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Effects of Physical Activity on Quality of Life of Coronary Artery Bypass Grafted Patients: Re-Examining the Evidence from Randomized Clinical Trials Through Systemic Review

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Abstract

Objective:

Coronary artery disease (CAD) is characterized by remodeling and thinning of the coronary arteries and is the major source of morbidity and mortality around the globe. Coronary artery bypass grafting (CABG) is the standard approach for the symptomatic relief and management of CAD in critical condition. Post-GABG patients has low quality of life and have long term complicated psychological outcomes. The present study aims to demonstrate the outcome of physical activity (PA) intervention on the quality of life of post GABG patients.

Methods:

120 post-CABG patients from Two randomized controlled trials meet the inclusion criteria and they were studied systemically. Endpoint analysis in the present study included mental and physical components associated with the quality of life. Various statistical tools were adopted for data management, and 95% confidence interval and mean difference were used for analysis.

Results:

Mild-moderate PA, including physiotherapy intervention or exercise for 4-24 weeks significantly enhance the scores of QoL in post-CABG patients at the end of follow up period in intervention group (36.41 ±5.12) than the control group (25.39 ±6.22). In contrast to control group, scores of both mental and physical components such as physical function, psychological role, bodily pain, general health, social function, mental health and vitality were significantly increase in the post-CABG individuals of intervention group.

Conclusion:

In summary, these finding concludes that mild-moderate PA can enhance the quality of life in post-GABG patients, nevertheless, future studies will be required with large population before recommending PA in rehabilitation programs of post-CABG patients.

Keywords: Physical activity, Life quality, Post-CABG patients, Clinical Trials, Systemic review

Introduction

Among the cardiovascular diseases (CVDs), coronary artery disease (CAD) is the primary cause of mortality around the globe. In USA, CAD has been estimated to account for almost 13% of total death cases and 43.2% of deaths attributable to CVDs in the year of 2016 [1]. It is a complicated severe inflammatory disorder, characterized by narrowing and remodeling of the coronary arteries which supply oxygen to the heart. CAD result in multiple clinical signs and symptoms, including coronary syndrome, stable angina, mild to severe cardiac arrest and maybe death [2]. Coronary artery bypass grafting (CABG) is standard approach for the management of chronic form of CAD and is superior to medical treatment in terms of relief of symptoms

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and survival [3]. It has also been revealed that CABG decrease the overall risk of major adverse cerebrovascular events [4]. Despite of its success in increasing the survival chances of CAD patients and preventing the risk of cerebrovascular events and major adverse cardiac and, CABG is associated with postoperative anxiety, hostility, depression and pain. Post-CABG pain and anxiety are associated with low quality of life and poorer long-term psychological consequences [5, 6]. Furthermore, complete recovery of the mental functions may be delayed because of depression or reversible impairment of cognition. Therefore the quality of life (QoL) may not improve as expected by patients [3].

A comprehensive cardiac rehabilitation (CR) program should aim at increasing the QoL along with increasing the patients' survival, thus this in turn can result in have a convincing outcome on the patient's psychological and physical well-being, shifting the pathological behaviors and interactive patterns and encouraging to result in a better and healthier lifestyle [7, 8]. Improving quality of life in post-CABG through non-pharmacological interventions such as physical activity is thus highly recommended. Numerous studies have shown the positive outcomes of physical activity in improving QoL of post-CABG patients while selecting different types of physical activities with different intensities and durations for assessing various parameters of QoL.

This systemic review has been undertaken in order to systematically review the effects of short-term exercise interventions for improving QoL in post-CABG patients. Results of the analysis will assess the effects of such short-term physical activities on various parameters that can be used for determining the quality of life in patients.

Literature review

The QoL is dependent on psychological physical, and social variables which are obviously determined through acts, viewpoint, attitude and behavior of the person. One of the world's most imperative health challenges is heart disease. Studies have shown that exercise-based therapy successfully reduces the risk of cardiac mortality for patients with CAD [9]. Cardiac disease is one of the world's most urgent health issues. The increasing incidence of morbidity and disability induced by cardiac disorders accompanied by social harm, and while clinical progress and cardiovascular surgery increase the living status of the patient, however, some studies show that postoperative patient life quality improvements were weak and people effected from CAD appear to experience changes [10, 11].The limits of operation and the regular state of affairs of coronary artery disease patients have worse effects on their lifestyle [12].

The cardiovascular rehabilitation programmed is a holistic programme that involves PA, exercise , diet and psychological therapy, regulation of blood lipid and blood glucose, blood pressure, avoidance of smoking. This programme is the preferred approach to rehabilitate and boost patients ' quality of life following open-heart surgery, as well as avoid potential complications [12, 13].

Studies have shown that exercise-based therapy successfully reduces the risk of cardiac mortality for patients with CAD. Results from a study of twenty-two randomized exercise clinical trials after myocardial infarction found that PA reduces the likelihood of reinfarction and the risk of cardiovascular deaths [14]. The findings of two systematic studies, including forty-eight randomised controlled trials, showed a 20% decline in deaths and a 27% decrease in cardiovascular related deaths rates in the diseased state in the second to fifth year [15, 16]. A research performed on patients with heart failure, who undergo CABG, was assessed the QoL in the intraoperative and postoperative periods, comparing it to their anxiety, age, and attendance in their cardiac rehabilitation programme (CRP). Even with all the CABG recovery procedure, it is feasible indicated that the role of life of patients increased before 1 month and after coronary artery bypass grafting though varying with regard to gender, age , and attendance in the cardiac CRP [17].

A self-controlled clinical trial, performed with a group of seventy patients with CAD and impared function of left (mild-moderate) ventricular, assessed the effect of the CRP on PA ability, functional status and quality of life. This trial was continue for 8 weeks and sleep, walking, riding, and other activities were tested by users. They noticed that the overall PA capacity improved at the end of the programme (from 8 to 10 metres; $P<0.001$), such as functional capacity and QoL [18]. In another study a randomized clinical trial was conducted in 2 groups of Yazd Afshar Hospital CAD patients. All of the 70 participants were patients with postoperative coronary artery, split into two classes. There results shows enhance in QoL in the intervention group after the PA [19]. Between 2011 and 2012, fifteen CABG patients (51.4 ± 6.4 years, 14 male, 1 female) without changing their medication were enrolled in a hospital-based CRP (Phase 3) for controlled individual exercise training sessions (thrice a week for eight weeks; moderate

intensity 60-minute session. Eight weeks of controlled exercise training (cardiac rehabilitation) was successful in improving the hemodynamic responses and functional exercise ability in patients with CABG [20]. Another systematic review confirms that in post-CABG patients, all forms of CRPs contribute to changes in the QoL and a decrease in cardiac risk factors. However, due to differences in the components of CRPs, these changes differed greatly among previous studies [21].

While cardiac rehabilitation is an important module of cardiac patient care, the number of participants and participating in the rehabilitation process is low for these patients, particularly in developed countries. There's no continuing recovery in our country following discharge from hospital. Unluckily the rate of referrals for rehabilitation assigned by physicians or hospitals is unusually nominal [22, 23].

Methods

Data search and collection

Cochrane Controlled Trials Registry, Springer database, PubMed, Google Scholar and Scifinder were searched for collection of relevant data using key words “Physical activity, Exercise, Effects, Coronary artery bypasses grafting, Patients, Randomized clinical trials”.

Inclusion and exclusion criteria

Randomized clinical trials that have been reported during 2009-2019 for examining the effects of PA on QoL in CABG patients having age range of 35-70 years were selected for meta-analysis. Physical activity reported in the selected study included mild to moderate exercise or physiotherapy intervention was selected for duration of 4 to 24 weeks with exercise frequency of at least 3 times a week. The control groups in the selected studies did not receive any physical activity interventions. Studies selected for meta-analysis determined the QoL both in terms of physical and mental components including psychological role (PR), physical function (PF), bodily pain (BP), vitality, general health (GH), mental health (MT), and social function (SF),). Studies that recruited participants with previous physical activity interventions were not selected for the meta-analysis. Moreover, studies recruiting CABG patients with other diseases were also excluded. Similarly, studies that report other treatments or intervention programs along with physical activity for CABG patients were not included. Studies reporting comparison of same physical activity in different settings were not included.

Extraction and management of data

Data was extracted by two authors and the eligibility criteria and the quality of the methods were reviewed. Each study was included after a complete consensus was reached between both the reviewers. Information extracted from the studies included design of the study, participant characteristics, outcome measures, kind of intensity, exercise, and intervention time of exercise as well as nature of the control group.

Quality assessment

The Cochrane Collaboration recommendations were used to evaluate the risk of bias for included studies in the present study. Information including performance bias, selection bias, detection bias, and attrition bias were assessed.

Statistical analysis

Average of mean and Standard deviations (SD) values were calculated for every parameter under consideration in this study. Student Two-tailed unpaired T-test was used for comparing parameters among patients within group and between control group and intervention group. P value less than 0.05 was considered statistically significant.

Results

Search of literature and selection of studies

Relevant literature was searched using searching tools of Cochrane Controlled Trials Registry, Springer database, PubMed, Google Scholar and Scifinder. A total of 12 studies reporting effects of physical activity or other form of exercise on QoL in 1694 post-CABG patients were collected [3, 5, 24-33]. Ten studies were excluded due to different reasons as shown in Figure 1. Only two studies [24, 25] recruiting 120 post-CABG patients (60 in each control and intervention group) for investigation of physical activity effects on QoL met the inclusion criteria and were selected for further analysis.

Risk of bias for selected studies

Quality assessment for selected studies was for performed in order to find the risk of bias. Cochrane Collaboration recommendations through the risk of bias table of RevMan 5 was followed for the evaluation. The risk of bias was assessed for parameters such as blinding of outcome assessments, random sequence generation, incomplete outcome data, allocation concealment, blinding of participants, selective reporting, and other bias and results are tabulated in Table 1.

Effects of physical activity on life quality of coronary artery bypass grafted patients

The post-CABG patients in the control group of the selected studies were found with an average of 61.73 ±9.27 years. Similarly, the post-CABG patients in the intervention group were found with an average age of 59.22 ±7.80 years. Improvement in QoF after physical activity intervention in post-CABG patients was measured in terms of different parameters including PF, PR, BP, GH, and vitality, SF and MT. In case of control group, physical function (PF) was not significantly different among the patients after surgery and follow up period (P>0.05) as shown in Figure 2A. Similarly, there was no significant different in PF in patients of both groups after surgery (P>0.05) as shown in Figure 2B. Interestingly, after follow up period, PF improved in patients in intervention group (36.80 ±9.05) as compared to control group (24.66 ±8.36) but without any statistical significance (P>0.05) as shown in Figure 2C.

Psychological role (PR) is another important parameter affecting QoL in post-CABG patients. Analysis shows that PR of post-CABG patients in control group decreased after follow up (after surgery= 16.58 ±15.90, after follow up= 15.31 ±10.35). Similarly, PR was also compared between the patients in control group and patients in intervention group after surgery, showing no significant difference (CG after surgery 16.58 ±15.90, IG after surgery 16.58 ±15.90). At the end of follow up period, PR markedly increased in patients of intervention group as compared to patients of control group without any statistical significance (P>0.05) as shown in Figure 3A. Improvement in body pain (BP) was the third parameter that was investigated in both control and intervention groups. BP in patients of control group slightly improved (after surgery= 28.10 ±12.22, after follow up=31.21 ±10.04). There was no significant difference in BP of both patients of control group (28.10 ±12.22) and patients of intervention group (28.13 ±12.12) after surgery. However, BP in patients of intervention group markedly improved after follow up as compared to BP in patients of control group, but without statistical significance (P>0.05) as shown in Figure 3B.

In case of general health (GH), the patients in control group were found with a decline in their GH (after surgery 31.20 ±7.95, after follow up 22.65 ±4.92). It also showed a decline in the patients of intervention group (after surgery 31.27 ±9.14, after follow up 25.98 ±4.87). However, BP slightly improved in patients of intervention group (25.98 ±4.87) as compared to patients in control group (22.65 ±4.92) after follow up period, without statistical significance (P>0.05). In case of vitality analysis, there was no significant difference in the score of vitality of patients in control group after surgery (27.93 ±9.80) and at the end of follow up periods (28.06 ±8.07). Similarly, the score of vitality of patients in control group and were almost similar for both control group (27.93 ±9.80) and intervention group (28.07 ±10.24) after surgery. However, at the end of follow up period, scores of vitality improved for the patients in intervention group (37.25 ±8.29) as compared to patients in control group (28.06 ±8.07), but without statistical significance (P>0.05).

In case of social functioning (SF), there was no significant difference the scores of SF in patients of control group after surgery (27.36±13.98) and at the end of follow up period (29.55±13.98). Similarly, after surgery, the score of SF were almost similar for both control group (27.36 ±13.98) and intervention groups (27.23 ±14.10). However, SF scores markedly increased in patients of intervention group (45.62 ±7.95) as compared to control group (29.55±13.98) at the end of follow up period, but without any statistical difference (P>0.05). When analyzed for mental health (MT), the scores of MT were almost similar for both control group (32.08 ±11.52) and intervention group (32.74±11.31) after surgery. However, at the end of follow up period, scores of MT improved for intervention group (40.39 ±8.17) as compared to control group (32.57±9.76). Similarly, score for overall QoL were also analyzed based on the data of the selected studies. There was no significant difference in the QoL of patients of both control group (25.33 ±7.69) and intervention group (24.95 ±7.87) after surgery. However, the scores of overall QoL increased for intervention group (36.41 ±5.12) when compared to control group (25.39 ±6.22) at the end of follow up period.

Discussion

Previolsy many studies investigating the clinical outcome of physical activity as intervention for the rehabilitation and improvement of QoL in patients with heart diseases [34-37]. However, no systemic review exists that can provide strong evidence to clinicians about physical activity as a complementary intervention for improved of QoL in post-CABG patients. To the best of our understanding, this is the first type of systemic review that provides a solid understanding about improvement in parameters of QoL in post-CABG patients upon intervention of physical activity.

Based on literature search, 2 randomized clinical trials were selected out of total 12 collected studies for analyzing effects of physical activity on QoL in post-CABG patients. Selection of the included studies from the pool of collected studies was made on base of similarity of various variables including patient's characteristics, exercise and end point parameters. The average age of patients both in control and intervention groups did not vary significantly. The included studies did not show any risk of bias except in blinding of participants and personnel. Seven different parameters that were common between both the included studies were analyzed for assessing improvement in QoL of post-CABG patients after follow up with and without physical activity intervention.

PF is the personal potential to perform the PA in daily life. PF reflects physical fitness, motor function and control, and daily PA [38]. Results of analysis revealed PF in post-CABG patients increased upon receiving physical activity intervention as compared to those post-CABG patients that did not receive any physical activity intervention. Findings of PF in our analysis are in consistence with previous published report suggesting improvement in PF of heart patients upon physical activity intervention [39]. This in turn suggests safety basis for the execution of everyday and routine actions and a decrease in falls, disabling symptoms and bone fractures such as dyspnea and fatigue for cardiac patients. Psychosocial stress and Cardiovascular diseases usually coexist in self-catalyzing relationships and bidirectional. Moreover, adverse events of these diseases deteriorate or even cause psychiatric issues, such as generalized anxiety disorder or major depression, thus affecting patients QoL negatively [40]. Analysis of the current study showed improvement in PR and MT in post-CABG patients upon intervention of physical activity. Which is in strong agreement with previous reported studies showing that physical activity in the form of exercise can treat existing depression or prevent future depression in heart patients [41].

Pain is one of ineffectively managed symptoms that affects the recovery status of cardiac surgery patients, and negatively affects a patient's health in terms of reduce DoL, physical functions and impaired sleep, and enhance the economic burden of the treatment [42]. Analysis of the current study also showed physical activity intervention moderately improves the scores of in body pain in post-CABG patients. Moreover, general health, vitality and social functioning in post-CABG patients were also found improved after physical activity intervention. Improvements in these parameters can be linked to the improvement in body pain. Absence of pain in post-CABG patients maintains daily activities such as sufficient energy for self-help, physical mobility, independence from others, emotional stability, social contacts, adequate sleep and rest, and lack of pain and other symptoms of distress [43, 44]. Lastly, scores of overall QoL increased for intervention group as compared to control group at the end of follow up period, revealing that physical activity intervention can improve QoL in post-CABG patients.

Conclusion

Post-GABG patients experience anxiety, hostility, depression and pain, thus result in with worse QoL and psychological outcomes for long-term. In this systemic review, we systemically evaluated the effects of PA intervention on QoL of post GABG patients. Results of systemic analysis reveal that mild to moderate physical activity such as exercise or physiotherapy intervention for 4-24 weeks can improve QoL moderate manner through improvement in mental and physical components including physical function, psychological role, bodily pain, general health, mental health, vitality, and social function.

Limitation and future outlook

There were numerous limitations in our current study. Analysis of this systemic review suggest moderate improvement in QoL in post-CABG patients upon intervention of physical activity, however, there certain limitations associated with this analysis. These limitations include (1) small number of selected studies and small size patient's population, (2) narrow average range of the patients recruited in selected studies and (3) high risk of bias of one included study. The current study findings contribute towards theory and practices in various ways, includes (1) An internal review of current services and training initiatives for cardiac rehabilitation to encourage the development of appropriate clinical practice and patient education programmed, (2) Strengthened peer support services, explicitly addressing individuals in need of post-CABG cardiac recovery programme, and (3) Formulation of a 'pack' or series of cardiac rehabilitation programme strategies at national and local institutes following CABG. However, further detailed analysis is required in this regard owing to the limitations regarding number of included studies, patient's population, and average age range of the patients and high risk of bias.

Conflict of interest

All the authors declare no conflict of interest

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Figures

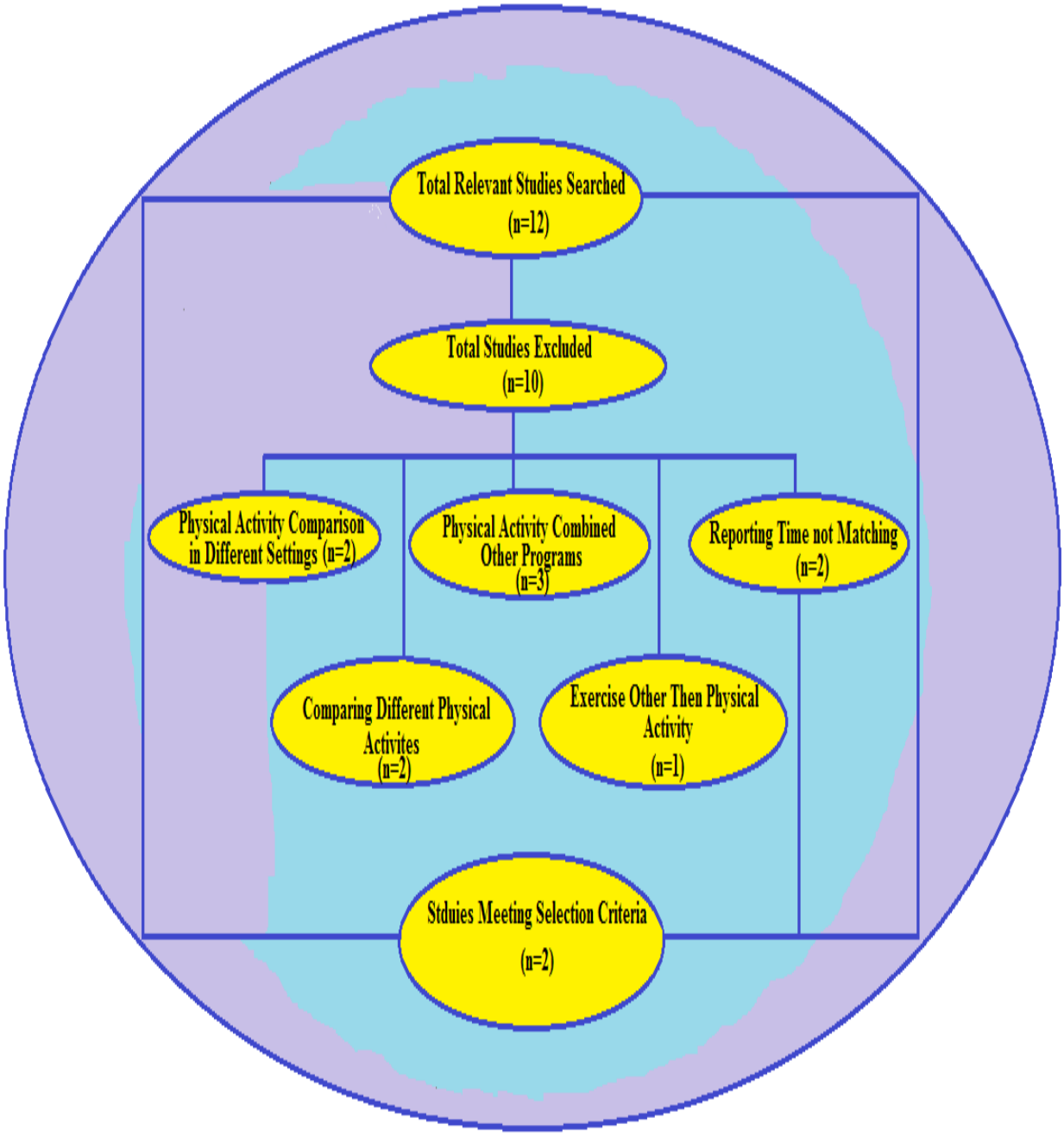

Figure 1. **Schematic representation of studies inclusion in meta-analysis**

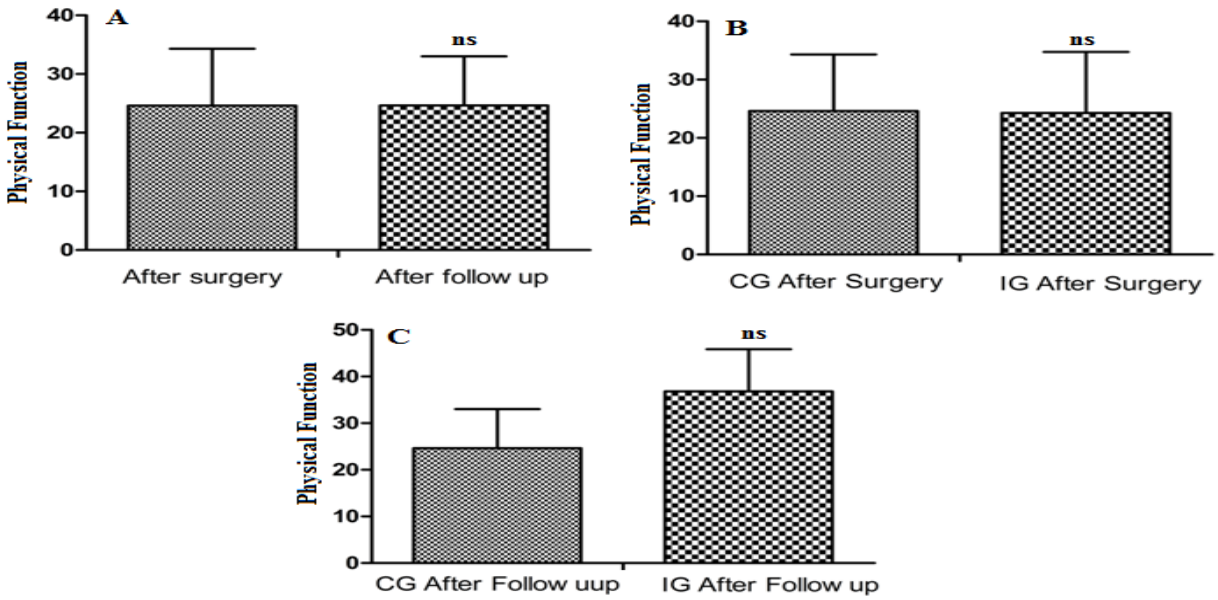

Figure 2. **Comparison of improvement in PF where (A) PF comparison among patients in CG after surgery and after follow, (B) PF comparison between patients in CG and IG after surgery and (C) PF comparison between patients in CG and IG after follow up**

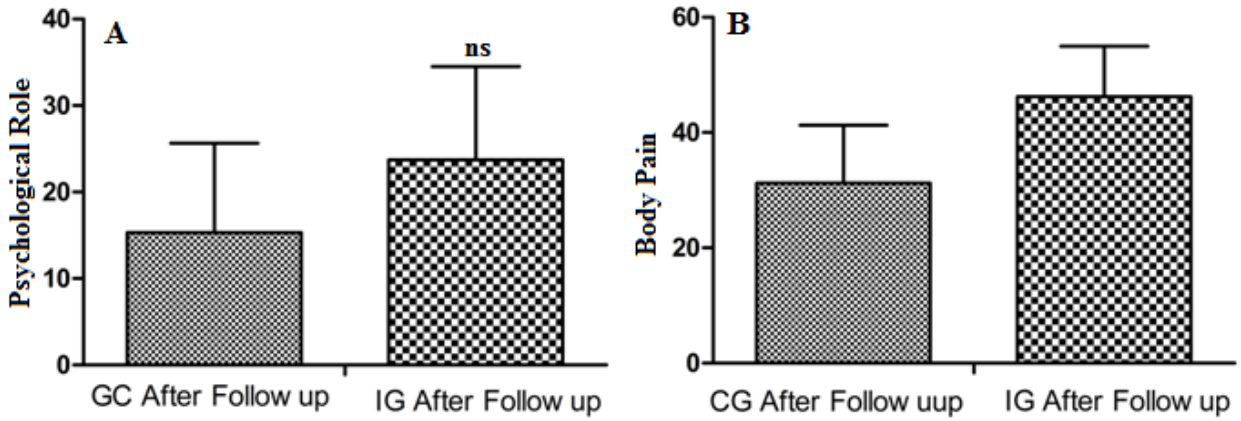

Figure 3. **(A) PR comparison between patients in CG and IG after follow up and (B) BP comparison between patients in CG and IG after follow up**

Tables

Table 1. **Evaluation of risk of bias for selected studies**

Study	Random Sequence Generation	Blinding of Outcomes	Allocation Concealment	Incomplete Outcome Data	Blinding of Participants and Personnel	Selective Reporting	Other
[24]	√	×	×	√	×	√	Not known
[25]	√	√	√	√	×	√	Not known

√: Low Risk, ×: High Risk