Posterior Lumbar Interbody Fusion: An Old Concept with New Techniques

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***Abstract:** The estimated cumulative cost of health care attributable to back pain exceeds $25 billion per year in the United States, and more than 200,000 spine fusion procedures are performed each year in an effort to relieve discogenic back pain and instability. These numbers are projected to rise in the face of our aging population. As new interbody grafting sources have been developed, posterior lumbar interbody fusion (PLIF) is being used with increasing frequency. PLIF was once a procedure that required extensive dissection of the musculoligamentous complex of the dorsal spine. Advances in surgical technique and technology now allow access to spinal structures with minimal trauma to surrounding tissue. Knowledge of the various fusion procedures can assist nurses caring for the unique needs of patients undergoing spinal surgery.*

Severe, unremitting back and leg pain that is unresponsive to conservative medical therapy compels many patients to consider elective spinal fusion. The application of lumbar fusion procedures arose from the concept that low back pain and radiculopathy are caused by disc degeneration and consequential instability (Friberg & Hirsch, 1992). In 1940 the first successful posterior lumbar interbody fusion (PLIF) was performed using a shaped spinous process autograft (Cloward, 1982). Numerous modifications of interbody grafting sources have been designed since that time, including autologous iliac crest and fibular grafts, allograft bone, calcium carbonate and phosphate derivates, bone chips, metallic implants, carbon fiber implants, and threaded cages (Boult et al., 2000; see Table 1 for a glossary of related terms). Augmenting the PLIF technique with pedicle screws has become standard practice because of the high rate of pseudoarthrodesis encountered with stand-alone grafts (Steffee, 1989).

New developments in instrumentation have contributed to improved technical applications and outcomes of the PLIF procedure (Sears, 2002). PLIF offers several theoretical advantages that the traditional posterolateral decompression and fusion technique lacks. It provides a wider area of intervertebral bone-to-graft contact area, improved blood supply to the graft from the rich cancellous portion of the vertebral centrum, and increased load sharing of the grafts because the fusion center is proximate to the center of motion (Khoo, Palmer, Laich, & Fessler, 2002). PLIF includes complete decompression of the neural foramen and nerve roots, restoration of the predisease interbody distance and neural foraminal height, and near-total discectomy and restoration of segmental lordosis at the fused level (Branch, 1996).

PLIF remains controversial, however, because of wide variability in outcomes and fusion rates compared with traditional surgical techniques (Fischgrund et al., 1997). The accepted indications include spondylolisthesis, recurrent disc herniation, failed-back syndrome, and degenerative disc disease with mechanical back pain (Greenberg, 2001). This article discusses advances in PLIF technology and techniques, indications for PLIF, nursing management issues throughout the perioperative period, and ongoing spine research. It also presents practical guidelines and resources for nurses in practice.

Advances in Technique

Although the traditional posterior lumbar procedure has demonstrated an excellent rate of fusion (Gill & Blumenthal, 1993), it requires an extensive incision (the open approach) and results in significant iatrogenic injury to the dorsal musculoligamentous complex. The open approach entails a 5–7-inch midline incision, which can be a source of significant postoperative pain, irritation, and muscle spasm (Fig 1). In contrast, the minimally invasive percutaneous PLIF technique reduces the amount of operative iatrogenic injury without sacrificing the goals of the traditional open procedure (Khoo et al., 2002). PLIF entails the same degree of spine decompression and stabilization. It has been used among patients who previously would have required the traditional open approach (Kim, Lee, Chung, & Lee, 2005). It is an ideal procedure for the patient who presents with clearly defined symptoms (i.e., L4–L5 radiculopathy) that correlate with diagnostic studies and do not require adjacent-level exploration of neural elements.

The percutaneous PLIF procedure uses microsurgical and endoscopic instruments through two small (25 mm) incisions. An endoscopic Kerrison rongeur and drill are used to perform the laminotomy and decompression of the nerve roots. Rongeurs, curettes, and disc-space shapers are used to perform the discectomy. After full decompression, the endplates are prepared for graft placement. An interbody distractor device is placed into the disc space to restore intervertebral height, and

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Table 1. Terms Related to Spinal Fusion

Term	Definition
Allograft	Bone implant from a source other than the patient (usually from a cadaver)
Autograft	Bone implant taken from the patient. The bone may be grafted from another site, such as the hip or leg. Alternatively, the patient's bone taken during the laminectomy can be morselized and reused by placing it into a cage (a cylindrical, metal-mesh interbody implant).
Arthrodesis	Bony fusion that can be augmented with instrumentation
Intervertebral	Between the vertebrae
Interbody graft	A graft, usually made of bone or metal, that is implanted between the two vertebral bodies
Lordosis	Inward curvature of the spine, normally found in the cervical and lumbar regions
Pseudoarthrodesis (nonunion)	Failure of the bones to fully fuse together
Spondylolisthesis	A condition occurring when one vertebra slips forward in relation to an adjacent vertebra

an appropriately sized graft is secured between the vertebrae. Pedicle screw instrumentation can be placed through the same incisions.

Transforaminal lumbar interbody fusion (TLIF) is a modification of the PLIF procedure. It has been used to treat symptomatic spondylolisthesis and degenerative disc disease with radiculopathy (Fig 2). This technique allows access to the posterolateral disc space by removing the pars interarticularis and inferior facet of the cephalad vertebra along with the superior articular facet of the caudal vertebra (Fig 3). Lumbar pedicle screws and placement of an interbody graft between the vertebrae provide a single-stage circumferential fusion through the posterior approach (Salchi et al., 2004). Retraction on the nerve roots and dural sac is minimized as the approach projects inferior to the exiting nerve root and lateral to the traversing nerve root through a unilateral incision (Brislin & Vaccaro, 2002). This approach is ideal for the patient presenting with unilateral symptoms (i.e., right lower extremity L4–L5 radiculopathy).

Advances in surgical technique were preceded by the development of technology that allowed them to be applied. For instance, intraoperative fluoroscopy can be tedious and time consuming and is limited to two-dimensional imaging of the complex, three-dimensional spine structure. The use of a newly designed system, image-guided spine navigation, allows three-dimensional imaging. It can make finding landmarks more precise and efficient and can predict correct localization and trajectory of spinal instrumentation before placement. CT or MRI through the appropriate spinal levels is obtained preoperatively, and image data is transferred to the computer workstation in the operating room suite. Three to 5 reference points for each spinal segment to be instrumented are selected and stored in the image data set, then identified in the operative field and registered (Kalfas, 2003). Bony landmarks for pedicle localization are used to identify screw entry points, on which the drill guide is placed. The navigational probe is passed through the guide, which generates a multiplanar CT image. For placement of the minimally invasive percutaneous pedicle screw-rod instrumentation placement, the guiding K-wire is advanced to the planned segmental fusion site. A multiaxial pedicle screw is then attached to the screw extender sleeve and passed over the K-wire. The rod inserter is passed through both screw heads for each ipsilateral pair of pedicles within the motion segment fused. The rod is then placed and secured, conjoining the pedicle screws. This type of imaging allows those familiar with the system to rapidly and accurately place pedicle screw-rod instrumentation.

Identifying Patients Who May Benefit

Degenerative processes within the intervertebral disc and lumbar vertebrae from normal aging or repetitive motion can cause segmental instability, recurrent disc herniation, spondylolisthesis, or degenerative disc disease (Slosar, 2002). Patients with these disorders often experience a similar clinical course. They may describe isolated back pain or radiculopathy (leg pain) with a progressive pattern that interferes with daily activities. Many have attempted conservative measures such as physical therapy, chiropractic manipulation, epidural steroid injections, and acupuncture, with limited success. Careful patient selection is crucial. The main goal of surgery is to prevent further neurological injury and deformity. However, patients may be primarily concerned with the amount of pain relief the procedure will provide. It is important to differentiate the type of pain the patient is experiencing from the pain the PLIF procedure will resolve so that expectations of surgical outcome are mutually understood. The discussion should include symptoms that may be permanent or persist for some time after surgery. Most patients can expect resolution of radicular symptoms and 50% improvement in back pain (Fritzell, Hagg, Weeberg, & Nordwall, 2002).

Spinal Instability

Patients with spinal instability often present with radiculopathy and neurologic deficits such as sensory changes and motor weakness. Spinal instability occurs when the spine, under physiologic loads, is unable to maintain its

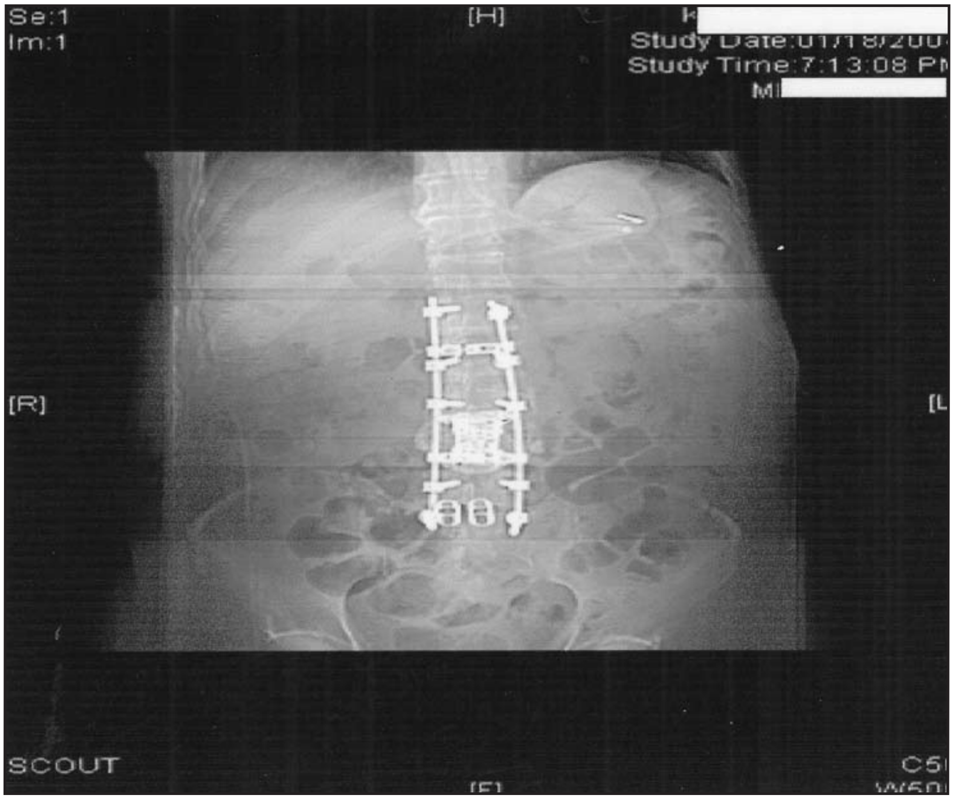

Fig 1. *X ray of a 58-year-old male after an open posterior lumbar interbody fusion*

Fig 2. *X ray of a 60-year-old male after a transforaminal lumbar interbody fusion*

pattern of displacement so that there is no neurologic deficit, major deformity, or incapacitating pain (White & Panjabi, 1990). Thus, radiographic and clinical criteria are used to determine spinal instability. The findings from the neurologic examination should correlate with the level of pathologic motion on radiographic studies. An accepted standard for radiographic instability is more than 4 mm of translation or more than 10º of angular motion between adjacent endplates on lateral flexion-extension X rays (Hanley, Spengler, Weisel, & Weinstein, 1994). Patients with symptomatic recurrent disc herniation or failed-back syndrome should be evaluated for segmental instability, using flexion/extension radiographs, as this may be the cause of pain.

Degenerative Spondylolisthesis

Degenerative spondylolisthesis, a form of segmental instability, does not cause symptoms in a majority of people. About 6% of the population have a progressive spondylolisthesis, usually presenting with a combination of back pain and leg pain that has intensified over time (Fig 4). As the intervertebral disc degenerates, chronic ligamentous laxity with compensatory facet joint hypertrophy and infolding of the ligamentum flavum causes spinal stenosis at the level of the slip. The anterolisthesis of the superior vertebrae causes direct neural compression as the inferior articular processes impinge into the canal. The primary goal of surgery is to relieve neural compression. However, arthrodesis can relieve back pain, maintain stability, and prevent progressive deformity (Nork, Hu, Workman, Glazer, & Bradford, 1999).

A randomized, prospective series of patients underwent one-level decompression with or without fusion for degenerative spondylolisthesis. Of those who underwent decompression alone, 44% had good to excellent results at the 2-year follow-up evaluation (Herkowitz & Kurz, 1991). In contrast, 96% of the patients who underwent both decompression and fusion reported good to excellent results. Although surgeons may advocate the need for instrumentation to increase successful fusion, results of clinical outcomes (i.e., pain relief, function) may not correlate with arthrodesis alone (Fischgrund et al., 1997). Instead, instrumentation increases the intervertebral distance to predisease height, allows complete and longer lasting spinal root decompression, and maintains lordosis of the lumbar spine.

Degenerative Disc Disease with Mechanical Low Back Pain

Patients with degenerative disc disease often present with debilitating low back pain that becomes worse with

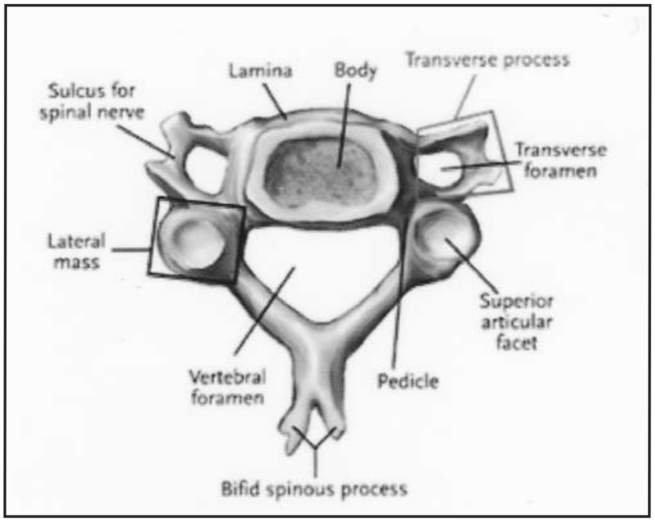

Fig 3. *Anatomy of the vertebral body*

Fig 4. *Degenerative spondylolisthesis*

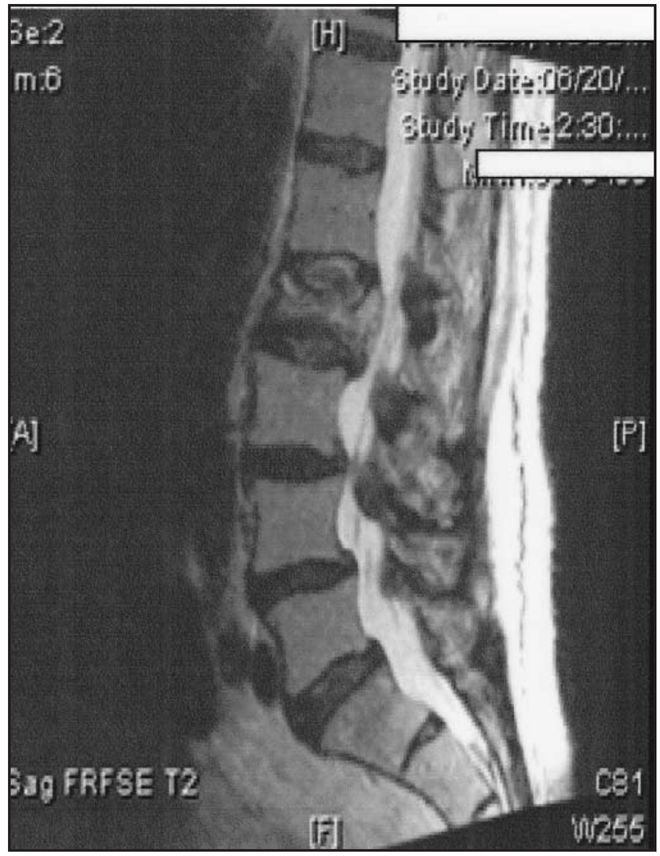

Fig 5. *MRI of a 60-year-old male with degenerative disc disease and mechanical low back pain.This patient had degenerative discs between L2-L3, L3-L4, and L4-L5. (Notice the black disc spaces.) A spinal tumor at L1 is eroding the vertebral body, causing spinal cord compromise. Between L2 and L3, spinal stenosis is causing spinal cord compromise. Notice the wavy pattern of the spinal cord in contrast to a straight pattern seen in a normal MRI.*

activity (Slosar, 2002). Nerve and blood vessel ingrowth and excessive production of proinflammatory cytokines have been implicated in the pain experienced from disc degeneration (Freemont, Watkins, Le Maitre, Jeziorska, & Hoyland, 2002). Nonsurgical treatment options should be explored. However, if pain persists or becomes worse, consideration of lumbar fusion to treat one- or two-level disease (Fig 5) is appropriate. Careful patient selection is critical and can be performed by thoroughly discussing the goals of surgery with the patient and detecting any psychosocial contraindications. Fritzell, Hägg, Wessberg, Nordwall, and the Swedish Lumbar Spine Study Group (2001) conducted a clinical trial on outcomes following lumbar fusion as opposed to nonoperative approaches among 294 patients with chronic low back pain. Patients were randomized to four treatment groups representing physical therapy and three types of fusion. At the 2-year follow-up assessment, back pain was reduced by 33% in the surgical groups compared with 7% in the conservative group ($p = .0002$). The fusion groups also rated their overall outcome as better and had a lower rate of disability than the nonoperative group.

Nursing Management Issues

Presurgical Evaluation

Presurgical evaluation should include a thorough history and physical examination (Fig 6). Formal documentation of the patient's presurgical neurologic examination is paramount for ongoing clinical evaluation. In addition, risk stratification for cardiovascular, pulmonary, or peripheral vascular comorbidities should be obtained. Nearly 1 in 10 Americans more than 65 years of age suffers from some form of heart failure (American College of Cardiology & American Heart Association, 2002). These patients may benefit from perioperative beta-blocker therapy. Placing the patient in a prone position for several hours can have detrimental effects on a compromised cardiovascular or pulmonary system. The length of time expected to be spent in the prone position should be highlighted on the referral form. Immobility or obesity can also predispose patients to asymptomatic deep vein thromboses (DVT) that must be treated before surgery. DVTs in susceptible patients are diagnosed by bilateral venous duplex of the lower extremities. The Agency for Healthcare Research and Quality guideline for treatment of DVT recommend the use of unfractionated heparin or subcutaneous low-molecular-weight heparin until adequate anticoagulation is achieved (2003). Patients then switch to oral anticoagulants (warfarin) for at least 6 weeks. Alternatively, patients with a diagnosed DVT who are facing impending surgery may elect to undergo placement of an inferior vena cava filter to prevent pulmonary embolism, a detrimental postoperative complication.

Patients undergoing open procedures or for whom extensive blood loss may be an issue can be presented with the option of autologous blood donation. Blood donation needs to be completed as least 72 hours before surgery (American Association of Blood Banks, 2005).

A multidisciplinary approach can improve outcomes for spinal patients. Those with substantial neurologic deficits, such as motor weakness that impairs activity, can be referred to a physical medicine rehabilitation (PMR) physician before surgery to provide continuity of care during hospitalization and rehabilitation. The PMR physician can be another resource for detecting intraoperative and postoperative complications or detecting psychosocial issues that may affect surgical outcomes. A pain specialist can also be of value in the patient's care. The pain specialist can provide recommendations for postoperative pain relief and later assist in weaning the patient from narcotics. Clear communication between the surgeon and consulting practitioners is essential and can ultimately lead to better patient outcomes and patient satisfaction.

Preoperative Teaching

One of the most challenging facets of patient care can be providing time for the patient and family to ask questions and address concerns. Scheduling in the outpatient clinic is often highly regimented, and time is scarce. However, nothing will add more to the patient's perioperative experience than offering time to discuss issues. Models or pictures of the surgical procedure and instrumentation can be used to clarify what will be done and provide an overview of the expected perioperative course. The discussion should include the expected level of postoperative pain and methods to decrease pain. Many studies have demonstrated that including information related to the sensory aspect of surgery (e.g., the expected amount of pain) and teaching coping mechanisms such as relaxation techniques result in higher patient satisfaction scores than giving only procedural information (Hill, 1982; Ridgeway & Mathews, 1982). Information can also be presented through videotapes, written instructions, or conversation with another individual who has already undergone the procedure. Some practices use a patient contract that reiterates the goals of surgery and details the patient's responsibilities throughout the recovery process.

The surgeon should address possible complications and consequences of the procedure and thoroughly review intraoperative and postoperative risks. Possible consequences of the procedure include the effect of the fusion on other spinal levels. Fusion causes increased intradiscal pressure, increased facet loading, and hypermobility of adjacent segments. Because symptomatic adjacent segment disease is estimated to affect 5.2%–18.5% of patients

Medical history: ____

Surgical history: ____

Medications: ____

Cardiology preoperative clearance or other referral

Scheduled for ________.

Check for follow-up of clearance on _______.

Preoperative care

___ Reviewed list of risks and potential complications of surgery; consent signed.
___ Reviewed preadmission testing, OR waiting room location.
___ Reviewed list of medications, what to take the day of surgery (check for anticoagulants).
___ Offered autologous blood donation.
___ Offered smoking-cessation resources.
___ Discussed postoperative activities in the hospital (physical therapy, rehabilitation consult).
___ Discussed patient's role in recovery (wearing TEDS or SCDs; incentive spirometer, ambulation, lumbar corset, pain medication regimen; no NSAIDs).
___ Reviewed expected course of recovery, including neural regeneration
___ Reviewed activity restrictions, bathing, and wound care, including signs of infection.

Postoperative care

Postoperative AP/Lateral films scheduled for______________.

___ Discussed need for anticoagulation clinic follow-up.
___ Discussed need for cardiology follow-up.
___ Discussed need for home health resources, outpatient physical therapy.
___ Discussed need for bone stimulator.
___ Reinforced abstaining from NSAIDs.
___ Reviewed rehabilitation plan.

Fig 6. *Lumbar surgery continuity-of-care checklist*

1. Obtain a thorough history and physical, identifying specific regions of pain and the degree of neurologic deficits.
2. Establish with the surgeon the diagnosis of spinal pathology and the best procedure to correct the pathology.
3. Provide preoperative teaching regarding the spinal pathology and the procedure that the surgeon will use to correct the pathology.
4. Address co-morbid conditions of the patient that could increase risks and the likelihood of complications in the intraoperative, postoperative, and rehabilitative phases.
5. Make appropriate referrals to address the risks and potential complications.
6. Follow up on the referral by discussing the recommendations with the surgeon and patient.
7. Follow the patient's continuity-of-care checklist to plan the surgery.

Fig 7. *Nursing guidelines for the patient undergoing spinal fusion*

undergoing fusion (Park, Garton, Gala, Hoff, & McGillicuddy, 2004), the potential need for further surgery should be presented.

The healthcare team's expectations of the patient and family should also be addressed; these include compliance with the incentive spirometer, activity restrictions, pain medication regimens and the rehabilitation plan. Smoking cessation resources should be provided to the patient and family at this time. Many surgeons encourage or even require smoking cessation before the procedure is performed, because cigarette smoke and nicotine have been implicated in bone demineralization and delayed bone healing (Kwiatkowiski, Hanley, & Ramp, 1996). Smokers are 2.8 times more likely to develop pseudoarthrodesis, or nonunion (Glassman et al., 1998). Taking the time to discuss preoperative issues and the plan of care will not only help the patient cope with the unknown variables associated with surgery but also will lead to continuity of care throughout the perioperative period (Fig 7).

Intraoperative and Immediate Postoperative Care

Positioning the patient to provide maximal comfort and protection from stretch and pressure injuries is a vital nursing measure. Nursing personnel should ensure the use of adequate padding and sequential compression devices as well as strict adherence to sterile technique. A multidisciplinary approach to management of intake and output, insertion and management of a urinary catheter, appropriate administration of antibiotics, and maintenance of hemodynamic stability can ensure good patient outcomes in the operating room.

Treatment for acute postoperative pain varies according to clinical practice preferences. Epidural anesthesia and analgesia have been shown to be superior to intravenous analgesia with respect to pain quality; incidence of side effects; and pulmonary, cardiac, and gastrointestinal dysfunction (Rodgers et al., 2000). The difference between patient-controlled analgesia and epidural infusion was investigated by Cohen et al. (1997) in a prospective, randomized, double-blind clinical trial. This study involved 54 patients randomized between 2 groups that received either an epidural or patient-controlled analgesia (PCA) delivery system. Postoperative time to liquids and solid food, ambulation, length of stay, side effects, and perception of pain were not statistically significant. One possible reason for the lack of effect may have been that the epidural catheters were placed 2–3 levels cephalad to the operative level. When local anesthetics are used, it is essential that the medication is delivered to the spinal nerve roots innervating the tissue injured by surgery.

As a follow-up study, Gottschalk et al. (2004) investigated the use of intraoperative epidural placement using 0.1% ropivacaine versus placebo among 30 patients undergoing posterior spinal fusion. All patients received an intravenous PCA. In contrast to the study by Cohen et al. (1997), they placed the catheter in the middle of the operation field and introduced it 3 cm in the cranial direction. In addition, they used a higher infusion rate of 12 ml/hr. They found that continuous epidural infusion of 0.1% ropivacaine resulted in significantly lower pain scores and opioid consumption and higher patient satisfaction scores, when compared with a placebo.

Yoshimoto et al. (2005) investigated the use of preemptive epidural anesthesia for pain control in patients undergoing posterior spinal fusion. They found that preoperative epidural anesthesia with morphine was useful in obtaining stable hypotension during surgery, thereby reducing blood loss. Neurologic assessment immediately after surgery was possible in all patients who underwent the preoperative epidural anesthesia. Preoperative epidural anesthesia for posterior lumbar spine fusion reduced intractable pain after surgery with few complications. As these studies show, an anesthesiologist who is knowledgeable about the unique needs of the spinal patient can significantly improve the surgical experience.

After surgery, an anterior-posterior and lateral standing lumbar plain film may be obtained to verify alignment of the screws and spine but is not necessary if obtained intraoperatively. If postoperative pain is out of proportion to expected pain after operation and impairs activities, a CT of the lumbar spine should be taken to evaluate the screw location and assess the integrity of the spinal canal.

Postoperative Care and Discharge Self-Care Education

For 90% of patients, PLIF is expected to relieve radicular pain immediately after surgery (Fritzell, Hägg, Wessberg, & Nordwall, 2002), due to direct decompression of the spinal nerve roots and stabilization of the spine. The expected sequence of healing is relief of radicular pain, followed by increase in motor strength and, finally, resolution of parasthesias. Patients may complain of persistent numbness and tingling, which may have been present before surgery. Neuronal regeneration can take time; the damaged nerve heals at an estimated rate of 1 inch per month. Thus, it is not uncommon for patients to have parasthesias for an extended time, even up to 1 year. During this time, patients often need reassurance and encouragement to continue with the rehabilitation plan. Gabapentin, a drug used for neurogenic pain, may be used during the rehabilitation period to relieve this type of pain.

Nonsteroidal antiinflammatory drugs are known to impede osteogenic activity and have been shown to decrease the fusion rate. Glassman et al. (1998) conducted a retrospective study among 288 patients following lumbar fusion and found that nonunion was approximately 5 times more likely after postoperative ketorolac administration. Thus, many surgeons do not use nonsteroidal antiinflammatory drugs for as long as 3 months after surgery (Deguichi, Rapoff, & Zdeblick, 1998).

Patients who have narcotics prescribed for pain relief should also take a stool softener daily or as needed to avoid constipation. Adequate nutrition should be encouraged to enhance the healing process. Eating a balanced diet that includes a variety of protein and fresh fruits and vegetables can prevent constipation.

The use of a lumbar orthotic is commonly recommended after fusion procedures; however, the clinical utility of these cumbersome devices has come under scrutiny. Some surgeons allow activities without the orthotic and consider it as a supportive device for comfort, used as needed by the patient. Generally, patients are encouraged to wear the orthotic as much as is tolerable for the first 3 months. Complete fusion is expected to occur approximately 6 months following the procedure in healthy individuals without comorbid conditions. Patients at high risk for pseudoarthrodesis, such as smokers, those with severe osteoporosis, or those who have undergone multiple procedures, may benefit from bone stimulator therapy.

Activity restrictions should be thoroughly discussed with the patient and family. Bending or twisting from the waist and lifting more than 5 lb usually are not permitted for 3 months. Limitations, such as avoidance of overexertion from climbing stairs or pushing or pulling maneuvers (e.g., vacuuming or mowing the lawn), should also be discussed. These activities are usually restricted for 3–6 months. Physical therapy should be initiated the day after surgery to promote activity, strengthen muscles, and review correct body mechanics. Outpatient physical therapy is prescribed for those with motor weakness to continue the strengthening and endurance of the impaired muscle group.

Wound care is simplified when a minimally invasive method is used, because there are only two small incisions. For percutaneous incisions, adhesive strips (Steri-Strips™) are placed on the surface of the skin and should be covered only when showering. Immersion in water is not allowed until the adhesive strips come off. The adhesive strips should be allowed to fall off or be removed by the nurse or physician after healing is adequate (about 14 days). For larger midline incisions closed with staples or sutures, the entire incision needs to be covered when showering. No ointment or cream is needed. Patients should be instructed to have someone check the incision sites every day for signs of infection and to report to the healthcare team high fevers, purulent discharge, or other signs of infection.

Patients undergoing minimally invasive surgery (percutaneous PLIF or TLIF) spend an average of 3 days in the hospital, as opposed to the 5–7 days spent by patients undergoing an open PLIF. Written discharge instructions that review pain medications, nutrition, orthotic use, activity restrictions, and wound care are a valuable reference tool for patients and their families. A designated discharge planner can assist the patient with questions and ensure that the patient receives discharge information relevant to the patient's situation.

Research in Spine Surgery

Biotechnology research is becoming an important avenue for improving outcomes in spinal surgery. The use of recombinant bone morphogenetic protein-2 (rBMP-2) to enhance spinal fusion has been reported to increase the rate of fusion compared with the use of autograft alone (Zigler, Boden, Anderson, Bridwell, & Vaccaro, 2002). Radiolucent interbody devices that allow visualization of fusion maturation while maintaining the strength and stability needed to facilitate fusion have added to the armamentarium of grafting sources. Bioabsorbable implants, which disintegrate over a period of months, have been developed and are currently being used by some surgeons (Zigler et al.).

Research concerning the degenerative processes within the intervertebral disc and lumbar vertebrae shows that these processes may be influenced by nerve and blood vessel ingrowth and increased production of proinflammatory cytokines (Freemont, Watkins, Le Maitre, Jeziorska, & Hoyland, 2002). These factors have been implicated as directly promoting degenerative processes and may become new targets for preventing and treating disease. Gene therapy targeting these processes and creating a chemical environment conducive to restoring cell function and integrity is an exciting new field (Wehling, 2001). Biotechnology research may in the future lead to a change from fusion procedures to fusionless systems that replace spinal structures instead of adding extra instrumentation. Several Web sites provide updates on the most recent advancements in spinal surgery and spine research as well as patient teaching resources: www.spineuniverse.com, www.back.com, www.spine-health.com, and www.spineresearch.com.

Outcome studies in the spine population are essential to establish evidence-based nursing interventions. Neuroscience nurses can be involved in this type of research and provide a unique lens through which to view specific clinical problems. Research concerning quality-of-life outcomes (e.g., functional status, reintegration into the workforce, resumption of activities) is scarce in the literature (Bono & Lee, 2004). This is partly due to the wide variation in technique among surgeons and the lack of clinical outcomes reporting among surgical practices. However, to evaluate the continuous success of a certain procedure in a particular patient population, database collection, reporting mechanisms, and publication of outcomes need to be priorities for surgeons and the healthcare team.

Summary

Advancements in lumbar fusion techniques allow patients to spend less time in the hospital and to experience less pain and a quicker recovery time. With the population aging, the number of lumbar fusions performed each year is expected to rise. Despite advances in surgical technology, these patients still require vigilant nursing care to ensure optimal recovery. Neuroscience nurses can have a positive, direct impact on the care provided for spine patients by understanding the indications for surgery, being knowledgeable about the various procedures, managing the multidisciplinary approach to patient care, and providing patient and family education throughout the perioperative period.

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