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Effect of Suggested Physical Therapy Program on Renal Functions for Burned Patients

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Abstract : To assess the therapeutic efficacy of resisted and aerobic exercises as physical therapy program on improving the renal function in third degree burned patients. **:** Thirty patients male and female with renal complications after burn injury participated in this study. Their ages ranged from 30 to 50 years old. They divided into two groups, control group which include 15 patients received normal routine of medications for six weeks, and study group which include 15 patients received Aerobic and resisted exercises program in addition to normal medication routine for six weeks at frequency five sessions per week. Both groups were assessed pre and post treatment for serum creatinine and albumin using laboratory analysis and fatigue assessment using Piper fatigue Scale.
Key words: (Renal functions–burn– Aerobic and resisted exercise-Fatigue assessment).

Introduction

Acute kidney injury (AKI) is a common complication in burn patients as well as critically ill patients with incidences reported ranging from 1% to 40%, and mortality reported ranging from 50% to 100%, [7]. The mortality associated with AKI remains exceedingly high in these patients despite advances of critical care and renal replacement therapy (RRT). The incidence of AKI patients who need RRT has been up to 50% in burned patients, [13].

Because severe burn is typically characterized by stress, inflammation, and hyper metabolism and is one of the most severe forms of acute trauma, it's still difficult to cope with and predict critical changes such as renal, cardiovascular and hepatic dysfunctions. The adequate treatment of AKI is early diagnosis and rapid termination and prevention of the underlying insult while preserving kidney function,[8]. Although known risk factors are generally old age, total body surface area (TBSA) burned, sepsis and multi organ dysfunctions in burned patients with AKI, many studies have been conducted to identify early biomarkers to diagnose AKI in critically ill patients, [4].

Most studies have reviewed blood urea nitrogen (BUN) and serum creatinine as routinely available clinical biomarkers of glomerular filtration and severity of kidney injury. However, BUN and serum creatinine have had some serious limitations in practice to provide either a sensitive or specific indication of the development of AKI and renal function, [19].

Recently, several favorable biomarker candidates such as urinary kidney injury molecule-1, neutrophil gelatinase-associated lipocalin, interleukin-18, cystatin C, clusterin, fatty acid binding protein-liver type and osteopontin have not only emerged, [3]**,** but also other biomarkers such as creatine kinase (CK), AST, lactate dehydrogenase (LD), serum and urine myoglobin have still been described and showed variable results, [16]**.**

The benefits of exercise in the kidney disease population have been researched for over 30 years, with evidence now for the primary and secondary prevention of chronic kidney disease and tertiary prevention of end stage renal disease through restoration of physical function and reduction of disease-related complications, [11]**.**

As the incidence of patients with chronic kidney disease reaching end-stage renal disease in the UK is increasing, added to the current shortage of organ donors, a considerable strain is placed on renal units to provide life-maintaining dialysis. The financial considerations of this cannot be under-estimated. Haemodialysis is estimated to cost around £35 000– 60 000 per patient per year, leading to more than 3% of the NHS budget being spent on end-stage renal disease services alone, [2]**.**

Therefore there are clear pressures to help curtail the number of patients with chronic kidney disease reaching end-stage renal disease and improve the efficiency of haemodialysis. Exercise could help. In the management of these patients, attempts are made to optimize sugar and blood pressure control to reverse arrest or delay progression of renal impairment. In the general population individuals who undergo regular physical activity have improved diabetic control, improved blood pressure control in hypertensives and overall improved health-related quality of life as a result of enhanced psychological wellbeing and improved physical functioning, [10]**.**

This is significant as many patients with kidney disease are hypertensive and/or diabetic. Further the level of physical inactivity in chronic kidney disease patients is high which, in itself, is an independent risk factor for cardiovascular disease, by far the most common cause of mortality in end-stage renal disease patients, [5]**.**

Central to the reduced physical capacity and difficulty experienced with many activities of daily living is the marked muscle wasting and poor physical conditioning that many chronic kidney disease patients have, especially those with end-stage renal disease. Building muscle strength through resistance exercise leads to an improvement in daily function, [17]**.**

Materials And Methods

Subjects:

Thirty patients participated in this study. These patients were divided into two groups group (A) (study group) that received their routine medication plus the selected physiotherapy program and group (B) (control group) that received their normal routine of medications only. Inclusive criteria for participants were age between 30 and 50 years, sub acute and chronic stage of burn, from both sexes, receiving same medical care and had renal complications due to burn. Exclusive criteria were subjects who had other co morbidities which affect results. The study was approved by the Institutional Ethics Committee of the Faculty of Physical Therapy, Cairo University, Egypt, and all subjects signed a consent form.

Instrumentation:

In this study the measuring equipment and tools were Clinical chemistry system apparatus, this study used Siemens EXL clinical chemistry system to assess serum creatinine and albumin pre and post study, exercise treadmill (Cybex Trotter 685 treadmill) was used in this study for aerobic exercise application, exercise bike (Matrix R1x exercise recumbent bike) was used for exercise in this study, cuff weight: Used to provide resistance during resisted exercise application and Revised Piper Fatigue Scale **(RPFS):** This scale is used to determine level of fatigue subjectively.

Procedures:

A- Evaluation procedures:

1-Laboratory analysis (Serum Creatinine and Albumin).

Blood sample was taken from patient, before treatment application (pre-treatment) and after six weeks of treatment application (post- treatment). Serum creatinine and albumin analysis had been done using Siemens EXL clinical chemistry system.

2-Revised Piper Fatigue Scale.

It is a numeric scale used for over 20years to assess fatigue level mainly in cancer patients. It is composed of 27 questions. 22 questions are numerically scaled from 0 to 10 to measure four dimensions of subjective fatigue (Behavioral, Affective, Sensory and cognitive). The other 5 questions are not added to the total score but are recommended to furnish rich and qualitative data. The final score is graded from 0 to 10 to detect the severity of fatigue as follows: 0 NONE, 1-3 MILD, 4-6 MODERATE and 7-10 SEVERE,[15]. Each patient had completed Revised Piper Fatigue Scale questionnaire after an explanation before treatment (pretreatment) and after six weeks (post treatment).

B. Treatment procedures:

This current study was designed to investigate the therapeutic effect of physical therapy program on renal function of third degree burned patients, so the treatment protocol was applied through the following steps and phases. The patients were checked carefully to make sure there were no contraindications. Every patient was given information about the measurement and treatment procedures before the beginning of the treatment. All participants were asked to be cooperative with treatment program. Therapists assess and confirm that a patient is able to comply with detailed step-by-step instructions provided. **For (Group A)** the study group they received normal routine of medications and the selected Physiotherapy program as follows, a combination of Aerobic and Resisted exercise were done to the patient. A target of thirty minutes of exercise for five days per week as follow:(5-10 minutes as warm up in form of stretching exercise and walking), (10-15minutes main phase aerobic exercise for large muscle groups as gogging, walking and cycling for three alternative days. Aerobic exercise intensity was classified by the person as 'somewhat hard'; that is, their breathing and heart rate increased, making it difficult to talk continuously while exercising and resisted exercise using cuff weights, weight bearing exercise and stair climbing on the other days. Resisted exercise was at intensity (weight) that can be lifted for (12-15) repetitions and (5-10 minutes as cooling down).**For Group B** the control group, they received only their routine medications.

Statistical analysis:

Data will collected two times as follow: before starting (pretreatment) & after six weeks (post treatment). These data was transferred into IBM card using IBM personal computer with statistical program. In this study, the mean, standard deviation and standard error were calculated for all variables in both groups. Independent "T" test was used also to compare between pre test and post test in each group. Benferroni post hoc test to reveal differences between results of two groups at pre treatment and post treatment. The level of significance for all statistical tests was set at $p < 0.05$.

Results

The post treatment results revealed that the mean value of Serum Creatinine (mg/dl) before treatment application (pre-treatment) was 1.9 ± 0.14, while the mean values of Serum Creatinine (mg/dl) after six weeks of treatment application (post) were 1.45 ± 0.12 with maximum and minimum values 2.2 and 1.3 respectively.

The percentage of improvement in Serum Creatinine (mg/dl) was 23.68 % after six weeks of treatment application when compared with before treatment (pre-treatment)

Table (1) and fig (1), Shows comparison between results of group (A) and group (B) pre treatment, there is no significant difference between the two groups. While **table (2) and fig (2),** shows the comparison

between results of both groups post treatments. As conducted from the two tables, we can show significant differences between results of both groups post treatment and between pre treatment and post treatment for both groups as well.

Table (1) Comparison between group A and B pre treatment

Item	Serum Creatinine	Serum Albumin	RPFS
Group (A)	1.45	3.45	4.5
Group (B)	1.57	3.15	5.5

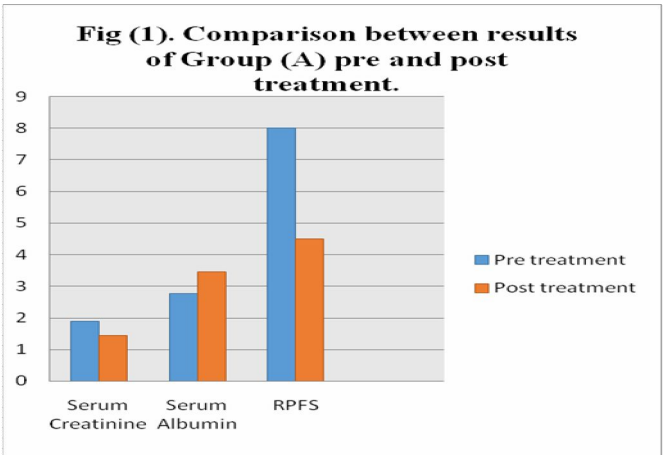


Table (2) Comparison between group A and B post treatment

Item	Serum Creatinine	Serum Albumin	RPFS
Group (A)	1.9	2.77	8
Group (B)	1.82	2.9	7.5

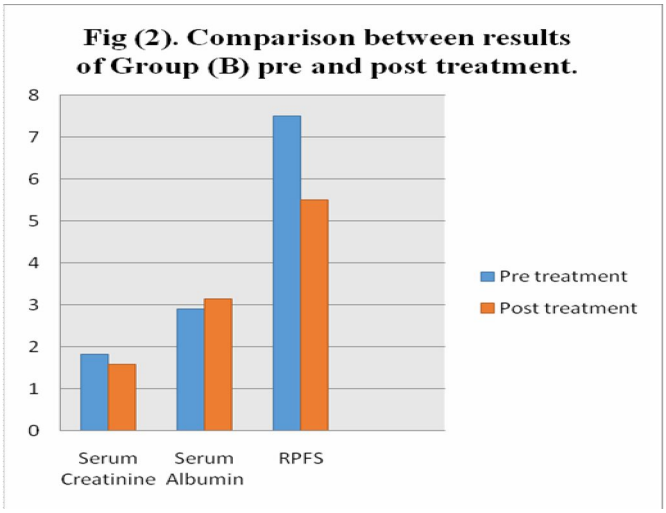
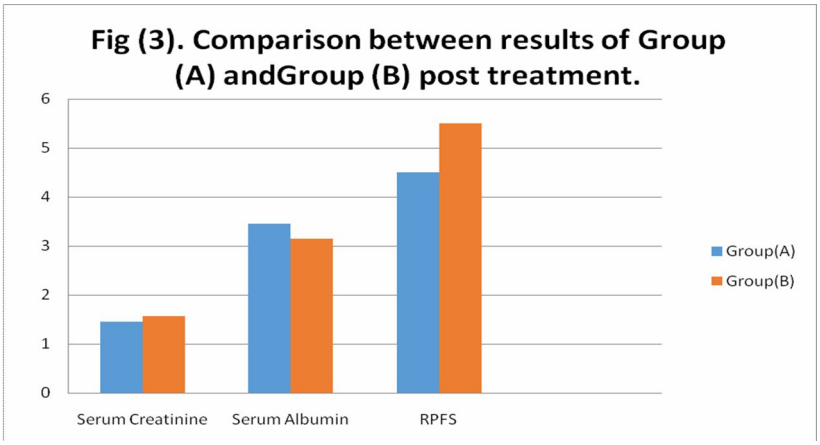


Fig (3). Shows comparison of results between group (A) and group (B) after application of the program for six weeks (Post treatment).



It is clear from **fig (3),** after six weeks of treatment application (post) of aerobic and resisted exercise group, the Serum Creatinine (mg/dl) (group A) had a significant increase when compared with Routine of medication group (group B) (p=0.029), the Serum Albumin (g/dl) had a significant increase when compared with Routine of medication group (group B) (p=0.008) and the Revised Piper Fatigue Scale (RPFS) had a significant increase when compared with Routine of medication group (group B) (p=0.04).

Discussion

Results of this study showed that aerobic and resisted exercises have good effects on renal functions and fatigue for patients who suffer renal complications due to burn injury.

Despite major advances in therapeutic strategies for the management of patients with severe burns, including improved resuscitation, enhanced wound coverage, infection control, and management of inhalation injuries, the consequences of a severe burn are profound and result in complex metabolic changes that can adversely affect every organ system. Multiple organ dysfunction syndrome (MODS) is a progressive disorder that commonly occurs in acutely ill patients, regardless of etiology of the injury or illness. MODS exist in a continuum with the systemic inflammatory response syndrome (SIRS) which affects most patients with a severe burn, with or without an infection, [9].

The risk of MODS increases with burn wounds >20 percent TBSA, increasing age, male gender, sepsis, hypo perfusion, and under resuscitation, [18].

Acute tubular necrosis and acute kidney injury, Acute tubular necrosis and acute kidney injury (AKI) are caused by a reduction of cardiac output and blood volume along with an increased secretion of stress mediators(e.g., angiotensin, aldosterone, and vasopressin). AKI is associated with a high mortality rate for severely burned adults and children (88 percent and 56 percent, respectively), [6].

Immediate fluid resuscitation upon admission to the emergency department is the fundamental approach to preventing AKI. Early renal failure can occur as a consequence of under perfusion and under resuscitation. A second period of risk occurs 2 to 14 days after the initial resuscitation,[9].

Reduced urine output despite adequate fluid administration is usually the first sign of acute renal failure. This will be followed by a rise in serum creatinine and urea concentrations. Early renal support (haemodialysis or haemofiltration) will control serum electrolytes and accommodate the large volumes of nutritional supplementation required in a major burn,[1].

Many characteristics apart from renal function may influence the creatinine concentration, such as age, gender and race: younger patients, males and Blacks have higher serum creatinine concentrations for the same given GFR, compared with older patients, females and Caucasians,[12].

The benefits of exercise in the chronic kidney disease population have been researched for over 30 years, with evidence now for the primary and secondary prevention of chronic kidney disease and tertiary prevention of end stage renal disease through restoration of physical function and reduction of disease-related complications,[11].

As a result of improvements in VO2max that occur from cardiovascular training it has been hypothesized that if patients with chronic kidney disease were able to increase their VO2max a survival benefit may be found. Studies have shown an improvement in VO2max can be achieved in patients with chronic kidney disease and the physiological response is similar to other patient groups,[10,11].

This may be because moderate intensity of exercise was prescribed. When more vigorous exercise intensity has been used, a greater improvement has been seen, [10], although the patients enrolled have often been the healthiest end-stage renal disease individuals, of small number and considered not to be a true reflection of the end-stage renal disease population. Equating survival benefit and VO2max improvement in this cohort is therefore difficult but the greatest physiological changes appear to be in those who were least active beforehand, [10,11].

Combined aerobic and resistance based exercise programs lead to greater improvements in VO2max (40–50%) which may mean that this is more efficacious for patients with chronic kidney disease then aerobic or resistance-based programs alone, [10,11,14].

Conclusion

Within the limitations of the present study, the most notable conclusions are:-

1. Aerobic and resisted exercises as physical therapy program on improving the renal function in third degree burned patients.
2. The serum and CBC analysis is extremely effective, valid and inexpensive tool in assessment of renal function.
3. This study may be useful for reducing complications of renal function after burn and improving physical performance of daily living activities, because of independent lifestyle among those populations.

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