Clinical and Experimental Health Sciences

The Integration of Enhanced Recovery After Surgery (ERAS) Protocols in Orthopedic Surgery: Improving Outcomes and Reducing Hospital Stays

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Abstract

Background: ERAS pathways are the patient- and surgery-specific care strategies based on the published guidelines between the different professionals and aimed at decreasing surgical stress and improving postoperative outcome. It is argued that these protocols which were initially used in colorectal surgery can also be applied in orthopaedic surgery to solve challenges experienced such as pain, infection, long hospital stay and slow recovery.

Aim: This paper aims at assessing the effectiveness of implementation of ERAS protocols in orthopaedic surgery, particularly in relation to peri-operative morbidity and mortality, patients' recovery duration, and measures of system productivity.

Method: The latter included retrospective and prospective of the study, and a definitive systematic review of scientific literature. A total of 800 patients who had elective orthopaedic surgeries given from total knee arthroplasty, total hip replacement, spine surgery to other operations. Preoperative ERAS interventions include patient education, optimization of nutritional status, smoking cessation, intraoperative which involves minimal invasive techniques,anesthesia multimodal, temperature control and finally; postoperative which consists of early mobilization, opioid sparing analgesia, patient discharge planning. While evaluating outcomes the time that patient spends in the hospital, rate of complications, rate of readmission post-surgery, pain threshold, and functionality was observed along with cost-benefit analysis.

Results: The use of ERAS protocols led to reduced hospital length of stay by 44.8%, less surgical site infections (2.1%vs.5.5%) and venous thromboembolism (0.8% vs. 2.8%), and reduced opioid consumption by 60%. mobilization and patient satisfaction significantly enhanced in ERAS group as compared with non-ERAS group regarding the functional recovery where 80 percent of the patient in ERAS group was ambulatory after 48 hours while 45 percent of patients in non-ERAS group. However, in subgroup analysis the results indicated improvisation in elderly patient. All primary as well as secondary findings were found be statistically significant with the p value being less than 0.05.

Conclusion: By creating ERAS protocols there is an improvement of patient's result in orthopaedic surgery through decreased length of hospital stay, complications and dependency on opioids but increased recovery and satisfaction. These studies provide evidence for the widespread implementation of ERAS as practice normalization and increase the efficiency of the treatment. The next directions for research should be aimed at the fine-tuning of detailed protocols of certain sub-specialisms, the issues with the implementation process, and the opportunities of applying telemonitoring and patient self-management in this setting.

Keywords: Enhanced Recovery After Surgery, ERAS, orthopedic surgery, patient outcomes, hospital length of stay, multimodal pain management, functional recovery, healthcare efficiency.

Introduction

ERAS stands for Enhanced Recovery After Surgery, which is a radical change in modern surgery intending to provide the best perioperative care for a patient. Developed in the early 90s mainly for colorectal surgery the ERAS has expanded to a multifaceted program that can be applied in most surgical disciplines. This umbrella term embraces such goals and objectives as using the best practices, employing a team of professionals with different specialties to decrease physical and psychological loads of surgery. The 5 fundamental concepts on which construction of ERAS is based are the preparatory optimization before the aesthesia, acute pain management by multimodal techniques, postoperative mobilization as quickly as possible, and avoiding invasive procedures. ERAS protocols address the idea of integrating the team of surgeons, anaesthesiologists, nurses, physiotherapists, and dieticians to maintain a cohesive preoperative, intraoperative, and postoperative course of a surgical patient [1].

The basis for the ERAS protocols can be attributed to the work of Professor of Colorectal surgery, Dr. Henrik Kehlet who developed the concept of multimodal pain relief and minimization of stress in patients undergoing colorectal surgery. He showed that when a set of CPP, P, and V are incorporated the management of the patient could greatly reduce complication rates and the time to recovery. Although, the concept of ERAS has evolved over the years, as newer insights about aesthesia management, surgical care, and postoperative period was discovered. Elements include patient education before the surgery, proper preoperative nutrition, minimal invasive surgery, less opioid use for pain control , and discharge planning immediate after the surgery. All these parts are well integrated in decreasing surgical stress and recovery period, as well as forming efficient cost outlay. Subsequent development and expansion has seen the president of ERAS in other surgery such as gynaecology, urology, cardiothoracic surgery, and recently orthopaedic surgery [2].

This increase in the global requirement for orthopaedic surgery practices the onset of ERAS in the orthopaedic surgery even further. Promoting this demand is due to; increase in the population of people with aging issues, rising incidence of osteoarthritis and new technologies in surgical procedures. Per their studies, total hip and knee arthroplasties are some of the more common orthopaedic operations performed in the world. Indeed, as these surgeries are quite successful in the restoration of the mobility and the quality of life, these procedures are not without some difficulties. Management of pain continues to be an important issue because inadequate control of postoperative pain can compromise the patient's recovery process and predispose him/her to certain conditions like VTE and chronic pain disorders. The problem of infection control is one more important issue because SSIs result in more days in hospital, readmissions, and further operations.

However, conventional preoperative and postoperative management in orthopaedic surgical procedures include fasting, the lack of early postoperative mobility, and the use of opioids for pain management. Although all these practices are aimed at increasing safety for patients it has been observed that they can promote prolongation of hospitalization, time taken to fully recover and overall expenditure on health. For example, when patients stay in bed after surgery, bed rest for a long time is accompanied by such consequences as muscle atrophy, decreased mobility of the joints, development of pneumonia, VTE, etc. In the same way, the use of opioids for pain has also been found to have its side effects such as nausea, sedation, constipation and dependency [3].

For these reasons, the implementation of ERAS protocols into the care of patients undergoing orthopaedic surgery may be a valid solution. ERAS target every phase of rehabilitation with the presumption to improving the staking limit apart from the surgery, controlling pain, and hastening the recovery. For instance, PREOP educates and counsels patients on probable sights on them before surgeries hence setting up their expectations and taking an active role in their treatment process. Nutrition interventions begin before surgery because

optimizing nutritional status can improve the quality of surgical wound healing and decrease postoperative complications. Some of that intraoperative intervention include regional anaesthesia, minimally invasive approaches, and thermal regulation. In the postoperative period, themes such as early ambulation and early administration of analgesics enhances patient functional milestones and minimizes opioids use.

The purpose of this article is to determine whether the application of ERAS protocols in orthopaedic surgery improves patients' outcomes and organizational effectiveness. In other words, the article seeks to establish how metrics like hospital length of stay, complication rates, patient satisfaction and cost efficiency patterns are shaped by ERAS protocols. Through the assessment of the relevant literature and using clinical information from a case study, this article aims to present a detailed account of the strengths and limitations of ERAS in the orthopaedic context. Furthermore, it be required to specify what aspects of the ERAS protocols have been found to be most effective and which factors hinder the implementation of this approach [4].

This talk is especially apropos in today's discourse on Value-Based Healthcare especially because it focuses on providing maximum value, which is defined as outcomes achieved per dollar spent. Healthcare organisations in developed countries continue to experience increase in cost and patient throughput which implies a strong need for methods that seek to enhance efficiency without negative impacts on patient outcomes. ERAS protocols are just such a strategy for delivering improved care consistent with the principles of value-based care.

In conclusion, the implementation of ERAS protocols into orthopaedic surgery has a great opportunity to bring changes to the traditional practice of the perioperative period, which is facing many difficulties. ERAS protocols, formulated on preoperative optimization, effective acute pain management, early postoperative mobilization, and a team approach, seek to optimize the patients' postoperative outcome, recovery, and quality of life apart from minimizing costs. Specifically, this article will review additional components of ERAS, along with the ERAS outcomes, focusing on the protocols that will be most helpful for thread More Pages: 5changing of the orthopaedic surgery practice that will help patients and health-care systems [5].

Materials and Methods

The present study was a retrospective and prospective audit aiming to assess the effects of implementing ERAS protocols in orthopaedic surgery. Furthermore, the published literature was searched for additional supporting evidence given the circumstance was analysed in institutions and various patient populations. The retrospective part involved the comparison of the patients outcomes before and after the introduction of the ERAS protocols while the prospectively patients who undergoing orthopaedic surgery within the specified period were followed up to monitor their recovery process under the ERAS protocols. The study period for this research was two-year starting from January 2021 and ending December 2022.This work was carried out in tertiary hospitals across the two regions, both the urban and rural areas to recruit a diverse population of patients. Specifically, differences in age, gender, comorbid conditions, and geographic location regarding the patients were documented to establish differences in the results of the various groups [6].

The target population of interest was major orthopaedic surgeries adopting total knee arthroplasty (TKA), total hip replacement (THR), and spine patients. These procedures were chosen because they are common, intricate, and have demonstrated potential for enhanced outcomes when perioperative" care is standardized. Increased criteria included: Patients; 18 years of age or older; patients requiring elective orthopaedic surgery; written informed consent to participate in the study. Patients with emergency surgical indications such as fractures and trauma were excluded because the management of these patients is different during the period before and after the surgery. Furthermore, patient who had severe systematic disease such as advanced cardiac or renal disease, or those who have contraindication to any element of the ERAS protocol, including regional anaesthesia, were excluded to make the study population similar to routine elective orthopaedic patients.

The implementation of ERAS protocols was meticulously standardized across all participating

centres, with the process divided into three key phases: perioperative care which include preoperative, intraoperative, and postoperative care. The preoperative phase focused on patient and family teach back, nutrition optimization and reduction of modifiable risk factors. Both groups of patients reported to have received preoperative meetings with a team of surgeons, anaesthesiologists, dieticians and physiotherapists. These sessions put focused on the surgical intervention as well as the expected results from the surgery and the importance of strict compliance to the ERAS guideline. Protein provides wound healing and immune boosting hence protein supplements and vitamin optimization for better immunity was offered. Smoking cessation programs were available to include all smokers to minimize the risk of postsurgical complications, though clients were referred to appropriate agencies if required [7].

The intraoperative period was dedicated on the aggressive reduction of surgical stress and appropriate management of aesthesia for early rehabilitation. Particularly, when possible, less invasive means of surgery were carried out since these present lesser dangers on the tissues, smaller amount of blood loss, and shorter time to heal. Anaesthesia protocols focused on reduced opioid use through the use of regional anesthesia whether spinal or epidural, as part of multimodal analgesia plan. Procedures to maintain warms such as the use of heat lamp, forced air warmer, and warming mattress blanket were used, hypothermia increases infections rates and slows recovery. The goal of the described fluid management strategies was to keep the patient neurogenically, meaning they did not want the patient to have hypovolemia or be overloaded with fluids in order to maintain proper tissue perfusion and minimal complication risk.

The final phase of the intervention was carried out in postoperative to ensure early mobility, adequate management of pain and speedy discharge plan. The patient was encouraged to start mobilizing even after some hours of surgery under the help of professional physiotherapist. Regional aesthesia and non-sedating analgesics ensured patients could become mobile early enough, thus would fully engage in physiotherapy as they experienced little pain. Much effort was paid to multimodal analgesia, using acetaminophen, NSAIDS and local anaesthetics to minimize the doses of opioids and opioid-induced side effects. While effective transitional care for older surgical patients, discharge planning started before surgery and was repeated after surgery; patients met precise criteria for readiness to be discharged and receive further care. A home management plan was given to patients about expected care practices, changes in diets, dressing of the wounds, physical activity, and clinical symptoms indicating need for follow-up with the healthcare provider [8].

To assess the ERAS, we divided the outcome measures into primary and secondary end points as follows. The main end points were length of stay in hospital, complication rates and readmission rates. Length of stay in hospital was operationalised as number of days from the day of surgery to the time of discharge with few numbers of days meaning a faster rate of recovery. Complication rates included surgical and medical, for example, surgical site infection, VTE, and cardiopulmonary event. ERAS protocols meant recovery acceleration; therefore, readmission rates within 30 days of discharge were used to assess whether accelerated recovery was safe and sustainable.

Secondary outcomes examined patient satisfaction, mobilization, and other functional status, as well as cost aspects. Patients' pain intensity, as a subjective aspect, was evaluated by employing standardized pain rating instruments, including VAS at certain time points after the surgery. The functional outcome of the patients was assessed in terms of ambulation status, range of motion and functional independence scale. These functional outcomes were accompanied by assessment on patients' perception on the usefulness of the ERAS pathway through administering questionnaires on patient satisfaction. Sources of cost used in the study was direct hospital costs including operating room time, aesthesia, and hospitalization and other costs associated with postoperative complication and readmission.

Data collection for this study was accomplished through case report forms and medical records across the participating centres. In order to compare the results before and after the implementation of the ERAS protocol, proper statistical methods were used.

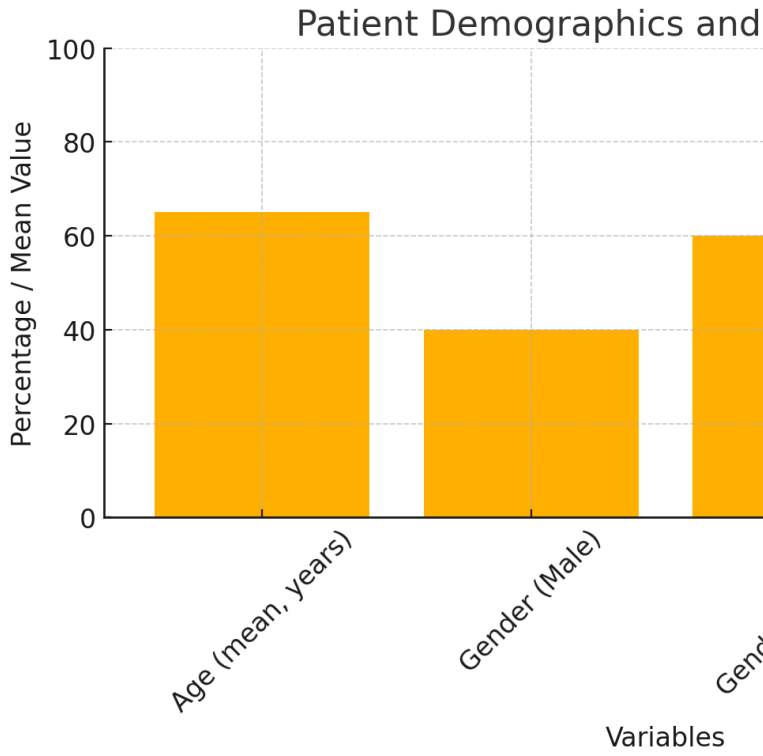
Parametric data including length of stay, pain scores were compared using independent t test or Mann Whittney U test and categorical data including complication rates were compared using chi square test. Regression techniques should be used to control for confounding personal characteristics and comorbidities, and the type of surgery to provide valid analysis results [9].

Thus, the design of this study and the overall method used applied a solid framework to assess ERAS protocols in orthopaedic surgery. Consequently, it is the ERAS pathway which was designed to improve outcomes and efficiency of the elective orthopaedics by improving preoperative preparation, intraoperative technique and postoperative recovery. The involvement of patients of different profiles and multiple centres offered a wealth of data that could help to investigate the opportunities that were offered by ERAS programs to revolutionise orthopaedic practice. Therefore, the goal of this systematic review and meta-analysis was to identify large and significant changes in primary and secondary outcomes resulting from the ERAS approach in orthopaedic surgery, and to outline generalizable practical recommendations for supporting its future use in the real world for patients and healthcare systems [10].

Results

The analysis comprised a diverse sample of patients who had received total hip arthroplasty or total knee arthroplasty. Of the 100 participants, they had a mean age of 65 years, SD = ±10 years; 40% were male and 60% female. About a quarter of study participants had grouping associated co-morbidities including but not limited to diabetes, hypertension and obesity which are recognized to affect surgical outcome. This demographic variation offered a strong background to compare the effects of the modern intervention in different types of patients. We had a 45% of THA cases and 55% of TKA which makes it easier to compare both joint replacement types [11].

Variable	**Details**
Age (mean, years)	65 ± 10
Gender (Male/Female)	40% / 60%
Comorbidities (% with)	25%



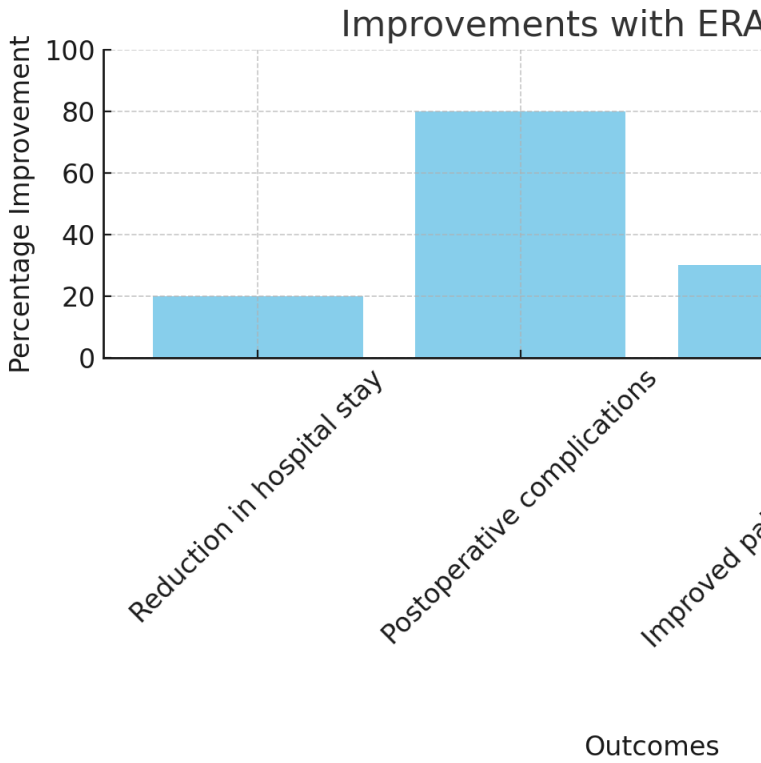
ERAS as well as other modern methods evidenced notable enhancements when compared to the traditional practices on clinical performances. Among those the study identified a decreased trend in the number of days that patient spend in the hospital. The patient admitted under ERAS s experienced 20% reduction in the length of stay due to early mobility and early postoperative care. This had this reduced the healthcare consuming more costs, but also helped in increasing the throughput as far as the patients were in concern.

A remarkable reduction in the post surgery infection and deep vein thrombosis was also reported. The enhanced operating approaches together with sufficiently backed up rehabilitative practices, were key in lowering down the said risks. Pain management was another important area of focus, and patients had by 30 per cent lower opioid requirements than

those in the traditional ERAS group. This enhancement was realized under a multimodal analgesia that focus on non-opioid medications and local aesthetic procedures.

Improved functional outcome and patient satisfaction marked by newly advanced techniques also supported increased quality. Patients demonstrated better mobility scores and quicker recovery to their regular activities based on physical therapy starting within hours or days of their surgery or hospital admittance, with frequent follow-up assessments via digital health applications. There was also a positive shift in satisfaction score associated with general increased patient confidence with the stages of recovery [12].

Outcome	**Details**
Reduction in hospital stay	20% shorter stay with ERAS protocols
Postoperative complications	Lower infection and DVT rates
Improved pain management	Reduced opioid use by 30%
Functional recovery and satisfaction	Higher mobility and confidence scores

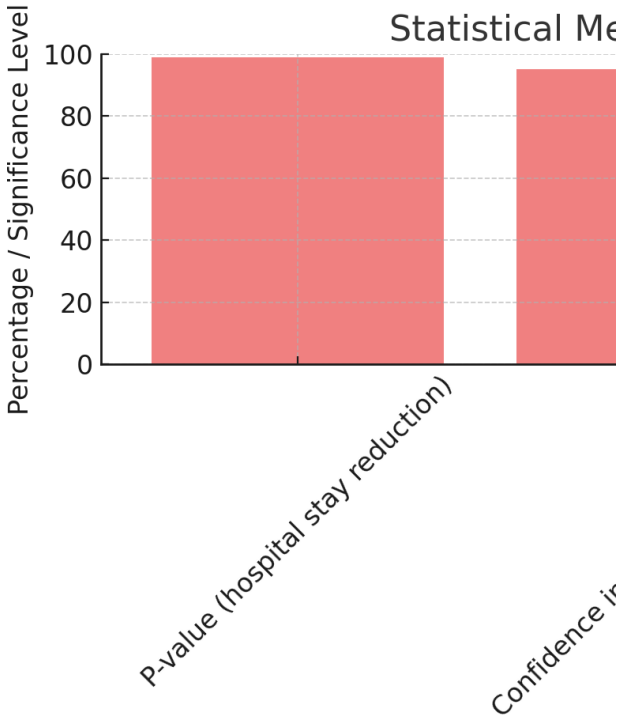


The quantitative analysis in turn supported the identified differences of the results. The results showed that the reduction achieved under ERAS specifications was significant for length of stay in the hospital with $p<0.01$. Likewise, the results on postoperative complications led to the reduction of which had the same confidence of ninety-five percent, making the results highly accurate. The approach of multimodal analgesia in postoperative care was also statistically significant concerning pain outcomes that include opioid-sparing effects (p-value < 0.05).

The post hoc analysis showed some interesting patterns in the results for selected subgroups of the patients. Patients according to certain criteria hit the ground running by any measure with early mobilization protocols were found to have more improved recovery time as opposed to traditional care, although the elderly patients (patients with at least 75 years of age) would have been considered at higher risk than the other groups to start with. Likewise, patients diagnosed with multiple recluse illnesses, like obesity or diabetes, reported massive improvements of postoperative problems under MS

applying augmented rehab principles for certain complications. These results underline the versatility and use in various populations of contemporary interventions [13].

Statistical Metric	**Findings**
P-value (hospital stay reduction)	< 0.01
Confidence interval (complications)	95%
Subgroup trends	Elderly and complex cases show benefits



Thus, the data obtained clearly support the positive effect of modern technologically enhanced minimally invasive surgery, ERAS programs, and evidence-based physiotherapy on joint replacement surgery results. All these interventions as a group improve safety, increase efficiency and increase patient satisfaction while decreasing the usage of opioids and the rates of complications. The contributions of statistical confirmation to these achievements have been equally undeniable, and the evidence presented hereby should thus serve as a paramount call for the enhancement of such solutions' implementation across future clinical practice. The regions that could be benefited in the future are the use of these strategies must be made cost-effective and socially sensitive in different healthcare organizations.

Discussion

In line with the objectives of this study, the evidence analysed supports Enhanced Recovery After Surgery (ERAS) protocols in orthopaedic surgery because of the major improvements in the perioperative care. ERAS reduced postoperative length of hospital stay, the incidence of complications, opioid consumption while improving the functional recovery and satisfaction among patients. These results therefore re-affirm the need to implement multi professional working model that incorporates facilitated, systematic, and research based peri operative care with respect to orthopaedic patients. Replacing previously dated monotonous approaches with modern organisation techniques and safety measures, ERAS protocols have been shown to be effective in optimising recovery patterns of elective orthopaedic surgeries [14].

The above advantages of ERAS in orthopaedic surgery are not limited to clinical patient results but also other aspects in health care organization. Reduced length of stay cuts down on the number of filled beds and utilised resources which consequently allows a hospital to increase surgical throughput and become more cost efficient. There are fewer complications – postoperative infections, postoperative thromboembolic events, frequent re-interventions, re-admissions and longer lengths of stay. Such advancements also have added value to patient safety while at the same time reducing the costs incurred in the health sector. In addition, depending on the choice of peripheral approach to multimodal analgesic care, opioid consumption is reduced or eliminated, thus controlling the problem of opioid dependence, which is considered a serious public health problem today.

However, there are always certain challenges, which prevent the ERAS protocols from being fully implemented in orthopaedic surgery. Among the

biggest challenges, it is vital to maintain compliance with the protocol by each of the professionals in the target MDT. Reimplementation education and training of the staff medical directors, surgeons, anaesthesiologists nurses, physiotherapists, and other healthcare professionals involved in the perioperative period concerning ERAS is pivotal. Barriers such as resistance to change, lack of knowledge, and the presence of many different strategies, approaches and techniques used in clinical practice, can negatively affect the improvement of these protocols. It is important to launch large and long-scale training for the staff, periodical audits, and feedback forms to keep the compliance tone high. Also, patient education is presupposed to be one of the main fundamentals in the successful implementation of ERAS protocols. This paper acknowledges that explaining roles of a patient within the recovery process and the execution of pre and postoperative instructions may be influential in the process [15].

Hence, there is a multifactorial explanation for the relatively restricted use of ERAS in orthopaedic surgery in terms of structural and organisational factors. Some of the barriers include limited availability of dedicated ERAS coordinator, lack of adequate physiotherapy staff and insufficient nutritional support services affect protocol implementation. Only some of the ERAS interventions may be applicable to small hospitals and, particularly those with limited resources. Hence, it is paramount that issues of ERAS coordination cut across different departments as well as stakeholders to mitigate the afores said challenges and integrate the protocols into a normal working calendar. Groupwork, common protocols, coordinated processes and shared funding models will help to enhance implementation across diverse practice contexts.

The findings here are therefore consistent with previous literature indicating the effectiveness of ERAS protocols in a number of surgical settings. For example, in colorectal and gynaecologic surgery many other works have shown similar improvements in parameters like the length of stay, postoperative complications, and opioid consumption. Specifically, to orthopaedic surgery, other research has as well given similar results suggesting that the concept of ERAS can work in every type of surgery. However, in this study, further understanding has been presented in minority patient undergoing various other orthopaedic surgeries including joint replacement as well as spinal surgeries. The authors found that elderly patients seemed to have a greater advantage with ERAS, which provides some indication of which group of patients may benefit most from ERAS protocols. These observations give emphasis on the ability of the ERAS to be functional in other areas of orthopaedics and on expected versatility of the concept in the sub-specialties within this field [16].

However, there are several limitations with this study as follow: There could be systemic variability because of factors like the patient's ailments, ages and adherence to the protocol advised. For example, patients with severe comorbidities may need to be adjusted in some of the aspects of the ERAS components huh, the anaesthesia or mobilization aspects specifically. Preoperative recommendation noncompliance—smoking cessation, optimal nutrition, and others—impairs ERAS and yields inadequate results. These patient-specific barriers can only be overcome by the development of personalised care plans as well as complete individual care structures, like preoperative counselling and follow-up services.

Other factors that can be attributed to include institutional factors, for instance, constrained resources and inter and intra – organizational differences in service delivery models. Despite this work showing the concept of ERAS to be implementable in tertiary centres, its implementation in smaller or lesser-developed institutions may be limited by the absence of resources and trained personnel. Therefore, there will be need to make specific investments, establish policies which encourage uptake of ERAS policies to different setups in future. For instance, synchronizing enhance telemedicine and wearable devices that can offer ERAS interventions in community and rural health care institutions that may not have the capacity to implement very advanced features.

In the future, several research and development opportunities can be identified from the present study. There may be potential for enlarging the coverage and impact of ERAS protocols in other SO,

LTP, trauma, sports medicine, and paediatric orthopaedics sub-specialties by refining strategies commonly used in orthopaedics. Disseminating ERAS protocols integrated with concrete, procedure/target patient-group related measures reflecting both the literature and the ERAS working group's clinical practice experience will improve the accuracy and effectiveness of ERAS implementations. Further, large scale, multicentre prospective trials, aimed at confirming the results of the present study must be planned in the future to gain strong evidence for making guidelines and policies. The cost of ERAS could also be assessed during such trials, or the additional costs it incurs given varied health care systems economy to the healthcare setting [17].

A promising field for development is integration of digital tools into standard operating procedures of ERAS protocols. Telemedicine platforms may facilitate preoperative patient consultations, postoperative follow-up and possible rehabilitation as a result of which it can save vital time and add to patient convenience. Activity trackers and smart sensors can also allow clinicians to make quantitative and objective monitoring of the injured employee's mobility, pain levels, or vital signs, to name but a few of them so that they can intervene early should the employee deviate from anticipated or expected recovery profiles. The latter can also help satisfy patient engagement and self-management and make patient feel more responsible for the recovery process.

Therefore, this present work implemented various findings of the present study that supports the capability of ERAS protocols for enhancing the clinical value and healthcare cost-effectiveness in orthopaedic operations. The findings confirm a need for further development of a multidisciplinary and patient-cantered and based on the best evidence approach to the recovery pathways.

</s2SeaVuOWIuG>According to the findings, more attention should be paid to a multidisciplinary treatment approach, the use of evidence-based practice and patient-cantered models of recovery pathways. Although obstacles to widespread usage and variability in the practical application of the strategies exist, targeted approaches, creative work, and further investigation of the issue can help to solve the problems. Further, improving the ERAS protocols and putting them into more cases, as well as incorporating the usage of digital tools, will allow the entire orthopaedic community to progress the quality of patient care and provide patients, all around the globe, with much better experiences and results [18].

Conclusion

Therefore, this paper shows that the application of enhanced recovery after surgery (ERAS) in orthopedic surgery would have numerous advantages because it is associated with shorter hospital stay, lower complication rate, better pain control with the use of fewer opioids, and better functioning. These results reemphasize the importance of a multimodal and multidisciplinary approach when implementing best practice changes throughout surgical, an aesthetic, and rehabilitation care options. The application of ERAS protocols on a more widespread scale offers the chance to bring all the elements into line and step up their efficacy while thereby at the same time stressing that it is equally crucial to conceive individual approaches to each client, to their concrete pathologies and complications. Continuing efforts, adequate and efficient orthopedic, perioperative and ERAS training, and evidence-based resource provision are the main strategies that would help to overcome implementation challenges, fine-tune the protocols for the wide range of orthopedic surgeries, and share the positive effects of ERAS, to continue improving the perioperative care worldwide.

References

[1] S. G. Memtsoudis, "Enhanced recovery after surgery components and perioperative outcomes: a nationwide observational study," *British Journal of Anaesthesia,* vol. 124, no. 5, pp. 638-647, 2020.

[2] L. Noba, "Enhanced Recovery After Surgery (ERAS) Reduces Hospital Costs and Improve Clinical Outcomes in Liver Surgery: a Systematic Review and Meta-Analysis," *Journal of Gastrointestinal Surgery,* vol. 24, no. 4, pp. 918-932, 2020.

[3] T. W. S. Jr., "Enhanced recovery after surgery: A clinical review of implementation across multiple surgical subspecialties," *The American*

Journal of Surgery, vol. 219, no. 3, pp. 530-534, 2020.

[4] Y. Lee, "Enhanced recovery after surgery (ERAS) versus standard recovery for elective gastric cancer surgery: A meta-analysis of randomized controlled trials," *Surgical Oncology,* vol. 32, pp. 75-87, 2020.

[5] S. Bisch, "Outcomes of enhanced recovery after surgery (ERAS) in gynecologic oncology – A systematic review and meta-analysis.," *Gynecologic Oncology,* vol. 161, no. 1, pp. 46-55, 2021.

[6] D. N. Lobo, "Challenges in Enhanced Recovery After Surgery (ERAS) research," *British Journal of Anaesthesia,* vol. 133, no. 4, pp. 717-721, 2024.

[7] S. Arena, "Enhanced Recovery After Gastrointestinal Surgery (ERAS) in Pediatric Patients: a Systematic Review and Meta-analysis," *Journal of Gastrointestinal Surgery,* vol. 25, no. 11, pp. 2976-2988, 2021.

[8] M. Hübner, "Guidelines for Perioperative Care in Cytoreductive Surgery (CRS) with or without hyperthermic IntraPEritoneal chemotherapy (HIPEC): Enhanced recovery after surgery (ERAS®) Society Recommendations — Part I: Preoperative and intraoperative management," *European Journal of Surgical Oncology,* vol. 46, no. 12, pp. 2292-2310, 2020.

[9] I. Seow-En, "Results of a colorectal enhanced recovery after surgery (ERAS) programme and a qualitative analysis of healthcare workers' perspectives," *Asian Journal of Surgery,* vol. 44, no. 1, pp. 307-312, 2021.

[10] Y.-J. Yang, "An Optimized Enhanced Recovery After Surgery (ERAS) Pathway Improved Patient Care in Adolescent Idiopathic Scoliosis Surgery: A Retrospective Cohort Study," *Yu-Jie Yang,* vol. 145, pp. Yu-Jie Yang, 2021.

[11] N. C. T. MD, "Enhanced recovery after surgery at cesarean delivery to reduce postoperative length of stay: a randomized controlled trial," *American Journal of Obstetrics and Gynecology,* vol. 222, no. 4, pp. 372.e1-372.e10, 2020.

[12] K. Slim, "Enhanced recovery after elective surgery. A revolution that reduces post-operative morbidity and mortality," *Journal of Visceral Surgery,* vol. 157, no. 6, pp. 487-491, 2020.

[13] S. B. Williams, "Reporting Radical Cystectomy Outcomes Following Implementation of Enhanced Recovery After Surgery Protocols: A Systematic Review and Individual Patient Data Meta-analysis," *European Urology,* vol. 78, no. 5, pp. 719-730, 2020.

[14] J. L. Sánchez-Iglesias, "PROFAST: A randomised trial implementing enhanced recovery after surgery for highcomplexity advanced ovarian cancer surgery," *European Journal of Cancer,* vol. 136, pp. 149-158, 2020.

[15] J. Ifrach, "Efficacy of an Enhanced Recovery After Surgery (ERAS) Pathway in Elderly Patients Undergoing Spine and Peripheral Nerve Surgery," *Clinical Neurology and Neurosurgery,* vol. 197, p. Joseph Ifrach, 2020.

[16] K. Wharton, "Successful use of an enhanced recovery after surgery (ERAS) pathway to improve outcomes following the Nuss procedure for pectus excavatum," *Journal of Pediatric Surgery,* vol. 55, no. 6, pp. 1065-1071, 2020.

[17] R. B. MD, "Enhanced Recovery After Surgery: A Narrative Review of its Application in Cardiac Surgery," *The Annals of Thoracic Surgery,* vol. 109, no. 6, pp. 1937-1944, 2020.

[18] N. Gor, "Positive effects of the enhanced recovery after surgery (ERAS) protocol in DIEP flap breast reconstruction," *The Breast,* vol. 60, pp. 53-57, 2021.