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Effect Of Isometric Hand Grip Exercises On Blood Pressure And On Quality Of Life In Patients With Acute Kidney Injury

A RANDOMIZED CLINICAL TRIAL

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Abstract: **BACKGROUND:** Acute kidney injury is a syndrome characterized by the rapid loss of the kidney's excretory function and is typically diagnosed by the accumulation of end products of nitrogen metabolism (urea and creatinine) or decreased urine output, or both. It is the clinical manifestation of several disorders that affect the kidney acutely. Prevalence of hypertension was 70%, with the highest rate in post-renal AKI (85%), followed by renal AKI (75%) and pre-renal AKI (30%). Quality of life is seen to be decreased in all stages of kidney disease.

AIM: To study the effect of isometric handgrip exercise on blood pressure and on QOL in AKI patients

METHODOLOGY: Forty-three subjects who fulfilled selection criteria included using simple random sampling. Subjects were evaluated for blood pressure using sphygmomanometer, and QOL using KDQOL-36 scale. Subjects were given isometric handgrip exercise 3 times per week for 8 weeks. After intervention of 8 weeks outcomes measures sphygmomanometer and KDQOL-36 scale were again taken.

RESULT: The results indicated that there is significant reduction of blood pressure after the given treatment protocol. Also there is increase in the QOL score due to the treatment.

CONCLUSION : The findings of this study support the effectiveness of Isometric Handgrip Exercises to lower blood pressure and increase QOL in patients with AKI.

Key Words: *Isometric hand grip exercise – Hypertension – AKI – Systolic blood pressure – Quality of life*

INTRODUCTION

Acute kidney injury is a syndrome characterized by the rapid loss of the kidney's excretory function and is typically diagnosed by the accumulation of end products of nitrogen metabolism (urea and creatinine) or decreased urine output, or both. It is the clinical manifestation of several disorders that affect the kidney acutely. Duration of greater than 3 months is defined as chronic, while duration of 3 months or fewer is termed acute. (1)

In India, incidence of AKI is varying from 0.8% to 38%. 0.8% in Himachal Pradesh, 0.83% in Karnataka, 33% in Delhi, and 37.7% in Maharashtra. AKI is more prevalent in hospitalized adults and leads to significant in-hospital mortality. More than a quarter of AKI patients were found to be elderly (>65 years). (2)

Prevalence of hypertension was 70%, with the highest rate in post-renal AKI (85%), followed by renal AKI (75%) and pre-renal AKI (30%).[1] It is thought that the excess salt and water retention cause the blood flow to the tissues to increase, causing the autoregulation phenomenon to begin. To reduce the excess blood flow, the tissue arterioles vasoconstrict.
The cardinal most consistent finding in HTN is that the resulting vasoconstriction raises the peripheral vascular resistance. (3)

Once hypertension has developed, several factors, including increased oxidative metabolism, with resultant relative renal hypoxia, may drive further progression of BP and CKD. High blood pressure can constrict and narrow the blood vessels, which eventually damages and weakens them throughout the body, including in the kidneys. The narrowing reduces bloodfow . (3)

If the kidneys' blood vessels are damaged, they may no longer work properly. When this happens, the kidneys are not able to remove all wastes and extra fluid from your body. Extra fluid in the blood vessels can raise the blood pressure even more, creating a dangerous cycle, and cause more damage leading to kidney failure. (3)

This is controlled by several factors including diurnal variations in autonomic function, salt excretion and the RAAS. Dysregulation of these leads to a non-dipping or even rising BP, which is associated with increased CVD morbidity and mortality and risk of CKD progression (4)

Studies have shown that isometric exercises are effective in lowering the blood pressure. (5)With less mechanical pressure on the muscle capillaries, an increased venous return may stimulate low baro-receptors. This reflexly leads to peripheral vasodilatation by reducing vasoconstrictor tonus. The increased venous return produces an increased cardiac output against less peripheral resistance, thereby lowering diastolic and systolic blood pressures (6)

Stimulation of the high baro-receptors in the carotid and aortic sinuses intermittently during isometric exercise may cause an immediate reflex slowing of the heart, which in turn may reduce blood pressure. (6)

Repeated daily isometric exercise over a long period may cause growth of the capillary bed in muscles and thereby increase the volume of blood in this area, which in turn may decrease arterial blood pressure (6)

Quality of life decreased in all stages of kidney disease. A reduction in physical functioning, physical role functioning and in the physical component summary was observed progressively in the different stages of kidney disease (7)

Quality of life can be assessed by KDQOL-36 scale in patients with acute kidney injury with hypertension.

SUBJECT AND METHODS

Subjects:
This study was carried out on a random sample of forty three AKI patients with hypertensive and it was conducted for 8 weeks. Duration of the study was 6 months.

All participants were given a full explanation of the treatment protocol and informed consent

Instrumentation:
Stethoscope:
Mercury column sphygmomanometer: To measure blood pressure pre & post treatment.

Hand grip dynamometer to determine maximum voluntary contraction (MCV).

Spring loaded hand grip device:
Easily adjust resistance level from (10 to 40kg):

- Comfortable anti slip handles fit any hand size.
- High quality stainless steel tension springs provide long lasting **[11]** . *:*

Measurement of blood pressure:
The procedure was carefully and clearly explained to each patient. The blood pressure was assessed using sphygmomanometer,

Treatment procedures:
All subjects had full illustration as well as, explanation about the protocol of the study and signed a written approved consent form before the study.

Duration of the study: 24min. Frequency: 3 times per week, for 8 weeks

1. Isometric hand grip exercise was performed) by using stress ball for 3 sessions/ week for 8 weeks
2. Before starting first treatment session, each patient was instructed briefly about the treatment procedure, which was explained carefully to them to gain confidence and cooperation.
3. They were in sitting position during training with the working arm extended toward front.
4. Before each training session each subject's maximum voluntary contraction (MVC) value was determined.
5. Patients performed four bouts (2min) of isometric hand grip exercise with the dominant hand by using stress ball at 30% of maximum voluntary contraction (MVC).
6. Each bout was separated by 4 min rest period.

RESULTS

Normality test using Shapiro-Wilk

Variable	Time Frame	z-value	p-value
BP 1	Pre	0.946	0.043
	Post	0.926	0.009
BP 2	Pre	0.959	0.132
	Post	0.933	0.015
QOL	Pre	0.949	0.055
	Post	0.931	0.013
Age	--	0.969	0.287

Table no 1

Statistical analysis were performed by using SPSS 23, and as the sample size is less than 2000 so Shapiro-Wilk test used to identify the normality and data do not follow normal distribution by ($P < 0.05$). Data set is not normally distributed as all the variables have not indicated p-value greater than 0.05 in the observation. The researcher shall use non-parametric test for data analysis purpose in the following sections. To find out the effect within the group, paired Wilcoxon test is used. $P < 0.05$ considered as statistically significant in the study (CI 95%)

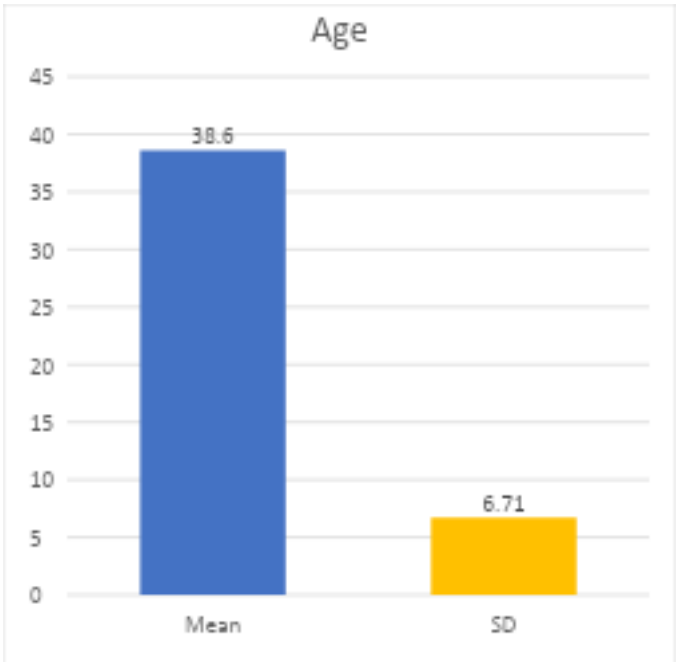
Descriptive Statistics

Variable	Minimum	Maximum	Mean	SD
Age	26.00	54.00	38.60	6.71

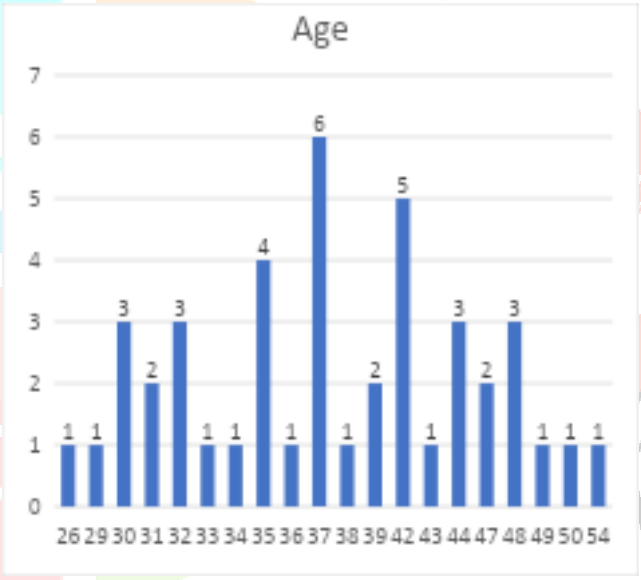
Table no 2

0.	Frequency	Percent
26.00	1	2.3
29.00	1	2.3
30.00	3	7.0
31.00	2	4.7
32.00	3	7.0
33.00	1	2.3
34.00	1	2.3
35.00	4	9.3
36.00	1	2.3
37.00	6	14.0
38.00	1	2.3
39.00	2	4.7
42.00	5	11.6
43.00	1	2.3
44.00	3	7.0
47.00	2	4.7
48.00	3	7.0
49.00	1	2.3
50.00	1	2.3
54.00	1	2.3
Total	43	100.0

Table no 3



Mean Age Graph



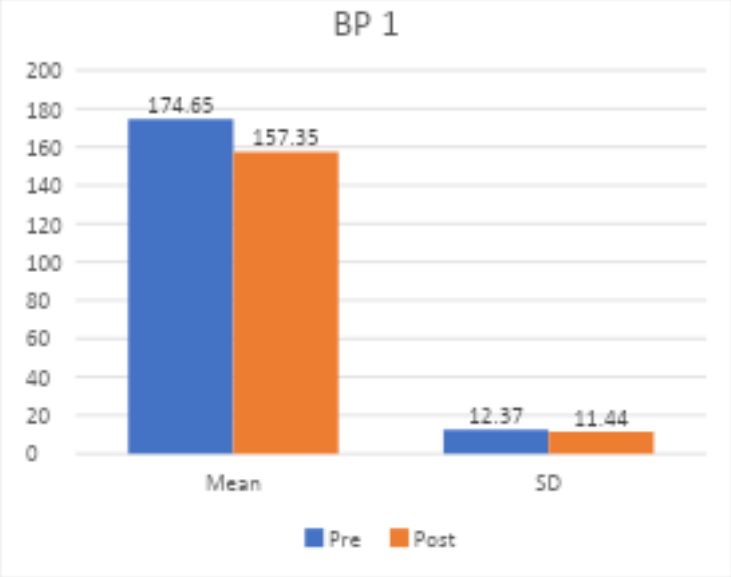
Age Frequency Graph

Comparison of pre-test and post-test scores of BP 1 by Paired Sample Wilcoxon Test

Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Pre	174.65	12.37	17.30	6.89	2.51	16.479	0.001*
Post	157.35	11.44					

Table no 4

The mean value indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 5.65 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.



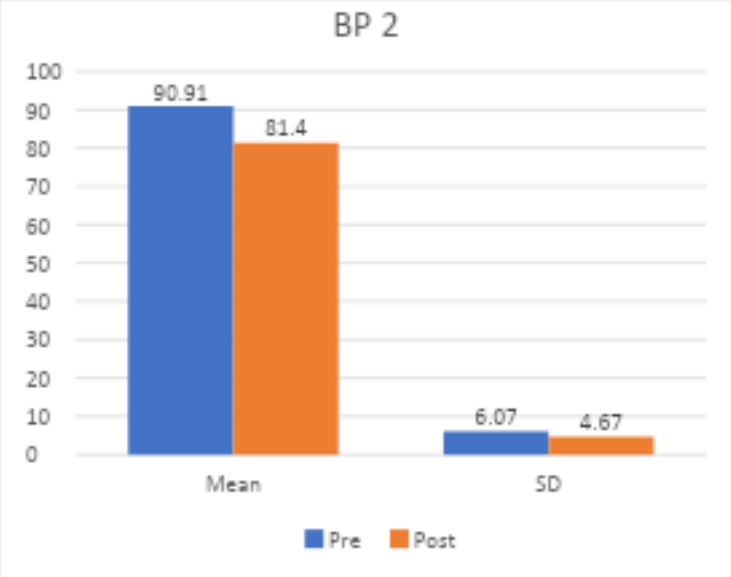
Comparison of Pre and Post BP 1

Comparison of pre-test and post-test scores of BP 2 by Paired Sample Wilcoxon Test

Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Pre	90.91	6.07	9.51	3.80	2.50	16.410	0.001*
Post	81.40	4.67					

Table no 5

The mean value indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 2.50 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.



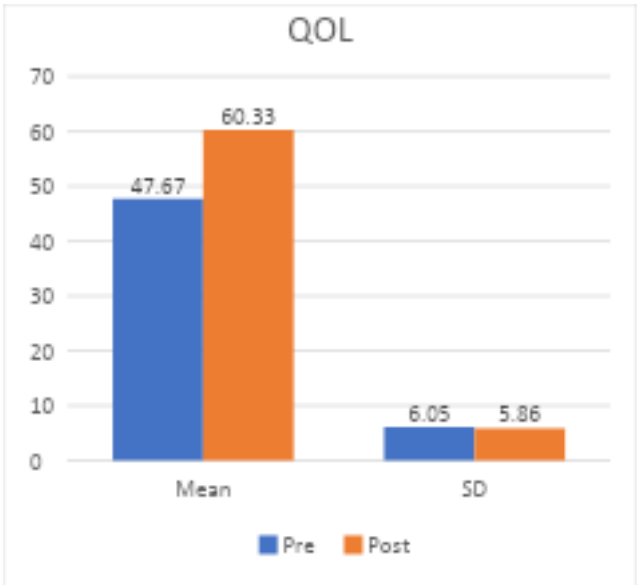
Comparison of Pre and Post BP 2

Comparison of pre-test and post-test scores of QOL by Paired Sample Wilcoxon Test

Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Pre	47.67	6.05	12.65	2.42	5.23	34.295	0.001*
Post	60.33	5.86					

Table no 6

The mean value indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 5.23 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention



Comparison of Pre and Post QOL

DISCUSSION

In our study, there was there was a statistically highly significant decrease in the mean value of blood pressure. There was also a significant increase in the QOL score after the treatment.

The result of the study agreed with those of Garg, Rinku et al., (2014) who found that after10 weeks of IHG training performing 3min bouts of IHG exercise separated by 5 minute rest period for 3times weekly for 10 weeks, there was a significant reduction in resting systolic and diastolic blood pressure. IHG might be simple, cost effective and non-pharmacological method in decreasing blood pressure. (10)

The result of this study agreed with those of Jared J Richards et al (2022) The purpose of this study was to compare the BP, heart rate (HR) and rates of perceived exertion (RPE) responses between a bout of IHG training performed using the traditional computerized device and a more affordable, inflatable stress ball. Twenty healthy adults performed one bout (4, 2-min isometric contractions, with 1-min rests between each contraction at 30% maximal voluntary contraction) of IHG training using the traditional computerized device, and one bout with the inflatable stress ball. BP, HR, and RPE were recorded. The potential to offer IHG training using a stress ball as a BP-lowering standard of care treatment in primary care is innovative and timely. (2)

Conclusion:

It could be concluded that the isometric hand grip exercise is a simple, cost free and non pharmacological method in reducing blood pressure and can be used as adjunct method in treatment of hypertension in AKI patients.

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