

Approaches of Neurosurgeons and Orthopedists to the Protocol for Enhanced Recovery After Surgery (ERAS) in Spinal Pathologies: A Single Center, Survey Study

Beyin Cerrahları ve Ortopedistlerin Spinal Patolojilerde Cerrahi Sonrası Gelişmiş İyileşme (ERAS) Protokolüne Yaklaşımları: Tek Merkez, Anket Çalışması

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ABSTRACT

Objective: The Enhanced Recovery After Surgery (ERAS) protocol defines multimodal interventions applied to patients during the postoperative period to enable them to return to their normal life functions as quickly as possible. It encompasses the perioperative process from the patient's hospital admission to discharge. The aim of our study is to observe the approaches of neurosurgeons and orthopedists at our center regarding the ERAS protocol in spinal pathologies and create awareness to ensure the routine implementation of ERAS.

Methods: The survey, organized according to the items of the ERAS protocol for spinal surgeries, was delivered to the participants in person or via email after obtaining approval from the local ethics committee. The survey consisted of questions aimed at investigating the approaches of surgeons regarding fundamental aspects such as anesthesia, analgesia, surgical approach, fasting-nutrition, and early mobilization during the preoperative, intraoperative, and postoperative periods of spinal surgery.

Results: The survey was completed by 53 doctors, with 22 (41.5%) being neurosurgeons and 31 (58.5%) orthopedists. When evaluating the responses of the participants to the questions related to the preoperative period, it was found that patient education, blood glucose regulation for diabetic patients, preoperative skin preparation, and the use of prophylactic antibiotics and anti-thrombotic agents were all implemented at a rate of 100%. Regarding the choice of anesthesia method, it is noteworthy that 38.7% of orthopedists preferred regional anesthesia, while 59% of neurosurgeons opted for general anesthesia. In terms of postoperative care, the surgical teams showed a preference for removing surgical drains and urinary catheters on the first day after the surgery. As for early mobilization, 87.1% of orthopedists preferred the first postoperative day, whereas 72.7% of neurosurgeons chose the day of surgery for mobilization.

Conclusion: The clinics that participated in the survey demonstrated practices that were either closely aligned or suitable to the elements constituting the ERAS protocol, even if these practices

ÖZ

Amaç: Cerrahi Sonrası Gelişmiş İyileşme protokolü (ERAS), hastaların postoperatif dönemde mümkün olan en kısa sürede normal yaşam fonksiyonlarına geri dönmeleri için uygulanan multimodal yaklaşımları tanımlar. Hastanın hastane başvurusuyla, taburculuğu arasındaki perioperatif süreci kapsar. Çalışmamızın amacı, merkezimizdeki beyin cerrahları ve ortopedistlerin spinal patolojilerde ERAS protokolüne yaklaşımlarını gözlemlemek ve farkındalık yaratarak ERAS'ın rutin kullanımını sağlamaktır.

Yöntem: Spinal cerrahiler için ERAS protokolü maddelerine göre düzenlenen anket, yerel etik kurul onayı sonrasında katılımcılara elden veya mail yoluyla iletildi. Anket cerrahların, spinal cerrahinin preoperatif, intraoperatif ve postoperatif dönemlerindeki anestezi, analjezi, cerrahi teknik, açlık-beslenme ve erken mobilizasyon gibi temel konulardaki yaklaşımlarını araştıran sorulardan oluşmaktaydı.

Bulgular: Anket 22'si (%41.5) beyin cerrahı, 31'i (%58.5) ortopedist olmak üzere 53 doktor tarafından dolduruldu. Katılımcıların preoperatif dönemle ilgili sorulara verdikleri cevaplar değerlendirildiğinde; hasta bilgilendirme, diyabetik hastaların kan glukoz regülasyonunun sağlanması, preoperatif cilt hazırlığının yapılması, profilaktik antibiyotik ve antitrombotik ajan kullanımının %100 oranında olduğu saptandı. Anestezi yöntemi tercihinde ortopedistlerin %38.7 oranında rejyonel anestezi, beyin cerrahlarının ise %59 oranında genel anestezi uygulamalarını tercih ettikleri görüldü. Cerrahi ekipler, cerrahi dren ve idrar sondasını postoperatif daha çok 1. gün çıkarmayı tercih etmişlerdir. Mobilizasyon için ise ortopedistler %87.1 oranında postoperatif 1. günü, beyin cerrahları ise %72.7 oranında cerrahi gününü tercih etmişlerdir.

Sonuç: Ankete katılan kliniklerin rutin uygulamaları ERAS başlığı altında olmasa da, protokolü oluşturan maddeler incelendiğinde protokole yakın veya uygun uygulamalarının olduğu görülmüştür.

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were not explicitly categorized under the ERAS heading. To ensure the widespread and accurate adoption of ERAS protocols in clinical settings, it is essential to provide the surgical teams with adequate information and encourage them to utilize ERAS principles.

Keywords: Enhanced recovery after surgery, spinal procedures, orthopedic surgeon, neurosurgeon

ERAS protokollerinin kliniklerde yaygın ve doğru kullanımı için, cerrahi ekipler ERAS konusunda bilgilendirilmeli ve kullanımı konusunda teşvik edilmelidir.

Anahtar sözcükler: Ameliyat sonrası gelişmiş iyileşme, spinal prosedürler, ortopedist, beyin cerrahi

INTRODUCTION

The “Enhanced Recovery After Surgery” (ERAS), which was developed by Henrik Kehlet, defines multimodal approaches used to ensure that the patient returns to normal life activities as soon as possible after surgery. Kehlet identified the philosophy of the pathophysiological role of the components of the stress response to surgical trauma for postoperative morbidity and whether changing these responses might enhance the surgical outcome, and that multimodal interventions might enhance outcomes (1). Using this approach, the main objectives of ERAS were improving surgical results and patient experience, reducing complications, and accelerating discharge by shortening the hospital stay (2,3).

ERAS protocol for different surgical disciplines consists of more than 20 evidence-based titles, some of which involve common and some of them surgery-specific applications for preoperative, intraoperative, and postoperative periods (4,5). Although it is difficult for a protocol beyond traditional practices and proposes radical innovations to be involved in the routine quickly, the remarkable results of the studies that determine the level of evidence and the strength of the recommendations on ERAS led to increased indications and frequency of application of the ERAS protocol in spinal surgeries, as in many surgical disciplines. Spinal surgery patients were a special group of patients that require great attention in terms of both anesthesia management and surgical interventions with a wide range of patients and interventions. Spinal surgical interventions, mainly performed by neurosurgeons and orthopedists, involve many common and different approach and philosophies.

The purpose of the present study was to investigate the approaches of the Neurosurgery and Orthopedics departments of the Gazi University Faculty of Medicine Hospital to the ERAS protocol in spinal surgeries and to present them in the light of literature and to ensure that the protocol is an established practice in spinal surgery by raising awareness on ERAS.

MATERIAL and METHODS

This single-center survey study was conducted with a survey that was prepared to evaluate the approaches of neurosur-

geons and orthopedists at the Gazi University Faculty of Medicine Hospital to ERAS protocol applications in spinal surgeries after the approval of the Gazi University Rectorate Ethics Commission (E.700664). All physicians who actively worked in these two departments in our hospital and who agreed to participate in the survey were involved in the study. A survey was prepared by utilizing the current ERAS protocol recommendations for spinal surgery and involved multiple-choice questions on the demographic characteristics of the participants and the approaches in the preoperative, intraoperative, and postoperative periods, to decrease the metabolic traumas caused by the surgery and accelerate the healing process. The survey questions are given in Table I. The survey was delivered to the participants by hand or through e-mail, and the answers were evaluated through “Research Electronic Data Capture (REDCap)”. Descriptive data is given as ratios and mean \pm SDs.

RESULTS

The survey was filled by 53 doctors, 22 (41.5%) neurosurgeons, and 31 (58.5%) orthopedists. It was found that 49 (92.3%) of the participants were male, except 4 (7.7%) females. When the academic positions were evaluated, it was found that 5 (22.7%) professors, 3 (13.6%) associate professors, 1 (4.5%) assistant professor, and 13 (59.1%) research assistants participated in the survey from neurosurgery department, and these numbers were 5 (16.1%) professors, 2 (6.5%) associate professors, 2 (6.5%) assistant professors and 22 (71%) research assistants among orthopedists. Considering the total values, it was found that most of the participants were research assistants (66%). The mean age of the research assistants was found to be 28.32 ± 4.9 in department of orthopedics and 28.54 ± 1.45 in neurosurgery department.

When the answers of the participants about the preoperative period were evaluated, patient information, blood glucose regulation of diabetic patients, preoperative skin preparation, prophylactic antibiotic and antithrombotic prophylaxis usage were found to be 100% in both departments. Also, the recommendations of the participants on quitting smoking in the preoperative period (90.6%) were higher than the recommendations for quitting alcohol (56.6%). It was found that orthopedists (smoking 96.8%, alcohol 61.3%) were more

Table I. Survey Form

Survey Form	
Approaches of Neurosurgeons and Orthopedists to the Protocol for Enhanced Recovery After Surgery (ERAS) in Spinal Pathologies: A Single Center, Survey Study	
I. General Information	
1. In which department do you work?	
Department of Orthopedics and Traumatology	<input type="checkbox"/>
Department of Neurosurgery	<input type="checkbox"/>
2. Please mark your academic position.	
Professor Dr.	<input type="checkbox"/>
Associate Professor	<input type="checkbox"/>
Assistant Professor	<input type="checkbox"/>
Research Assistant	<input type="checkbox"/>
3. Indicate your age and gender information.	
Age:	
Gender: F	<input type="checkbox"/>
M	<input type="checkbox"/>
II. Preoperative Period	
1. Are your patients informed in writing and/or verbally about concepts such as preoperative preparation, oral intake, early mobilization, pain, breathing exercises, and the necessity of taking an active role in these issues in the preoperative period?	
No:	<input type="checkbox"/>
Yes: Oral	<input type="checkbox"/>
Written	<input type="checkbox"/>
Both	<input type="checkbox"/>
2. Do you routinely administer premedication to your patients?	
No:	<input type="checkbox"/>
Yes:	<input type="checkbox"/>
3. Which of the following is your preoperative fasting practice?	
After midnight	<input type="checkbox"/>
6 h for solids, 2 h for liquids	<input type="checkbox"/>
CH-rich oral fluid loading	<input type="checkbox"/>
4. Do you advise your patients about smoking preoperatively?	
No:	<input type="checkbox"/>
Yes: Quit as much as possible before the surgery	<input type="checkbox"/>
Quit at least 4 weeks before the surgery	<input type="checkbox"/>
Quit at least 24 h before the surgery	<input type="checkbox"/>
5. Do you advise your patients about preoperative alcohol use?	
No:	<input type="checkbox"/>
Yes: Quit as much as possible before the surgery	<input type="checkbox"/>
Quit 24 h before the surgery	<input type="checkbox"/>
Quit 4-8 weeks before the surgery	<input type="checkbox"/>
6. Do you make evaluations for preoperative anemia optimization?	
No	<input type="checkbox"/>
Yes	<input type="checkbox"/>
7. Do you provide preoperative blood glucose regulation for your diabetic patients?	
No	<input type="checkbox"/>
Yes	<input type="checkbox"/>
It is arranged by us at the ward.	<input type="checkbox"/>
The internal medicine team is consulted.	<input type="checkbox"/>

Table I. Cont.

Survey Form	
8. Do you have an application for pre-operative skin preparation?	
No	<input type="checkbox"/>
Yes	<input type="checkbox"/>
9. Do you use antibiotic prophylaxis?	
No	<input type="checkbox"/>
Yes	<input type="checkbox"/>
10. Which of the following is your approach in antithrombotic prophylaxis?	
LMWH	<input type="checkbox"/>
Antiembolic socks	<input type="checkbox"/>
III. Intraoperative Period	
1. What is your approach to anesthesia applications?	
I leave it to the anesthetist's choice.	<input type="checkbox"/>
I prefer general anesthesia for all my patients.	<input type="checkbox"/>
I prefer the application of regional anesthesia techniques in suitable patients.	<input type="checkbox"/>
2. Do you have a practice for the prevention of intraoperative hypothermia?	
No:	<input type="checkbox"/>
Yes:	<input type="checkbox"/>
I leave it under the control of the anesthesia team.	<input type="checkbox"/>
I apply pre-warming in the preoperative period.	<input type="checkbox"/>
3. Do you have a standard approach to surgical technique?	
Minimally invasive technique	<input type="checkbox"/>
Navigation	<input type="checkbox"/>
Endoscopy	<input type="checkbox"/>
Robotics	<input type="checkbox"/>
I apply surgical techniques specific to patients.	<input type="checkbox"/>
4. Do you use drains for surgical site drainage?	
I use it for all.	<input type="checkbox"/>
I do not use any.	<input type="checkbox"/>
Patient-specific.	<input type="checkbox"/>
5. Do you use routine urinary catheters in your patients?	
No.	<input type="checkbox"/>
Yes.	<input type="checkbox"/>
IV. Postoperative Period	
1. What is your drain removal time?	
Postoperative 1 st day	<input type="checkbox"/>
Postoperative 2 nd day	<input type="checkbox"/>
2. When do you pull the urinary catheter?	
Postoperative 1 st day	<input type="checkbox"/>
Postoperative 2 nd day	<input type="checkbox"/>
According to the patient's need	<input type="checkbox"/>
3. When do you start oral feeding in the postoperative period?	
4 h after surgery	<input type="checkbox"/>
8 h after surgery	<input type="checkbox"/>
Postoperative 1 st day	<input type="checkbox"/>
4. What is your approach to mobilization in the postoperative period?	
I mobilize the patient on the day of surgery.	<input type="checkbox"/>
I mobilize on the 1 st postoperative day.	<input type="checkbox"/>

Table I. Cont.

Survey Form	
5. What is your postoperative analgesia approach?	
NSAID	<input type="checkbox"/>
Acetaminophen	<input type="checkbox"/>
Opioid	<input type="checkbox"/>
Gabapentin	<input type="checkbox"/>
Thank you for completing the survey!	

CH: Carbohydrate, NSAID: Non-steroidal anti-inflammatory drug.

sensitive than neurosurgeons (smoking 81.8%, alcohol 50%) in preoperative recommendations regarding smoking and alcohol use. It was also found that anti-thrombotic prophylaxis was preferred more by orthopedists. Details of the findings related to the preoperative period are given in Table II.

Table III shows the intraoperative period data and it is striking that orthopedists prefer regional anesthesia with a rate of 38.7%, and neurosurgeons prefer general anesthesia with a rate of 59%. It was found that the rate of orthopedists choosing according to the preferences of the anesthetists in determining the anesthesia method was higher. Regarding surgical approaches, it was found that 77.4% of orthopedists decide on the surgical technique on a patient basis, while 90.9% of neurosurgeons use more minimally invasive surgical techniques. Details of the intraoperative period data are given in Table III.

When the postoperative data were evaluated, both surgical teams preferred to remove the surgical drainage (77.4%) and urinary catheter (75.6%) on the 1st postoperative day. For mobilization, orthopedists preferred the 1st postoperative day with a rate of 87.1%, while neurosurgeons preferred the day of surgery with a rate of 72.7%. Detailed findings of the post-operative period are given in Table IV.

All participants who filled out the surveys said that they did not apply the ERAS in a disciplined manner because they did not have a clear idea of the ERAS, but this survey created an awareness on the subject.

DISCUSSION

The approaches of the doctors in the Neurosurgery and Orthopedics departments of the Gazi University Faculty of Medicine Hospital to the ERAS protocol in spinal surgeries were investigated in this survey study. The approaches of two different surgical disciplines to the ERAS protocols were compared, and the awareness levels of the physicians dealing with spinal surgery, in general, were evaluated.

According to the ERAS Protocol, this process, which accelerates the postoperative recovery of the patients, must start

with the outpatient application of the patients, that is, from the preoperative period. Enhanced Recovery After Surgery protocols in spinal surgery focus on the importance of preoperative education and counseling. The first step in the preoperative period is to prevent the patient's anxiety by informing the patient verbally and in writing on basic issues such as preparation, pain, oral food intake, and early mobilization (6-8). Regarding the answers of the participants from the two sections who participated in our survey, it was found that 100% of preoperative patient information is provided. Although preoperative patient education is highly recommended, more studies are needed to determine the specific patients, timing, and application method who will benefit most from preoperative education and counseling (9).

Preoperative anxiety is a common condition. During the transfer of the patient to the operating room, benzodiazepines are among the most commonly used agents because they cause retrograde amnesia and increase patient satisfaction. In a large retrospective cohort study conducted with 94,887 procedures in general surgery and orthopedic surgery, benzodiazepine use was associated with increased postoperative side effects (10). The ERAS protocol does not recommend unnecessary premedication because benzodiazepines can cause neurocognitive disorders and opioids and other sedating agents prolong hospital stay (9,11). However, it must be found whether patients who regularly use such drugs can continue their drugs in the preoperative period with a psychiatry consultation. In the present study, it was found that the majority of the participants (84.9%) did not apply premedication, for this reason, they were compatible with the ERAS protocol.

The survey showed that majority of the both teams (90%) started fasting after midnight. When patients wait longer for the beginning of surgery, this practice exceeds the fasting times recommended by anesthesia. That is why the fasting periods must be adopted according to the estimated surgical times. Neither participant preferred oral administration rich in carbohydrates. Allowing carbohydrate loading through the intake of a clear carbohydrate drink two hours before surgery

Table II: The Responses of the Participants to the Preoperative Period Questions of the Survey, n (%)

Preoperative Period	Orthopedists, n (%) 31 (58.5)	Neurosurgeons, n (%) 22 (41.5)	Total, n (%) 53 (100)
Patient information			
No	0	0	0
Yes	31 (100)	22 (100)	53 (100)
Oral	22 (71)	11 (50)	33 (62.3)
Written	4 (13.9)	6 (27.3)	10 (1.9)
Both	5 (16.1)	5 (22.7)	10 (18.9)
Premedication			
No	29 (93.5)	16 (72.7)	45 (84.9)
Yes	2 (6.5)	6 (27.3)	8 (15.1)
Preoperative fasting protocol			
After midnight	29 (93.5)	20 (90.9)	49 (92.5)
6 h for solid, 2 h for liquid	2 (6.5)	2 (9.1)	4 (7.5)
CH-rich oral fluid loading	0	0	0
Advice against smoking			
No	1 (3.2)	4 (18.2)	5 (9.4)
Yes	30 (96.8)	18 (81.8)	48 (90.6)
Quit as much as possible before surgery	14 (46.7)	18 (100)	32 (66.7)
At least 4 week	1 (3.3)	0	1 (2.1)
Before 24 h	15 (50)	0	15 (31.3)
Advice against alcohol			
No	12 (38.7)	11 (50)	23 (43.4)
Yes	19 (61.3)	11 (50)	30 (56.6)
Quit as much as possible before surgery	7 (36.8)	11 (100)	18 (60)
Before 24 h	12 (63.2)	0	12 (40)
Preoperative anemia assessment			
No	6 (19.4)	1 (4.5)	7 (13.2)
Yes	25 (80.6)	21 (95.5)	46 (86.8)
Preoperative glucose assessment			
No	0	0	0
Yes	31 (100)	22 (100)	53 (100)
By our team in the ward	5 (16.1)	8 (36.4)	13 (24.5)
Internal medicine	26 (83.9)	14 (63.6)	40 (75.5)
Skin preparation			
No	0	0	0
Yes	31 (100)	22 (100)	53 (100)
Prophylactic antibiotic			
No	0	0	0
Yes	31 (100)	22 (100)	53 (100)
Antithrombotic agent preference			
LMWH	24 (77.4)	14 (63.6)	38 (71.7)
Stockings	31 (100)	22 (100)	53 (100)

h: Hours, CH: Carbohydrate; LMWH: Low molecular weight heparin.

Table III: The Responses of the Participants to the Questions of the Intraoperative Period of the Survey, n (%)

Intraoperative Period	Orthopedists, n (%) 31 (58.5)	Neurosurgeons, n (%) 22 (41.5)	Total, n (%) 53 (100)
Anesthesia Preference			
Anesthesiologist's preferences	25 (80.6)	9 (40.9)	34 (64.1)
General anesthesia for all my patients	0	13 (59)	11 (20.7)
Regional techniques for suitable patients	12 (38.7)	0	14 (26.4)
Prevent of hypothermia			
No	5 (16.1)	2 (9.1)	7 (13.2)
Yes	26 (83.9)	20 (90.9)	46 (86.8)
Control of anesthesia	26 (100)	14 (70)	40 (87)
Preemptive heating during the preoperative period	0	5 (25)	5 (10.9)
Surgical Technique			
Minimally invasive	5 (16.1)	10 (45.5)	15 (28.4)
Navigation	0	4 (18.2)	4 (7.5)
Endoscopy	2 (6.5)	3 (13.6)	5 (9.4)
Robotics	0	3 (13.6)	3 (5.7)
Specific to each patient	24 (77.4)	2 (9.1)	26 (49)
Surgical drains			
For all surgeries	9 (29)	7 (31.8)	16 (30.2)
Never	1 (3.2)	0	1 (1.9)
Specific to each patient	21 (67.7)	15 (68.2)	36 (67.9)
Urinary catheter			
No	8 (25.8)	0	8 (15.1)
Yes	23 (74.2)	22 (100)	45 (84.9)

h: Hour.

Table IV: The Responses of the Participants to the Postoperative Questions of the Survey, n (%)

Postoperative Period	Orthopedists, n (%) 31 (58.5)	Neurosurgeons, n (%) 22 (41.5)	Total, n (%) 53 (100)
Time of removal of the drain			
Postoperative 1 st day	26 (83.9)	15 (68.2)	41 (77.4)
Postoperative 2 nd day	5 (16.1)	7 (31.8)	12 (22.6)
Time of removal of the urinary catheter			
Postoperative 1 st day	20 (87)	14 (63.6)	34 (75.6)
Postoperative 2 nd day	3 (13)	3 (13.6)	6 (13.3)
According to patient's need	0	5 (22.7)	5 (11.1)
Oral intake after surgery			
4 h after surgery	24 (77.4)	18 (81.8)	42 (79.2)
8 h after surgery	7 (22.6)	4 (18.2)	11 (20.8)
Postoperative 1 st day			
Mobilization			
On the day of surgery	4 (12.9)	16 (72.7)	20 (37.7)
Postoperative 1 st day	27 (87.1)	5 (22.7)	32 (60.4)
Postoperative analgesia preference			
NSAID's	15 (48.4)	14 (63.6)	29 (54.7)
Acetaminophen	14 (45.2)	10 (45.5)	24 (45.4)
Opioid	10 (32.2)	6 (27.3)	16 (33)
Gabapentin	0	4 (18.1)	4

h: Hour, NSAIDs: Non-steroidal anti-inflammatory drugs.

helps the patient to remain close to their normal physiologic state. Carbohydrate loading was shown to expedite the return of bowel function, decrease insulin resistance, and maintain lean body mass and muscle strength, in addition to decreasing patient discomfort and anxiety (12). Regarding the widely accepted pre-operative fasting protocols, it is clear that both groups do not apply ERAS protocols on this issue.

It is already known that smoking increases perioperative and postoperative pulmonary, cardiovascular, and wound complications, and it is recommended to stop 4 weeks before surgery (13,14). Cessation of alcohol 4-8 weeks before surgery decreases postoperative complications but not mortality in literature in the orthopedic and neurosurgical population (15,16). Although the participants said that they informed the patients against smoking (90.6%) and alcohol (56.6%) use in the preoperative period, only one participant (2.1%) responded in line with the Protocol regarding quitting time. Also, it is striking that the awareness of the surgeons who participated in this study on cessation of smoking is higher than their awareness on cessation of alcohol. According to the results, we believe that it is necessary to increase awareness among the participants on both the time to stop smoking and having alcohol.

Pre-operative anemia is associated with an increased risk of transfusion, infection, morbidity, length of stay, morbidity, and transfusion. Anemia must be corrected before elective major spinal surgery (17,18). It was found in the present study that 86.8% of surgeons approached anemia in compliance with ERAS protocols and there was no significant difference between the two branches regarding the subject.

Perioperative hyperglycemia is linked with an increased risk of infection and cardiovascular morbidity and mortality postoperatively in diabetic and nondiabetic patients (19,20). For this reason, it has a critical role in the ERAS protocol. All of the participants declare that they achieved preoperative glucose regulation in line with the ERAS protocol, mostly with the recommendations of the endocrinology department (75.5%).

The risk of deep vein thrombosis and thromboembolism in elective spinal surgery is estimated as 0.9% and 0.7%, respectively (21). Because of the low thrombosis tendency in spinal surgery, compressive stockings are used mostly in prophylaxis, but anti-thrombotic agents are preferred if mobilization is delayed. All surgeons who participated in the survey said that they used compressive stockings, while the use of LMWH was 77.4% in orthopedists and 63.6% in neurosurgeons. The most important reason for this difference was considered to be the habits of orthopedists from extremity surgery. In the present study, different approaches were not seen between the two teams in terms of thromboembolism prophylaxis, and it was found that the practices were close to the ERAS protocols.

In anesthesia applications, regional anesthesia is remarkably higher in orthopedists compared to neurosurgeons. The reason for this may be that general anesthesia is the main method in neurosurgery, apart from awake craniotomy, and early neurological examination is a must for neurosurgeons. Also, although orthopedists were familiar with these techniques because of the widespread use of regional anesthesia in orthopedic operations, regional anesthesia applications in spinal surgery differ between centers. Also, the anesthesia team can profoundly impact patients' recovery postoperatively by choosing shorter-acting premedications and using decreased levels of volatile anesthetics, or using total intravenous anesthesia (TIVA), minimizing the use of opioids and adequate pain management, maintaining euolemia, normothermia, and administering prophylactic antiemetics. For this reason, because of the critical role of anesthetists in the ERAS protocol, it is a wise choice to decide the anesthesia method together with anesthetists.

According to the ERAS protocol, neuromuscular blockade and neuraxial techniques must be preferred in spinal surgery as part of multimodal anesthesia strategies. Thanks to these techniques and increasingly applied plan blocks (Erector Spinae Plane Block, Quadratus Lumborum Block, Thoracolumbar Interspinal Plane Block), opioid consumption is decreased, effective pain control can be achieved and recovery is improved (22).

Temperature monitoring and maintaining normothermia during the intraoperative and postoperative periods is another important element of the ERAS protocol. Hypothermia is associated with adverse effects such as delayed wound healing, increased wound infection, increased blood loss, cortisol levels, and significantly increased oxygen consumption which might precipitate cardiac events (23). The awareness of the two departments, which apply pediatric spinal surgery is remarkably high and no significant differences were detected between the groups.

Minimally invasive techniques have advantages such as less blood loss, tissue damage, wound site problems, hospital stay, and faster mobilization. For this reason, when surgical techniques are analyzed, minimally invasive methods, intraoperative neuromonitoring, and other modern techniques, although not part of the ERAS protocols, are fully compatible with the target of these protocols (24). It was found that neurosurgeons applied minimally invasive methods more frequently.

According to ERAS protocol, urinary and other catheters, surgical drains must be avoided in patients with short elective and minimally invasive spine surgeries. If they were used, they must be removed as soon as possible. Removing unnecessary tubes, catheters, and drains allows for an earlier phys-

iologic return and decreases gastrointestinal, pulmonary, and infectious complications. Especially prolonged use of urinary catheters was associated with an increased risk of infection and post-operative urinary retention following spine surgery (25). The majority of the surgeons in both departments preferred not to use or early removing of drains and catheters.

Early oral intake enhances wound healing, decreases infection, enhances insulin resistance, and allows for a faster return of muscle function (26). Although the benefits of early oral intake in spinal surgery are not at a high level of evidence in the ERAS protocol, it must be applied in spinal surgery because it is recommended generally for all surgeries. In the present study, both teams started oral intake at the 4th post-operative hour, which can be considered early.

Early ambulation (mobilization) decreases the incidence of ileus, decreases pulmonary and thromboembolic complications, allows for faster organ recovery, and enhances muscle strength. These interventions and a close abidance of ERAS protocols allow for a faster return to the physiologic baseline. In spinal surgery, the ERAS protocol recommends targeting early mobilization, and morbidity and hospital stay were shortened in patients mobilized on the day of the operation (27). In this study, the neurosurgeons mobilize patients earlier than orthopedic surgeons. The possible explanation of this diversity may be the minimal invasive approaches like lumbar microdiscectomy and anterior cervical discectomy and fusion are mostly performed by neurosurgeons and these cases are mobilized within hours after surgery.

Poor postoperative pain control is detected in 57% of patients after elective spinal surgeries (28). The concern of providing adequate postoperative analgesia regimens is a common concern in all surgeries. Many different analgesics are used in postoperative pain. The use of multimodal agents and techniques for postoperative analgesia is becoming increasingly popular. Opioids are effective in treating acute postoperative pain following spinal surgery. However, opioid-sparing techniques are important and must be applied in ERAS to allow patients to recover early and decrease complications related to opioid use (29). Although there are randomized controlled studies on this subject for different surgeries, there is a need for well-designed and high-evidence studies regarding spinal surgeries. The routine uses of multimodal analgesic regimens to enhance pain control and decrease opioid consumption is recommended (9). In the present study, it is shown that the surgeons in both departments routinely use NSAID's and acetaminophen and rarely prefer opioids.

The main limitations of the study were that although orthopedists mainly perform deformity and trauma surgery, neurosurgeons are more interested in degenerative and oncological cases. Pediatric spine surgery is performed more frequently

by orthopedists, except for congenital spinal cord malformations. The surgical approach differences of these cases naturally show variability in terms of approach to ERAS protocol. Also, the familiarity of orthopedists with anesthesia methods in extremity surgeries causes them to prefer regional anesthesia more than neurosurgeons. In the present study, two different disciplines working together with the same anesthesia unit in a single center were evaluated. More detailed and different results can be obtained with future studies involving larger numbers and different centers.

As a result, although the routine practices of the clinics are not under the title of ERAS, when the headings that constitute the protocol were evaluated, it was found that they have applications close to or appropriate to the protocol. It is also noteworthy that there are steps that need to be developed. Also, all of the participants said that they did not apply it because they did not have enough information on the ERAS protocol, but that the survey created awareness on the Protocol.

In spinal surgery, ERAS protocols have a critical role in terms of ease of application, shortening the hospital stay, accelerating the return to physiological functions, and reducing complications.

CONCLUSION

It is important that all members of the team have knowledge of ERAS Procedures, and that their awareness and skills are at a sufficient level to accelerate the post-surgical recovery process and to provide the expected benefit from ERAS. Surgical teams must be informed about ERAS and encouraged to use it for the widespread and correct use of ERAS protocols in clinics.

AUTHOR CONTRIBUTIONS

The conception or design of the work, data collection, data analysis and interpretation, drafting the article and critical revision of the article belong to the author.

The author (GE) reviewed the results and approved the final version of the manuscript.

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