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Review Article

Rehabilitation Strategies of Total Hip Replacement Surgery

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Received date: December 09, 2023; **Accepted date:** December 23, 2023; **Published date:** January 04, 2024

Citation: Yousra A. Mohamed Ali, Hadeel O A Osman, Reem A H Hussein, Maab S M Alzain, Abrar Bakry Elmalik, et al., (2024), Rehabilitation Strategies of Total Hip Replacement Surgery, *J Clinical Orthopaedics and Trauma Care*, 6(1); DOI: 10.31579/2694-0248/077

Abstract

Prosthetic joints and limbs represent a technological advancement in medical science that provides amputees with an artificial counterpart to their lost appendages. These devices are designed to replicate the normal range of movement of the human body, and with the integration of artificial intelligence, they offer numerous benefits to those who have lost limb or joint function. These individuals can return to the normal way of life, including activities such as walking, running, praying, and even involve in international sports competitions. The causes of limb or joint loss are multifarious, varying from disease to traumatic injury, and affect a significant number of individuals worldwide. Prosthetic joints are typically constructed using a combination of metal, bioceramics, and polymers, and joint arthroplasty, or replacement has revolutionized the field of orthopedic surgery. However, arthroplasty is not without its complications, such as persistent pain after surgery, functional deficits which persist, and shorter hospital stays, unless appropriate precautions are taken before, during, and after the operation. Total hip arthroplasty is a widely performed procedure globally, making the implementation of the Enhanced Recovery After Surgery (ERAS) protocol all the more critical. The ERAS protocol, aimed at maximizing hip surgery patients' postoperative recovery process, was crafted as a program to optimize how such individuals recuperate following their procedures. By seeking to expedite convalescence, ameliorate life's caliber, and downgrade intricacy frequency, the initiative targets recovery's celerity, existence's trait, and complication's rate of reduction. Appropriately coordinated rehabilitation concepts for elective total hip surgery can potentially save hospital resources and alleviate heavy workloads from staff. Henceforth, this examination aims at conducting an exhaustive evaluation of rehabilitation care delivery, advancing contemporary medical execution, and optimizing the effectiveness of the ERAS protocol through a multidisciplinary assessment of its capacity to integrate medical research into clinical practice.

Keywords: total hip arthoplasty; preoperative; rehabilitation protocol; post-operative recovery; functional recovery

Introduction

Osteoarthritis (OA), a disabling chronic degenerative joint disease, influences about 500 million persons globally.[1] OA of the hip and knee predominantly affects joint cartilage, resulting in pain, edema, and stiffness.[2] Osteoarthritis is one of the most common causes of pain, disability, and socioeconomic expenses worldwide. It's epidemiology is intricate and complicated, with elements related to genetics, biology, and biomechanics.[3] Although they are found as early as age of 50, complaints populations (65 years and more) There is no drug that can treat osteoarthritis; instead, most drug therapies try to relieve symptoms.[4] Joint fusion surgery,

also known as total arthroplasty (TJA), is the most effective therapy option for osteoarthritic hip discomfort. Total Hip Arthroplasty, like any other surgery, includes the risk of post-operative complications, the most common and serious of which is surgical site infection (SSI).[5] Given that there is a growing elderly population in China and across the globe, both replacement of the total hip and knee surgeries are also on an upward trend. Designing viable solutions is critical to improving healthcare standards and achieving better outcomes for those who have had a total hip or a total knee replacement. [6] Over the last 15 years, the use of a systematic, evidence-based perioperative care protocol (which is also known as the "fast track" or the "enhanced recovery path"), especially the Advanced Recovery After Surgery (ERAS) procedure, resulting in is minimizing hospital stays and adverse events associated with many different kinds of surgeries. Furthermore, Due to the high-volume models, hospital stays for total hip and knee replacements have been decreased from four to three days.[7] The ERAS Program focuses on three phases which are, begore, during, and after the operation, the to improve program efficacy and outcomes. Therefore, the adoption of the program on the total knee and hip replacement procedures leading to numerous benefits, such as shortening the duration of hospital stay (LOS) and which results in lowering hospital costs for patients. Moreover, it showed reduction on the rate of re-admission after surgery and has lessened variety of complications such as risk of infection, bleeding, post-operative thrombosis and the long-term immobility. [8]

In this review, we have discussed the advantages of applying ERAS protocol on orthopedic practice (total hip arthroplasty). Therefore, our aim is to introduce the concept of ERAS protocol and apply it to orthopedic practice in Sudan. The Appropriate application of it lowering the risk of morbidity, death, and functional limitations following total hip arthroplasty.

Preoperative

Approximately 20 years ago, a multidisciplinary strategy with an integrated approach resulted in the establishment and developing of the Enhanced Postoperative Recovery Program (ERAS). All surgical procedures that adopted the program showed excellent results, including shorter hospital stays, fewer medical complications, and lower readmission rates. [9] lower postoperative complications were associated with higher adherence to the set of ERAS measures at 30 days after surgery. [10] ERAS protocol for total hip arthroplasty surgery includes three phases preoperative, intraoperative, and postoperative care. Preoperative phase includes many components, such as preoperative counseling; Preoperative education's main goals are to increase patients' understanding, control their expectations, and influence their lifestyle decisions for the better. Patients are advised to reduce modifiable risk factors prior to surgery.[11] There are numerous preventable variables known to cause postoperative problems that can be addressed to enhance patient health. When performing elective orthopedic procedures on patients with an elevated body mass index, poorly controlled diabetes, or a history of smoking, serious complications can arise. [12] Patient behaviors (e.g., smoking and excessive alcohol consumption) and medical condition (e.g., ischemic heart disease, hypertension, sleep apnea, and malnutrition) should be detected, considered, and maybe treated. Oral tamsulosin should be recommended and started three nights before hospital admission for patients who are at risk of urinary retention due to prostatitis. Adequate preoperative nutrition is essential for postoperative healing, decreasing surgical stress, preserving normal glycemic control and prevent surgical site infections (SSI). An ideal metabolic state is achieved by carbohydrate loading on the day of surgery. 50% less insulin resistance occurs when a person is fed as opposed to fasting.[11] Smoking is linked to bad postoperative complication, such as periprosthetic joint infection (PJL) which can lead to implant failure. Preoperative smoking cessation decrease the incidence of (PJI). [13] Exercise served as a useful rehabilitation technique to improve postoperative physical performance when compared to actively conducted assessments such as chair rise test for test leg strength and endurance, walking speed, and climbing staircases. [14] The risk of considerable postoperative loss of blood is associated with total hip arthroplasty (THA). Numerous measures can be taken to reduce this risk and prevent the need for transfusions, such as optimizing hemoglobin levels prior to surgery, administering systemic tranexamic acid during the procedure, carefully controlling surgical hemostasis, and incorporating adrenaline into the local anesthetic infiltration. Postoperative infection can be avoided by lowering patient risk factors such as alcohol consumption, diabetes management, and anemia. On the morning of the procedure, the patient is recommended to use a 4% chlorhexidine gluconate (CHG) irrigation solution. It is inconvenient to shave the surgery location.[11] When compared to a control group, patients who had motion analysis and motor imaging one-day preoperative, showed reduced loss of function during the first few days after total hip arthroplasty.[15] The home detection system tracked the environment and actions of people in their residence prior to a patient's operation and evaluates the patient's surgical outcome.[16]

Intraoperative

Total hip replacement is a demanding procedure that requires the removal and replacement of both the femoral head and the acetabulum. This procedure takes approximately 2 hours. Depending on the patient's overall health, this surgery is conducted under general or epidural anesthesia. Most healthcare providers, however, favor epidural anesthetic since it has less complications. The surgeon cuts through the tissue layers, usually along the rear or lateral of the hip joint, resulted in exposing it, and removal of the diseased head and neck, as well as damaged bone and cartilage, while preserving the healthy bone. Finally, the acetabulum is cleansed and replaced with a metal shell and polyethylene liner, followed by the insertion of the femoral stem. To fix the shaft, the surgeon may or may not apply cement. Finally, the ceramic is gently connected to the shaft and the hip joint is reinstalled. The prosthetic components might be cemented or non-cemented. Acrylic cement is used to secure the glued component to healthy bone. Materials having rough surfaces are used to make uncemented pieces. This permits the bone to grow over it and anchor it.

A handful of surgeons employ a metallic ball and socket, while others utilize ceramic pieces, which are resistant to deterioration compared to plastic. Recently, there have been occurrences of metal-on-metal hip replacements resulting in constraints. The hip replacement surgery has become commonplace. However, like with any operation, there is some risk involved. [17,18] Intraoperative stability test done for hip Rang of movement had good postoperative outcome and patient satisfaction for cutting toenails and putting on socks.[19] Patients undergoing THA should be given fixed, intermittent, low-dose heparin prophylaxis during the surgery, which offers plenty of benefits by lowering the risk of thromboembolism from 24.3% to 8.3%. [20] The time between entering of the patients to the operating room, to the skin incision should be minimized, which refers to the patient’s vulnerability to PH during the procedure. [21] This study found that administering one 20 mg per kg of tranexamic acid intraoperatively to individuals having THA reduced the transfusion rate.[22] During surgery, complications such as temporary sciatic nerve damage, acetabular fracture,

and intraoperative femoral fractures (IFF) might occur. Some studies found a 5% chance of IFF when utilizing the femoral stem in THA. The most common reason for revision surgery is aseptic loosening, and complications become more common as people get older. IFF is common during calcar, greater trochanter, and femoral dialysis procedures. Because IFF results in inferior functional outcomes and lower patient satisfaction, it is critical to determine the risk group and avert problems. A unique cement-less femoral implant with numerous additional characteristics that may enhance THA outcomes has been developed, i.e., Anatomical S-shaped implant to eliminate morphometric mismatch with the proximal femur, guaranteeing secondary stability. Groove in the proximal section of the shaft to promote initial rotational stability. And to ensure osseointegration, it has a CaP coating on the proximal two-thirds. The implant's polished tip permits it to glide inside the medullary canal without producing strain, minimizing the incidence of thigh discomfort. [17-20,23] Overall, intraoperative nerve monitoring reduces the number of injuries to the nerves that might occur during surgery. [24]

Postoperative

Even when patients are discharged from the hospital, physical therapy programs have a good influence on gait, muscular strength, and duration of hospital stay, and their usage should be promoted. It also reduces oxidative stress indicators including cholesterol, ST2, and LPS. [25][26] Patients with developing dysplasia of the hip who participate in physical activity following THA might notice decreased pain and increased function, particularly within the first three months. [27] Routine postoperative clinical assessments and the need for cryotherapy seem to accelerate patient recovery in the outpatient context and decrease hospital stay, hence its usage is suggested during the early phases of rehabilitation following total hip arthroplasty. [28,29] Rapid recovery and local infiltration anesthesia combined with a complete strategy allow patients to stay in the hospital for fewer days, require less rehabilitation, and spend less money on medical care overall.[30] Even in the absence of cognitive decline, clinical and demographic variables, as well as cognitive function, have an important role in the way of gaining mobility following surgery. Explain how higher-order cognitive processes, such as executive functions, are crucial to the formation of motor plans, and how they interact with proprioceptive and visual inputs. [31] Patients' self-efficacy, physical function as the patient stated, quality of health-related aspects, and levels of anxiety and depression, are improved with the use of mobile applications and smart phones. [32,33] When compared to standard care, the self-efficacy-boosting intervention offered by nurses boosted exercise compliance as well as physical, psychological, and social functioning following hip replacement. [34] Internet-based patient rehabilitation management systems can help patients recover not only physically but also mentally, opening up new views and methods to clinical rehabilitation [35]. The use of color in the medical industry is an excellent way to promote speedier healing and well-being. We were able to demonstrate that the color has a beneficial effect on the quality of living of the patients postoperatively. [36]

Discussion

In this article, they noted about ERAS protocol that was generated 20 years ago. They reported that Benoyed to surgical techniques had good benefits in reducing hospitalization and medical complication without risen of re-admission rates. [9] An extensive research study was conducted in 131 hospitals, involving 6146 patients, to evaluate the relationship between the utilization ERAS procedures and complications among individuals undergoing elective THA. They discovered that regardless of whether the medical facility had an established ERAS protocol, those who had been more compliant with the ERAS items encountered lower complications after their surgery. [10] In an increasingly environment where healthcare constraints are on the rise, an adaptable system is required. The ERAS-outpatient route provides a solution. To enhance patient outcomes, its concepts must be implemented to a short-stay regimen for THA by reducing adverse events and maintaining hospital stays under 24 hours. Reduced hospital stays periods after THA increase the number of available beds in an environment with limited financial resources. The ERAS outpatient route provides a framework for standardized treatment that promotes satisfaction with care while meeting the demands of the healthcare provider. It yields a solution that benefits all parties concerned. [11] High BMI, cigarette use, and poor control of hyperglycemia are risk factors for orthopedic surgery, hence surgeons recommend patients to cease and control for these risks. In this study, they studied the 50 orthopedic hospitals in the United States in 2020 and discovered that 98% had a weight reduction clinic. 70% referred a patient to one of their facilities or a government-owned quit-smoking helpline. In addition, 48% of hospital had a patient dental check conducted prior to the surgery. [12] Using decision analysis, it was determined whether a preoperative smoking cessation strategy was cost-effective across a 90-day after total joint arthroplasty (TJA) episode of treatment. They found that, patients who were required to participate in a smoking cessation intervention paid $32 less than patients who were not on average over the course of 90 days ($23,457 vs. $23,489). When the success rate of the intervention was higher than 56%, sensitivity analyses showed that the smoking cessation intervention was more cost-effective than no intervention. [13] Exercise-based pre-habilitation prior to a hip replacement procedure has been shown in studies to improve post-operative physical functioning in patients compared to the absence of the intervention in assessments as the six-minute walk evaluation, Timed Up and Go exercise, chair-rise examination, and stair climbing. Pre-habilitation education, on the other hand, had no meaningful effect on post-operative functionality. [14] Another research used action observation and motor imaging on patients having THA for end-stage hip osteoarthritis. Sessions by a physiotherapist a day ahead to surgery, demonstrated that this group showed less functional deterioration in the first few days' post-operatively compared to another group of who had only education sessions before the surgery devoid of any type of exercise. [15] Wearable sensors and continuous home monitoring systems, for example, can benefit patients pre-operatively, during hip or knee replacement preparation and recuperation, and by measuring the surroundings and activities of individuals in the patient's home, gives insight into its activities and functions. As a result, this approach offers a novel method for assessing surgical outcomes in patients. [16] Patients are often hospitalized for two days following surgery. A follow-up evaluation for her first 10-14 days will be scheduled to measure hip endurance and mobility, remove staples, and confirm alignment utilizing X-rays. Home care visits also will be conducted with a nurse, physical therapist, and occupational therapist. Depending on the outcome of these visits, physical therapist would decide when to start attending outpatient physical therapy, which usually starts 5-6 weeks post-surgery. Patient’s commitment to exercise program is very helpful in regaining strength post-surgery and shortening the recovery period to total of 2-3 month for gaining hip strength and getting back to normal routine. [17] In complete hip replacement surgery, the medical professional is able to provide a patient the option of general or spinal anaesthetic based on their overall health. There are several types of prostheses used in surgery; your surgeon may advise you on which type is best for you and address any worries you may have about

the replacement. [18] The precise positioning of the femoral and acetabular components is critical to the success of total hip arthroplasty. Using technology improvements as using of imageless guidance during the operation (Naviswiss device) for setting items in their precise location has been shown in studies to lower the risk of malposition and provide a better surgical result. [19] The risk of thromboembolic disease after surgery has been reduced by 24.3% to 8.3% by using fixed intermittent low dose intravenous heparin intra-operatively. [20] In 2017, 672 individuals having complete joint arthroplasty were studied in order to minimize perioperative hypothermia (PH). Preoperative use of warmed intravenous fluid and forced-air warming is useful in lowering PH during pre-operative holding and anesthesia induction. [21] The intraoperative administration of tranexamic acid (20 mg/kg) has shown a reduction in hemoglobin drop in the peri-operative period, as well as a reduction in the rate of blood transfusion in patients having THA and TKA. [22] The cementless femoral stem (SP-CL) implant has been introduced into the area of THA. According to studies, the incidence of intraoperative femoral fractures is 5%, therefore it considers the most prevalent SP-CL complication.[23] Femoral and sciatic nerves monitoring during THA with high riding developmental dysplasia has showed less risk of nerve injury intra-operatively. [24] Rehabilitation program for those who have undergone complete hip replacements. Using a randomized, double-blind clinical procedure, they observed that both random sampling groups were homogenous and that there were no age differences between the sexes. Hospital stay duration was lower in the study's intervention group compared to the ones in the control group, and the intervention group began gait training earlier than the control group. They concluded that speedier physical treatment should be promoted since it improves movement patterns, endurance of the muscles, and the duration of hospitalization even after being released. [25] Following a 21-day in a rehabilitative course for osteoarthritic individual undergone THA, LPS, cholesterol, and ST2 levels in serum greatly reduced, while total SOD and GPx activity, as measured in hemolysates, significantly increased. General therapy after a hip replacement for osteoarthritis reduces oxidative damage in individuals. Properly tailored, frequent physical activity is a critical component of the postoperative regimen, since it improves redox balance and assists in patients' optimum recovery after surgery. [26] In addition to evaluating the degree of complications of THA among individuals having DDH, clinical findings should be evaluated, and a postoperative rehabilitation program should be provided. This approach was used to enroll 89 DDH hips. Every patient underwent a transverse proximal femoral shortening osteotomy. Starting on the first day following the operation and lasting until the sixth week, the rehabilitation program was put into action. At the end of the third month and the first year, the Harris Hip Score was used to assess function and the Visual Analogue Scale was utilized to quantify discomfort. The Trendelenburg test was used to assess hip abduction weakness before and after surgery. In the end, they discovered that the third month had statistically significant gains for both function and discomfort (p 0.001). From three months to a year, this improvement in pain persisted (p = 0.001). From month three to one year, the function did not, however (p=0.47). In the first assessment, the Trendelenburg test was positive in every case; at one year, it had dropped to 24.7%. The rate of complications was 11.23%. [27] The importance of ordering regular diagnostic tests among individuals undergoing their first total joint arthroplasty has recently been called into question, particularly in following the adoption of ERAS guidelines in Total Joint Arthroplasty. Numerous research investigations have shown that normal diagnostic tests after surgery are unnecessary for unilateral THA and ought to only be occur on individuals who have risk factors. Adult patients who undergone first one-sided THA and received multimodal care during surgery in line with ERAS protocols were included in a retrospective cohort study. The key study outcomes are the percentage of cases of acute anemia necessitating blood transfusion and the occurrence of low albumin levels requiring albumin supplementation. The secondary outcomes include the incidences of acute kidney injury, and irregular blood sodium levels, serum potassium levels, and serum calcium levels. These variables were analyzed to determine the rate of any sort of medical procedure that was closely related to aberrant testing results following surgery, to clarify the occurrence of unusual lab outcomes after first one-sided Total Hip Arthroplasty, along with identifying the risk factors. [28] After a hip arthroplasty, cryotherapy is used in the early postoperative stage to gauge its effects on pain management and any blood loss after the surgery. The technique was the use of a cryotherapy machine (Hilotherm) in those who had performed THA was investigated in a prospective cohort study.

The results of this investigation revealed that: 1. Hilotherm treatment causes decreased postoperative blood loss but does not appear to appreciably alleviate discomfort. 2. Given that patients appear to recover more quickly from total hip arthroplasty and spend less time in the hospital, continuing cryotherapy may be needed in the early stages of rehabilitation. [29] A prospective trial of one surgeon with 165 hips over the course of two years, up until June 2016, they discovered that patients benefit from a more thorough approach with Local Infiltrates Analgesia (LIA) and quick healing, which results in shorter hospital stays, a lower incidence of rehabilitation, and a consequent decrease in medical costs. [30] A variety of studies indicate a link between preoperative cognitive functioning, specifically higher-level frontal executive functionality, along with after surgery motion enhancement [31] The development of smartphone software centered around rehab services improved patients' symptoms of stress along with depressive mood disorders, self-assurance, physical well-being, and health-related quality of life. [32] The smartphone care management system produced preliminary outcomes that were equivalent to those obtained with traditional care models, as well as a significant reduction in Physical Therapy (PT) utilization. In terms of complications, readmission rates, ED visits, and health care appointments in case of urgency, noninferiors were also detected. The use of such equipment allows individuals to recuperate on their own time and avoids the need for further healthcare visits, which may result in cheaper total healthcare expenses. [33] The effect of a self-efficacy enhancing intervention program on the rehabilitation outcomes of patients (self-assurance, commitment to functioning training, hip movement, engagement and interaction with others, feeling anxious or depressed, and overall quality of living). A study conducted in the People's Republic of China, among fifteen hundred individuals with one-sided THA, found that intervention, as opposed to surgery, has the advantage of improving quality of life over time, by increasing exercise tolerance as well as a person's engagements with environment and others, mental, and physical well-being following the surgery. Therefore, they advise combining these therapies with normal care soon postoperatively.[34] Comparison studies were conducted on two groups of older individuals with fractured hips of the same age group who underwent total hip replacement surgery to compare the usefulness of residence-based remote rehabilitation using an online recuperation management software and telephone, as well as an outpatient monitoring system. The study found that Internet-based rehabilitation management systems promote physical and psychological rehabilitation of patients the best, as long as this group achieves a greater rate of complication prevention than the telephone group. [35] Colors in hospital rooms are one of the most effective interventions to

enhance patient health and speed up post-operative rehabilitation. A positive impact of color on post-operative quality of life. [36] Enhanced orthopedic surgery recovery paths According to this study, the ERAS pathway has improved results and shortened hospital stays. Although ERAS implementation has made tremendous strides in the past few years, there is still a lot of work to be done in terms of both work and research. [37] Although THA has a relatively low complication, the surgical approach plays a role in exacerbates issues. The posterior procedure was determined to have an equal dislocation rate and a substantially lower complication rate than the anterior approach. The most common causes of early complications were compensatory fracture and surgical site infection. [38] The data was calculated using the Opal device by APDM, a wearable inertial device for gait monitoring, and was then subjected to an ANOVA analysis. An ANOVA test demonstrates a statistically significant change in six spatiotemporal markers linked to walking, rotating, and Anticipatory Postural Adjustments (APA) between the hospitalization stage and the stage of discharge. Individuals hospitalized at the Operating Rehabilitation had better mobility, according to research data. [39] Patients may experience static balance issues years after THR. Posture stabilization exercises should be included into existing THR rehabilitation methods.[40] Postoperative rehabilitation may improve the operation results as well as quality living, yet there is no sufficient evidence to back this up due to a range of study approaches and differences in findings across released studies. The prediction of postoperative functional outcomes can be accomplished by evaluating analyzing the activeness rates before and after the surgery. [41-43] Education programs with an emphasis on patient empowerment following hip replacement surgery can significantly boost self-care ability and self-assurance, as well as minimize depression in elderly patients during the acute period, or the first six weeks after surgery. [44] Continuous leg pressing, and hip abductor muscles exercise started in the very first week after surgery can enhance endurance and reduce cardiac demand in a submaximal test. [45] When utilizing stairs, it is best to carry a protected load. The sooner patients are able to walk without the use of crutches, the better. However, the first six weeks should be spent using walking aids. [46,47] According to a paper published by Di Monaco et al.54, therapy beyond 6 weeks is still beneficial and should concentrate on exercises that utilize the body's weight and hip abductor muscles to enhance the pace of walking and stepping tempo. Following surgery, the postoperative functional period lasts six months, and research assessing rehabilitation regimens are uncommon. [48] In accordance with the surgeon's post-operative guidelines, passive hip flexion, hip external rotation, and hip abduction stretching the gastro/soleus while standing, warming up the muscles on a stationary cycle, when positioning the patient for treatment, be aware of any surgical hip precautions. Also, keep in mind that no hip abductor NMES should be used in the early stages. Gait Training. Practice mobility over ground and stairs with the least restrictive assistive device. [49] After the war in Sudan, the number of people who were injured increased especially by gunshot injuries that affect joints. The Sudan Ministry of Health should get more attention to the ERAS protocol in general surgery and particularly on hip arthroplasty by training health providers to give them more knowledge and practice. They should support the research that develops this protocol to enhance surgical care, reduce length of stay in hospital that reduce the medical cost and achieved the goals for hip arthroplasty.

Conclusion

In conclusion, The ERAS protocol had significant benefits shown in human life after surgery. Had three main points pre-operation, intraoperative, and postoperative phases. The pre-operative phase includes counseling, enhancing patient health. Intraoperative phases start from entering the operative room till out of it. Postoperative phases include three stages early stage from the first week to six weeks, the middle stage from six to twelve weeks, and the late stage after twelve weeks. Despite the development of the ERAS protocol taking around 20 years, there are a lot of missing data we need to research about it especially.

We recommend applying the ERAS protocol among hospitals in Sudan, especially in the rural areas, exercising the medical staff to get more knowledge, experience and become professional, and supporting research about the ERAS protocol in Sudan to improve the protocol and bring as much as possible as benefit.

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DOI:10.31579/2694-0248/077