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Original Research Article

Evidence of benefit of lower limb exercise immediately after major abdominopelvic surgery

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ABSTRACT

Background: Repeated active dorsiflexion of the ankle joint in knee and hip flexion state (moving the whole lower limb) i.e. active lower limb exercise (ALLE). Benefits of ALLE over non-ALLE approaches during the postoperative period in patients following major abdominopelvic surgery was studied. The aims of the study were to determine whether early return of intestinal peristaltic sound (IPS), early pain relief, early control of blood sugar in diabetic patients and early return of wellbeing of patients occurred in patients undergoing major abdominopelvic surgery.
Methods: Randomized comparative study was done. 100 patients above 15 years of age who underwent major abdominopelvic surgery participated in this study from one of the government medical colleges. Samples were randomly allocated to the experimental and control group. Experimental group were counselled, motivated, and trained in pre-operative period, to do ALLE in short interval after operation. Data was collected on post operative day (POD) 0, POD 1, POD 2, and POD 3. The tools used to collect data was visual analogue scale (VAS) for pain, capillary blood glucose (CBG) for blood sugar level, IPS for intestinal motility and WHO-5 well-being index for assessment of wellbeing.
Results: Patients who were in the test group showed- better pain relief and lees use of analgesic (p value=0.0259), better control of blood sugar in diabetic patients (p value=0.0076), early return of IPS (p value=0.0002) and early return of wellbeing (p value=0.0056).
Conclusions: ALLE after major abdominopelvic surgery is very effective practice for better relief of pain, early return of IPS, better control of blood sugar in diabetic patients and less anxiety and more comfort.

Keywords: Abdominopelvic, Lower-limb exercise, Surgery

INTRODUCTION

Abdominopelvic surgery is an umbrella term used to refer to surgical procedures undertaken in the abdominal area to diagnose and possibly treat a presenting medical problem.[1] Different technique and medical procedures may be used depending on the abdominal organ involved and the type of condition being explored. Most of these procedures traditionally require opening the abdomen with a large incision and are referred to as open abdomen surgeries or laparotomies.[1,2] The recovery journey after abdominopelvic surgery is often a multifaceted process that requires multi-practitioners' input to be successful. Recovery remains a nebulous concept, lacking a clear definition among both health-care professionals and patients.[2] The main goal of ALLE (repeated active dorsiflexion of the ankle joint in knee and hip flexion state) post-abdominopelvic surgery is to expedite recovery from surgery.

Any surgical intervention in human body is a traumatic event. Restoring the patients' health after surgery is the aim of surgeon. With respect to the effects of YOGA on the human body, the modification of homeostasis of human physiology by active lower-limb exercise in surgical patients is of interest. Benefits of ALLE over without ALLE during post op period in patients after major

abdominopelvic surgery studied. Proprioception and interoception have major role in early post operative period to maintain homeostasis, feel wellbeing, to reduce anxiety, to reduce pain in some extent. Proprioception is the sense that lets us perceive the location, movement, and action of parts of the body. It encompasses a complex of sensations, including perception of joint position and movement, muscle force, and effort.[3] Interoception is a type of a hidden sense. Interoception refers to the sensing of internal signals from our own body. There are three types of interoceptive signals: a) biochemical; b) mechanical force that alters structure, that is, through stretch or tissue extension) thermal or electromagnetic signals. ALLE activate the interoceptive pathway, which subsequently motivates the body to take action to restore homeostasis (body balance is altered in general anaesthesia).[4] IPS is controlled by the autonomic nervous system (ANS). Interoceptive signals through active lower limb exercise help to stimulate the ANS, thereby facilitating early return of IPS.[5]

Exercise also promotes pain relief and is characterized by-an increase in serotonin (5-HT) levels, a reduction in serotonin transporter levels and an increase in opioids in the central inhibitory pathway.[6]

However, a smaller number of studies being conducted in the above-mentioned topic. So, the current study aimed to find out the effect of ALLE after major abdomino-pelvic surgery. The objective of the study was to determine whether early return of IPS, early pain relief, early control of blood sugar in diabetic patients and early return of wellbeing of patients occurred in study group.

METHODS

Randomized comparative study was done in Midnapore Medical College and Hospital from February 2023 to August 2023. The study incorporated 100 participants who met the inclusion criteria as mentioned below. These subjects were evenly divided into two groups through random assignment: 50 in the control group and 50 in the test group. In the preoperative phase, we provided counselling, encouragement, and instruction to patients in the study group, preparing them to perform ALLE shortly after their surgery. The control group received standard nursing care, while the cases group engaged in ALLE exercises in addition to receiving routine postoperative nursing care. The tools used to collect data was visual analogue scale for pain, capillary blood glucose (CBG) for blood sugar level, IPS for intestinal motility and WHO-5 well-being index for assessment of wellbeing. And data was collected on post operative day (POD) 0, POD 1, POD 2, and POD 3.

Inclusion criteria

Patients aged 15 years and above. Patients who have undergone major abdominopelvic surgery (both emergency and elective). Patients who have provided informed consent.

Exclusion criteria

Patients below 15 years of age. Patients with altered consciousness due to septicemia. Patients who declined to participate in the study.

RESULTS

Randomized comparative study was done in Midnapore Medical College and Hospital. The study incorporated 100 participants who met the inclusion criteria. These subjects were evenly divided into two groups through random assignment: 50 in the control group and 50 in the test group. In our study, the largest cohort of patients was within the 47-55 years of age range (Figure 1). Additionally, the number of female patients exceeded that of male patients (Figure 2).

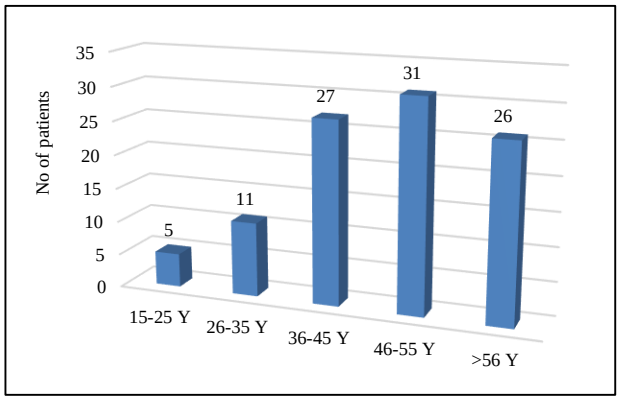

Figure 1: Distribution of patients according to age.

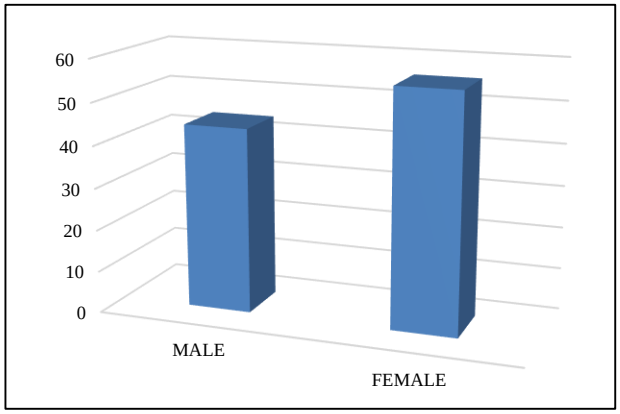

Figure 2: Distribution of patients according to sex.

Effect of ALLE on pain control

A visual analogue scale (VAS) is one of the pain rating scales used for the first time in 1921 by Hayes and Patterson.[7] It is often used in epidemiologic and clinical research to measure the intensity or frequency of various symptoms. For example, the amount of pain that a patient

feels ranges across a continuum from none to an extreme amount of pain. From the patient's perspective, this spectrum appears continuous; their pain does not take discrete jumps, as a categorization of none, mild, moderate, and severe would suggest. It was to capture this idea of an underlying continuum that the VAS was devised.[8]

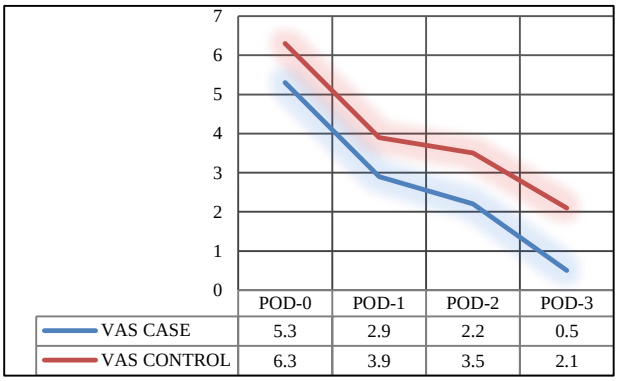

Figure 3: Distribution of mean VAS score according to time.

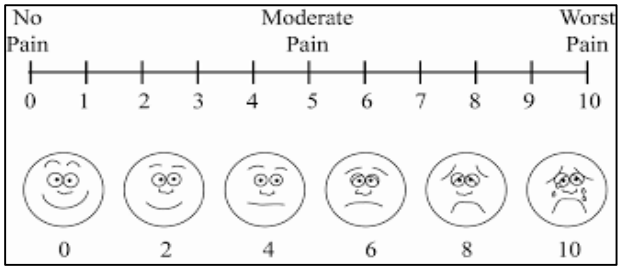

Figure 4: VAS scale.

The mean VAS score was calculated and compared between the test and control groups. The p value of the test group (0.0259) was less than 0.05 after implementing ALLE. The mean VAS scores of both test and control groups on POD-0, POD-1, POD-2, and POD-3 are presented in Figures 3 and 4.

Effect of ALLE on blood sugar control

The CBG was assessed in both the test and control groups and subsequently compared. The p value of the test group (0.0076) was found to be less than 0.05 after implementing ALLE. The CBG values were obtained on POD-1, POD-2, and POD-3 in both the test and control groups (Figure 5).

Return of IPS after implementing ALLE

IPS were assessed and compared in both the test and control groups. The p value of the test group (0.002) was less than 0.05 after implementing ALLE. IPS were observed on POD-1, POD-2, and POD-3 in both test and control groups (Figure 6).

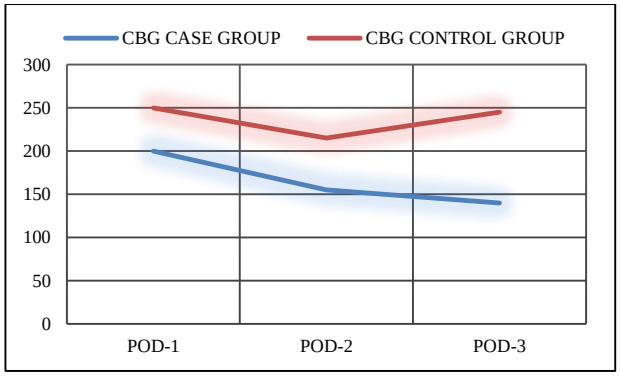

Figure 5: Mean blood sugar level according to time.

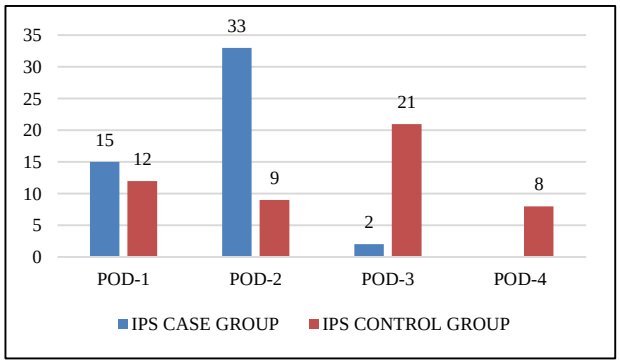

Figure 6: Return of IPS according to time.

Effect of ALLE on wellbeing

The WHO-5 (world health organisation-5) well-being index is a short, self-administered measure of well-being over the last two weeks.[9,10] It consists of five positively worded items that are rated on 6-point Likert scale, ranging from 0 (at no the time) to 5 (all the time). The raw was multiplied by 4 to give final scores from 0 to 100, with lower scores indicating worse well-being. A score of ≤50 indicates poor wellbeing. The 5-item World Health Organization Well-Being Index (WHO-5) is among a widely used questionnaire assessing subjective psychological well-being in research and clinical settings. Since its first publication in 1998, the WHO-5 has been translated into more than 30 languages and has been used in research studies all over the world. The questionnaire is mentioned below in Figure 8.[25]

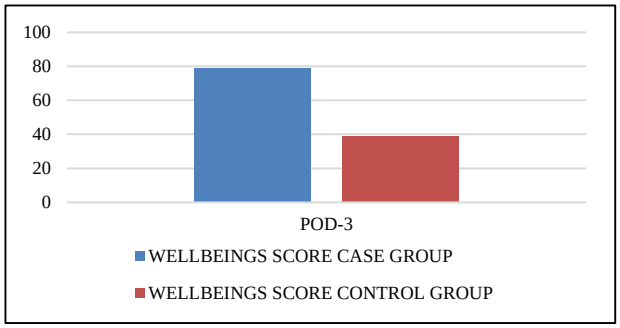

Figure 7: Well-being index score on POD-3.

The WHO-5 well-being index was utilized as an assessment tool in both the test and control groups, and the results were compared. The p value of the test group (0.0056) was less than 0.05 after implementing ALLE. Participants were instructed to select, for each of the 5 statements, the option that most closely aligned with their emotional state over the preceding 72 hours. The score was calculated on POD-3 (Figure 7).

WHO-Five Well-Being Index (WHO-5)

Please indicate for each of the five statements which is closest to how you have been feeling over the past two weeks. Notice that higher numbers mean greater well-being.		All of the time	Most of the time	More than half of the time	Less than half of the time	Some of the time	At no time
1	I have felt cheerful and in good spirits	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
2	I have felt calm and relaxed	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
3	I have felt active and vigorous	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
4	I woke up feeling fresh and rested	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐
5	My daily life has been filled with things that interest me	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐	0 ☐

Total raw score on WHO-5 goes from 0 to 25. To obtain a percentage score ranging from 0 to 100, the raw score is multiplied by 4.
A percentage score of 0 represents worst possible, whereas a score of 100 represents best possible quality of life.

Total raw score ☐☐ x 4 = ☐☐

(0-25) (0-100)

Figure 8: The questionnaire.[25]

DISCUSSION

During the postoperative phase, individuals who underwent ALLE exhibited superior outcomes. These included enhanced pain management with decreased analgesic consumption, improved diabetes control among diabetic patients, quicker restoration of IPS, and accelerated recovery of overall well-being.

Proprioception and interoception play a critical role in the early postoperative period, contributing to the maintenance of homeostasis, enhancement of well-being, reduction of anxiety, and alleviation of pain. IPS, which is regulated by the autonomic nervous system (ANS), is integral to these processes. Interoceptive signals generated through active lower limb exercise have been demonstrated to stimulate the ANS, thereby supporting its regulatory functions and promoting recovery during the postoperative phase.[11]

Proprioception is the sense that lets us perceive the location, movement, and action of parts of the body. It encompasses a complex of sensations, including perception of joint position and movement, muscle force, and effort.[12]

Interoception, a "hidden sense", involves perceiving internal bodily signals essential for physiological balance and self-awareness. Interoceptive signals are of three types: a) biochemical (chemical or hormonal changes), b) mechanical (which alter bodily structures through mechanisms such as stretching or tissue extension), and c) thermal or electromagnetic (temperature or electrical activity changes). These signals are critical for maintaining homeostasis, emotional regulation, and bodily awareness.[13]

Exercise promotes pain relief through multiple physiological mechanisms, including an increase in serotonin levels (5-HT), a reduction in serotonin transporter activity, and an elevation of endogenous opioids within the central inhibitory pathways. These changes collectively enhance pain modulation, contributing to analgesic effects and improved pain management.[14]

Exercise is a critical intervention in the management and control of diabetes, supported by a range of physiological mechanisms. Firstly, physical activity enhances insulin sensitivity, enabling more efficient glucose uptake by skeletal muscles and reducing blood glucose levels. Secondly, exercise promotes glucose utilization by increasing muscle contraction-mediated glucose uptake, both during and after physical activity, thereby improving glycemic control.[15,16]

ALLE facilitates the early return of intestinal peristaltic sounds in the postoperative period through a variety of physiological mechanisms. Firstly, physical activity stimulates the autonomic nervous system (ANS), particularly the parasympathetic branch, which enhances gastrointestinal motility and promotes the restoration of normal peristaltic activity. Secondly, exercise improves systemic and regional blood circulation, increasing oxygen and nutrient delivery to the gastrointestinal tract, thereby supporting tissue repair and functional recovery.

Additionally, early mobilization and gentle exercise help mitigate the risk of postoperative ileus, a common condition characterized by the temporary cessation of intestinal motility. By stimulating intestinal contractions, physical activity aids in preventing this complication. Exercise also triggers the release of gastrointestinal hormones, such as motilin, which further enhance intestinal motility and accelerate the return of peristaltic sounds.

Moreover, ALLE exerts anti-inflammatory effects and reduces stress-related hormonal responses, both of which can positively influence gastrointestinal function. The mechanical stimulation provided by changes in body position and movement during exercise also encourages peristalsis, facilitating the passage of gas and stool.[17-20]

Lower limb exercise plays a significant role in improving well-being during the postoperative period through various physiological and psychological mechanisms. ALLE improve blood circulation, reducing the risk of deep vein thrombosis (DVT) and promoting faster healing by ensuring adequate oxygen and nutrient supply to tissues. Gentle movement and exercise can help alleviate pain by releasing endorphins, the body's natural painkillers. This can also reduce the reliance on pain medications, which often have side effects. Physical activity has been shown to reduce anxiety and depression, common issues in the postoperative period. ALLE stimulates the release of neurotransmitters like serotonin and dopamine, which improve mood and overall mental health.[21-24]

In spite of every single effort my study has lacunae. The notable short comings of this study are: the sample size was small. Only 100 cases are not for this kind of study. The study has been done in a single centre. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

CONCLUSION

In summary, ALLE is a highly beneficial measure after major abdominopelvic surgery, as it modifies physiological processes to improve pain relief, blood sugar control, IPS recovery, and overall well-being, ultimately leading to faster and more effective postoperative recovery.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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