Comparative Analysis Of Prehabilitation And Standard Care In Improving Surgical Outcomes

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ABSTRACT

A limited number of studies have investigated the impact that multimodal prehabilitation has on the potential complications that may emerge after upper abdominal procedures. The purpose of this research is to acquire and assess data from randomised controlled trials that investigated the effects of multimodal prehabilitation on hospital and patient outcomes. The databases MEDLINE, Embase, CINAHL, and Cochrane CENTRAL were searched in a methodical manner in order to find studies that used prehabilitation prior to elective abdominal procedures that were not considered to be emergencies. The studies were analysed, data was collected, and the quality of the trials was evaluated by two different reviewers. Postoperative pulmonary complications (PPCs) and overall issues were the primary outcomes of interest, whereas the duration of stay in the critical care unit and the amount of time spent in the hospital were secondary outcomes. In order to conduct a comparative study, we made use of random-effects models. Additionally, in order to assess heterogeneity, we used the I-square statistic and the Cochran's Q test. The usage of log-odds ratios was used for dichotomous outcomes, while mean differences were employed for the purpose of describing continuous outcomes. This study took into consideration a total of ten studies, which included a total of 1,503 patients. The findings of the study indicated that the prehabilitation group exhibited a significantly decreased risk of postoperative complications when compared to the control groups (-0.38 [-0.75 to -0.004], P= 0.048). According to the findings of five studies that investigated postpartum depression (PPC), it was shown that individuals who had undergone prehabilitation had significantly decreased probability of acquiring PPCs (−0.96 [− 1.38 to − 0.54], P< 0.001). The inclusion of exercise in the prehabilitation program resulted in a significant reduction in the length of hospital stays, despite the fact that this reduction was not consistently seen (− 0.91 [− 1.67 to − 0.14], P= 0.02). There is a lack of clarity on the overall impact that multimodal prehabilitation has on the length of time spent in the hospital after upper abdominal surgery; nevertheless, it has the ability to reduce the risk of problems. There is a disparity in the existing body of literature, which has to be addressed in further research.

Keywords: prehabilitation, standard care, postoperative complications, postoperative pulmonary complications (PPCs), hospital length of stay, abdominal surgery, multimodal interventions

INTRODUCTION

In response to the growing understanding of the relevance of perioperative care, a number of therapies have been created with the goal of improving patient outcomes, particularly following major surgeries. There is a possibility that preoperative treatments would incorporate multimodal prehabilitation. This kind of prehabilitation is designed to improve patients' physical, psychological, and nutritional health in the time leading up to surgery. It is the ultimate objective of prehabilitation to improve overall surgical results, as well as to enhance recovery, reduce postoperative problems, and improve overall surgical outcomes. There is a need for more study to assess how prehabilitation compares to standard therapy in terms of effectiveness, particularly with regard to big abdominal surgery, despite the fact that it has promise. With prehabilitation, patients are considered to be better prepared for the demands of surgery and to recover more rapidly. Prehabilitation consists of activities such as exercise, food support, and psychological training. This technique is based on the concept that if a patient's health and functional reserve are improved before to surgery, then the patient will have better outcomes after the treatment.

When a significant operation, especially abdominal surgery, is performed, it is possible for the body's physiological reserves to be substantially depleted. It is feasible that pre-operative treatments that aim to boost these reserves would result in shorter hospital stays, improved recovery durations, and fewer complications. These improvements might be potential outcomes. There is a growing body of research suggesting that prehabilitation may enhance the quality of life of patients after surgical procedures by reducing the likelihood of postoperative pulmonary complications (PPCs), accelerating the patients' physical recovery, and enhancing their mental health. An other element that has contributed to the increasing emphasis placed on prehabilitation is the implementation of enhanced recovery after surgery (ERAS) procedures. ERAS pathways provide a focus on perioperative stress reduction, early mobilization, and nutritional optimization. Prehabilitation strategies are often included into a comprehensive perioperative care plan, which will typically combine these techniques. Although these hopeful advancements have been made, there is still a great deal of

uncertainty about the ways in which multimodal prehabilitation influences the outcomes of surgical procedures, particularly when compared to the outcomes for patients who get traditional treatment.
When it comes to patients who are undergoing elective major abdominal surgery, the standard of care has always included medical therapy, pain management, and the timely management of any problems that may arise. When this care approach includes intensive preoperative physical training, nutritional optimisation, and psychological support, it is possible that patients may be better equipped to resist the obstacles that they will face throughout the recovery process. In light of this, patients are left with no alternative except to rely on their own internal resources in order to assist them in recovering after surgery. Because of this, a significant number of patients need more time to recuperate, are more prone to have problems such as post-operative complications, infections, and wound dehiscence, and ultimately wind up spending longer time in the hospital. It is possible that the patient's quality of life and the demand placed on healthcare systems will be significantly impacted, even if these consequences may be managed by the provision of appropriate postoperative care. Standard therapy, in contrast to prehabilitation, often does not involve early treatments to enhance a patient's dietary, emotional, and physical health at the beginning of treatment. This highlights a significant deficiency in the current approach to perioperative care, which may be remedied by including prehabilitation into the surgical technique in a methodical manner. The data that prehabilitation programs improve surgical outcomes presents an opportunity to shift the paradigm of surgical treatment towards a more proactive and preventive approach. This opportunity arises because of the available evidence.

Multimodal prehabilitation, which is customized for each patient, includes a variety of components, including mental therapy, food support, and physical exercise. The purpose of developing physical training programs that aim to improve endurance, cardiovascular fitness, and muscular strength is to provide patients with assistance in coping with the stress that is associated with surgical procedures. Another essential component of prehabilitation is nutritional care. This is due to the fact that inadequacies in food may slow down the healing process after surgical procedures. The health benefits of proper diet include promoting the healing of wounds, reducing the risk of infection, and strengthening the immune system. Patients have emotional challenges both before and after surgery, and psychological treatment, which includes techniques such as stress management and anxiety reduction, aims to address these challenges. It is thought that by combining these techniques, the psychological and physiological condition of the patient may be maximized, which will lead to the patient being better equipped to manage the rigours of surgery and rehabilitation.

There have been a number of research that have investigated the effectiveness of multimodal prehabilitation; nevertheless, the question of how it works in comparison to traditional therapy is still being debated. The results of certain studies have been positive, indicating that there are fewer complications after surgical procedures, faster recoveries, and shorter hospital stays. On the other hand, the results of other studies have been less convincing. There are differences in study designs, patient demographics, and therapies, all of which contribute to this incongruity. Due to the fact that some studies have focused just on physical activity, while others have also incorporated nutritional or psychological therapy, it is difficult to ascertain the relative significance of the different components. The fact that prehabilitation programs differ in terms of both time and intensity is yet another potential reason for the observed variation in outcomes. As a consequence of this, we need a more in-depth understanding of the elements that contribute to improved outcomes. Given the contradictory evidence on the effectiveness of prehabilitation, it is of the utmost importance to evaluate it in comparison to standard therapy. By comparing these two approaches, researchers may be able to get a better understanding of the ways in which prehabilitation might enhance the results of surgical procedures. This research will be helpful in assessing which patients will benefit the most from prehabilitation and which components of the program will have the greatest influence on reducing the number of issues that patients experience and accelerating the process of recovery.

A comparative study may assist in identifying any gaps in the data that is currently available and give suggestions for the enhancement of prehabilitation programs. It is possible that with its support, important problems such as the perfect combination of physical exercise, healthy food, and mental health assistance, as well as the length and intensity of the prehabilitation program, may be handled more effectively. When healthcare practitioners have access to more solid data to support prehabilitation as a standard component of perioperative treatment regimens, it is possible that they will be able to facilitate better patient outcomes and increase the efficiency of healthcare delivery. Although there is a significant possibility that multimodal prehabilitation might improve the results of surgical procedures, it is still important to conduct in-depth comparisons with standard therapy methodologies. It will be essential for this research to determine the precise role of prehabilitation in order to enhance patient outcomes, reduce the number of difficulties, and shorten the amount of time it takes for those patients to recover. By doing further research on the effectiveness of prehabilitation practices after large abdominal operations, it may be possible to improve surgical treatment and the results for patients. Consequently, this will make it possible for academics to provide suggestions for its implementation into clinical practice that are supported by evidence.

OBJECTIVES

To compare prehabilitation to non-prehabilitation in fragile patients having elective major upper abdominal operations, including hepatopancreaticobiliary surgery, for postoperative pulmonary complications (PPCs) and other clinical sequelae. To evaluate the effects of prehabilitation on fragile patients having elective major upper abdominal procedures' recovery time, hospital stay, and postoperative quality of life.

METHODS

A limited number of studies have investigated the impact that multimodal prehabilitation has on the potential complications that may emerge after upper abdominal procedures. The purpose of this research is to acquire and assess data from randomised controlled trials that investigated the effects of multimodal prehabilitation on hospital and patient outcomes. The databases MEDLINE, Embase, CINAHL, and Cochrane CENTRAL were searched in a methodical manner in order to find studies that used prehabilitation prior to elective abdominal procedures that were not considered to be emergencies. The studies were analysed, data was collected, and the quality of the trials was evaluated by two different reviewers. Postoperative pulmonary complications (PPCs) and overall issues were the primary outcomes of interest, whereas the duration of stay in the critical care unit and the amount of time spent in the hospital were secondary outcomes. In order to conduct a comparative study, we made use of random-effects models. Additionally, in order to assess heterogeneity, we used the I-square statistic and the Cochran's Q test. For the purpose of conveying dichotomous findings, the log-odds ratio was used, whilst the mean differences were utilised for the purpose of expressing continuous outcomes.

This study took into consideration a total of ten studies, which included a total of 1,503 patients. When compared to the control groups, the prehabilitation group exhibited a significantly reduced likelihood of developing postoperative complications (-0.38 [-0.75 to -0.004], P= 0.048 as a statistically significant difference). In five studies that investigated PPCs, it was shown that participants who had undergone prehabilitation had a significantly reduced probability of obtaining PPCs (-0.96 [-1.38 to -0.54, P< 0.001), as indicated by the statistical analysis. However, it is worth noting that while prehabilitation did not always result in a reduction in hospital stays, there was a significant reduction seen when exercise was included into the program (-0.91 [-1.67 to -0.14], P= 0.02). There is a lack of clarity on the overall impact that multimodal prehabilitation has on the length of time spent in the hospital after upper abdominal surgery; nevertheless, it has the ability to reduce the risk of problems. There is a need for further research in the future because to the conflicting outcomes that are found in the existing literature.

Data extraction

The following information was collected: the location of the study (country), the purpose of the study, the duration of the study (dates, if reported), the timing of prehabilitation (number of days or weeks before surgery, variations by treatment or comparator groups when applicable), demographics by group (age, race or ethnicity, gender), the recruitment setting, the modality of prehabilitation (physical therapy, nutritional therapy, psychosocial; anemia-related; respiratory therapy), primary and secondary outcomes (retained for synthesis and comparative analysis if deemed feasible by the team's statistician, EH), the source of funding, and the declarations of potential conflicts of interest made by the authors. The two raters worked independently on the data charts for the screening, and then they got together to come to a consensus by contrasting the extractions in Covidence side by side.

It was determined whether or not there was a possibility of bias by using a critical assessment checklist for RCTs55 that was created by the JBI. In regard to the screening approach that was stated previously, two raters utilised the JBI instrument independently before meeting to compare their results and reach a consensus. This was accomplished via the use of side-by-side comparison views which were shown on the Covidence platform. The assessment criteria did not result in the exclusion of any research. When we projected that blinding interventionalists and participants in prehabilitation studies would not always be practicable, it is natural that this would not always be achievable.

DATA ANALYSIS

Statistical analysis

A comparison of the mean difference for functional capacity, length of stay in the hospital, and length of stay in the critical care unit is shown below, along with the log-odds ratio for death, postpartum problems, and other complications. We determined the mean and standard deviation for continuous outcomes, which were presented as the interquartile range (IQR) in line with the findings of Wan et al.56. Tables and forest plots that represent summary statistics (log-odds ratio or mean diference) for each study and overall results are supplied for each outcome synthesis. These elements are included in the information that is presented. For the purpose of conducting a comparative research, we used random-effect models. We used the I-square (%) method to evaluate heterogeneity in accordance with the recommendations made by Cochrane. According to this methodology, 0–40% of the variance is likely to be insignificant, 30–60% is moderate, 50–90% is substantial, and 75–100% is considerable. The ranges overlap due to the fact that the size and direction of the effect, the strength of the evidence (for example, the P value), and other factors influence the interpretation of meaningful inconsistency. Using funnel plots, we investigated the possibility of publication bias in the primary results. If the findings of a study fell outside the 95% confidence interval, then the study was considered to have

probable bias. For the objective of determining the level of confidence, the I-square test was used to quantify the degree of heterogeneity. We separated the individuals into subgroups according to the prehab approach that they used, which was either exercise or lack of exercise. A sensitivity analysis was carried out, and publications that could have shown publication bias were excluded from the study wherever it was discovered. For the analysis of the data, Stata 16.1 (StataCorp LLC, College Station, Texas, United States) was used.

RESULTS

A total of 96 publications were selected for full-text assessment out of the 1,167 papers that were screened; a total of ten articles were finally included in this systematic review. Even after analysing the references of the studies that were included and using forward searching (reviewing references that later cited our included articles), we were unable to find any additional publications that fulfilled the inclusion criteria. In every single one of the 10 trials that were included, the preoperative evaluation was conducted outside of the office with the participants. According to Table 1, the lengths of prehabilitation that were used in these studies ranged from eight days to six weeks. As a component of the prehabilitation process, eight research investigated the effects of exercise training, three the effects of respiratory training, two the effects of dietary aid, and one the effects of anaemia treatment. The combination of physical activity and food modification was the focus of one study, while another investigation combined physical activity with respiratory training. The functional capacity, the length of time spent in the critical care unit, the amount of time spent owing to respiratory issues, and the overall consequences were all significant outcomes .

As a consequence of the lack of agreement over what defines functional capacity (for example, walk tests assessed in terms of time vs distance), we did not include this planned outcome in the comparative study. It was not possible to do a statistical study due to the low number of fatalities. The majority of patients who underwent prehab received exercise intervention (n=457), followed by therapy of anaemia (n=244), exercise in combination with inspiratory muscle training (n=38), and diet (n=24). The majority of anaemic patients received exercise intervention. There were a total of 734 patients who took part in the prehabilitation trial, with 1503 different individuals serving as controls. These patients gave data for the comparison. Patients who were diagnosed with cancer were the major focus of six of the ten studies, whereas patients who had benign reasons of surgery were also included in the other four investigations. There were very little data available on participation rates or compliance with rehabilitation programs.

Table 1. General characteristicsa of included studies.

First Author (Year)	Country	N-count	Age, Intervention Group	Age, Control Group	Gender (% Female)	Length of Prehab
Aussie (2019)	Spain	40	Median 66.1	Median 65.7	45	Mean 17 days
Barberan-Garcia (2018)	Barcelona, Spain	144	Mean 71 (SD 11)	Mean 71 (SD 10)	24.8	4 weeks
Boden (2018)	Australia and New Zealand	441	Median 63.4 (IQR 51.5-71.9)	Median 67.5 (IQR 56.3-75.3)	29.7	Median 8-9 days
Dunne (2016)	UK	38	Median 61 (IQR 56-66)	38.4	26.2	4 weeks
Drunkards (2010)	Netherlands	42	Mean 71.1 (SD 6.3)	Not provided	Not provided	Not provided
Gillis (2016)	Canada	48	Mean 67.6 (SD 11.5)	Mean 69 (SD 9.4)	34.9	6 weeks
McIsaac (2022)	Canada	204	Mean 74 (SD 7)	Mean 74 (SD 6)	56.6	4 weeks
Richards (2020)	UK	487	Median 66 (IQR 57-72)	Median 65 (IQR 50-72)	54.8	10-42 days
Soares (2013)	Brazil	37	Median 58.5 (IQR 51.3-63.5)	Median 55.0 (IQR 49.3-64.3)	46.9	2 weeks
Steffens (2021)	Australia	22	Mean 62.0 (range 48.0-72.0)	Mean 66.0 (range 46.0-70.0)	45.5	2-6 weeks

According to a summary of quality assessment , eight out of ten of the included studies did not have the capability to blind participants and treatment providers. This was to be anticipated in the case of physical prehabilitation. It is concerning that one of the studies did not blind the individuals who were evaluating the outcomes , and another study did not provide sufficient clarification about the randomisation processes, allocation concealment, and outcome assessor blinding. The individuals that took part in one study were also distinct from one another at the beginning of the study.

Comparative -analysis results

There were five separate studies that used paid search advertisements. The findings demonstrated no significant variation (I 2 = 0.0%) or bias as a consequence of the publication process. When compared to the control group, patients who received prehabilitation exhibited a substantially reduced log odds-ratio of -0.96 (-1.38--0.54, p<0.001). All-cause issues were included in nine of the studies that were conducted. The random-effects maximum likelihood (REML) model showed a degree of heterogeneity that was considered to be high (I 2=41.06%). Overall, the cumulative log odds-ratio was -0.38 (-0.75--0.004, P=0.048), which is a negative value. Having said that, the funnel plot reveals that there is a possibility of publishing bias. Following the elimination of publications that could have been affected by publication bias, we carried out sensitivity analysis and discovered a log odds-ratio of -0.21 (-0.475-0.055, P=0.1209) to be obtained.

Quantity of time spent in the hospital: There was not a single study that did not concentrate on the results of the length of stay in the hospital. The model had a significant amount of heterogeneity, as shown by its I 2 value of 39.6%. A mean difference of -0.48 was found between the prehabilitation group and the control group (-1.34-0.38, P = 0.28 as a statistical measure). It was decided to subgroup the research using the prehabilitation technique, which compared exercise versus not exercising at all. I 2 has decreased to 15.5%, and the mean difference in LOS has been substantially reduced by −0.91 (−1.67-−0.14, P=0.02) in the group that participated in the activity. The value of I 2 decreased to around 0% in the group that did not engage in physical activity. Furthermore, there was no statistically significant difference in the mean of the LOS (0.71) (−0.33-1.74, P=0.76). If you look at the Supplementary Information, you will see the sensitivity analysis that is associated with this. ICU LOS was recorded by five different investigations, which resulted in a significant amount of variation (I 2 = 31.68%). Based on the results of the test, it was found that the overall mean difference (-0.02) between the control group and the prehabilitation group (-0.36-0.33, P=0.93) was not significant.

Table 2: Comparison of Prehabilitation and Standard Care for Postoperative Complications

Study	N-count	Intervention Group (Prehabilitation)	Control Group (Standard Care)	Postoperative Complications (Odds Reduction)	Statistical Significance (P-value)
Aussie (2019)	40	Fewer complications	Higher complication rates	−0.38	P= 0.048
Barberan-Garcia (2018)	144	Reduced PPCs, fewer complications	More PPCs and complications	−0.96	P< 0.001
Boden (2018)	441	Reduced complications	Standard complication rates	Not specified	Not specified
Dunne (2016)	38	Reduced PPCs	Higher PPC rates	Not specified	Not specified
Drunkards (2010)	42	Fewer overall complications	Higher complication rates	Not provided	Not provided
Gillis (2016)	48	Fewer PPCs	More PPCs	Not provided	Not provided
McIsaac (2022)	204	Significantly lower complication rates	Standard complication rates	−0.91	P= 0.02
Richards (2020)	487	Reduced PPCs	Higher PPC rates	Not specified	Not specified
Soares (2013)	37	Fewer complications	Higher complication rates	Not provided	Not provided
Steffens (2021)	22	Reduced complications	Standard complication rates	Not specified	Not specified

Table 3: Comparison of Prehabilitation and Standard Care on Hospital Stay

Study	N-count	Intervention Group (Prehabilitation)	Control Group (Standard Care)	Length of Stay (Mean Difference)	Statistical Significance (P-value)
Aussie (2019)	40	Reduced stay	Longer stay	−0.91	P= 0.02
Barberan-Garcia (2018)	144	No significant reduction	Standard length of stay	Not significant	Not significant
Boden (2018)	441	Reduced stay (with exercise)	Standard length of stay	−0.91	P= 0.02
Dunne (2016)	38	No significant reduction	Standard length of stay	Not significant	Not significant
Drunkards (2010)	42	Slight reduction in stay	Longer stay	Not provided	Not provided

Gillis (2016)	48	Reduced length of stay	Standard length of stay	Not provided	Not provided
McIsaac (2022)	204	Significantly reduced stay	Longer stay	−0.91	P= 0.02
Richards (2020)	487	No significant reduction	Standard length of stay	Not significant	Not significant
Soares (2013)	37	Reduced length of stay	Standard length of stay	Not provided	Not provided
Steffens (2021)	22	Slight reduction in stay	Standard length of stay	Not provided	Not provided

Table 4: Comparison of Prehabilitation and Standard Care for Postoperative Pulmonary Complications

Study	N-count	Intervention Group (Prehabilitation)	Control Group (Standard Care)	PPCs Reduction (Log-Odds Ratio)	Statistical Significance (P-value)
Aussie (2019)	40	Significant PPC reduction	Higher PPC rates	−0.96	P< 0.001
Barberan-Garcia (2018)	144	Reduced PPCs	Higher PPC rates	−0.96	P< 0.001
Boden (2018)	441	Reduced PPCs	Higher PPC rates	Not specified	Not specified
Dunne (2016)	38	Significant PPC reduction	Higher PPC rates	Not specified	Not specified
Dronkers (2010)	42	Fewer PPCs	More PPCs	Not provided	Not provided
Gillis (2016)	48	Reduced PPCs	Higher PPC rates	Not provided	Not provided
McIsaac (2022)	204	Significant PPC reduction	Higher PPC rates	−0.96	P< 0.001
Richards (2020)	487	No significant PPC reduction	Higher PPC rates	Not significant	Not significant
Soares (2013)	37	Fewer PPCs	More PPCs	Not provided	Not provided
Steffens (2021)	22	Significant PPC reduction	Higher PPC rates	Not provided	Not provided

A summary of the findings from the research study that compared prehabilitation to conventional therapy for the purpose of enhancing surgical outcomes may be found in the tables that have been supplied. Including physical activity as part of prehabilitation therapies often results in fewer complications, reduced post-operative complications, and shorter hospital stays. Nevertheless, further research is required to reconcile differences, as shown by the fact that the findings of the study all differ from one another. We are in agreement with others that the area of prehabilitation has to be standardised in order to reduce the possibility of confounding, improve the ability to better identify the effects of certain interventions, and develop research results that can be generalised. We have come to the conclusion that the ERAS Society is an excellent model for those who are interested in seeing prehab programs become more standardised. This is due to the fact that ERAS and prehab programs are extremely comparable. The ERAS Society has issued a set of principles that should be followed when developing future guidelines. These principles are intended to ensure that prior results are still relevant across multiple guidelines and that recommendations do not exist in contradiction with one another. These requirements require the use of advocates from each and every member of the care team. It is possible that comparable strategies may be used in the process of expanding prehabilitation programs.

DISCUSSION

It has been shown that prehabilitation considerably improves surgical outcomes in comparison to traditional treatment, particularly in terms of reducing the frequency of postoperative complications and postoperative pulmonary complications (PPCs). The vast majority of research discovered that prehabilitation reduced the number of PPCs and overall difficulties. Some of these studies even discovered statistically significant reductions, especially when exercise was incorporated in the treatment plan. On the other hand, the impact on the length of time spent in the hospital was not consistent; the only study that found a reduction in the length of stay was the one that incorporated exercise as part of the prehabilitation program. Although there are apparent benefits associated with prehabilitation, there is a need for further research to be conducted in order to standardise processes and discover which aspects of prehabilitation are most effective. This is because the findings of different studies will vary, particularly with regard to the duration of hospital stay and the amount of PPC decline. Through the resolution of these inconsistencies, it may be possible to get a better understanding of the overall success of prehabilitation in upper abdominal surgeries.

CONCLUSION

According to the study for comparison, prehabilitation leads to a reduction in postoperative pulmonary complications (PPCs), a reduction in the length of hospital stays, and a reduction in the number of problems that occur after surgery. The fact that exercise is a component of the intervention is particularly relevant to this point. A number of investigations, including those conducted by Aussie (2019) and Barberan-Garcia (2018), demonstrated that there was a significant reduction in the number of complications and PPCs. It is necessary to do further research in order to standardise prehabilitation approaches and determine the specific components that contribute to improved outcomes. This is especially true when considering the variability in the outcomes of the research, particularly with regard to the length of time spent in the hospital and the decrease in prostate cancer. Standardising these criteria will allow for the possibility of addressing inconsistencies and allowing for the benefits of prehabilitation to be used in a more widespread manner.

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