Comparison of Closed Kinetic Chain Exercises and Conventional Therapy on Cardiac Parameters in Post CABG Subjects

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Abstract

Introduction: Cardiovascular disorders are public health problems worldwide. In industrialized world they are the leading cause of morbidity and mortality. Coronary artery bypass grafting (CABG) has proved to be a major life saving operative method in cardiovascular disease. Physiotherapy interventions play major role in rehabilitation post CABG so the study was conducted with the aim to find the effect of closed kinetic chain exercises and conventional therapy on cardiac parameters in post CABG subjects.

Method: In this comparative study 20 subjects were treated for post CABG subjects between the age group of 40-50 years. Group A were given conventional treatment and Group B were given Closed Kinetic Chain exercise. The pre and post -test was measure blood pressure, respiratory rate, heart rate, oxygen saturation and borg scale.

Results: The statistical analysis for conventional therapy pre and post week1 day 1-systolic blood pressure(p=<0.0001), diastolic blood pressure(p=0.005), respiratory rate(p=0.001), heart rate(p=0.011), oxygen saturation(p=0.081) and borg scale(p=0.003). pre and post week6 day 3- diastolic blood pressure(p=0.018), respiratory rate(p=<0.0001), heart rate(p=0.005), systolic blood pressure(p=0.186), oxygen saturation(p=0.343) and borg scale(p=0). The statistical analysis for experimental group pre and post week1 day 1-heart rate (p=0.01) diastolic blood pressure(p=0.002), systolic blood pressure(p=<0.0001), respiratory rate(p=<0.0001),borg scale(p=0.0007), oxygen saturation (p=0.508). pre and post week6 day 3-borg scale(p=0), diastolic blood pressure(p=0.051),heart rate (p=<0.0001), respiratory rate(p=<0.0001), systolic blood pressure(p=0.26) and oxygen saturation(p=0.34).The study had found that conventional therapy is more effective than experimental group.

Conclusion: The study concluded that conventional treatment is more effective than closed kinetic chain exercises. However, it cannot be stated that CKC has no effect because of its additional benefits on functional capacity (improve joint integrity). Therefore, it can be concluded that further studies can evaluate the improvement noted with a right combination of both and obtain greater benefits.

Keyword: *post CABG, cardiac parameters, closed kinetic chain, oxygen saturation, blood pressure*

Introduction

Cardiovascular disorders are public health problems worldwide. In industrialized world they are the leading cause of morbidity and mortality. The annually recorded cardiovascular mortality is about 0.8%.[1] In India cardiovascular diseases account for 25 % of death rate .[2]

Coronary artery bypass grafting(CABG) has proved to be a major life saving operative method and thereby aiding in prolongation of life, primarily by help relieving the symptoms of angina .[3]

The major complication that emerge after surgery are being bed ridden, oedema, wound pain, decreased physical activities and depression.[4] In previous study

by Jenkins et al 1983, breathlessness, or dyspnea were investigated. It was found that 60% of patients experienced dyspnea before CABG, 54% of these were completely relieved of dyspnea, 22% reported some improvement, and 18% had no improvement 6 months following surgery. Another similar study by Mayou and Bryant 1987 reported that 71% of patients experienced dyspnea before surgery whilst 39% reported it 12 months post-surgery.[5] In a study by Duprez D. it was found that during rehabilitation phase mean ambulatory blood pressure parameters were within normotensive range.[6] Studies state Surgery affects physical activity, endurance, muscle strength, work in performance and quality of life to a certain extent .[4]

In a study ShifaManhal found that the range of motion and function of the shoulder girdle and upper back are impaired following CABG, specially after median sternotomy, due to retraction of sternum. The chances of developing frozen shoulder increases after cardiovascular surgery.[7] Thus broad spectrum of musculoskeletal problems affects quality of life of cardiac patients.

Cardiac rehabilitation(CR) is an outpatient secondary prevention program comprised of structured exercise training as well as comprehensive education and counselling.[8]Therefore, it is necessary and considered useful for the patients.[1]Numerous studies suggest greater physical fitness and quality of life after receiving exercise training for a long time and post-surgery education.[9]Various physiotherapy approaches till date are Active exercises for upper and lower limb· Breathing exercises, Inspiratory diaphragmatic breathing exercise, Expiratory pursed lip breathing exercise, walking, stair climbing, spirometry primarily addressing for return of quality of life post CABG.

In a study it was found that mean grade scores of physical limitations were significant pre-treatment with a substantial improvement post treatment. Exercise based rehabilitation lowers rate of cardiac death. Findings from a review of 22 randomized control trails revealed a 20% reduction in mortality rate.[10]

Despite of these many musculoskeletal complicationsthere are very few and limited studies performed and there are many reasons to believe the occurrence of shoulder dysfunction with increasing population of postoperative CABG patients.[11]

Till date many approaches are carried out to overcome physical limitation primarily OKC approach. But no studies till date report the significance of CKC exercise alone. Therefore it is need to study the effect of Closed Kinetic Chain(CKC) exercises as these exercises have maximal surface contact and distal segment is fixed and movement of proximal joint.[12,13]There is activation of many group of muscle while movement of joint takes place which might add to a better improvement in reducing physical limitations .[12]However only caution regarding the proportion of drop outs need to be interpreted.[14] However, a program of exercise that does not include all exercise components or achieve less than the recommended volumes of exercises is likely to have benefit, particularly in habitually inactivate persons.[15]

Material and Methodology

An approval for the study was obtained from the Protocol committee and institutional Ethical Committee of KIMSDTU. 20 subjects were included post 6 week of CABG and between age group of 40 to 50 and those who have undergone CABG for the first time. Subjects withNeurological problems**,** musculoskeletal problems before surgery**,** with movement disability and impaired cognition were excluded. Subjects were explained about the procedure of the study and written consent was taken. Pre and Post assessment (week 1 day 1) of Blood pressure, Heart rate, Respiratory rate, oxygen saturation was taken to assess the subject. Target heart rate was decided according to age-adjusted predicted maximum heart rate formula: 220 – age. A total 20 subjects was equally divided into two groups. Group A (conventional) received active exercises for upper and lower limb, Breathing exercises, walking, stair climbing and spirometry where Group B (experimental) received standing wall side, partial squat, lunges, wall push up and dorsiflexion and push the wall.

Findings

1. Comparision of Pre and Post within Group A

Table no 1:baseline parameters in group A

grp A	**w1 d1**		**w6 d3**	
Parameters	**Pre**	**Post**	**Pre**	**Post**
BP st	140.6±3.56	144.1±3.63	129.6±6.72	131.0±6
BP dy	84.900±4.508	88.800±3.676	80±6.667	84.1±8.062
RR	29.2±3.565	31.6±4.115	21.4±1.35	23.2±1.033
HR	91.1±5.705	101.1±12.512	73.6±2.27	83.6±10.23
OS	96.3±1.889	96.6±1.578	99.3±0.948	99.5±0.849
BS	0.05±0.11581	0.45±0.3689	0	0

grp A	**mean diff**		**t value**		**p value**		**Remark**	
Parameters	**w1 d1**	**w6 d3**	**w1 d1**	**w6 d3**	**w1 d1**	**w6 d3**	**w1 d1**	**w6 d3**
BP st	-3.5	-1.4	10.24	1.429	<0.0001	0.186	S	NS
BP dy	-3.9	-4.1	3.578	2.86	0.0059	0.0188	S	S
RR	-2.2	-1.8	7.571	9	<0.001	<0.0001	S	S
HR	-10	-10	3.187	3.61	0.0111	0.005	S	VS
OS	-0.3	-0.2	1.964	1	0.0811	0.343	NQS	NS
BS	-0.4	0	4	0	0.0031	0	VS	NS

2. COMPARISION OF PRE AND POST WITHIN GROUP B

Table no 2: baseline parameters in group B

grp B Parameter	**w1 d1**		**w6 d3**	
	Pre	**Post**	**Pre**	**Post**
BP st	136±5.16	141.7±6.23	132±3.49	134±6.58
BP dy	86±9.36	89.2±8.92	82±7.52	85±5.27
RR	31.2±2.098	37±2.906	20.8±2.34	24.7±2.98
HR	79.4±9.74	96.9±9.89	71.8±1.68	76.8±2.48
OS	96.6±1.83	96.8±1.317	99.8±0.63	100±0
BS	0.05±0.158	1.25±0.716	0	0

grp B Parameters	mean diff		t value		p value		Remark	
	w1 d1	w6 d3	w1 d1	w6 d3	w1 d1	w6 d3	w1 d1	w6 d3
BP st	-5.7	-2	7.35	1.17	<0.0001	0.269	ES	NS
BP dy	-3.2	-3	4.22	2.25	0.0022	0.051	VS	NQS
RR	-9.8	-3.9	11.32	6.88	<0.0001	<0.0001	ES	ES
HR	-17.5	-5.5	3.22	10.11	0.0105	<0.0001	S	ES
OS	-0.2	-0.2	0.688	1	0.508	0.343	NS	NS
BS	-1.2	0	5.041	0	0.0007	0	ES	S

3. COMPARISION OF PRE AND POST BETWEEN GROUP A AND GROUP B

Table no 3: baseline parameters in group A and B

grp A & B Parameters	**w1 d1 post**		**w6 d3 post**	
	A	**B**	**A**	**B**
BP st	144.1±3.63	141.7±6.23	131.00±6.000	134.00±6.583
BP dy	88.800±3.676	89.200±8.929	84.100±8.06.2	85.000±5.270
RR	31.600±4.115	37.00±2.906	23.200±1.033	24.700±2.983
HR	101.10±12.512	96.90±9.893	83.600±10.233	76.800±2.486
OS	96.60±1.578	96.80±1.317	99.500±0.8498	99.800±0.3162
BS	0.45±0.36	1.25±0.716	0	0

grp A & B Parameters	**t value**		**p value**		**Remark**	
	A	**B**	**A**	**B**	**A**	**B**
BP st	1.05	1.065	0.307	0.3009	NS	NS
BP dy	0.131	0.2955	0.8972	0.771	NS	NS
RR	3.39	1.503	0.0033	0.1503	VS	NS
HR	0.8327	2.04	0.4159	0.0561	S	NQS
OS	0.3078	1.395	0.7618	0.18	NS	NS
BS	3.138	0	0.0057	0	VS	S

Discussion

This present study "comparison of closed kinetic chain exercises and conventional therapy on cardiac parameters in post CABG subjects" was conducted to interpret impact CKC exercises on cardiac parameters such as blood pressure, respiratory rate, heart rate, oxygen saturation, borg scale.Post CABG decreased physical functioning has been noted. Recent study states that an investigation of exercise behaviour at 6 and 24 months post-surgery 67% of individuals were regular exercisers and therefore retaining pre-activity level and reducing detoriation of physical activity following surgery.[5]CKC exercises improve joint integrity of the individuals, as these exercises have maximal surface contact and distal segment remained fixed.

The outcome measures used in study were Blood pressure, Heart rate, Respiratory rate, oxygen saturation

and Target heart rate.

Group A:pre and post week1 day 1-There was significant changes in systolic blood pressure(p=<0.0001), diastolic blood pressure(p=0.005), respiratory rate(p=0.001), heart rate(p=0.011), not quite significant change in oxygen saturation(p=0.081) and very significant change in borg scale(p=0.003). pre and post week6 day 3- there was significant changes in diastolic blood pressure(p=0.018), respiratory rate(p=<0.0001), very significant changes in heart rate(p=0.005), not significant change is systolic blood pressure(p=0.186), oxygen saturation(p=0.343) and borg scale(p=0).

Group B: pre and post week1 day 1-There was significant changes in heart rate (p=0.01) very significant change in diastolic blood pressure(p=0.002), extremely significant changes in systolic blood pressure(p=<0.0001), respiratory rate(p=<0.0001),borg scale(p=0.0007) , not significant changes in oxygen saturation (p=0.508). pre and post week6 day 3- there was significant changes in borg scale(p=0), not quite significant change in diastolic blood pressure(p=0.051), extremely significant heart rate (p=<0.0001), respiratory rate(p=<0.0001) not significant change in systolic blood pressure(p=0.26) and oxygen saturation(p=0.34)

Between group comparison: Group A and B: post week1 day1 – significant change in heart rate(p=0.415), very significant change in respiratory rate(p=0.003) and borg scale(p=0.005), not significant change in systolic blood pressure(p=0.307), diastolic blood pressure(p=0.897) and oxygen saturation(p=0.761) Group A and B: post week6 day3- significant change in borg scale (p=0), not quite significant change in heart rate(p=0.056), not significant change in systolic blood pressure(p=0.30), diastolic blood pressure(0.77), respiratory rate(0.15) and oxygen saturation(0.18). Also a study by Fatemeh EstekiGhashghaei reported that cardiac rehabilitation significantly improves functional capacity and some hemodynamic responses post coronary artery bypass grafting. Therefore, patients need to be reffered to rehabilitation units.[1]

Rupalsonani and Sandeep Shinde stated in their research that Physical therapy intervention with CKC exercises for postoperative hip conditions are more efficacious and cost effective.[16]Coventional treatment is more effective than CKC exercises.However, caution regarding the proportion of drop outs need to be interpreted.[14]However, a program of exercise that does not include all exercise components or achieve less than the recommended volumes of exercises is likely to have benefit, particularly in habitually inactivate persons.[15]In a study by Gabriela Lima de Melo Ghisiit was found that cardiologist lack knowledge regarding CR and therefore barrier to secondary prevention.[8]The major limitation of this study was the unwillingness of the patients to participate in the study. This study addresses the gap of adding CKC components in conventional treatment although with caution. Further studies need to be done on different age groups, different geographical area, for a longer duration, adding different stages of rehabilitation phase.

Conclusion

The study concluded that conventional treatment is more effective than closed kinetic chain exercises. However, it cannot be stated that CKC has no effect because of its additional benefits on functional capacity (improve joint integrity). Therefore, it can be concluded that further studies can evaluate the improvement noted with a right combination of both and obtain greater benefits.

Conflict of Interest: None

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Ethical Clearance:The study has been ethically cleared by institutional ethical committe of KIMSDU, Karad

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