Implementing a nurse-led prehabilitation program for patients undergoing spinal surgery

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Abstract: Prehabilitation, or "prehab," helps patients optimize strength, function, and nutrition before surgery. This evidence-based practice project presents strategies for implementing a prehab program to prepare patients for spinal surgery. Nurses play an integral role in educating patients preoperatively about the myriad lifestyle changes associated with spinal surgery.

Keywords: enhanced recovery after surgery, ERAS, nurses, patient education, prehab, prehabilitation, spinal surgery

Prehabilitation or "prehab" refers to optimizing preoperative conditioning to maintain a normal level of function during and after surgery and to improve postoperative outcomes.[1-3] The goals of prehab encompass enhancing general health and well-being before surgery; boosting physiologic, metabolic, and psychosocial reserves; and preparing the patient mentally and physically for surgery.[3-12]

Prehab often involves a multidisciplinary approach focusing on exercises (aerobic, strength, and high-intensity endurance training); nutrition; smoking cessation; alcohol reduction; and mitigating stress, anxiety, depression, and low self-efficacy.[1,5,7-9,11,13-15]

Prehab is primarily designed for patients at greatest risk of postoperative complications due to older age and other comorbidities.[16] Prehab enables patients to engage in their own care and recovery, which promotes autonomy, empowerment, positive well-being, enhanced coping skills, and improved stress management.[10,15]

Some studies suggest that prehab is associated with reduced postoperative morbidity, including postoperative pain, complications, hospital length of stay, need for postoperative rehabilitation, cost (lower postacute care payments for skilled nursing facility and home health services), readmission rates, and more rapid return to baseline functional capacity.[1-5,8,9,11,14,16,17]

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The Michigan Surgical and Health Optimization Program (MSHOP) initiated a prehab program that involved a call or electronic message from a member of the MSHOP team as well as information for patients about better nutrition, tobacco cessation, positive thinking, goal-setting, and stress management.[16] Patients used a pedometer to track daily steps and an incentive spirometer to practice deep breathing to improve lung function. Patients who embraced these preoperative techniques had a decreased hospital length of stay, and total costs were reduced as patients who had prehab were less likely to need home healthcare postoperatively.[16]

Prehab programs have been adopted in numerous specialties including knee and hip arthroplasty, colorectal, cardiac, upper gastrointestinal/hepatobiliary, and other abdominal procedures.[1-4,7,14,16,18-20] Few studies have addressed its use in patients undergoing spinal surgery.[7,21-29] A nurse's role in prehab has rarely been reported.[4,12]

No guidelines for prehab before spinal surgery have been established.[23] Few studies have reported using prehab in lumbar spinal surgery (see *Literature review: Prehab before lumbar spinal surgery*).[7,21-29] The studies were either randomized controlled trials or review articles. These studies usually focused on one aspect of prehab before spinal surgery, such as the effect of cognitive behavioral therapy, neuroscience pain education, or exercises. The prehab experience before spinal surgery has been generally viewed favorably by both the patients and providers in these studies. Main findings included lower healthcare expenses, patients who were better prepared for surgery and reached recovery milestones faster postoperatively, higher patient satisfaction rate, lower pain intensity, shorter hospital stay, a faster reduction in

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Literature review: Prehab before lumbar spinal surgery

Study	Type of study	Methods	Main findings
Nielsen et al. 2008[26]	Randomized controlled trial	Integrated program (prehab and early rehab) for patients before lumbar surgery compared with standard care	No differences in health-related QOL scores between patients with integrated program and control
			Patients with integrated program obtained postoperative milestones sooner, returned to work, and sought less primary care after hospital discharge.
			Integrated program less costly per patient compared with standard care program
Nielsen et al. 2010[27]	Randomized controlled trial	Prehab and early rehab for patients before lumbar surgery compared with standard care	Intervention group had improved function at the time of surgery.
			Postoperatively, the intervention group reached recovery milestones faster than the control, left the hospital earlier, higher patient satisfaction.
Louw et al. 2014[24]	Randomized controlled trial	Effect of preoperative pain neuroscience education prior to lumbar surgery	No statistical difference between the control and neuroscience education groups with respect to the primary outcome measure of LBP, leg pain, and function 1 year postoperatively
			The neuroscience education group was better prepared for surgery, and surgery met their expectations.
			Patients who had neuroscience education had 45% less healthcare expenditure compared with control at 1 year follow-up period.
Rolving et al. 2015[28]	Randomized controlled trial	Effect of preoperative CBT for patients undergoing lumbar fusion	Patients who had CBT preoperatively had no better outcomes at 1 year postoperatively.
			Reduction in disability was achieved faster in patients who had CBT preoperatively.
Lotzke et al. 2016[23]	Randomized controlled trial	Physiotherapeutic prehab program based on CBT before lumbar fusion	Hypothesis-driven article; no results reported
Rolving et al. 2016[29]	Randomized controlled trial	Preoperative CBT for patients undergoing lumbar fusion versus control	Estimated quality-adjusted life years 1 year postoperatively were significantly better for patients who underwent preoperative CBT.
			No difference in overall cost between the prehab group and the control
Gometz et al. 2018[7]	Review	Patients who had preoperative exercises as a part of prehab before spinal surgery	Prehab reduced the total cost of healthcare spending associated with spinal surgery.
			Lack of significant evidence evaluating functional outcomes after physical therapy prehab
Janssen et al. 2021[22]	Review	Effect of prehab interventions (exercise therapy and CBT) before lumbar surgery on physical functioning, pain, complications, adverse events related to prehab, health-related QOL, psychological outcomes, hospital LOS, use of analgesics, return to work	Cognitive behavioral therapy in prehab had no greater effect on outcomes than usual care.
			Exercise therapy in prehab had positive effect on short-term outcomes.

(Continues)

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Literature review: Prehab before lumbar spinal surgery *(Continued)*

Study	Type of study	Methods	Main findings
Marchand et al. 2021[25]	Randomized controlled trial	Exercise-based prehab compared with usual care prior to lumbar surgery	Significant but small improvements in the prehab group (post-prehab for pain intensity, lumbar spinal stenosis-related disability, lumbar strength in flexion, low back extensor muscle endurance, total ambulation time, sit-to-stand performance)
			Significant difference for patients in the prehab group starting at 3 months postoperative follow-up for low back-related disability
			Exercise-based prehab did not improve short-term postoperative recovery in patients with lumbar spinal stenosis.

LBP: low back pain
CBT: cognitive behavioral therapy
QOL: quality of life
LOS: length of stay

disability, better quality-adjusted life 1 year postoperatively, and improved short-term outcomes with exercises.[7,21-29]

Enhanced recovery after surgery (ERAS) is an evidence-based and multidisciplinary approach to surgical care to minimize the stress of surgery and help patients recover promptly by maintaining normal physiology.[30,31] ERAS incorporates preoperative, intraoperative, and postoperative components. Gillis et al.[6] reported the association between prehab and ERAS in colorectal surgery. The authors noted that patients were often fearful, anxious, and isolated preoperatively. The authors posited that patients would benefit from an integrated prehab and ERAS program to meet patients' physical and psychological needs and address surgical expectations. This evidence-based and patient-focused approach with direct patient engagement in their care may improve patient satisfaction, experiences, and outcomes. Hartley reported how nurses use ERAS from prehab to rehab to aid in surgical recovery.[31]

In August 2020, the prehab program for spinal surgery was initiated at our institution when our team from the neurospine department noted that not all patients were aware of the expectations of lumbar fusion surgery and the physical demands required of this type of procedure. Before the prehab program, patients scheduled to undergo spinal surgery were told varying information about the surgery by different individuals. Using consistent and uniform language about what to anticipate with a lumbar fusion was an objective of prehab. Additionally, patients were unaware of the importance of early postoperative mobility, and this necessity was stressed during prehab.

The primary aims were twofold: (1) physical therapy to increase strength preoperatively and (2) patient education (see *Pre-prehab goals*). The education included setting expectations about what to anticipate during the hospital stay as well as postoperative home safety and restrictions, emphasizing the importance of postoperative mobility and reinforcing the need to manage post-surgical pain preemptively.

We also sought to enhance patient satisfaction after implementation. This evidence-based practice (EBP) project presents strategies to prepare patients for spinal surgery through our institution's prehab program.

This article discusses the use of prehab in spinal surgery and the importance of nurses in the prehab process. The goals of this EBP project were to (1) educate the

Pre-prehab goals

- Prepare patient for an upcoming spinal surgery.
- Increase strength to improve recovery from a spinal surgery.
- Set expectations for patients before the spinal surgery.
- Educate the patient about what to anticipate with therapy at the hospital, home safety (beds, rugs), and restrictions.
- Stress the importance of mobility postoperatively.
- Discuss the need to ask for pain medications postoperatively.

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patient on postoperative exercises, (2) set patient expectations about what to anticipate after surgery, and (3) improve early mobility by teaching and setting expectations.

Project background

Lumbar fusions are the modality of choice for spinal deformity and instability.[32] The volume of elective lumbar fusions increased by 62.3% from 122,679 cases in 2004 to 199,140 cases in 2015 in the US.[32] Most of these increases were noted in patients age 65 years and older and to treat spondylolisthesis and scoliosis. Aggregate hospital costs increased by 177% between 2004 and 2015, surpassing $10 billion in 2015 and averaging more than $50,000 per admission.

Approximately 1.36 million instrumented spinal procedures (cervical fixation, thoracolumbar fixation, and lumbar interbody fusion procedures) were performed in the US in 2021, and an estimated 1.50 and 1.52 million will be performed in 2023 and 2024, respectively, according to CPT and ICD codes.[33] Nurses who care for patients undergoing lumbar fusion should be familiar with lumbar spinal anatomy, spinal pathology, surgical indications, and diagnostic methods.[34] Additionally, nurses should be adept at individualizing patient care and being cognizant of postoperative complications.[35-37]

Nurses play a crucial role in the multidisciplinary prehab team by coordinating the prehab process, offering psychological support, and developing and improving prehab education.[4,12,35-37] Nurses engage and inspire patients to adhere to the prehab program while encouraging self-motivation. In turn, patients may feel encouraged to persist with the prehab requirements, including smoking cessation, exercises, nutritional suggestions, and mindfulness practices.[12] Some studies have reported that the success rate of spinal fusion surgery is significantly lower in smokers than that in nonsmokers.[38] For this reason, smokers are strongly encouraged to discontinue cigarette smoking to improve the outcome of spinal fusion surgery.

Watson and Ducheine[12] stressed the need for awareness of health literacy in prehab, allowing patients to participate in their own preparations for surgery. Nurses are invaluable in helping patients understand health information to enhance their engagement and interactions in healthcare.[12,39]

The patient-centered prehab process encourages patients to assume an active role in their care preoperatively. Dana et al.[4] found that nurses in a perioperative prehab program assume many responsibilities, including ensuring that patients attend all scheduled prehab visits, determining why a patient may discontinue prehab, and collaborating with surgical and oncology services to be apprised of a patient's clinical course and surgery. Nurses serve as the first-line contact with patients, closely associate with the professionals on the multidisciplinary prehab team, and ensure continuity of care.[4]

Prehab has also been used in treating patients diagnosed with cancer. Oncology nurses lead the prehab efforts to reduce the burden of cancer on patients.[37] Prehab in the oncology setting begins after the initial diagnosis of cancer and before surgery and other treatments to promote "physical and psychological health to reduce the incidence and/or severity of future impairments."[36] For example, prehab involving speech therapy should start before radiation instead of after its completion. Nurses play an important role in the success of oncology prehab processes.[35]

Based on the literature, prehab has numerous benefits, such as helping patients feel stronger before surgery, improving postoperative function, preparing patients for the physical challenges of surgery, enhancing patient psychological outcomes, decreasing hospital readmissions, and reducing healthcare expenditures.

Nurses play a crucial role in the multidisciplinary prehab team by coordinating the prehab process, offering psychological support, and developing and improving prehab education.

Methods

Under an Institutional Review Board-approved protocol, our prospective EBP project analyzed the survey completed by the participating patients about their prehab experience at our Institution.

In their preoperative appointments with spinal surgeons, patients were identified by nurses and NPs and referred to prehab if they met at least one of four criteria: (1) scheduled for posterior lumbar decompression and fusion; (2) used an assistive device; (3) were at least 80 years old; and/

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Prehab education

Education component	Specific instructions
Spinal restrictions	No bending, lifting, or twisting
	Typically in place until 3 months postoperatively
	Encourage walking and movement within these restrictions.
Driving restrictions	No driving until cleared by the surgeon
	No driving while on pain medications
Pain medication schedule	Must request pain medications and muscle relaxants; they will not be given routinely
Therapy needs	Will be getting up on the day of surgery
	Evaluated twice per day by inpatient therapy until discharged
	Outpatient physical therapy will be scheduled 4-6 weeks postoperatively at the first follow-up visit with the surgeon.
	Short-term rehabilitation is typically not covered by insurance; most patients are unable to go to rehab unless there is a complication.
	Patients will be prepared to return home and set up a support system.
	Approximately 50% of patients who go home will have home physical therapy.
Transfer safety	Teach patients on log roll for bed mobility, safe car transfers, and sit-to-stand with/without assistive devices.
Exercises	Review, demonstrate, and educate the patient on prehab exercises for multiple visits.
	Add restriction-safe exercises as appropriate.
Home safety	Bed height, rugs, bathroom set-up, pet care
	Encourage equipment.
	Insurance does not typically cover shower chairs or commodes.
Assistive devices	The goal is to not use an assistive device after surgery if the patient is not currently using one.
	Braces are given by the spine surgeons.
Fall risk	Call! Don't fall!
	Staff must help the patient get out of bed.
Estimated length of hospital stay	Educate patient on estimated length of hospital stay.
Other questions, such as stationary bike use	Inform patients that they may use a stationary bike, initially with no tension.
	Will need to check with the surgeon about when tension can be added

or (4) lived alone. Patients were given the option of either in-person or virtual prehab visits.

Prehab sessions were either a one-time visit (usually if the surgery was the following week) or once per week until the lumbar surgery date (as many prehab visits as possible). All exercises recommended by prehab were safe to perform postoperatively with restrictions in place.

The prehab flowsheet was incorporated into our institution's software company Epic Systems Corporation (Epic) (Verona, WI) that contained the patients' electronic health records (EHRs). The flowsheet included the spinal surgeon's name, date of surgery, estimated length of hospital stay, and education (spinal/driving restrictions, pain medication schedule, therapy needs [postoperative inpatient therapy, possible need for inpatient rehabilitation, home therapy, or outpatient therapy after discharge from the hospital], transfer safety, appropriate exercises). A patient's prehab order was placed in Epic, and the initial prehab evaluation and all repeated visits were tracked within Epic.

Patients scheduled to undergo spinal surgery were educated either in-person or virtually during prehab about what to expect after their surgery regarding mobility and the safety measures they could take to minimize accidents at home (falls) (see *Prehab education*). Postoperative conditions were discussed, including restrictions (spinal, driving), pain medication schedule, therapy needs, home and transfer safety, exercises, assistive devices, fall risks, estimated length of hospital stay, lumbar surgery clinical path, and smart phrases (.prehabassess, .prehabexercises,

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.prehabgoals, and .nsrctelehealth [for telehealth]).

Patients were given two handouts (if their prehab was in-person) with prehab exercises done one-on-one with a physical therapist. The first handout included spine exercises for the lower body, such as specific ankle, knee, and hip exercises, and instructions about squats and how to enhance calf muscle strength. The second handout presented pictures of how to perform a log roll properly. The patients only performed an exercise if it did not increase pain. A physical therapist demonstrated the exercise, and the patient returned the demonstration.

The nurse identified patients who would be appropriate for this education. A physical therapist was responsible for the education and physical therapy prehab components. The importance of requesting pain medication and muscle relaxers postoperatively was emphasized during the prehab education.

After surgery, the nurse documented the time the patient could ask for the next round of pain medications and muscle relaxers on each patient's room dry-erase board. This helped patients know when they were "due." The physical therapist explained this process before surgery.

The educational points were reiterated at each prehab session. Patients were encouraged to bring a caregiver who would assist them at home after spinal surgery to all sessions.

Nurses also discussed the benefits of prehab before its initiation, preadmission testing nurses reviewed the prehab information, and nurses on the hospital surgical floor reinforced the prehab

Demographics

Participant characteristics	Number of patients (N = 43)
Median age (range)	63 years (30-86 years)
Gender	
Male	26 (60.5%)
Female	17 (39.5%)
Race	
White	38 (88.4%)
Black	5 (11.6%)
Procedure	
Posterior lumbar decompression and fusion	37 (86.0%)
Posterior lumbar decompression (no fusion)	1 (2.3%)
Anterior lumbar interbody fusion/posterior lumbar decompression and fusion	1 (2.3%)
Posterior thoracic laminectomy (no fusion)	1 (2.3%)
Lumbar laminectomy for intradural extramedullary mass resection	1 (2.3%)
Anterior/posterior lumbar decompression and fusion	1 (2.3%)
Anterior cervical diskectomy and fusion	1 (2.3%)
Distance from our Institution (miles)	
Median and range	42 miles (Range: 1-237 miles)
<20 miles	16 (37.2%)
20-50 miles	17 (39.5%)
>50 miles	10 (23.3%)
Prehab	
In-person	26 (60.5%)
Virtual	16 (37.2%)
Both	1 (2.3%)
Number of visits	
1	29 (67.4%)
2	1 (2.3%)
3	4 (9.3%)
4	4 (9.3%)
5	3 (7.0%)
8	1 (2.3%)
10	1 (2.3%)
Assistive device preoperatively	
Yes	23 (53.5%)
No	20 (46.5%)
Assistive device postoperatively	
Yes	17 (39.5%)
No	26 (60.5%)
Lives alone	
Yes	6 (14.0%)
No	37 (86.0%)

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education with patients preoperatively (with a particular focus on requesting pain medications postoperatively and getting out of bed the day of surgery).

Each participant was given a survey on their first postoperative visit focused on their prehab experience. The NP was in the room with the patients when the surveys were given. If the patients missed their first postoperative visit, they were called and asked the questions by the RN program coordinator or the NP.

Questions posed during the survey included specific spinal surgery performed, date of surgery, in-person versus virtual prehab, number of prehab visits, use of an assistive device pre- and postoperatively, living arrangements (live alone versus with another individual), and personal opinions about the prehab (pain medications, safety concerns, exercises, restrictions, benefit of prehab).

All patients were invited to complete the survey between September 1, 2021, and August 30, 2022. The following item elicited the free text responses: "Please write any additional comments that you have regarding prehab (how was it helpful, what could we have told you to make your surgical experience better)".

The "yes/no" questions and scaled questions (ranging from 5 = strongly agree to 1 = strongly disagree) of the survey were summed. Results were presented as frequencies and percentages.

Results

Patient profiles

A total of 43 patients underwent prehab before spinal surgery (see *Demographics*). The median age was 63 years (range: 30-86 years), and the majority of patients were male (26 [60.5%]). Most patients were White (38 [88.4%]). The most common procedure was a posterior lumbar decompression and fusion (37 [86.0%]).

Most patients underwent prehab in-person (26 [60.5%]), while 16 [37.2%] patients had virtual prehab. One (2.3%) patient received both in-person and virtual prehab. Most patients (29 [67.4%]) were treated with one prehab visit. The median distance from the patient's home to our institution was 42 miles (1 mile to 237 miles), with 10 (23.3%) patients living more than 50 miles away. A greater number of patients used an assistive device preoperatively compared with postoperatively (23 [53.5%] versus 17 [39.5%]). Most patients did not live alone (37 [86.0%]).

Survey

Of the nine statements posed to patients who underwent prehab prior to spinal surgery, over half of the patients ranked all of the questions as "strongly agree" except for the question about prehab exercises where only 16 (37%) of patients ranked it as "strongly agree" (see *Patients' opinions*).

The question with the greatest number of patients (33 [77%]) who responded with "strongly agree" pertained to recommending prehab to other patients.

Patients' opinions

Statements	Rankings (1-5) 1: Strongly disagree, 5: Strongly agree (N = 43)				
	1	2	3	4	5
Prehab taught me I would have to ask the nurse for pain medication when I needed it.[a]	0 (0%)	2 (5%)	5 (12%)	8 (20%)	26 (63%)
Prehab helped me with safety concerns in my home.	0 (0%)	2 (5%)	6 (14%)	8 (18%)	27 (63%)
The exercises I was given at prehab were helpful.	1 (2%)	3 (7%)	6 (14%)	17 (50%)	16 (37%)
Prehab helped me feel more confident to go home after surgery.	2 (5%)	0 (0%)	1 (2%)	15 (35%)	25 (58%)
After having prehab, I felt more prepared for getting out of bed after surgery.	1 (2%)	2 (5%)	2 (5%)	12 (28%)	26 (60%)
Prehab taught me the activity restrictions I would have after surgery.	0 (0%)	2 (5%)	1 (2%)	12 (28%)	28 (65%)
I feel the prehab experience was valuable.	2 (5%)	2 (5%)	1 (2%)	9 (21%)	29 (67%)
I feel the prehab experience made my surgical experience better.	1 (2%)	3 (7%)	5 (12%)	10 (23%)	24 (56%)
I would recommend prehab to other patients having this type of surgery.	1 (2%)	2 (5%)	1 (2%)	6 (14%)	33 (77%)

[a]Two patients did not recall whether prehab taught about asking the nurse for pain medications postoperatively.

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Discussion

Several factors were of primary concern regarding prehab for spinal surgeries at our institution. As the majority of patients underwent a lumbar fusion in our EBP project, cessation of cigarette smoking was required before surgery. Preadmission testing confirmed that patients had discontinued cigarette smoking.

While our prehab program promoted ERAS, the main component of ERAS that was instilled in our prehab patients was early mobility on the day of surgery. In this respect, most patients were out of bed before they were evaluated by a physical therapist postoperatively.

Nurses have an important responsibility in identifying patients who qualify for prehab before lumbar surgery and subsequently re-enforcing the prehab education on numerous occasions before the surgical date.

Patients were also instructed to ask for pain medications postoperatively as these medications would not be routinely given to them. Patients were also informed that they would need to request their muscle relaxers and how muscle relaxers assist with pain control. Pain medications are prescribed "every 4 hours PRN (as needed) for pain"; therefore, the nurse does not routinely bring the medication to the patient. The patients must request pain medication when they are in pain. If it has been more than 4 hours, the nurse can give the medication. Prehab education encourages the patient to ask for the medication before getting out of bed or working with physical therapy so they will be able to move around better with less pain. Without this education, patients typically expect the nurse to bring the medication every 4 hours and do not routinely request it. Patients who request their muscle relaxers postoperatively become more active because their pain is better controlled. Based on our personal observations and comments written by patients in the prehab surveys, patient satisfaction is enhanced since patients request their medications postoperatively and do not think the nurse is "late" in giving their medications.

Additionally, since the prehab notes are in a patient's EHR on Epic, the physical therapist can review the prehab evaluation at the patient's initial inpatient postoperative evaluation and have more information about the patient's preoperative mobility and functioning. This information also benefits the care manager (also a nurse) in coordinating discharge needs. The care manager can review the notes from prehab to determine the patient's home medical equipment needs and their preoperative mobility status. This information is also helpful in anticipating the patient's discharge needs, such as skilled rehab.

Limitations

Limitations included the short period in which the prehab program for spinal surgery was implemented, the small number of patients included in the EBP project, that the NP was present in the room with the patient when the survey was completed at the first postoperative visit, the lack of a comparison between patients undergoing spinal surgery with and without participating in prehab, the lack of follow-up of prehab patients postoperatively to determine the effect of prehab on their surgical outcomes, and that no specific outcome data were collected.

Regarding the latter, the surveys were focused on patient feedback, since we wanted to determine whether the patients found the program beneficial and whether they felt it contributed positively to their surgical experience. We intend to examine more specific outcome data and patient satisfaction measures in the future.

Conclusion

Prehab is "training for surgery"[14] with lifestyle changes that benefit patients preoperatively, postoperatively, and long-term. High-risk patients undergoing spinal surgery have specific needs pertaining to pain medications (unable to take nonsteroidal anti-inflammatory medications due to the fusion component) and mobility (out of bed on the day of surgery).

Our institution's multimodal educational and physical therapy prehab program addressed these particular requirements. Nurses have an important responsibility in identifying patients who qualify for prehab before lumbar surgery and subsequently re-enforcing the prehab education on numerous occasions before the surgical date. Further research at our institution will focus on the impact of prehab on patients undergoing spinal surgery on postoperative outcomes. ■

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