Obstructive Sleep Apnea in hemodialysis patients

Thesis

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Contents

List of abbreviations

ESRD	: End stage renal disease
CKD	: Chronic kidney disease
eGFR	: Estimated glomerular filtration rate
APD	: Automated peritoneal dialysis
CAPD	: Continuous ambulatory peritoneal dialysis
PSQI	: Pittsburgh sleep quality index
ICSD	: International Classification of Sleep Disorders
ASDA	: American Sleep Disorders Association
REM	: Rapid eye movement
RBD	: REM-sleep behavior disorder
NREM	: Non-rapid eye movement sleep
CA	: Confusional arousals
SRED	: Sleep-related eating disorder
SDB	: Sleep-disordered breathing
OSAS	: Obstructive sleep apnea syndrome
PLM	: Periodic limb movement
HTN	: Hypertension
DM	: Diabetes mellitus
BMI	: Body mass index
SWS	: Slow wave sleep
RDI	: Respiratory disturbance index
BUN	: Blood urea nitrogen
HGB	: Hemoglobin
AHI	: Apnea /hypopnea index
HD	: Hemodialysis
PTH	: parathyroid hormone
ACTH	: Adrenocorticotropic hormone
KT/V	: Clearance of urea multiplied by time over distribution volume.
KUF	: Ultrafiltration coefficient
MPO	: Membrane permeability outcome
PMMA	: polymethyl methacrylate
CPFA	: coupled plasma filtration adsorption
HDF	: Hemodiafiltration
HF	:Hemofiltration
Na^+D	: prescribed dialysate sodium concentration
EBPG	: European Best Practice Guidelines
MBD	: mineral and bone disorder
SA	: Sleep apnea

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INTRODUCTION

Sleep is a physiological state of unconsciousness in which the brain is relatively more responsive to internal than to external stimuli, the predictable cycling of sleep and the reversal of relative external unresponsiveness are features that distinguish sleep from other states of unconsciousness ***(chokoroverty, 1997).***

With advances in dialysis techniques and medical care, mortality and morbidity rates of patients on regular hemodialysis have markedly decreased, and further improvement of dialysis clearance is no longer the sole goal for these patients. On the contrary, improvement in life quality of patients has become the new aim of medical practitioners today. In order to achieve both physical and mental health, basic human needs must be first satisfied. Beyond doubt, a good sleep is very important to the life quality of everyone.However, many patients on dialysis suffer from sleep disorders **(Chang and Yang, 2011).**

HD patients report sleep problems more than twice as frequently as healthy control subjects. Although polysomnographic information in HD patients is limited, the available data suggest that sleep disordered breathing (SDB) may affect a significant percentage of dialysis patients **(Merlinoet al.,2006).**

Subjective sleep complaints have been reported in up to 80% of patients with end stage renal disease (ESRD). Sleep disturbances, such as insomnia, sleep apnea syndrome (SAS), restless legs syndrome (RLS), periodic limb movements (PLM) disorder and excessive daytime sleepiness (EDS) have been frequently reported in these patients. These alterations have been described as having a negative effect on quality of life and functional status. However, long term studies about repercussion of these abnormalities on morbidity and mortality have yet to be performed. Moreover, studies about the role of dialysis shift on sleep abnormalities, morbidity and mortality are still scarce **(Molnar et al.,2005).**

Sleep disordered breathing (SDB) is the most common cause of poor sleep in kidney disease patients with manifestations ranging from obstructive apneas,in which upper airway obstruction leads to cessation or reduction of airflow despite persistent ventilator efforts, to central apnea, in which airflow is absent because of cessation of ventilatory efforts or mixed(central and obstructive) apnea. Studies in the past have consistently shown a high prevalence of SDB in patients on hemodialysis (HD) because of compromised upper airway stability (extracellular fluid volume overload), ventilatory control instability (altered central and peripheral chemosensitivity), and reduced upper airway muscle tone (uremia). Risk factors of SDB in the general population such as older age, male gender, obesity, smoking, increased neck circumference and diabetes are also prevalent in the CKD population ***(Maria-EleniRoumelioti et al., 2004).***

The prevalence of sleep apnea in the general population is approximately 2–4%, it has been reported to be greater than 50% in patients with end stage renal disease (ESRD) ***(Kraus et al., 1997).***

AIM OF THE STUDY

1. To study the presence of sleep apnea in Hemodialysis patients.
2. To Study the nature of the sleep apnea if present.
3. To explore risk factors that affect the sleep apnea if present.

Chapter:-1

Hemodialysis

ESRD is a prevalent condition with impaired quality of life and survival. Given the scarcity of transplantable donor kidneys, hemodialysis remains the dominant form of renal replacement therapy in the developed world. Complications of uremia, associated comorbidities, and the hemodialysis treatment itself likely contribute to the excess mortality associated with ESRD ***(Lacson et al.,2010).***

Intensive hemodialysis has been in use for decades. The greater removal of fluid and uremic waste afforded by this regimen are in turn associated with improved BP, endothelial function, and ventricular mass, all of which are important predictors of survival in persons with ESRD. However, given the potentially greater burden associated with more intensive therapy, well designed studies evaluating hard endpoints are needed ***(Blagg , 2009).***

Normal kidneys perform at least two major functions; first they remove a variety of toxins and second they remove excess fluid from the body. In addition, the kidneys are important metabolic organs involved in glucose metabolism and production of erythropoietin, renin, vitamin D, etc. The kidneys accomplish its toxin-excreting function by first filtering large amounts of plasma to form a filtrate with a composition resembling that of the plasma except for the absence of proteins and protein-bound substances. Much of the filtered fluid is reabsorbed leaving behind a volume of urine that contains the waste products that require removal from the body every day. All of this is a continuous process that occurs twenty four hours a day. The goals of hemodialysis are mainly also two fold. First hemodialysis removes kidney failure-related toxins and second it is capable of removing excess water and salt. Hemodialysis accomplishes these goals in a manner different from what a normal kidney does. Plasma is passed outside of the body into a dialyzer (i.e., a filter) containing a large number of hollow fibers. These fibers separate the plasma from the dialysate and provide a large surface area for diffusion to take place. The dialysate is formed by mixing purified water with proper amounts of electrolytes and other essential constituents (such as glucose). As opposed to our own kidneys, there is some barrier to movement of molecules, even for those of relatively small sizes such as vitamin B12 (molecular weight 1,355). Also there is no reabsorption with dialysis, making adding needed small molecule to the dialysate, the only way of not removing these molecules from the body ***(Sam,2014).***

Hemodialysis as currently practiced is not a continuous process, unlike our kidneys. Even though the removal, during the time of dialysis, of small molecules such as urea is not dissimilar to the removal provided by the normal kidney, the overall clearance of urea is only about one tenth of that of the normal kidneys. This is because people commonly only receive dialysis for 12 hours or less a week whereas the normal kidney labors every second of the day. The dialysate composition is now standardized in most dialysis units with room allowed for small variations. However theoretically there is unlimited possibility to vary the dialysate composition based on the needs of the patient. During hemodialysis treatments, water and sodium are not ordinarily removed by diffusion but rather through the process of ultrafiltration. Ultrafiltration is commonly accomplished by lowering the hydrostatic pressure of the dialysate compartment of a dialyzer, thus allowing water containing electrolytes and other permeable substances to move from the plasma to the dialysate. The sodium level of an ultrafiltrate is not too distant from that of plasma. Finally, noteworthy is the fact that the dialyzability of a substance depends not only on the size of the substance but also on the permeability of the dialyzer membrane and the degree of protein-binding of that substance ***(Sam ,2014).***

The aim of hemodialysis (HD) technique has, and will always be, to simulate or reproduce the physiologic process of glomerular ultrafil tration. Conventional HD, which is performed over 4-h duration and conducted three times per week, does not fulfill this criterion. The major deficiencies of this technique include limited solute clearance and volume control, which have been associated with poor quality of life and unacceptably high rates of morbidity and mortality ***(Song et al.,2011)***.

Over the past four decades, it has been proposed that the accumulation of various "uremic toxins", and in particular middle-size and protein-bound molecules, contribute to this increased mortality. These toxins include urea, phosphorus, parathyroid hormone (PTH), β2-microglobulin, homocysteine, leptin and a variety of esoteric molecules such as advanced glycation end products, asymmetric dimethylarginine and advanced oxidation protein products. Furthermore, persistence of increased interdialytic weight gain and limited ability of conventional HD to maintain adequate homeostasis, without frequent episodes of hypotension and increased risk for cardiovascular and all-cause mortality, resulted in failure of many HD patients to achieve adequate volume control and remain permanently volume overloaded. This has been