Outcome of Critically Ill Patients with Acute Kidney Injury Requiring Sustained Low Efficiency Dialysis as Renal Replacement Therapy

Thesis
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بسم الله الرحمن الرحيم

-﴿ قَالَ رَبِّ اشْرَحْ لِي صَدْرِي ¡ وَيَسِّرْ لِي أَمْرِي ¡ وَاحْلُلْ عُقْدَةً مِّن لِّسَانِي ¡ يَفْقَهُوا قَوْلِي ﴾-

صدق الله العظيم

*قرأن كريم سورة طه الآية ٢٥:٢٨

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Hossam El Din Ahmed Sayed

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ACE	Angiotesin converting enzyme
ADQI	Acute dialysis quality intiatives
AKI	Acute kidney injury
AKIN	Acute kidney injury network
ANA	Antinuclear antibodies
ANCA	Antineutrophil cytoplasmic antibody
APACHE	Acute physiology & chronic health evaluation
ARDS	Adult respiratory distress syndrome
ARF	Acute renal failure
AUC	Area under curve
ASO	Antistreptolysin O
ATN	Acute tubular necrosis
BEST	Beginning & ending supportive therapy
BPH	Benign prostatic hypertrophy
BUN	Blood urea nitrogen
CA	Cancer
CAVH	Continuous arteriovenous hemofiltration
CEPD	Continuous equilibrium peritoneal dialysis
CHF	Congestive heart failure
CIN	Contrast induced nephropathy
CKD	Chronic kidney disease
CRRT	Continuous renal replacement therapy
CVVH	Continuous venovenous hemofiltration

CVVHDF	Continuous venovenous hemofiltraion & dialysis
DIC	Disseminated intravascular coagulopathy
ESRD	End stage renal disease
ELISA	Enzyme linked immune sorbent assay
FACTT	Fluid & catheter treatment trial
FE	Fractional excretion
GBM	Glomerular basement membrane
GFR	Glomerular filtration rate
GI	Gasterintestinal
HCO3	Bicarbonate
HD	Hemodialysis
HTN	Hypertension
HUS	Hemolytic uremic syndrome
^{131} I	Iodine-131
ICU	Intensive care unit
IHD	Intermittent hemodialysis
IL-18	Interlukins-18
IV	Intravenous
K	Potassium
KIM-1	Kidney injury molecule
LDH	Lactate dehydrogenase
MRA	Magnetic resonance angiography
MRI	Magnetic resonance imaging
Na	Sodium

NAC	N-acetylcysteine
NGAL	Neutrophil gelatinase-associated lipocalin
NH3	Ammonia
NSAIDs	Non steroidal anti-inflammatory drugs
PD	Peritoneal dialysis
PGE 2	Prostaglandins E2
PICARD	Program to improve care in acute renal disease
RAD	Renal tubule assist device
RBCs	Red blood cells
RBF	Renal blood flow
RIFLE	Risk increase failure loss end stage renal disease
RPGN	Rapidly progressive glomerulonephritis
RRT	Renal replacement therapy
SLE	Systemic lupus erythematosus
SLED	Sustained low efficiency dialysis
TTP	Thrombocytopenic purpura
^{99m}Tc-MAG3	Technetium-99m-mercaptoacetyltriglycine
^{99m}Tc-DTPA	^{99m}Tcdiethylenetriaminepenta-acetic acid
UO	Urine output
WBCs	White blood cells

INTRODUCTION

Acute renal failure (ARF) has traditionally been defined as the abrupt loss of kidney function that results in the retention of urea and other nitrogenous waste products and in the dysregulation of extracellular volume and electrolytes. The loss of kidney function is most easily detected by measurement of the serum creatinine which is used to estimate the glomerular filtration rate (GFR). Increasing numbers of patients with acute renal failure are managed in the setting of an intensive care unit. Many such patients have multiorgan failure.Sepsis or both, with associated cardiovascular instability. **(Vesconi et al., 2009)**

The management of patients with acute renal failure or acute kidney injury (AKI) is principally supportive, with renal replacement therapy (RRT) indicated in patients with severe kidney injury. Multiple modalities of RRT are currently available. These include intermittent hemodialysis (IHD), continuous renal replacement therapies (CRRTs), and hybrid therapies, such as sustained low-efficiency dialysis (SLED). Despite these varied techniques, mortality in patients with ARF remains high, greater than 50 percent in severely ill patients. The initiation of RRT in patients with AKI prevents uremia and immediate death from the adverse complications of renal failure. It is possible that variations in the timing of initiation, modalities, and/or dosing may affect clinical outcomes, particularly survival. **(Vesconi et al., 2009)**

A large number of modalities are available for RRT. These include intermittent hemodialysis (IHD), peritoneal dialysis, continuous renal replacement therapy (CRRT), and hybrid therapies such as SLED.

Continuous renal replacement therapies "CRRT"Represents a family of modalities that provide continuous support for severely ill patients with AKI. These include hemofiltration, hemodialysis and hemodiafiltration which involve both convective and diffusive therapies. Although superior clearance of middle and larger molecular weight molecules is associated with convective therapies (hemofiltration) compared with diffusive therapies (hemodialysis). **(Uchino et al.,2007**)

Slow Low Efficiency Hemodialysis "SLED": It's a mode of dialysis using Hemodialysis machine with low pump over long time of dialysis with regular hemodialysis dilaysate low efflux filter and slow ultrafiltration. **(Kieslstein et al ., 2003)**

Aim of the work

The aim of this study is to determine the outcome (both survival and renal recovery) and identify the predictors of mortality of critically ill patients treated with SLEDD for ARF in the intensive care unit (ICU).

Chapter1

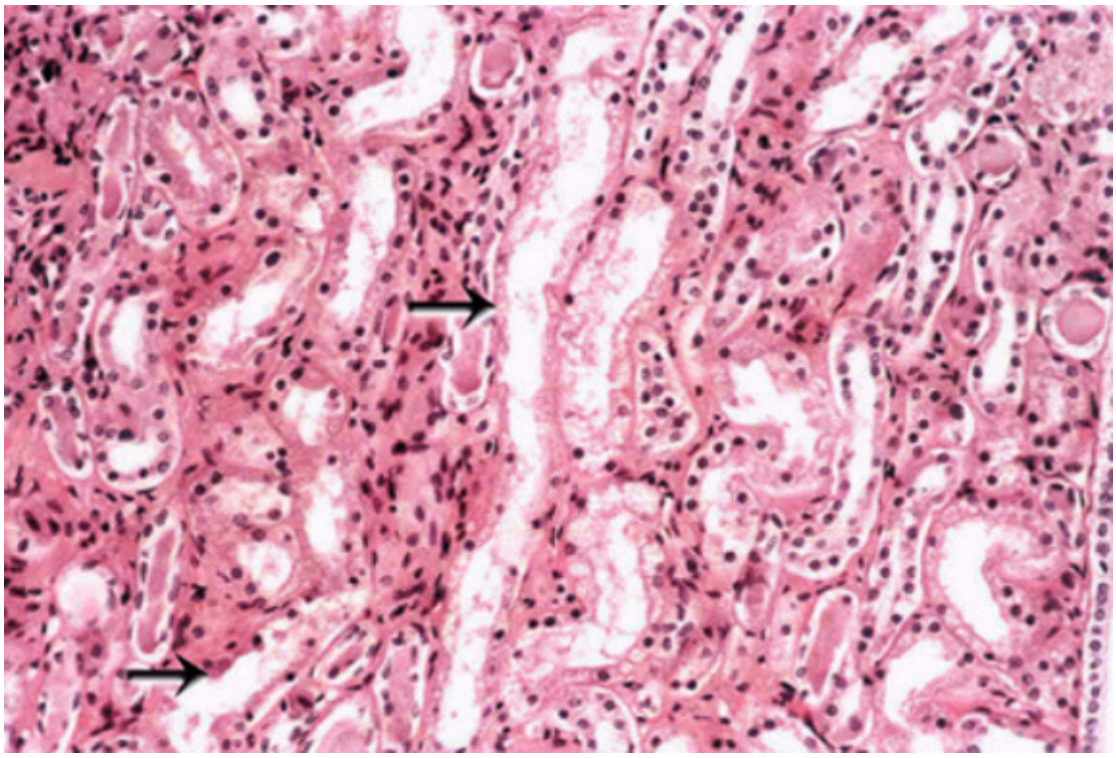
Acute Kidney Injury (AKI)

Introduction & Definition:

Acute renal failure (ARF), or acute kidney injury (AKI), as it is now referred to in the literature, is defined as an abrupt or rapid decline in renal filtration function. This condition is usually marked by a rise in serum creatinine concentration or by azotemia (a rise in blood urea nitrogen [BUN] concentration).

However, immediately after a kidney injury, BUN or creatinine levels may be normal, and the only sign of a kidney injury may be decreased urine production. A rise in the creatinine level can result from medications (eg, cimetidine, trimethoprim) that inhibit the kidney's tubular secretion. A rise in the BUN level can occur without renal injury, resulting instead from such sources as GI or mucosal bleeding, steroid use, or protein loading, so a careful inventory must be taken before determining if a kidney injury is present. **(Schrier et al .,2004)**

An example of AKI, apparently the result of acute tubular necrosis (ATN), is seen in the image below



Figure(1-1) Photomicrograph of a renal biopsy specimen shows renal medulla, which is composed mainly of renal tubules. Patchy or diffuse denudation of the renal tubular cells with loss of brush border is observed, suggesting acute tubular necrosis as the cause of acute renal failure

The RIFLE system

In 2004, the Acute Dialysis Quality Initiative work group set forth a definition and classification system for acute renal failure, described by the acronym RIFLE (Risk of renal dysfunction, Injury to the kidney, Failure or Loss of kidney function, and End-stage kidney disease; see the table, below).Investigators have since applied the RIFLE system to the clinical evaluation of AKI, although it was not originally intended for that purpose. AKI research increasingly uses RIFLE.

Table (1-1). RIFLE Classification System for Acute Kidney Injury

Stage	GFR** Criteria	Urine Output Criteria	Probability
Risk	SCreat† increased × 1.5 *or* GFR decreased >25%	UO‡< 0.5 mL/kg/h × 6 h	High sensitivity(Risk>Injury>Failure)
Injury	SCreat increased × 2 *or* GFR decreased >50%	UO < 0.5 mL/kg/h × 12	
Failure	SCreat increased × 3 *or* GFR decreased 75% *or* SCreat ≥4 mg/dL; acute rise ≥0.5 mg/dL	UO < 0.3 mL/kg/h × 24 h (oliguria) *or* anuria × 12 h	
Loss	Persistent acute renal failure: complete loss of kidney function >4 wk		High specificity
ESKD*	Complete loss of kidney function >3 mo		

*ESKD—end-stage kidney disease; **GFR—glomerular filtration rate; †SCreat—serum creatinine; ‡UO—urine output

When the failure classification is achieved by UO criteria, the designation of RIFLE-F_O is used to denote oliguria. The initial stage, risk, has high sensitivity; more patients will be classified in this mild category, including some who do not actually have renal failure. Progression through the increasingly severe stages of RIFLE is marked by