Nursing Interventions in Enhanced Recovery After Surgery for Adolescent Idiopathic Scoliosis: Improving Satisfaction and Patient Care

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Abstract

Background: Posterior spinal fusion for adolescent idiopathic scoliosis (AIS) is associated with substantial postoperative pain, functional limitations, and variable recovery trajectories. Enhanced Recovery After Surgery (ERAS) protocols are multidisciplinary, evidence-based pathways designed to attenuate surgical stress, accelerate convalescence, and improve patient experience. Nurses are central to ERAS implementation across the perioperative continuum. **Objective:** To synthesize current evidence on nursing interventions within ERAS pathways for AIS and evaluate their impact on clinical outcomes and patient satisfaction. **Methods:** Targeted literature review of systematic reviews and peer-reviewed studies on ERAS for AIS and nursing roles in ERAS across spine surgery, supplemented by pediatric spine patient-reported satisfaction studies. Sources prioritized meta-analyses, cohort studies, and clinical guidance (2018–2024). **Findings:** ERAS protocols for AIS consistently reduce hospital length of stay and opioid consumption without increasing complications or readmissions, highlighting the value of coordinated, multidisciplinary care with strong nursing leadership. Nursing-led components, preoperative counseling and expectation management, standardized multimodal analgesia delivery and monitoring, early mobilization facilitation, proactive prevention and treatment of postoperative nausea and vomiting (PONV), early oral intake and nutrition optimization, catheter/drain stewardship, and psychosocial support, are strongly associated with smoother recovery trajectories and high patient satisfaction. Prospective AIS data show very high satisfaction with enhanced discharge/ERAS-style pathways despite shorter stays, with perceived readiness and effective pain control as key drivers. **Conclusions:** Nursing interventions are foundational to ERAS success in AIS. Standardizing nurse-led elements and measuring adherence can further improve outcomes and experience.

Keywords: Adolescent idiopathic scoliosis (AIS), Enhanced Recovery After Surgery (ERAS), nursing interventions, patient satisfaction, perioperative care

Introduction

Adolescent idiopathic scoliosis (AIS) is a complex three-dimensional spinal deformity affecting a significant portion of the adolescent population, with prevalence rates ranging from 2% to 3% among Adolescents (Richard & Anthomy, 2023). When conservative treatments fail or the curvature progresses significantly, surgical correction, often involving posterior spinal fusion (PSF), becomes necessary. While PSF is highly effective in correcting spinal deformities and preventing further progression, it is a major

surgical procedure associated with considerable postoperative challenges. These challenges include intense pain, the risk of opioid-related adverse effects, prolonged hospital stays, delayed functional recovery, and varying levels of patient satisfaction (Creyf et al., 2024; Gadiya et al., 2021).

To mitigate these issues and enhance patient recovery, Enhanced Recovery After Surgery (ERAS) protocols have emerged as a transformative approach in perioperative care. ERAS is a multidisciplinary, evidence-based pathway designed to attenuate the physiological stress response to surgery, accelerate convalescence, and improve overall patient experience and outcomes (Ljungqvist et al., 2017). Initially developed for adult colorectal surgery in the 1990s, ERAS principles have been successfully adapted and implemented across various surgical specialties, including complex spinal procedures in pediatric populations (Rafeeqi & Pearson, 2021; Rove et al., 2023). In the context of pediatric spine surgery, ERAS has been consistently associated with shorter hospitalization, reduced opioid exposure, and comparable or improved safety profiles compared to traditional care pathways (Creyf et al., 2024; Gadiya et al., 2021; Koucheki et al., 2021).

The successful implementation of ERAS pathways relies heavily on a collaborative, interdisciplinary team approach, where each member plays a crucial role in optimizing patient care. Among these, nursing interventions are particularly pivotal. Nurses are at the forefront of patient care, integrating patient education, delivering and titrating multimodal analgesia, facilitating early mobilization, monitoring for complications, coordinating lines and drains, and providing continuous psychosocial support to adolescents and their families throughout the perioperative journey (Achrekar, 2022; Jensen, 2021). Their direct and continuous interaction with patients positions them as key facilitators in ensuring adherence to ERAS protocols and ultimately improving patient satisfaction and overall quality of care.

This comprehensive literature review aims to synthesize the current evidence on nursing interventions within ERAS protocols specifically for adolescent idiopathic scoliosis. It will explore how these interventions contribute to improving clinical outcomes, such as reduced length of stay and opioid consumption, and crucially, how they enhance patient satisfaction. By examining the efficacy of ERAS-based nursing practices, this review seeks to highlight best practices, identify areas for further research, and underscore the indispensable role of nursing in optimizing the recovery trajectory for AIS patients.

Methods

This narrative review was conducted by searching major electronic databases including PubMed/Medline, PMC, ScienceDirect, SpringerLink, and other relevant publisher sites. The search encompassed articles published between 2018 and 2024 to ensure the inclusion of contemporary evidence. Key search terms and their combinations included: “adolescent idiopathic scoliosis,” “AIS,” “enhanced recovery after surgery,” “ERAS,” “nursing interventions,” “nursing care,” “patient satisfaction,” “patient outcomes,” “multimodal analgesia,” “early mobilization,” “preoperative education,” and “posterior spinal fusion.”

We prioritized the inclusion of systematic reviews and meta-analyses focusing on ERAS in AIS (Gadiya et al., 2021; Koucheki et al., 2021). Additionally, prospective or retrospective cohort studies evaluating ERAS or ERAS-like pathways in AIS patients (Creyf et al., 2024; Yang et al., 2020) were included to capture real-world implementation and outcomes. Articles specifically addressing nursing roles and

interventions within ERAS across various spinal surgeries, including pediatric populations, were also considered (Achrekar, 2022; Jensen, 2021). The aim was to gather a broad yet focused collection of literature that would allow for a comprehensive understanding of the topic, emphasizing the impact of nursing on patient recovery and satisfaction within the ERAS framework for AIS.

ERAS for AIS: Outcomes and Rationale

The implementation ERAS protocols in AIS surgery has consistently demonstrated significant improvements in patient outcomes compared to traditional perioperative care. A foundational meta-analysis by Gadiya et al. (2021) provided compelling evidence that ERAS protocols significantly reduce the length of hospital stay (LOS) and opioid consumption in AIS patients undergoing spinal fusion. Crucially, these benefits were achieved without an increase in complication rates or readmission rates, underscoring the safety and efficacy of the ERAS approach. This study highlighted the multidisciplinary nature of ERAS pathways, emphasizing the coordinated efforts in optimal pain management, nursing care, and physiotherapy.

Subsequent institutional implementations and systematic reviews have further corroborated these findings. Creyf et al. (2024) reported that their ERAS care pathway for AIS surgery led to improved outcomes concerning pain scores, reduced morphine consumption, decreased LOS, and lower complication rates.

The physiological rationale underpinning the success of ERAS in AIS is multifaceted. By minimizing surgical stress and standardizing perioperative care, ERAS protocols aim to suppress the inflammatory response to surgery, optimize analgesia, and reduce opioid-related side effects such as postoperative nausea and vomiting (PONV), ileus, and sedation (Creyf et al., 2024; Gadiya et al., 2021; Ljungqvist et al., 2017). Readmission rates are also a concern after AIS surgery, often related to uncontrolled pain, surgical site issues, or other postoperative complications (Lee et al., 2020; Patel et al., 2021). This comprehensive approach facilitates earlier functional recovery, which is paramount for adolescent patients. For this specific demographic, structured education, active family engagement, and consistent coaching are particularly vital. These elements help to align patient and family expectations, reduce anxiety, and foster adherence to the recovery plan—domains that are primarily led and managed by nursing staff (Achrekar, 2022; Jensen, 2021; Yang et al., 2020). The shift from a reactive to a proactive care model within ERAS ensures that potential complications are anticipated and addressed promptly, leading to smoother recovery trajectories and an overall enhanced patient experience.

Nursing Interventions that Drive ERAS Success in AIS

Nurses are indispensable to the successful implementation and sustained effectiveness of Enhanced Recovery After Surgery (ERAS) protocols in AIS surgery. Their roles are diverse and span the entire perioperative continuum, encompassing education, direct patient care, continuous monitoring, and psychosocial support. These multifaceted interventions are critical in optimizing patient outcomes, accelerating recovery, and enhancing patient satisfaction.

Preoperative Education and Expectation Setting

One of the cornerstones of ERAS, preoperative education, is largely driven by nursing interventions. Nurses deliver structured counseling sessions to patients and their families, covering various aspects of the surgical pathway, including realistic expectations regarding pain management, mobilization milestones, management of

lines and drains, feeding protocols, and discharge criteria (Achrekar, 2022; Jensen, 2021). This proactive approach to information dissemination is crucial for reducing patient and family anxiety, improving engagement, and fostering a sense of preparedness. Studies have shown that clear and consistent information reduces uncertainty and is strongly associated with smoother transitions and higher patient satisfaction (Heiss & Raval, 2018; Yang et al., 2020). For instance, Yang et al. (2020) demonstrated that a significant majority of AIS patients felt their discharge time was appropriate when they were part of an enhanced discharge pathway, suggesting that effective preoperative education contributes significantly to patient readiness and satisfaction with the recovery process.

Standardized Multimodal Analgesia and Monitoring

Nurses play a critical role in the implementation and continuous monitoring of multimodal pain management strategies, which are central to ERAS. They are responsible for administering prescribed analgesics, including non-opioid medications (e.g., acetaminophen, NSAIDs when appropriate, gabapentinoids) and, where adopted, infusions like ketamine or lidocaine, to minimize opioid reliance (Creyf et al., 2024; Gadiya et al., 2021; Shah et al., 2020). Vigilant assessment of pain levels using validated pediatric scales (e.g., Faces Pain Scale-Revised, Visual Analog Scale) and adherence to escalation pathways enable timely adjustments to pain regimens, facilitating earlier mobilization and reducing opioid-related complications such as respiratory depression, nausea, and sedation (Achrekar, 2022; Creyf et al., 2024; Gadiya et al., 2021). The meta-analysis by Gadiya et al. (2021) explicitly highlighted that ERAS protocols employed a multidisciplinary approach focusing on optimal pain management, nursing care, and physiotherapy, underscoring the integral role of nurses in this aspect.

Early Mobilization Facilitation

Facilitating early ambulation is another vital nursing intervention within ERAS. Nurses actively cue and assist patients with their first steps post-surgery, often within hours of the procedure, and coordinate closely with physical therapists (Achrekar, 2022; Burgess & Wainwright, 2019). They provide encouragement, ensure patient safety during mobilization exercises, and reinforce proper posture and log-rolling techniques. This early activity is crucial for preventing common postoperative complications such as deep vein thrombosis (DVT), pulmonary atelectasis, and pneumonia, and it significantly promotes the faster return of bowel function (Fletcher et al., 2021; Gadiya et al., 2021; Creyf et al., 2024). Early mobilization is equally crucial for their recovery and functional independence.

Postoperative Nausea and Vomiting (PONV) Prophylaxis and Rescue

Postoperative nausea and vomiting (PONV) can significantly hinder recovery, delay oral intake, and prolong hospital stay. Nurses are instrumental in implementing and monitoring antiemetic protocols and hydration strategies, often in conjunction with opioid-sparing analgesia, to reduce the incidence and severity of PONV (Achrekar, 2022; Creyf et al., 2024). Their proactive approach in identifying at-risk patients and administering prophylactic measures, as well as providing timely rescue antiemetics, ensures patient comfort and adherence to feeding and mobilization protocols.

Nutrition and Early Oral Intake

Nurses play a key role in promoting early oral intake and optimizing nutrition post-surgery. They encourage early sips and feeds according to protocol, monitor patient tolerance, and identify any signs of ileus or poor intake. Collaboration with dietitians is essential when nutritional support is needed

to prevent delays in recovery and contribute to readiness for discharge (Achrekar, 2022). Adequate nutrition is vital for wound healing and overall recovery, and nurses ensure that patients meet their nutritional goals.

Catheter and Drain Stewardship

Timely removal of urinary catheters and surgical drains, as per ERAS protocols, is another critical nursing responsibility. This practice reduces the risk of infection (e.g., catheter-associated urinary tract infections) and enhances patient mobility and comfort (Achrekar, 2022). Nurses meticulously track criteria for removal and execute the process safely, contributing to a smoother and faster recovery.

Psychosocial Support and Family Engagement

Beyond physical care, nurses provide invaluable psychosocial support to adolescent patients and their families. Undergoing major surgery like AIS correction can be a daunting experience, and the emotional well-being of patients is paramount. Nurses offer continuous reassurance, address concerns, and create a supportive environment that fosters a sense of security and trust (Jensen, 2021). They empower adolescents by involving them in their care decisions and teaching coping strategies. Training family members to participate in care further enhances the patient's hospital experience and contributes to a positive recovery environment. As evidenced by studies on ERAS pathways, patient satisfaction remains high, and in some cases, even improves, due to the comprehensive and patient-centered care provided within these protocols (Yang et al., 2020; Zacha et al., 2023).

Discharge Readiness and Transition Planning

Nurses are central to assessing discharge readiness, ensuring that patients meet all criteria for safe discharge. They reinforce home instructions, including wound care, activity restrictions, medication schedules, and signs of potential complications. Effective discharge planning and ensuring seamless transitions to home care, often involving follow-up appointments and community resources, improve continuity of care and enhance overall patient and family satisfaction (Achrekar, 2022; Yang et al., 2020).

Patient Satisfaction in ERAS for AIS

Patient satisfaction is a crucial outcome measure in healthcare, reflecting the quality of care from the patient's perspective. In the context of ERAS for AIS, prospective data consistently demonstrate that most patients report high satisfaction with enhanced discharge or ERAS-style care pathways (Yang et al., 2020; Zacha et al., 2023). This high level of satisfaction is maintained despite shorter lengths of hospital stay, challenging the traditional notion that longer stays equate to better care or higher satisfaction. The key drivers for this sustained satisfaction are often linked to the effectiveness of nurse-driven interventions, particularly in pain optimization and expectation management.

For instance, Yang et al. (2020) found that while most AIS patients were satisfied with their early discharge, those who felt they were discharged "too early" had higher pain scores. This underscores the critical importance of effective, nurse-driven pain management and thorough preoperative education in aligning patient expectations with the accelerated recovery timeline of ERAS. When patients feel well-prepared and their pain is well-controlled, they are more likely to be satisfied with their recovery, regardless of the length of their hospital stay.

Broader ERAS literature across various surgical specialties corroborates these findings, consistently showing that ERAS protocols generally maintain or improve patient satisfaction and quality of life compared to conventional care pathways

(Achrekar, 2022; Gadiya et al., 2021; Salamanna et al., 2022). The emphasis on patient engagement, shared decision-making, and continuous communication, all of which are central to the nursing role in ERAS, contributes significantly to a positive patient experience. By empowering patients to be active participants in their own recovery, ERAS fosters a sense of control and partnership, which are key determinants of patient satisfaction (Lam & Seemann, 2024).

Implementation Considerations for Nursing

For the successful implementation and sustainability of an ERAS program for AIS, several key considerations related to nursing are paramount. These considerations ensure that nursing interventions are standardized, consistently applied, and continuously improved to optimize patient outcomes.

- **Standardized Pediatric Pain and Function Assessments:** Utilizing standardized and validated pediatric pain and function assessment tools at set intervals is critical. These assessments provide objective data to guide timely adjustments and escalations in care, ensuring that pain is effectively managed and functional recovery is on track (Achrekar, 2022; Creyf et al., 2024; Gadiya et al., 2021).
- **Empower Nurses as ERAS Champions and Coordinators:** Training and empowering nurses to act as ERAS champions or coordinators is a key strategy for successful implementation. These nurse leaders can coordinate the multidisciplinary team, troubleshoot barriers to adherence, and track patient outcomes, including patient-reported satisfaction (Jensen, 2021; Watson, 2018).
- **Provide Comprehensive Nursing Education and Training:** Ongoing education and training for all nursing staff involved in the care of AIS patients are essential. This training should cover the principles of ERAS, the specific components of the nursing bundle, and the rationale behind each intervention. Well-informed and confident nursing staff are more likely to adhere to the protocol and effectively educate and support patients and their families (Jensen, 2021).

Limitations of the Evidence

While the evidence supporting ERAS in AIS is growing, there are several limitations to consider. Most studies on ERAS in AIS are single-center, non-randomized, and retrospective in design, which can introduce bias and limit the generalizability of the findings (Creyf et al., 2024; Gadiya et al., 2021; Koucheki et al., 2021). There is also significant variability in the specific components of ERAS pathways and the methods used to report adherence, making it challenging to compare outcomes across studies and identify the most critical interventions (Koucheki et al., 2021).

Furthermore, pediatric-specific nursing metrics are seldom isolated in current research. This makes it difficult to quantify the independent effect size of each nursing element and to determine which nursing interventions have the greatest impact on patient outcomes and satisfaction. Future research should aim to address these limitations by conducting more rigorous, multicenter, randomized controlled trials and by developing standardized methods for reporting ERAS components and adherence. Additionally, studies should focus on isolating and evaluating specific nursing interventions to build a stronger evidence base for nursing practice within ERAS for AIS.

Conclusions and Recommendations

Enhanced Recovery After Surgery (ERAS) pathways have unequivocally demonstrated their value in improving perioperative outcomes for AIS patients without compromising safety. The evidence consistently shows that ERAS leads to

shorter hospital stays, reduced opioid consumption, and lower complication rates. At the heart of this success are the multifaceted and crucial interventions led by nurses.

Nurse-led interventions, spanning from comprehensive preoperative education and expectation setting to meticulous execution of multimodal analgesia, facilitation of early mobilization, proactive prevention of PONV, stewardship of lines and drains, and continuous psychosocial support, are the central levers for reducing length of stay, limiting opioid exposure, and maintaining high levels of patient satisfaction. The nursing role is not merely supportive but foundational to the success of the ERAS model.

To further advance the care of AIS patients, healthcare institutions should focus on formalizing pediatric spine ERAS nursing bundles with clear adherence dashboards. This will help to standardize care and ensure that all patients receive the full benefits of the ERAS pathway. Additionally, incorporating patient-reported outcomes (PROs) as a standard measure will provide valuable feedback for continuously refining care and ensuring that the patient's voice is at the center of quality improvement efforts.

Future research should prioritize multicenter, randomized controlled trials to strengthen the evidence base for ERAS in AIS. Studies should also focus on developing and validating pediatric-specific nursing metrics to better understand the independent impact of nursing interventions. By continuing to invest in nursing education, research, and leadership, we can further enhance the quality of care, improve patient satisfaction, and optimize the recovery journey for all adolescents undergoing surgery for idiopathic scoliosis.

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