	Fraction of Inspired Oxygen
GIT	Gasrtointestinal Tract
Hb	Hemoglobin
HD	Hemo-Dialysis
HES	Hydroxy Ethyl Starch
ICU	Intensive Care Unit
IL-1	Interleukin 1
IL-2R Abs	Interleukin-2 Receptor Antibody
Kg	Kilogram
K	Potassium
K/DOQI	Kidney Disease Outcomes Quality Initiative

Abb.	Full term
LDN	Living Donor Nephrectomy
MET	Metabolic Equivalent
M-3-G	Morphine-3-Glucuronide
M-6-G	Morphine-6-Glucuronide
MMF	Mycophenolate mofetil
MPA	Mico-Phenolic Acid
Na	Sodium
NKF	National Kidney Foundation
NSAID	Non Steroidal Anti Inflammatory Drugs
PEEP	Positive End Expiratory Pressure
PH	Pulmonary Hypertension
pH	power of Hydrogen
PT	Prothrombin Time
PTT	Partial Thromboplastin Time
PTH	Para-Thyroid Hormone
RRT	Renal Replacement Therapy
RT	Renal Transplant
S cr	Serum creatinine
TNF	Tumor Necrosis Factor
UOP	Urine Out Put
WIT	Warm Ischemia Times

Introduction

Kidney transplantation is a process of attaching new kidneys to replace previously diseased kidneys. In most cases, the need for kidney transplantation results from end stage renal disease (ESRD). ESRD is the last stage of chronic kidney disease when kidneys are functioning at 10-15% of their normal capacity and renal replacement therapy becomes necessary **(Martinez et al, 2013).**

Renal transplant (RT) is now considered the best therapeutic option for end-stage renal disease(ESRD). It not only improves quality of life, it also prolongs life. Following RT, the 5-year survival rate is approximately 70%, whereas the figure is only 30% for a similar group of patients undergoing dialysis **(Jankovic and Sri-Chandana, 2008).**

In 1954, Guild et al. performed the first successful renal transplantation on identical twins. In recent years the organ survival rate has increased significantly, mainly due to improvements in immunosuppressant therapy **(Schmid and Jungwirth, 2012).**

Organ viability associated with renal transplantation is a product of the managing of the donor patient, the allograft, and the recipient patient. Short and long-term outcome is influenced by perioperative fluid and drug treatment. Close intraoperative monitoring, optimization of intravascular fluid volume status to maximize kidney perfusion, and prompt correction of electrolyte disturbances are key to short and long-term success of renal transplants **(Jain et al, 2009).**

Aim of the Work

The aim of this research is to introduce the anesthetic management of a patient with end stage renal disease planned for renal transplantation in order to optimize the success rate of renal transplantation surgery.

Chapter (1)

Anatomy and Physiology of the Kidneys

Anatomy of the kidneys

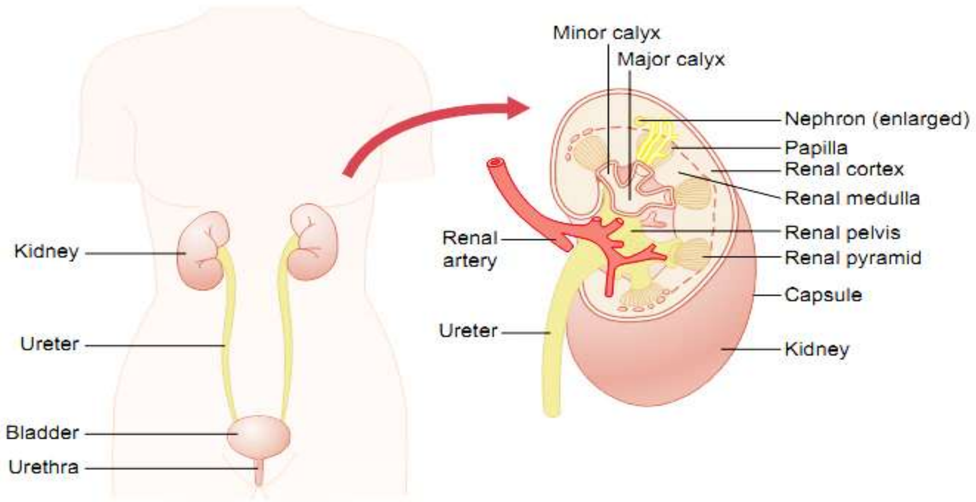

Fig 1 General organization of the kidneys and the urinary system from **Guyton and Hall (2006).**

The kidneys are reddish brown and lie behind the peritoneum high up on the posterior abdominal wall on either side of the vertebral column; they are largely under cover of the costal margin. The right kidney lies slightly lower than the left kidney because of the large size of the right lobe of the liver. With contraction of the diaphragm during respiration, both kidneys move downward in a vertical direction by as much as 1 inch (2.5 cm**) (Snell, 2012).**

On the medial concave border of each kidney is a vertical slit that is bounded by thick lips of renal substance and is called the hilum. The hilum extends into a large cavity called the renal sinus. The hilum transmits, from the front backward, the renal vein, two branches of the renal artery, the ureter, and the third branch of the renal artery. Lymph vessels and sympathetic fibers also pass through the hilum **(Snell, 2012).**

The kidney has two layers, an outer cortex, which is red and an inner medulla which is lighter in colour. The difference in colour is due to difference in vascularity. It is in the cortex that all filtration and bulk of reabsorption occur, and hence the richer blood supply. The cortex appears granular because it contains the glomeruli, Bowman's capsule and the tortous convoluted tubules. The medulla has a striated appearance because it contains largely straight running portions of the nephron **(Bijlani and Manjunatha, 2011).**

The kidney is composed of over one million nephrons, sometimes called renal or kidney tubules. Each nephron has its own blood supply, including two capillary regions. The nephron is formed of the renal corpuscle, the proximal convoluted tubule, the loop of Henle, the distal convoluted tubule and the collecting duct **(Mader, 2004).**

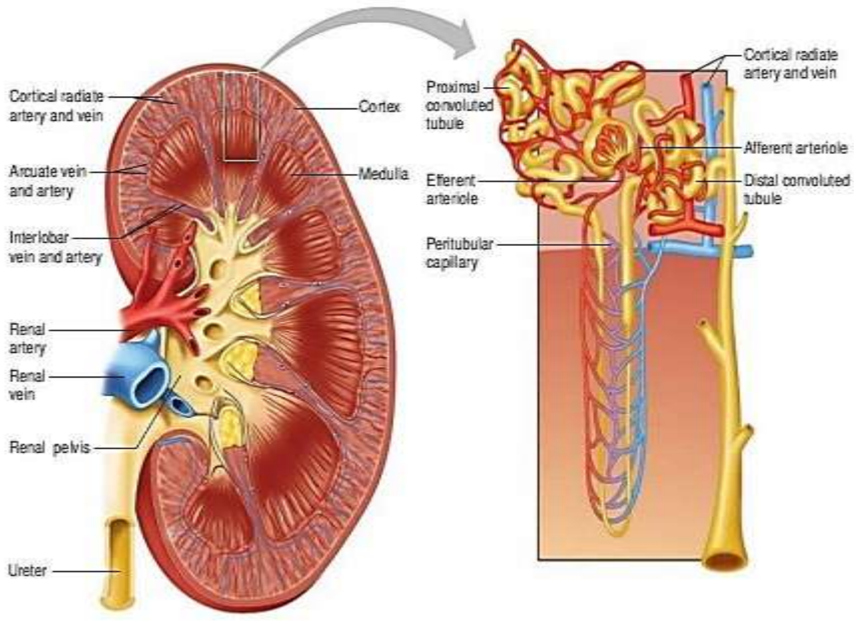

Fig 2 Structure of the kidney and the nephron from **Sheir et al (2012).**

Renal blood vessels:

Because the kidneys remove wastes from the blood and regulate it's volume and ionic composition, it is not surprising that they are abundantly supplied with blood vessels. Although the kidneys constitute less than 0,5% of the total body mass, they receive 20-25 % of the resting cardiac output via the right and left renal arteries. In adults, renal blood flow (the blood flow through both kidneys) is about 1200 ml per minute **(Derrickson and Tortora, 2012).**

A renal artery enters a kidney through the hilum and gives off several branches, called interlobar arteries, which pass between the renal pyramids. At the junction between the medulla and the cortex, the interlobar arteries branch, forming a series of incomplete arches, the arcuate arteries, which in turn give rise to interlobular arteries. The final branches of the interlobular arteries called afferent arterioles which lead to the nephron **(Sheir et al, 2012).**

From the afferent arterioles, blood flows into the glomerular capillaries, to the efferent arterioles, to the peritubular capillaries, to the veins within the kidney, to the renal vein, and finally to the inferior vena cava **(Scanlon and Sanders, 2007).**

Nerve supply:

The renal nerves are derived from the renal plexus which accompany the renal blood vessels throughout the renal parenchyma **(Tanagho and McAninch, 2008).**

Lymphatic drainage:

The lymphatics of the kidney drain into the lumbar lymph nodes **(Tanagho and McAninch, 2008).**