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REVIEW ARTICLE

# The management of lumbar disc herniation in pregnancy: A review

# Gebelikte lomber disk hernisinin yönetimi: Bir derleme

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**Abstract**

Although low back pain represents a highly prevalent symptom throughout gestation, its association with lumbar disc herniation remains uncommon. Promptly establishing a differential diagnosis for low back pain is critical to avert irreversible neurological impairment. Currently, there is a distinct lack of standardized clinical guidelines regarding the management of pregnancy-associated lumbar disc herniation. Given that the existing literature is predominantly composed of case reports and review articles, the overall level of clinical evidence remains limited. For this review, we analyzed published studies reporting on patients managed during pregnancy. Based on these data, this review aims to elucidate the clinical management of lumbar disc herniation in pregnant individuals, spanning from initial diagnosis to the determination of the optimal delivery method.

**Keywords:** Pregnancy, lumbar disc herniation, anesthesia, surgery position, surgery.

**Özet**

Bel ağrısı, gebelik süresince oldukça yaygın görülen bir semptom olmasına rağmen, lomber disk hernisi ile ilişkisi nadirdir. Kalıcı nörolojik hasarı önlemek için bel ağrısının ayırıcı tanısını hızlı bir şekilde koymak kritik önem taşımaktadır. Günümüzde, gebelikle ilişkili lomber disk hernisinin yönetimine dair standardize edilmiş klinik kılavuzlarda belirgin bir eksiklik bulunmaktadır. Mevcut literatürün ağırlıklı olarak olgu sunumları ve derleme makalelerinden oluşması nedeniyle, genel klinik kanıt düzeyi sınırlı kalmaktadır. Bu derleme kapsamında, gebelik sırasında tedavi edilen hastaları bildiren yayımlanmış çalışmalar analiz edilmiştir. Bu verilere dayanarak mevcut çalışma; ilk tanıdan optimal doğum yönteminin belirlenmesine kadar uzanan süreçte, gebe bireylerde lomber disk hernisinin klinik yönetimini aydınlatmayı amaçlamaktadır.

**Anahtar Kelimeler:** Gebelik, lomber disk hernisi, anestezi, cerrahi pozisyon, cerrahi.

## INTRODUCTION

Gestational low back pain (LBP) is a highly prevalent condition, reported to affect up to 56% of pregnant women (1). The etiology of LBP during this period is multidimensional and has been linked to a combination of musculoskeletal alterations and hormonal shifts, specifically involving fluctuations in relaxin, progesterone, and estrogen (2). Nonetheless, true disc herniation remains a notably rare clinical entity within this population, with estimates suggesting that it occurs in approximately 1 in 10,000 pregnant patients presenting with LBP (3).

Management strategies for lumbar disc herniation (LDH) during pregnancy show substantial similarities to those applied in non-pregnant populations, generally beginning with a minimum six-week trial of conservative treatment (4). When imaging is indicated, clinicians predominantly rely on magnetic resonance imaging (MRI) and ultrasonography (4). Despite advances in clinical management, decision-making in these patients remains challenging due to the need to simultaneously address maternal well-being and fetal safety. A coordinated multidisciplinary approach involving obstetricians, neonatologists, spine surgeons, and anesthesiologists is therefore recommended to evaluate all relevant aspects of care, including medication-related considerations and postoperative maternal-fetal follow-up (1,5).

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In cases where conservative strategies prove insufficient, definitive surgical interventions may be indicated. Circumstances that potentially warrant operative management include severe, unremitting back and leg pain refractory to non-surgical care, progressive neurological deficits, or cauda equina syndrome (CES) (1). The surgical options available for the pregnant population comprise microdiscectomy, laminectomy, and various endoscopic procedures (4,6). Nevertheless, intraoperative care presents distinct complexities; the determination of patient positioning is largely governed by gestational age, (1) whereas the selection of anesthetic agents must be adapted to maternal indications, keeping in mind that pregnancy does not represent an absolute contraindication to either general or regional anesthesia (1,5). Additionally, meticulous procedural planning is crucial to minimize exposure to intraoperative ionizing radiation, which carries a potential risk of adverse effects on the developing fetus (7).

Therefore, this review aims to provide a comprehensive overview of the management of lumbar disc herniation during pregnancy, specifically focusing on diagnosis, conservative and surgical treatments, and the mode of delivery, while ensuring maternal and fetal safety.

## METHODS

A literature search was conducted using the PubMed database. The search was performed using the search term “lumbar disc herniation in pregnancy.” The search strategy was restricted to human studies involving adults, published in English within the last decade, and offering free full-text access. To be eligible for inclusion, studies had to focus on adult pregnant populations and investigate either conservative or surgical interventions during pregnancy. The initial search yielded 22 records; however, 8 articles were excluded due to a lack of relevance to the study topic. Ultimately, 14 articles met all eligibility requirements and were synthesized in this review.

## DISCUSSION

The prevalence of low back pain during pregnancy has been reported to be 56% (1). Low back pain occurs most frequently during the fifth to seventh months of pregnancy (2). Its occurrence during pregnancy has been linked to multiple contributing factors. As maternal abdominal girth increases throughout pregnancy, the body’s center of gravity shifts anteriorly. This alteration is accompanied by an increase in lumbar lordosis and anterior pelvic tilt as compensatory adaptations. Consequently, the axial load exerted on the spine may increase (1). Increased secretion of hormones such as relaxin, estrogen, and progesterone during pregnancy also contributes to these changes (4,8).

The release of relaxin reaches its peak at the 12th week of pregnancy. Relaxin plays a pivotal role in connective tissue remodeling, collagen regulation, and pelvic ligament laxity. Analogous changes can be induced in the posterior longitudinal ligament, consequently predisposing patients to intervertebral disc herniation (1). Among pregnant patients presenting with low back pain (LBP), the incidence of definitive disc herniation and subsequent radiculopathy is remarkably low, estimated at approximately 1 in 10,000 cases (3,5). Existing literature indicates that severe neurological impairment complicates a maximum of 15% of these lumbar disc herniations, with cauda equina syndrome being the primary indication for urgent operative treatment (3).

Although gestation itself is not classified as an autonomous risk factor, LDH exhibits a higher prevalence among females of reproductive age. Some theorists suggest that the increased prevalence of LDH risk factors within the pregnant population, such as a high body mass index and advanced maternal age, may consequently increase the incidence of LDH (1).

A study by Nyrhi et al. reported that women who actively smoked prior to pregnancy had an increased likelihood of undergoing lumbar discectomy during pregnancy (OR 2.0, 95% CI 1.2–3.2) (8).

Therapeutic management of LDH during pregnancy requires careful consideration of the potential benefits and risks for both maternal and fetal well-being. Therefore, involvement of a multidisciplinary team comprising neonatologists, obstetricians, anesthesiologists, and surgeons has been recommended to support clinical decision-making (1).

Managing disc herniation in the pregnant population requires evaluation of several critical factors. These

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encompass the safety profiles of pharmacological agents and diagnostic modalities, definitive surgical indications, the optimal timing and technical approach of the intervention, appropriate anesthetic selection, and post-operative obstetric maintenance (5).

**Diagnosis**

Delayed diagnosis may lead to irreversible neurological sequelae, which can adversely affect maternal and fetal outcomes and may also impact subsequent parenting ability. Therefore, careful consideration of differential diagnoses for gestational low back pain remains essential (9). Low back pain or the development of motor deficits during pregnancy indicates the need for timely further assessment (10).

**Neurological Examination**

Neurological examination contributes to the identification of nerve involvement and guides treatment decisions. Considering its crucial role in radiculopathy diagnosis, rigorous neurological follow-up—specifically evaluating motor capacity, sensory changes, and deep tendon reflexes—is of paramount importance. This assessment becomes even more vital throughout gestation owing to the limited availability of imaging options. Consequently, early identification through bedside clinical examination has the potential to enhance clinical outcomes and prevent permanent deficits (4).

The primary symptom associated with LDH is radicular pain. Notably, the presence of localized low back pain is not a prerequisite for this condition (3).

**Distinguishing Between Physiological Gestational Back Pain and Lumbar Radicular Pain**

Physiological low back pain during pregnancy is thought to result from progressive lumbar lordosis and ligamentous strain and is most commonly observed in the second and third trimesters. It is typically described as a dull, dragging discomfort affecting the lower back or pelvic region, usually occurring bilaterally, with severity ranging from mild to moderate. Symptoms often improve with changes in posture, rest, or movement. Neurological manifestations such as paresthesia, numbness, or focal weakness are generally absent, and the pain remains confined to the lumbar and pelvic regions without radiating to the lower extremities (4).

Conversely, lumbar radicular pain characteristically presents as an acute, severe, lancinating discomfort that typically propagates from the lumbar region dermatomally down a single lower extremity. This condition is predominantly unilateral and frequently co-occurs with neurological deficits, including paresthesia, hypoesthesia, focal muscle weakness, or diminished deep tendon reflexes. Furthermore, this pain phenotype is often exacerbated by maneuvers that increase intrathecal pressure, such as coughing or sneezing, as well as postural transitions, substantially compromising the patient's mobility (4).

Given that routine gestational manifestations—namely urinary dysfunction and lower back pain—frequently mimic underlying spinal pathologies (11), meticulous clinical examination targeting subtle neurological impairments is paramount for the timely diagnosis of CES (9). This form of compressive myelopathy leads to a characteristic set of clinical manifestations, including sensorimotor impairment in the lower extremities, saddle anesthesia, and bowel or bladder dysfunction, with the latter often considered one of the most indicative features supporting a definitive diagnosis (12).

**Red Flags**

The presence of certain warning signs in pregnant individuals seeking care for back pain or radiculopathy can indicate critical neurological deterioration or other high-risk pathologies (4). While clinical guidelines regarding 'red flags' vary globally, they universally incorporate autonomic bladder or bowel dysfunction, crural pain and/or sensory alterations, loss of sexual sensation, and perineal numbness (13). If any of these red flags are identified, avoiding delays in referral and definitive diagnosis is paramount, requiring immediate transfer to a specialized center for advanced assessment and emergency management (4).

**These Red Flags Include**

Pronounced lower extremity or perineal sensorimotor deficits: This presentation strongly implicates lumbar nerve root compression or progressive neurogenic

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dysfunction (4). Sphincter incontinence (loss of bladder or bowel control): This represents a pathognomonic sign of CES, a neurosurgical emergency requiring immediate surgical decompression (4). Severe, unremitting, acute-onset pain refractory to rest or postural adjustments: Such non-mechanical pain phenotypes often signify advanced compressive or inflammatory spinal pathologies (4).

Pyrexia or constitutional symptoms of infection: These findings may suggest spinal or paraspinal infectious processes, particularly when coupled with focal vertebral tenderness (4).

Idiopathic weight loss or a history of malignancy: This potential red flag warrants further evaluation for metastatic vertebral lesions or systemic neoplastic disorders involving the axial skeleton (4).

**Imaging Techniques**

Magnetic resonance imaging (MRI) and ultrasonography are the modalities of choice for clinicians in contemporary medical practice (4). The use of MRI during gestation has gained widespread clinical acceptance, (3) and it is currently established as the gold standard for evaluating such soft-tissue pathologies (5).

Although in utero exposure to serial echo-planar MRI has been demonstrated to have no detrimental effects on the developing fetus (13), the precise risk profile of gestational MRI has not yet been definitively elucidated, necessitating further research in this domain (3).

The use of contrast-enhanced MRI during pregnancy is generally discouraged, as studies in animal models have suggested an association between exposure to contrast agents and an increased risk of spontaneous abortion (9). Consequently, whenever the clinical necessity of these agents arises, their potential implications and subsequent outcomes must undergo a meticulous risk-benefit evaluation (4).

While no definitive studies have established harmful sequelae from maternal MRI exposure, current guidelines from the American College of Radiology recommend avoiding MRI examinations during the initial trimester and omitting any related contrast agents. When a first-trimester scan is deemed essential, the balance of maternal benefits and fetal risks should be thoroughly communicated to the expectant mother, ensuring her capacity to provide fully informed consent (5).

**Conservative Management**

The clinical decision-making process regarding therapeutic options (both surgical and non-surgical) for LDH demonstrates high comparability between pregnant and non-pregnant cohorts (4). Initial therapeutic interventions warrant a minimum of six weeks of conservative care (4). Within this timeframe, clinical resolution of symptoms is documented in more than 85% of cases (1), underscoring that the vast majority of patients recover without the need for surgical intervention (3).

Conservative management primarily encompasses bed rest, physical therapy, pharmacological analgesia, and epidural steroid injections (1,4). Pain control strategies should be guided by the World Health Organization (WHO) analgesic ladder, and the use of nonsteroidal anti-inflammatory drugs (NSAIDs) should be avoided. For patients who continue to experience symptoms after three to four weeks of bed rest and oral analgesic treatment, epidural or transforaminal steroid injections may warrant consideration (1).

Whiles et al. reported that complete resolution of symptoms was more frequent among patients receiving conservative management than among those undergoing surgical intervention (61.54% vs. 56.41%). Conversely, prolonged symptoms after treatment were more common in surgically treated patients than in those managed conservatively (38.54% vs. 30.77%) (1).

**Drugs**

The United States Food and Drug Administration utilizes a five-tier classification system comprising categories A, B, C, D, and X to evaluate the safety of medications during pregnancy. Under this system, a wide spectrum of therapeutic agents is assessed, ranging from non-opioid and opioid analgesics to anti-inflammatory medications, muscle relaxants, and antiepileptic drugs (4).

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For gestational pain management, the use of pethidine and acetaminophen has been documented as safe (2). Paracetamol and cyclobenzaprine are likewise considered safe pharmacological options during pregnancy (9). In contrast, first-trimester exposure to opioids and corticosteroids has been associated with teratogenic effects; therefore, their use should be avoided whenever possible (9). Moreover, exposure to nonsteroidal anti-inflammatory drugs (NSAIDs) in early pregnancy may be associated with an increased risk of congenital malformations, particularly cardiac septal defects (2).

In the case report by Raja et al. parenteral paracetamol infusion was used as the sole analgesic treatment, followed by a switch to oral paracetamol on postoperative day 3 (9).

**Epidural Steroid Injections**

There is no definitive consensus regarding the use of epidural steroid injections for chronic low back pain (LBP). Although these interventions are effective in providing temporary symptomatic relief and postponing surgical intervention, sufficient evidence confirming their long-term efficacy remains lacking (4). As part of the treatment approach, nerve and local blocks may serve as alternatives to traditional analgesic therapies. However, prolonged exposure to corticosteroids has been associated with serious fetal complications, including reduced fetal weight, impaired respiratory movements, alterations in heart rate variability, and a greater risk of early-onset neonatal sepsis (2).

**Physiotherapy**

Physiotherapeutic interventions have proven effective in mitigating low back pain (LBP) and pelvic girdle pain while concurrently supporting work attendance. These interventions encompass a broad range of strategies, including walking, yoga, Pilates-based training, and exercises targeting movement control, as well as more specialized approaches, such as technology-supported rehabilitation programs and the McKenzie approach. Nonetheless, because pregnancy is accompanied by an increase in circulating relaxin concentrations that may promote joint hypermobility, physical therapists should avoid prescribing exercises requiring extensive ranges of motion (ROM). Furthermore, the application of electrical stimulation (electrotherapy) as well as pulsed or continuous ultrasound to the abdominal or lumbar regions is strictly contraindicated (4).

**Surgical Indication**

The decision to perform surgery during pregnancy should be guided by careful consideration of the potential maternal and fetal benefits relative to the associated risks. At the same time, inadequate management of intraoperative patient positioning, anesthesia, fetal monitoring, emergency delivery plans, and maternal blood pressure tracking can adversely affect surgical and obstetric outcomes. For this reason, optimal clinical decisions require a cautious approach and are most appropriately made through collaboration within a multidisciplinary team (MDT) involving anesthesiologists, neonatologists, obstetricians, and surgeons (11).

The literature presents differing views regarding the surgical management of LDH in pregnancy, with some authors not considering surgery contraindicated, whereas Matsumoto et al. favor a conservative treatment approach (1).

Surgical intervention may be indicated in cases of severe, persistent back and leg pain that does not respond to conservative management, progressive neurological impairment, or CES (1). Severe neurological deficits due to LDH have been reported in no more than 15% of patients (3). Progressive neurological deficits generally necessitate urgent intervention, whereas cauda equina syndrome requires emergent management (5).

In these instances, failure to perform surgery may lead to permanent neurological deficits; furthermore, intractable pain may induce maternal stress, thereby increasing the risk of miscarriage and preterm birth. Consequently, surgery may be considered a viable option (1,5).

**Surgical Management**

**Surgical Methods**

Surgical modalities available for the management of lumbar disc herniation in pregnant patients encompass microdiscectomy, laminectomy, endoscopic discectomy, (4) and full-endoscopic interlaminar discectomy (6).

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Microdiscectomy is recognized by spine surgeons as the 'gold standard' technique for lumbar discectomy, as it offers lower complication rates and shorter hospital stays (11). Although it is slightly more invasive than endoscopic surgery, its ability to minimize intraoperative fluoroscopy use provides a distinct advantage for this patient population (2). Conversely, fluoroscopy-assisted endoscopic discectomy may involve ionizing radiation exposure, which could be associated with increased fetal risk (4).

Full-endoscopic interlaminar discectomy, when planned based on preoperative MRI, may be performed as a minimally invasive spinal surgery in pregnant patients while avoiding intraoperative exposure to X-ray radiation (6).

In a case report by Takaishi et al., although full-endoscopic discectomy was considered minimally invasive with a smaller incision, microscopic discectomy was selected because of the shorter fluoroscopy time required for puncture and sheath placement (2).

**The Time of Surgery**

Unless patients present with severe and/or progressive neurological deficits or debilitating symptoms that severely impair quality of life, it is recommended to postpone elective surgical interventions during pregnancy until after the 24th gestational week. Beyond this threshold, neonatal survival rates exceed 80% (1).

Due to the well-established risk of fetal malformations associated with exposure to medications, radiation, and other teratogenic factors during the organogenesis phase, avoiding elective surgery during this period is strongly advised (2).

The second trimester represents a more favorable window for surgical interventions, given that the incidence of complications such as preterm labor is lowest during this phase (5). However, as gestation advances into the second half, fetal growth creates technical challenges for performing surgery in the prone position (2).

Existing literature suggests that discectomy performed immediately after cesarean section in the third trimester may be associated with favorable outcomes and no major perioperative complications (4).

Despite the fact that indicated surgical procedures may need to be performed regardless of pregnancy stage, the American College of Obstetricians and Gynecologists (ACOG) supports postponement whenever possible, favoring either the postpartum period or the second trimester because of the comparatively lower risk of spontaneous abortion (1).

In a study by Nyrhi et al. evaluating 91 lumbar discectomies performed during pregnancy, most procedures were undertaken during the first and second trimesters, with a mean gestational age at surgery of 15+3 weeks. Procedures performed in the third trimester accounted for only 12% of all cases. No fetal deaths were reported among patients who underwent lumbar discectomy during pregnancy. Additionally, cesarean delivery and discectomy were performed during the same hospitalization in fewer than five cases (8).

The management strategy and timing for most acute surgical conditions in pregnant patients should align with the protocols established for non-pregnant populations (5). Controversies persist regarding the optimal timing of surgical decompression in pregnant patients with confirmed CES (11). Nevertheless, minimizing the time to surgery is widely recognized as a critical determinant of favorable clinical outcomes (13).

Several studies and meta-analyses demonstrate a superior prognosis for patients who undergo surgical intervention within 48 hours of symptom onset (11). In cases involving delayed presentation, patients must be thoroughly counseled regarding the potential for persistent neurological deficits, particularly bladder and bowel dysfunction (13).

Maternal safety remains the paramount priority in patient management; therefore, maternal hypoxia, hypocapnia, and hypotension must be rigorously avoided, and proactive measures must be taken to prevent preterm labor (1).

**Positioning**

The selection of intraoperative patient positioning is primarily dictated by gestational age (1). Available evidence suggests that spinal procedures may be performed safely in pregnant patients using either the prone or lateral position (11).

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During the first and early second trimesters, the prone position is considered safe; it effectively decreases epidural venous pressure while providing optimal posterior access to the herniated disc (9). However, beyond the 12th week of gestation, prone positioning is discouraged unless a specialized Relton-Hall laminectomy frame is utilized, as abdominal compression may induce preterm labor (1). To mitigate this risk, Yildiz et al. reported a case in which the patient was placed prone on a Montreal mattress, with the abdomen positioned over the central hollow to prevent excessive pressure on the gravid uterus (13).

The prone position becomes less favorable in the third trimester because the enlarged uterus may compress major vascular structures, increasing the risk of fetal distress (9). Accordingly, left lateral positioning is commonly recommended in advanced second- and third-trimester pregnancies, as it facilitates surgical exposure and reduces the likelihood of aortocaval compression (1). In support of this, a review by Ardaillon et al. indicated a preference for the prone position during the early second trimester, whereas the left lateral position was predominantly favored during the latter half of the second trimester (12).

In pregnancies approaching term, one management option is to perform an elective cesarean section with the patient in the supine position and subsequently proceed with posterior spinal surgery after repositioning to the prone position (9). Nevertheless, the occurrence of preterm labor has been associated with an increased risk of unfavorable outcomes, particularly those related to respiratory morbidity (4).

**Anesthesia**

Pregnancy-induced anatomical and physiological alterations significantly influence anesthetic management (4). A thorough understanding of these changes is imperative for ensuring safe anesthesia. During pregnancy, physiological adaptations affecting both respiratory reserve and metabolic demand may increase vulnerability to hypoxia and oxygen desaturation at the time of anesthesia induction. Therefore, anesthetic management should focus on optimizing maternal safety and fetal oxygenation, thereby reducing the risk of hypoxia-related complications, including preterm labor (5).

There is no single, clearly defined anesthetic agent of choice during pregnancy. Evidence from the literature suggests that many pharmacological agents may exert teratogenic effects depending on the administered dose and the timing of fetal exposure during gestation. Current understanding indicates that most anesthetic medications commonly used in clinical practice can generally be administered after organogenesis has been completed. Nevertheless, assessing the safety of anesthetic agents during pregnancy remains challenging. Ethical constraints limit the investigation of placental drug transfer in humans, while extrapolation from animal studies is restricted by interspecies differences in placental structure and physiology. Although no anesthetic agent has been conclusively identified as teratogenic in routine clinical use, insufficient evidence exists to support the selection of a single preferred anesthetic drug during pregnancy (5).

Selection of the anesthetic approach should be individualized on the basis of maternal clinical considerations and the requirements of the surgical procedure (5). Notably, pregnancy does not constitute a contraindication for either general or regional anesthesia (1).

General anesthetic management in pregnancy presents distinct challenges related to maternal safety and fetal well-being (5). General anesthesia during pregnancy may affect uteroplacental circulation through increased catecholamine activity, potentially reducing uterine blood flow and placing the fetus at risk of hypoxemia or asphyxia. In addition, it may be associated with several maternal and fetal concerns, such as excessive ventilatory support, maternal oxygen desaturation, cardiovascular suppression, and possible exposure to teratogenic agents. Airway control may be more challenging in pregnant patients due to physiological changes, including breast enlargement and increased thoracic dimensions. Moreover, anatomical alterations associated with pregnancy, together with reduced lower esophageal sphincter tone, may increase susceptibility to gastric acid aspiration during induction of anesthesia (4). The decision to administer general anesthesia in early pregnancy should involve careful risk assessment, particularly because of concerns regarding spontaneous abortion during the first trimester (1).

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Consequently, many anesthesiologists favor regional anesthetic techniques over general anesthesia when feasible, as these approaches are associated with reduced systemic toxicity, (5) although controlled trials providing definitive evidence of adverse outcomes related to general anesthesia remain limited. Nevertheless, general anesthesia has been successfully utilized without any additional complications (9).

Regional anesthesia is recommended for shorter operative procedures (11). Pregnant patients typically require lower doses of anesthetic medications, which may be attributed to a decrease in the minimum alveolar concentration (MAC) and hormonal shifts that increase their sensitivity to local anesthetics (4).

ACOG supports the use of regional anesthesia when appropriate because it reduces fetal exposure to anesthetic medications. Nevertheless, this approach is not without potential complications, including acute hypotension, which may contribute to fetal distress and preterm labor (1).

Spinal anesthesia is widely utilized in obstetric surgical procedures due to its favorable safety profile. During the third trimester, it may reduce the likelihood of complications related to difficult airway management and aspiration associated with pregnancy-related anatomical alterations. In addition, this approach limits fetal exposure to anesthetic medications and may reduce concerns regarding potential teratogenic effects. By allowing the mother to preserve spontaneous respiration and independent airway control, spinal anesthesia can facilitate surgical conditions through decreased intraoperative bleeding. This effect may be attributed to reduced intrathoracic pressure, leading to less engorgement of epidural veins and consequently lower blood loss during surgery (4). Furthermore, pregnancy-related physiological changes can result in a faster onset and wider distribution of both spinal and epidural anesthesia (5).

Current evidence remains insufficient to determine whether the relative potency of neuraxial anesthetic–induced motor blockade differs between pregnant and non-pregnant patients. Neuraxial techniques may also be considered in individuals with previous neurological injury. During the acute phase of neurological injury, general anesthesia is generally preferred to minimize the risk of additional hemodynamic or respiratory compromise. Following this phase, neuraxial techniques may be considered, as the need for immediate stabilization becomes less critical (5).

Both general and spinal anesthesia are established approaches in obstetric surgery; however, available evidence does not support the clear superiority of either technique. The choice of anesthetic method should be individualized according to the patient's clinical condition and the judgment of the multidisciplinary care team. Accordingly, careful preoperative evaluation and collaboration with anesthesia professionals are required to select the optimal approach for each case (4).

**Fetal Monitoring**

Overall, fetal monitoring is deemed unnecessary until the 20th week of gestation; however, its implementation becomes mandatory beyond the 23rd week, whereas its utility between the 20th and 23rd weeks remains controversial (9). In this context, ACOG recommends evaluating fetal heart rate (FHR) using Doppler ultrasound before and after surgical procedures, irrespective of gestational age. For pregnancies with a viable fetus, assessment of uterine contractions may also be considered. In contrast, the Royal College of Obstetricians and Gynaecologists does not advocate routine continuous fetal monitoring in healthy women without major obstetric risk factors; however, such monitoring is advised when evidence of fetal compromise exists. Additionally, ACOG recommends that decisions regarding intraoperative fetal monitoring be individualized by a multidisciplinary team (MDT), taking into account maternal characteristics and the planned surgical procedure (11).

Based on these considerations, fetal monitoring during lumbar disc surgery may provide clinicians with valuable information regarding fetal well-being and allow early recognition of potential changes in fetal condition (4). Regarding intraoperative fetal assessment, the authors recommended monitoring maternal hemodynamic parameters, including blood pressure and oxygenation, to maintain appropriate physiological conditions for the fetus, while uterine contractions may be assessed using a tocodynamometer. In addition, for pregnancies

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in which fetal viability has not yet been achieved, they suggested restricting FHR monitoring to the periods before and after surgery rather than throughout the procedure (12).

**Monitoring Methods**

Cardiovascular Monitoring: Doppler ultrasound and fetal heart rate (FHR) monitoring enable continuous assessment of fetal cardiac activity, including changes in heart rate, movements, and physiological responses throughout the surgical procedure. These techniques may assist in the early detection of fetal distress or other potential concerns (4).

Echocardiography: In selected situations, fetal echocardiography may be utilized to provide a comprehensive assessment of cardiac anatomy and identify possible structural abnormalities of the fetal heart (4).

Response to Anesthetic Agents: Evaluation of fetal heart rate variations and fetal reactions to anesthetic exposure constitutes an important component of intraoperative fetal surveillance. Since some anesthetic agents may influence fetal cardiac function, their use requires careful consideration and appropriate monitoring (4).

**Radiation Exposure During Surgery**

Intraoperative exposure to ionizing radiation may potentially exert adverse effects on the developing fetus (7). To minimize these potential hazards, various radiation safety protocols have been documented in the literature. For instance, a case report by Mitha et al. described the use of a single lateral C-arm fluoroscopic image to confirm the correct vertebral level, while incorporating the ALARA (as low as reasonably achievable) principle and employing fetal shielding with lead aprons placed over the maternal abdomen (7). In contrast, a case report by Takaishi et al. reported that lateral fluoroscopy was used twice during the procedure: once during patient positioning and once during retractor placement (2).

**Complications from Surgery**

Literature estimates suggest that the cumulative risk of complications following a lumbar discectomy stands at around 5.6%, with up to 2% of patients potentially necessitating a secondary surgical intervention (12).

Among the postoperative complications that could impact both pregnancy and subsequent delivery, wound dehiscence represents a noteworthy concern. According to the authors, neurosurgical procedures in this patient population may be associated with a higher likelihood of wound-related complications; this observation may be explained by altered biomechanical stresses at the closure site, including increased pressure and mechanical stretching caused by the enlarging gravid abdomen (12). To mitigate other potential complications, a case report by Yildiz et al. described the postoperative administration of T.E.D. anti-embolism stockings alongside low-molecular-weight heparin to lower the risk of thromboembolic events (13).

Currently, there appears to be a paucity of comprehensive data regarding complication rates during pregnancy and their direct association with maternal morbidity. This paucity may be influenced by publication bias, with underreporting of adverse events and complications among the possible contributing factors (12).

**Delivery**

A 6-month waiting period between disc excision and subsequent conception has been suggested for women undergoing surgery before pregnancy (6). In contrast, there is no consensus in the literature regarding the preferred mode of delivery after LDH surgery when cesarean delivery is not performed during the same surgical session (1).

Following LDH surgery during pregnancy, cesarean delivery may be selected more commonly than vaginal delivery because of concerns regarding symptom recurrence or neurological deterioration, including CES (6). In their review, Egu et al. observed that cesarean delivery performed after spinal surgery was associated with improved symptom outcomes and a lower frequency of persistent symptoms compared with cesarean delivery before surgery or vaginal birth after spinal surgery (11).

Similarly, Esmaeilzadeh and colleagues observed that patients requiring emergent spinal surgery during the early second trimester ultimately underwent cesarean

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delivery at term, despite achieving complete post-surgical recovery (12).

Conversely, previous lumbar disc herniation, CES, or spinal surgery performed during pregnancy should not be considered absolute contraindications to vaginal delivery (12). Available evidence suggests that vaginal birth does not appear to increase the risk of persistent neurological symptoms in the long term (1). A retrospective cohort study by Berkmann and Fandino reported that 54% of patients who underwent microsurgical interlaminectomy for lumbar disc disease achieved uncomplicated vaginal delivery. The remaining 46% underwent cesarean delivery at a mean gestational age of 39 weeks and 3 days (range: 36–42 weeks); however, most cesarean deliveries were performed for obstetric indications, while only four cases were directly related to worsening low back pain (12). Furthermore, Kummer et al. described a case in which a patient underwent successful vaginal delivery with epidural anesthesia 12 days after surgery without reported complications (10).

However, certain considerations should be taken into account when evaluating vaginal delivery in this patient population. Brown et al. suggested that labor induction in women with lumbar disc herniation could potentially increase the risk of neurological compromise, which may be associated with elevated epidural venous pressure during maternal pushing efforts (6).

Currently, evidence regarding safe and effective analgesic strategies for these patients during childbirth remains limited (12). Although neuraxial anesthesia is commonly regarded as the preferred approach for obstetric analgesia, its use in pregnant women with underlying spinal disorders has raised concerns regarding technical difficulty and potential failure (14). Nevertheless, existing reports support the feasibility of neuraxial techniques, with one study reporting that 53% of patients received this form of analgesia without reported complications (12).

In cases where cesarean delivery is required in these patients, anesthesiologists may favor general anesthesia over neuraxial techniques; however, the choice should be individualized according to the patient's clinical characteristics and assessed on a case-specific basis (14). For pregnant patients seeking labor analgesia, alternative approaches such as intravenous patient-controlled analgesia (IV-PCA) and nitrous oxide may also be considered appropriate options (14).

At present, no consensus has been reached regarding the most appropriate management strategy. Therefore, until more robust evidence becomes available, decisions regarding the mode of delivery and anesthetic approach should be made through multidisciplinary collaboration involving obstetricians, neonatologists, surgeons, and anesthesiologists (1).

## CONCLUSION

In conclusion, explicit clinical guidelines regarding the management of LDH during pregnancy are currently lacking. Although existing recommendations generally prioritize initial conservative care and advise prompt surgical intervention when required to avoid irreversible neurological deficits, the overall reliance on limited, low-level evidence constrains the strength of these conclusions. Consequently, therapeutic strategies for this unique patient population must be individualized and driven by a multidisciplinary team, meticulously balancing the clinical needs and well-being of both the mother and the fetus.

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