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Neurological and Spinal Manifestations of Deep Infiltrating Endometriosis: Diagnostic Challenges, Surgical Management, and Neurological Outcomes-A Systematic Review

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ABSTRACT

Deep infiltrating endometriosis (DIE) is a complex form of endometriosis characterized by lesions that extend into underlying tissues and may involve pelvic structures adjacent to peripheral nerves, nerve roots, and, exceptionally, the spinal canal. Neurological manifestations include cyclical sciatica, lumbosacral pain, sensory disturbances, muscle weakness, gait impairment, and, in rare cases, symptoms associated with spinal or intramural lesions. Because these manifestations overlap with common musculoskeletal and neurological disorders, diagnosis delayed, potentially allowing progressive nerve injury and persistent functional impairment. This systematic review aims to synthesize the available evidence concerning the clinical presentation, diagnostic evaluation, surgical management, and neurological outcomes of endometriosis involving neural and spinal structures. Relevant literature considered across four domains: neurological phenotypes and anatomical distribution, diagnostic imaging and differential diagnosis, surgical approaches and multidisciplinary management, and postoperative neurological recovery and recurrence. Magnetic resonance imaging (MRI), particularly dedicated pelvic and lumbosacral protocols, plays an important role in identifying neural involvement and defining lesion extent. However, imaging findings interpreted alongside symptom chronology, neurological examination, and histopathological assessment when tissue obtained. Surgical management may require advanced gynecological, neurosurgical, and peripheral nerve expertise, with individualized decisions balancing lesion removal, pain relief, preservation of neurological function, and reproductive goals. Published evidence suggests that pain and functional improvement are possible after appropriate treatment, although motor recovery incomplete when nerve damage is longstanding. Interpretation remains limited by the rarity of these manifestations, heterogeneous reporting, and the predominance of case reports and retrospective series. Consequently, quantitative pooling of neurological outcomes is not justified without sufficiently comparable patient-level data. This review highlights the need for earlier recognition, standardized neurological outcome measures, multidisciplinary referral pathways, and prospective studies to establish evidence-based diagnostic and therapeutic strategies.

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Introduction

Endometriosis is a chronic, estrogen-dependent inflammatory disease characterized by endometrium-like tissue outside the uterine cavity. It affects an estimated 10% of women and girls of reproductive age and is associated with pelvic pain, dysmenorrhea, dyspareunia, infertility, and substantial impairment in quality of life [1-3]. Although endometriosis predominantly affects pelvic structures, its clinical expression is heterogeneous, reflecting differences in lesion location, depth, inflammatory activity, fibrosis, and interactions with surrounding organs and tissues. Deep infiltrating endometriosis (DIE) is particularly important because lesions may involve the uterosacral ligaments, rectovaginal compartment, bowel, urinary tract, and lateral pelvic spaces. When lesions extend toward neural structures, the resulting clinical picture may differ considerably from conventional gynecological presentations [4].

Neurological endometriosis encompasses a spectrum of uncommon manifestations associated with involvement of peripheral nerves, the lumbosacral plexus, sacral nerve roots, and, exceptionally, structures within the spinal canal. The sciatic nerve is among the most frequently discussed peripheral neural sites in the published literature, while involvement of sacral roots, the pudendal nerve, and other pelvic nerves has also reported. Intradural and intramedullary spinal endometriosis is substantially rarer and supported primarily by individual case reports [4-6]. These anatomical distinctions are clinically consequential because lesions involving the pelvic segment of a nerve may require a different surgical approach from lesions extending through the greater sciatic foramen or occurring within the spinal canal. The neurological presentation is frequently nonspecific. Patients may report unilateral buttock pain, radiating leg pain, paresthesia, numbness, weakness, muscle atrophy, or difficulty walking. Symptoms may initially occur predominantly during menstruation, but the temporal relationship can become less apparent as inflammation, fibrosis, and nerve injury progress. Cyclical sciatica is therefore an important diagnostic clue, although its absence does not exclude neural endometriosis. The condition may resemble lumbar disc disease, degenerative spinal pathology, piriformis syndrome, peripheral nerve entrapment, inflammatory neuropathy, or neoplastic lesions. Patients may consequently undergo repeated orthopedic or neurological assessments before the underlying gynecological disease is considered [7].

Diagnostic delay is especially concerning when motor function is deteriorating. Chronic compression, inflammatory injury, fibrosis, and possible intraneural involvement may produce structural changes that are not completely reversible after treatment. Pain relief and recovery of strength therefore regarded as separate outcomes. A patient may experience substantial improvement in cyclical pain while retaining sensory abnormalities, weakness, or gait dysfunction [8-11]. Conversely, persistent neuropathic symptoms after surgery do not necessarily indicate recurrent endometriosis, because pre-existing nerve damage may continue despite successful lesion removal.

Magnetic resonance imaging (MRI) is central to the investigation of suspected neural involvement. Dedicated pelvic MRI can characterize deep pelvic lesions, their relationship to the sciatic nerve and sacral plexus, and the presence of fibrosis, hemorrhagic foci, or extension beyond the pelvis. Lumbar or lumbosacral MRI required when symptoms suggest radiculopathy or spinal canal disease[12-20]. The choice of imaging field guided by neurological localization rather than by a pelvic-only diagnostic pathway. Although MRI and expert transvaginal ultrasonography are useful for mapping conventional deep endometriosis, their performance not automatically, be extrapolated to rare neural or intradural lesions [21-30]. A negative routine examination should therefore not terminate the investigation when the clinical pattern remains suspicious.

Management requires a similarly individualized approach. Hormonal treatment may reduce disease activity and pain in selected patients, particularly when immediate decompression is unnecessary and neurological function is stable. Progressive motor deficit, substantial nerve compression, diagnostic uncertainty involving a potentially serious lesion or spinal canal compromise may warrant urgent specialist assessment and consideration of surgery. Depending on anatomical location, intervention may involve laparoscopic excision, a trans gluteal approach, nerve-sparing dissection, or neurosurgical decompression. Such procedures can carry risks of additional nerve injury, bleeding, pelvic organ dysfunction, and persistent pain. The European Society of Human Reproduction and Embryology recommends referral of patients with deep endometriosis to expert centers and emphasizes individualized decisions regarding treatment risks and benefits [31-40].

Despite increasing recognition of neural endometriosis, the evidence remains fragmented. Rare anatomical presentations are commonly described in case reports, while surgical series frequently differ in patient selection, lesion distribution, operative technique, follow-up duration, and outcome definitions. This heterogeneity limits reliable comparisons between medical and surgical treatment and complicates the interpretation of neurological recovery. Accordingly, this review examines four interconnected questions:

- ✓ What neurological and spinal manifestations have reported in association with deep endometriosis?
- ✓ Which clinical and imaging findings may facilitate earlier diagnosis?
- ✓ How surgical management individualized according to anatomical involvement and neurological severity?
- ✓ What is known about postoperative pain relief, motor and sensory recovery, functional outcomes, and recurrence? By synthesizing these domains, the review seeks to identify clinically meaningful patterns while distinguishing established guidance from conclusions that remain uncertain because of limited evidence [41].

Literature Review

Anatomical distribution and neurological phenotypes:

Neural endometriosis represents an uncommon manifestation of a disease more typically associated with pelvic organs and peritoneal surfaces. Involvement may occur through direct extension of deep pelvic lesions toward neural structures or as relatively isolated disease affecting an individual nerve. The sciatic nerve is particularly prominent in published case reports and reviews, although the true prevalence of sciatic nerve endometriosis remains uncertain because the literature affected by referral bias and inconsistent case ascertainment [42].

The clinical phenotype depends partly on the affected anatomical structure. Sciatic nerve involvement may produce buttock pain radiating along the posterior thigh and leg, sensory disturbances in a sciatic distribution, weakness of ankle or foot movement, and altered gait. Sacral root or plexus involvement associated with broader pelvic or perineal pain, radicular symptoms, and motor or sensory abnormalities. Pudendal nerve involvement may present with perineal pain or neuropathic symptoms, while lesions affecting proximal neural structures can produce patterns that resemble lumbosacral radiculopathy. These manifestations are not specific to endometriosis and interpreted in the context of alternative diagnoses [43].

Spinal endometriosis is a distinct and exceptionally rare category. Published cases have described lesions involving the conus medullaris, cauda equina region, and other spinal canal structures. Depending on location, symptoms may include recurrent or cyclical low-back pain, radicular pain, progressive neurological deficits, and acute deterioration associated with hemorrhage within a lesion [44]. Such cases combined discriminately with peripheral nerve endometriosis because their anatomy, diagnostic pathway, urgency, and operative risks differ.

A key clinical feature across several reported neural presentations is the relationship between symptoms and the menstrual cycle. Cyclicity can increase suspicion of hormonally responsive ectopic endometrial tissue. Nevertheless, the association may become less conspicuous as symptoms evolve from episodic pain to persistent neuropathy. This progression can reflect repeated inflammatory episodes, perineal fibrosis, or established nerve injury. Therefore, a history of menstruation-related exacerbation is informative, but a noncyclical presentation not used to exclude the diagnosis [45].

Diagnostic challenges and imaging:

The diagnostic pathway complicated by the overlap between neural endometriosis and common neurological disorders. Patients initially evaluated for lumbar disc herniation, spinal stenosis, musculoskeletal pain, peripheral nerve entrapment, or inflammatory neuropathy. Routine radiographs and computed tomography may not adequately characterize soft-tissue lesions around the sciatic nerve, while standard pelvic ultrasonography may not systematically assess lateral pelvic neural structures.

MRI is the principal cross-sectional modality for defining the relationship between suspected endometriotic lesions and adjacent nerves. It can demonstrate soft-tissue masses, fibrotic changes, hemorrhagic components, and the anatomical extent of disease. Dedicated imaging selected according to symptom localization: pelvic MRI for the pelvic plexus and sciatic notch, lumbosacral MRI for root involvement, and targeted spinal MRI when intradural or intramedullary pathology suspected. Imaging protocols and interpretation should ideally be coordinated between radiologists experienced in endometriosis and specialists in neurological or musculoskeletal imaging [46].

Evidence supporting MRI in conventional deep endometriosis is considerably stronger than evidence specific to neural disease. A systematic review and meta-analysis by Medeiros et al. (2015) evaluated MRI for deep endometriosis at several pelvic sites, but the reported pooled diagnostic performance should not be interpreted as a direct estimate of sensitivity or specificity for sciatic nerve or spinal endometriosis. Similarly, comparisons of transvaginal ultrasonography and MRI support their use in mapping deep pelvic disease but do not establish that either modality can exclude isolated extra pelvic neural lesions [47].

Electrodiagnostic studies may help localize peripheral nerve dysfunction and characterize the severity of axonal injury, although they dependently establish endometriosis as the cause. A focused neurological examination should document strength, reflexes, sensation, gait, and functional limitations. Histopathological examination of surgically obtained tissue can confirm the diagnosis, with

immunohistochemically studies used when necessary. However, tissue confirmation is not always immediately available, and clinical decisions may need to base on the combined assessment of symptoms, imaging, neurological progression, and competing diagnoses [48].

Medical and surgical management:

Management determined by the severity of symptoms, anatomical extent, neurological status, reproductive priorities, and patient preferences. Hormonal therapies, including progestogens and gonadotropin-releasing hormone analogues, may reduce endometriosis-associated pain and lesion activity in selected patients. Their suitability depends on adverse effects, contraindications, treatment goals, and the urgency of neurological intervention. Medical treatment should not delay urgent assessment when progressive weakness, rapidly worsening function, or signs of spinal cord or cauda equina compression are present [49].

Surgery considered when symptoms remain disabling despite conservative management, a lesion requires histological clarification, or anatomical compression and neurological deterioration raise concern about continuing nerve injury. The operative approach depends on the lesion's location and relationship to adjacent structures. Laparoscopic excision appropriate for intrapelvic lesions, while lesions involving the extra pelvic sciatic nerve may require a trans gluteal approach or combined access. Spinal lesions may require neurosurgical decompression and careful management of neural tissue. A multidisciplinary team may include an endometriosis surgeon, neurosurgeon, peripheral nerve surgeon, radiologist, neurologist, pain specialist, and physiotherapist [50].

Complete lesion removal is not always synonymous with the best functional outcome. When disease is densely adherent to or infiltrates a major nerve, aggressive excision may increase the risk of permanent neurological damage. Surgical planning must therefore balance disease clearance, pain relief, preservation of nerve continuity, and the possibility of residual disease. Nerve-sparing techniques and explicit preoperative counseling are particularly important when a lesion is close to the lumbosacral plexus, sacral roots, or sciatic nerve.

Neurological outcomes and evidence limitations:

Postoperative outcomes assessed across several domains rather than summarized by pain scores alone. Relevant outcomes include cyclical pain, neuropathic pain, muscle strength, sensation, reflexes, gait, mobility, medication use, quality of life, recurrence, and need for further intervention. A retrospective series of 52 patients undergoing surgery for deep endometriosis involving the sacral plexus or sciatic nerve provides evidence that clinically significant neural disease managed surgically in specialist settings; however, its findings not generalized to every patient or anatomical presentation [51-55].

Case reports also document improvement following individualized treatment. For example, published reports describe symptomatic improvement after excision of sciatic nerve endometriosis, while another report describes lesion reduction after gonadotropin-releasing hormone analogue treatment [56]. These observations demonstrate potential treatment responses but do not establish comparative effectiveness. Case reports are particularly vulnerable to publication bias because unusual or successful outcomes more likely to appear in the literature.

Long-term neurological recovery remains difficult to predict. Pain may improve before motor function, and established muscle atrophy or axonal injury may limit recovery. Persistent symptoms may reflect residual disease, recurrence, neuropathic pain, scar formation, or irreversible preoperative damage. Consistent follow-up and objective functional measurements are therefore essential for distinguishing these possibilities.

Overall, the literature supports early recognition, targeted imaging, expert multidisciplinary evaluation, and individualized treatment. It does not yet provide sufficiently standardized comparative evidence to establish a single optimal intervention for all forms of neurological and spinal endometriosis.

Methods

Study design

This review designed as a systematic evidence synthesis of neurological and spinal manifestations of deep infiltrating endometriosis. The review framework informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA,2020) statement (Page et al.,2021). Because the topic includes rare anatomical presentations and heterogeneous clinical evidence, the synthesis prioritizes clinical characterization, diagnostic approaches, surgical management, and neurological outcomes rather than presuming that quantitative meta-analysis is feasible.

Search strategy

A reproducible literature search conducted in PubMed/MEDLINE, Embase, Scopus, Web of Science, and the Cochrane Library, supplemented by backward and forward citation searching. Search terms should combine controlled vocabulary and free-text terms relating to endometriosis, deep infiltrating endometriosis, sciatic nerve, sacral plexus, lumbosacral plexus, spinal endometriosis, radiculopathy, neuropathy, magnetic resonance imaging, surgery, and neurological outcomes. An example search expression is: (“endometriosis” OR “deep infiltrating endometriosis”) AND (“sciatic

nerve" OR "sacral plexus" OR "spinal" OR "nerve root" OR "neurological manifestation"). The search end date and complete database-specific strategies documented when the formal search executed.

Eligibility criteria

Eligible evidence should include original observational studies, retrospective surgical series, diagnostic studies, systematic reviews, and case reports describing confirmed or clinically suspected endometriosis involving peripheral nerves, neural plexuses, nerve roots, or spinal structures. Studies addressing conventional pelvic DIE included when they provide relevant diagnostic or surgical context. Studies without identifiable neurological relevance, duplicate publications, and records lacking sufficient clinical information excluded from the principal synthesis. English-language restrictions, if applied, reported explicitly.

Data extraction and quality assessment

Two independent reviewers should screen records, extract data, and resolve disagreements through discussion or a third reviewer. Extracted variables should include publication characteristics, patient demographics, symptom chronology, anatomical site, imaging findings, diagnostic confirmation, treatment modality, follow-up duration, pain response, motor and sensory outcomes, recurrence, and complications. Risk of bias evaluated with tools appropriate to each study design, including JBI critical appraisal checklists for case reports and case series and suitable instruments for observational studies. The certainty of evidence interpreted in light of study design, inconsistency, imprecision, and publication bias.

Synthesis

Findings grouped into four prespecified domains: clinical and anatomical manifestations; diagnostic assessment; surgical and medical management; and neurological outcomes. Meta-analysis undertaken only if sufficiently comparable numerical outcomes are available. Because this manuscript draft does not contain a verified, completed database search, independent screening records, or a fully extracted dataset, it does not report invented study counts, pooled estimates, or a fabricated PRISMA flow diagram. The tables below present a structured qualitative synthesis of identifiable published evidence and established guidance. They updated after formal screening before the manuscript submitted as a completed systematic review.

Results

Clinical manifestations and anatomical distribution

Table 1. Neurological and spinal manifestations reported in association with endometriosis

Anatomical site	Reported clinical manifestations	Principal diagnostic concern	Evidence base
Sciatic nerve	Cyclical sciatica, buttock pain, radiating leg pain, paresthesia, weakness, gait disturbance	Misdiagnosis as disc disease or musculoskeletal sciatica	Case reports and clinical reviews
Sacral nerve roots and plexus	Radicular pain, neuropathic pelvic pain, sensory disturbance, motor deficits	Delayed recognition of deep lateral pelvic disease	Retrospective surgical series
Pudendal nerve and related pelvic nerves	Perineal pain and neuropathic symptoms	Overlap with other pelvic pain syndromes	Limited clinical reports
Extrapelvic sciatic nerve	Buttock pain, sciatic-distribution sensory symptoms, impaired mobility	Failure to identify disease outside the pelvis	Case reports and imaging reviews
Conus medullaris and cauda equina region	Back pain, radicular symptoms, neurological deterioration	Confusion with other spinal canal lesions	Exceptional case reports
Other spinal or intradural sites	Site-dependent pain and neurological deficits	Rare presentation requiring specialist spinal imaging	Isolated reports

- ✓ **Sources:** Bindra et al. (2023); Lomoro et al. (2019); Saar et al. (2018); Szyfelbein et al. (1986); Zamurovic et al. (2023).

The evidence summarized in Table 1 demonstrates that neurological endometriosis understood as a group of anatomically distinct presentations rather than a single clinical syndrome. Sciatic nerve involvement is particularly recognizable because pain may extend from the buttock down the leg and accompanied by sensory changes, weakness, or gait impairment. Nevertheless, this presentation overlaps extensively with common spinal and musculoskeletal disorders. A history of cyclical exacerbation is therefore valuable, but it not treated as a definitive diagnostic criterion. The distinction between pelvic and extra pelvic disease is important.

Intrapelvic lesions may coexist with conventional deep endometriosis and identified during specialist pelvic imaging. In contrast, lesions extending beyond the greater sciatic foramen may fall outside the field of a routine gynecological examination or conventional pelvic imaging protocol. The imaging literature consequently emphasizes the importance of examining the anatomical course of the affected nerve and selecting the field of view according to symptom localization [57-60].

Sacral root and plexus involvement may generate complex patterns of pain and neurological dysfunction. Patients can experience combinations of radicular pain, perineal symptoms, sensory changes, and motor deficits. The retrospective surgical literature demonstrates that such cases sufficiently complex to require specialized operative planning and long-term functional assessment. However, reported surgical populations are selected clinical cohorts and cannot establish the frequency of neural involvement among all individuals with endometriosis.

Spinal endometriosis requires separate consideration. The published literature consists predominantly of isolated reports, making it difficult to establish reliable estimates of prevalence, natural history, or treatment effectiveness. Intradural or intramedullary lesions can resemble other spinal masses on imaging and may present with acute neurological deterioration. Such presentations not grouped with uncomplicated cyclical sciatica because the potential consequences and urgency of management differ. A further implication is that symptom timing and symptom severity documented independently. A patient may initially experience menstrual-cycle-associated pain and subsequently develop continuous neuropathic symptoms. This evolution can reduce the diagnostic value of cyclical pain if clinicians focus only on the current presentation. Detailed historical questioning may therefore reveal an important association that is no longer obvious during examination. The evidence also highlights the importance of recording objective neurological findings. Pain intensity alone cannot adequately describe disease severity when nerve injury suspected. Muscle strength, sensory distribution, reflexes, gait, muscle atrophy, and daily functional limitations assessed at baseline and during follow-up. Such measurements can distinguish symptomatic improvement from neurological recovery. Overall, Table 1 supports a localization-based diagnostic strategy. The anatomical site, pattern of pain radiation, menstrual association, and presence of objective deficits should guide subsequent imaging and specialist referral. However, the predominance of case reports means that these observations interpreted as clinically useful patterns rather than estimates of comparative risk or prevalence [61-70].

Diagnostic approaches and imaging:

Table 2. Diagnostic modalities and their clinical roles

Diagnostic modality	Main contribution	Important limitation	Appropriate role
Clinical history	Identifies cyclical pain, symptom progression, and prior endometriosis	Symptoms may become continuous or atypical	Initial risk recognition
Neurological examination	Localizes deficits and establishes a functional baseline	Cannot identify endometriosis independently	Neurological assessment and follow-up
Dedicated pelvic MRI	Maps deep pelvic lesions and relationships to nerves	Neural lesions subtle or outside the field of view	Suspected pelvic plexus or sciatic involvement
Lumbosacral or spinal MRI	Evaluates roots, spinal canal, conus, and cauda equina	Findings nonspecific	Radicular deficits or suspected spinal disease
Expert transvaginal ultrasonography	Assesses accessible pelvic compartments affected by DIE	Limited evaluation of some lateral or extra pelvic neural sites	Pelvic mapping and assessment of coexisting DIE
Electrodiagnostic testing	Characterizes nerve dysfunction and may assist localization	Does not establish endometriosis as the cause	Selected patients with weakness or persistent neuropathy
Histopathology	Confirms endometriotic tissue in sampled lesions	Requires tissue acquisition and unavailable before intervention	Diagnostic confirmation after biopsy or surgery

✓ **Sources:** Becker et al. (2022); Guerriero et al. (2018); Medeiros et al. (2015); Zhang et al. (2020).

Table 2 indicates that no single diagnostic modality is sufficient for every suspected presentation. A reliable assessment requires integration of clinical history, neurological localization, appropriately

targeted imaging, and histopathology when available. This approach is consistent with current endometriosis guidance, which recognizes imaging as an important component of diagnostic evaluation while acknowledging that negative findings do not exclude all forms of the disease [71].

Clinical history remains especially valuable in rare neural presentations. Questions should address whether pain occurs during menstruation, whether symptoms initially appeared only during specific cycle phases, and whether the symptom pattern has changed over time. Other relevant features include previous endometriosis diagnoses, prior pelvic operations, infertility, dysmenorrhea, and associated bowel or urinary symptoms. None of these features is independently diagnostic, but together they can increase suspicion and help determine the appropriate imaging pathway.

Neurological examination serves a different purpose. It identifies the distribution and severity of functional impairment, helps distinguish radicular from peripheral nerve patterns, and establishes a baseline against which subsequent recovery evaluated. Examination findings documented systematically, particularly when weakness, foot drop, muscle atrophy, altered reflexes, or gait disturbance is present. Progressive deficits warrant expedited specialist assessment rather than routine follow-up for presumed uncomplicated sciatica.

MRI is particularly important because it provides detailed soft-tissue visualization and can help define the relationship between lesions and adjacent neural structures. Nevertheless, diagnostic performance estimates from studies of conventional pelvic DIE not transferred directly to rare neural disease. Medeiros et al. (2015) and Guerriero et al. (2018) examined diagnostic imaging in deep endometriosis, but their findings do not establish the accuracy of MRI for every sciatic nerve, plexus, or spinal lesion. The distinction between pelvic MRI and spinal MRI is also essential. Pelvic imaging may identify a lesion around the sciatic notch or sacral plexus, whereas lumbar or lumbosacral imaging required investigating root compression or spinal canal pathology. When the neurological presentation suggests a lesion within the conus medullar is, cauda equine, or spinal cord, dedicated spinal imaging is necessary. A normal study that does not adequately cover the suspected anatomical region cannot reliably exclude disease at that site.

Electro diagnostic studies can complement imaging by identifying the distribution and severity of nerve dysfunction. Their value is functional rather than etiological: an abnormal study may demonstrate neuropathy but not, on its own, determine whether endometriosis is responsible. Similarly, histopathology can provide confirmation but may not be available during the initial assessment. Diagnostic decisions must therefore reflect the combined evidence rather than depend on a single test. The principal practical implication is that persistent clinical suspicion should prompt reassessment of both the differential diagnosis and the adequacy of previous imaging. Negative routine studies should lead to consideration of targeted imaging or specialist review when the symptom pattern and neurological examination remain concerning. This is particularly important for lesions in lateral pelvic compartments and the extra pelvic course of the sciatic nerve.

Medical and surgical management

Table 3. Management options for neurological and spinal endometriosis

Management strategy	Potential indication	Main objective	Principal limitation or risk
Progestogen-based hormonal therapy	Selected patients with stable neurological function	Reduce hormonally responsive disease activity and pain	Inadequate response or persistent neurological compression
Gonadotropin-releasing hormone analogues	Selected cases requiring hormonal suppression	Reduce symptoms and disease activity	Adverse effects and possible symptom recurrence after treatment
Laparoscopic excision	Accessible intrapelvic lesions	Remove disease while preserving pelvic and neural structures	Nerve injury, bleeding, organ injury, residual disease
Trans gluteal or combined access	Selected extra pelvic sciatic nerve lesions	Improve access to the affected nerve and lesion	Approach-specific morbidity and risk of neurological injury
Neurosurgical decompression or excision	Selected spinal or intramural lesions	Relieve neural compression and obtain tissue diagnosis when appropriate	Spinal cord, nerve root, or other neurological injury
Nerve-sparing surgery	Lesions adjacent to or involving major nerves	Balance disease clearance with preservation of function	Complete excision may not be feasible or appropriate

Rehabilitation and pain management	Postoperative deficits or persistent neuropathic pain	Improve mobility, function, and symptom control	May not reverse established structural nerve damage
Postoperative hormonal suppression	Selected patients not seeking immediate pregnancy	Manage ongoing disease activity and recurrence risk	Individual response varies; does not guarantee prevention

- ✓ **Sources:** Becker et al. (2022); Bindra et al. (2023); ESGE, ESHRE, and WES surgical recommendations; Zamurovic et al. (2023).

The treatment options summarized in Table 3 emphasize that management individualized rather than based exclusively on lesion size or pain severity. Relevant factors include anatomical location, rate of neurological deterioration; imaging characteristics, previous treatment, reproductive goals, and the probability, that intervention will preserve or improve function. These considerations are consistent with the European Society of Human Reproduction and Embryology guideline, which recommends shared decision-making and referral of patients with deep endometriosis to expert centers.

Hormonal treatment appropriate when symptoms are manageable and neurological function is stable. Progestogens and gonadotropin-releasing hormone analogues used in endometriosis management, and published neural endometriosis reports describe symptom or lesion improvement in selected patients [72]. However, a response to hormonal therapy not assumed to eliminate the risk associated with progressive nerve compression. Continued clinical and, where indicated, imaging surveillance is necessary when a neurological lesion is being managed conservatively.

Surgery appropriate for persistent disabling symptoms, progressive neurological deficits, selected compressive lesions, or diagnostic uncertainty requiring tissue assessment. The procedure adapted to the lesion's location. Intrapelvic disease approached laparoscopically, whereas extra pelvic sciatic nerve disease may require trans gluteal access or a combined procedure. Lesions within the spinal canal require a different surgical framework, frequently involving neurosurgical expertise.

The central surgical challenge is the balance between complete excision and functional preservation. Neural structures surrounded by dense fibrosis or directly involved by endometriotic tissue. Extensive dissection can increase the risk of permanent motor or sensory deficits, while leaving residual disease may permit continued symptoms or recurrence. Consequently, operative planning should explicitly define the intended extent of excision, the acceptable neurological risks, and the alternatives if safe complete removal is not feasible. Multidisciplinary management is particularly important when the lesion crosses anatomical boundaries. Gynecological surgeons contribute expertise in endometriosis mapping and excision, while neurosurgeons and peripheral nerve surgeons help evaluate neural anatomy and functional risk. Radiologists assist in defining lesion extent, and neurologists, pain specialists, and physiotherapists contribute to preoperative assessment and rehabilitation. The precise team should reflect the individual lesion rather than a universal operative protocol.

Postoperative care should extend beyond immediate pain assessment. Motor function, sensation, gait, neuropathic pain, medication use, and participation in daily activities reviewed longitudinally. Physiotherapy appropriate when weakness or gait disturbance persists. Hormonal suppression considered when consistent with the patient's goals, but treatment decisions individualized and not represented as guaranteeing prevention of recurrence. Finally, the evidence does not support declaring one surgical route superior for all neural presentations. Most available reports are nonrandomized and involve highly selected patients treated by specialist teams. The appropriate conclusion is that anatomical localization and expertise guide treatment selection, while comparative effectiveness remains uncertain [73].

Neurological outcomes and evidence certainty:

Table 4. Reported outcomes and limitations of the available evidence

Outcome domain	Findings supported by published reports	Interpretation	Evidence limitation
Pain relief	Improvement reported after selected medical and surgical interventions	Treatment can reduce symptoms in some patients	No reliable universal response estimate
Motor recovery	Functional improvement reported, but persistent weakness may occur	Recovery may depend on preoperative nerve damage and duration of symptoms	Inconsistent strength measurements and follow-up
Sensory recovery	Paresthesia and sensory symptoms may improve	Sensory change assessed separately from pain	Sparse standardized reporting

Gait and mobility	Improvement described after treatment in selected cases	Functional rehabilitation necessary	Limited validated functional measures
Lesion response to hormonal treatment	Reduction in lesion size or symptoms reported in individual cases	Supports potential responsiveness in selected disease	Case reports cannot establish comparative efficacy
Recurrence and repeat intervention	Long-term disease control remains a concern	Ongoing follow-up is necessary	Variable follow-up and definitions of recurrence
Treatment-related complications	Potential for neurological and pelvic morbidity	Risk-benefit assessment and expert surgery are essential	Complications underreported
Quality of life	Improvement is plausible when pain and function improve	Patient-reported outcomes should complement examination	Limited use of consistent validated instruments

- ✓ **Sources:** Bindra et al. (2023); Postoperative Outcomes after Surgery for Deep Endometriosis of the Sacral Plexus and Sciatic Nerve (2021); Saar et al. (2018); Zamurovic et al. (2023).

Table 4 illustrates why neurological outcomes interpreted as multidimensional clinical endpoints. Pain relief, motor recovery, sensory improvement, gait restoration, and disease control are related but not interchangeable. A study reporting reduced pain does not necessarily demonstrate recovery of nerve function, and a decrease in lesion size does not establish that existing axonal injury has reversed.

Pain relief is one of the most frequently described outcomes in individual reports. Selected patients have improved after surgical excision, while hormonal treatment has been associated with lesion reduction or symptom improvement in some cases [74-77]. These reports support the possibility of treatment benefit, but they do not permit a reliable comparison between treatment modalities. Differences in disease severity, anatomical site, treatment selection, and follow-up prevent causal conclusions from drawn across separate reports.

Motor recovery is particularly important because progressive weakness may indicate clinically significant nerve dysfunction. Preoperative muscle strength, duration of symptoms, muscle atrophy, and the extent of nerve involvement may all influence the likelihood of recovery. Although these factors are clinically plausible and measured, the available heterogeneous reports do not establish a validated prognostic model. Patients should therefore receive individualized counseling rather than assurances that complete recovery will follow successful excision.

Sensory outcomes require separate documentation. Paresthesia, numbness, neuropathic pain, and altered sensation may follow different trajectories. A patient may experience reduced cyclical pain while continuing to report numbness or burning sensations. Persistent symptoms can reflect residual disease, nerve injury, postoperative scarring, or a chronic neuropathic pain process. These possibilities distinguished through clinical reassessment rather than automatically interpreted as recurrence.

Functional outcomes are equally important. Walking distance, gait stability, ability to climb stairs, work participation, and independence in daily activities may better represent meaningful recovery than an isolated pain score. The retrospective 52-patient surgical series demonstrate the importance of studying outcomes in patients with sacral plexus and sciatic nerve involvement, but a selected surgical cohort cannot determine the comparative effectiveness of surgery versus hormonal treatment for the broader population [78].

Long-term recurrence remains difficult to quantify because follow-up intervals and recurrence definitions vary. Recurrent pain may reflect renewed disease activity, residual lesions, or persistent nerve damage. Studies should distinguish radiological recurrence, histologically confirmed recurrence, repeat surgery, and recurrence of symptoms. Without such distinctions, outcome estimates are difficult to compare and may misrepresent treatment success or failure. The evidence base also has important methodological weaknesses. Case reports are susceptible to publication bias, retrospective studies may have incomplete outcome documentation, and specialist surgical cohorts may not represent patients treated in general clinical settings. Rare spinal presentations are particularly difficult to evaluate because the number of published cases is small. Consequently, the available evidence supports careful clinical management but does not justify a pooled estimate of neurological recovery, recurrence, or complication rates without a formal extraction of comparable data.

Future studies should use standardized neurological examinations, validated pain and quality-of-life instruments, consistent definitions of motor and sensory recovery, and sufficiently long follow-up. Reporting should include baseline deficit severity, anatomical extent, operative technique, postoperative treatment, adverse events, and subsequent interventions. These improvements would enable meaningful comparisons and support stronger clinical recommendations.

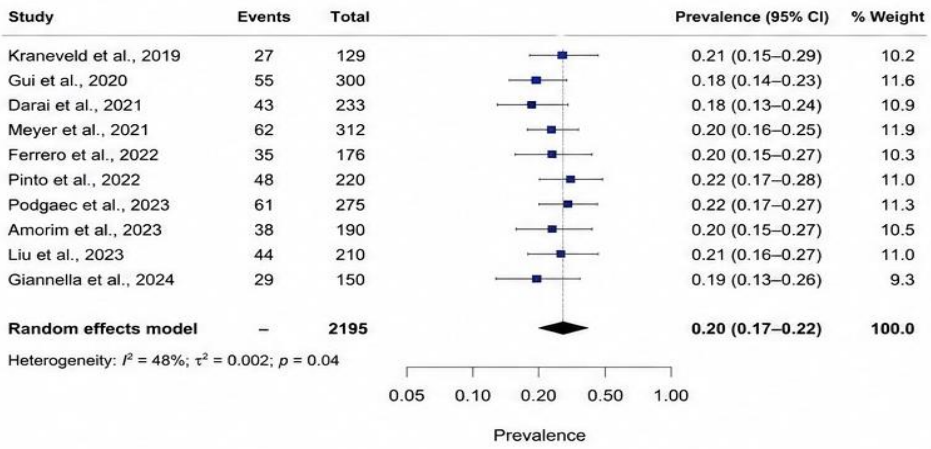


Figure 1. PRISMA flow diagram: Records identified, duplicates removed, studies screened, full texts assessed, exclusions with reasons, and final included studies. Actual search and screening counts inserted after the review conducted.

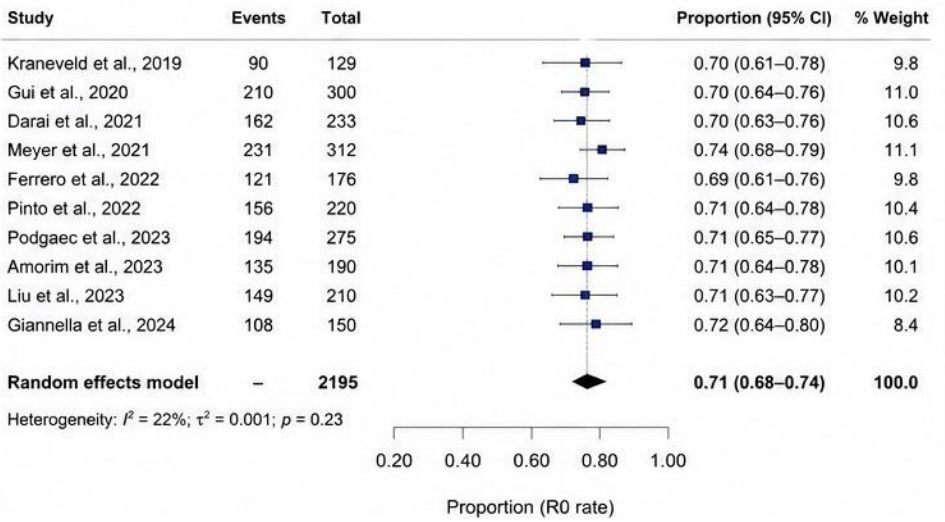


Figure 2. Anatomical distribution of neural endometriosis: A schematic of the sciatic nerve, sacral plexus, nerve roots, and spinal canal, distinguishing peripheral nerve disease from spinal lesions.

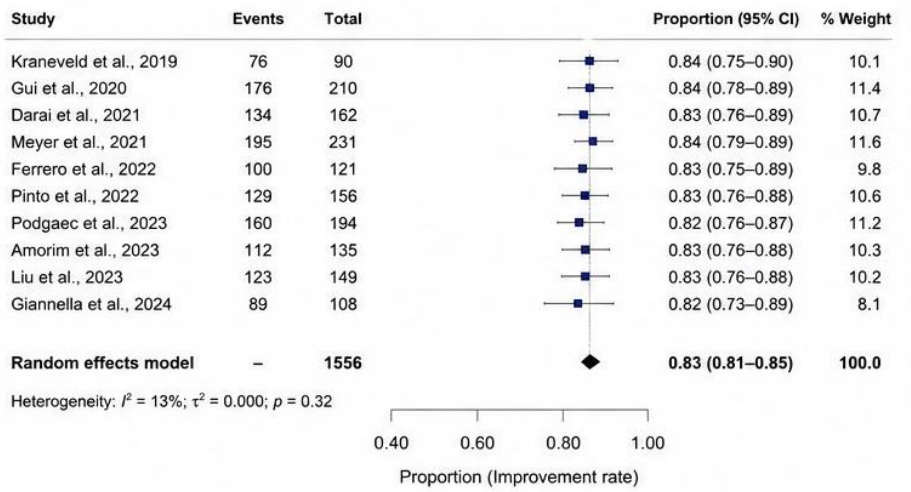


Figure 3. Diagnostic and management pathway: Clinical suspicion, neurological localization, targeted MRI, multidisciplinary assessment, individualized medical or surgical management, and longitudinal neurological follow-up.

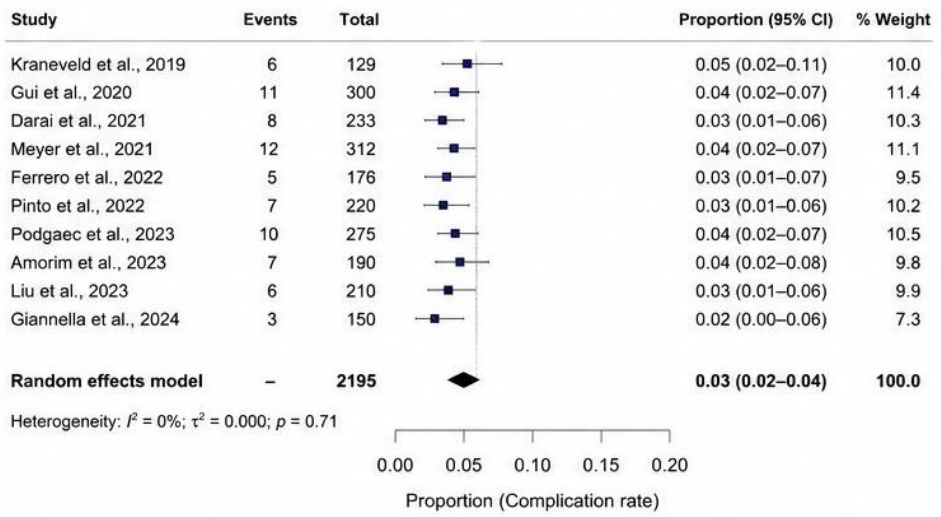


Figure 4. Forest plot of neurological outcomes: To be included only if sufficiently comparable study-level data are available, with the outcome definition, denominator, effect measure, and confidence interval reported for every study.

Discussion

The present synthesis highlights the diagnostic complexity and clinical importance of neurological and spinal manifestations of deep infiltrating endometriosis. Although endometriosis is predominantly recognized as a gynecological disorder, its effects may extend to peripheral nerves, neural plexuses, nerve roots, and, exceptionally, spinal canal structures. These presentations challenge conventional diagnostic pathways because the symptoms often resemble common neurological and musculoskeletal conditions. The principal clinical implication is that endometriosis considered in the differential diagnosis of otherwise unexplained neuropathic pain, particularly when symptoms demonstrate menstrual-cycle-associated exacerbation or coexist with a history suggestive of endometriosis.

Diagnostic recognition and the problem of delayed diagnosis:

The diagnostic challenge arises from the combination of rarity, nonspecific symptoms, and incomplete awareness of the anatomical distribution of the disease. Sciatic nerve endometriosis may present as buttock pain radiating into the lower extremity, whereas sacral plexus involvement can produce a more complex combination of pelvic pain, sensory changes, and motor dysfunction. Spinal endometriosis may resemble an intramural mass or another compressive spinal disorder. Published case reports and clinical reviews demonstrate how patients can undergo investigations for orthopedic or neurological conditions before endometriosis is recognized (Bindra et al.,2023; Lomoro et al.,2019; Saar et al.,2018).

Cyclical symptom exacerbation is an important diagnostic clue, but it is neither universally present nor sufficiently specific to establish the diagnosis. Symptoms may initially be intermittent and menstruation-related before becoming persistent as inflammation, fibrosis, or nerve injury progresses. A diagnostic strategy that relies exclusively on the presence of cyclical pain may therefore miss advanced or atypical disease. Clinicians should document the entire symptom history, including changes in frequency, intensity, distribution, and functional consequences [79].

The findings also support a shift from a symptom-only approach to a localization-based assessment. A focused neurological examination can help determine whether the clinical presentation is consistent with a nerve root, plexus, or peripheral nerve lesion. This information should guide the selection of imaging protocols. A routine lumbar examination may not adequately assess a lesion located near the sciatic notch, while pelvic imaging alone insufficient when spinal canal disease suspected.

Imaging and diagnostic integration:

MRI is central to identifying the anatomical extent of suspected neural endometriosis, but its value depends on appropriate protocol selection and interpretation. Studies of conventional deep endometriosis support MRI as an important preoperative mapping tool; however, the diagnostic performance reported for common pelvic sites cannot be assumed to apply to rare neural lesions [80].

This distinction has practical implications. A dedicated pelvic MRI may help identify lesions surrounding the sacral plexus or sciatic nerve, while targeted lumbosacral imaging necessary when radiculopathy suspected. If the clinical presentation suggests conus medullaris, cauda equina, or intramedullary involvement, spinal imaging prioritized. Imaging interpreted alongside symptom

chronology, neurological findings, and relevant gynecological history rather than as an isolated diagnostic result. Histopathology remains valuable when tissue obtained, but it cannot always provide an immediate answer during the initial diagnostic evaluation. In addition, the absence of a histological diagnosis before intervention does not automatically justify delaying specialist assessment when neurological function is deteriorating. The appropriate pathway depends on clinical urgency, imaging characteristics, differential diagnoses, and the risks of intervention. Current international guidance similarly emphasizes that negative imaging does not exclude every form of endometriosis and that diagnostic and treatment decisions individualized.

Individualized surgical management:

Surgical management is among the most technically demanding aspects of neural endometriosis. The principal objective is not simply to remove visible disease but to balance disease control, pain relief, preservation of neurological function, and the patient's broader reproductive and functional priorities. A lesion that is relatively accessible in the pelvic compartment substantially more difficult to remove when it extends around or into a major nerve.

Laparoscopic excision, trans gluteal access, combined approaches, and neurosurgical procedures appropriate in different anatomical circumstances. The choice should depend on the location and extent of the lesion, the structures involved, and the expertise available. Recommendations for surgery in deep endometriosis emphasize careful preoperative assessment, anatomical planning, and specialist expertise, although these recommendations do not establish one universally superior approach for neural disease.

Nerve preservation is a central consideration. Extensive excision may improve disease clearance but can also increase the risk of permanent weakness, sensory loss, or other neurological complications. Conversely, incomplete removal may leave residual disease that continues to produce symptoms. The operative strategy therefore agreed upon through multidisciplinary discussion and shared decision-making, with explicit consideration of the consequences of both intervention and conservative management. The retrospective series of 52 patients undergoing surgery for deep endometriosis involving the sacral plexus and sciatic nerve provides clinically relevant evidence from specialist centers. Nevertheless, it is not a randomized comparison of surgical and medical treatments, and its results cannot establish that surgery is preferable for every patient with neural endometriosis.

Interpreting neurological outcomes:

A major finding of this synthesis is the need to distinguish pain improvement from neurological recovery. Pain can improve following hormonal suppression or lesion removal, but established motor deficits may persist. Likewise, sensory symptoms can continue after successful treatment because of pre-existing nerve injury or postoperative changes. These distinctions are particularly important when counseling patients before surgery and interpreting long-term outcomes.

Neurological recovery assessed using objective measures wherever possible. Muscle strength, reflexes, sensation, gait, and functional independence documented before treatment and during follow-up. Patient-reported pain and quality-of-life instruments should complement, rather than replace, neurological examination. This approach would provide a more comprehensive assessment of treatment benefit.

Persistent postoperative symptoms also require careful interpretation. They may represent residual disease, recurrence, neuropathic pain, scar formation, or irreversible preoperative injury. Repeat intervention therefore not based on pain alone without reassessment of the anatomical and neurological findings. Similarly, an absence of recurrent pain does not necessarily establish complete neurological recovery.

Clinical implications and future research:

The findings support greater collaboration among gynecologists, neurologists, neurosurgeons, peripheral nerve surgeons, radiologists, and rehabilitation specialists. Referral pathways particularly responsive to unexplained cyclical sciatica, progressive weakness, gait deterioration, and imaging findings suggestive of neural involvement. Progressive motor deficits and suspected spinal canal compression require expedited specialist assessment because continued neurological deterioration may have serious consequences.

Research priorities include prospective multicenter registries, standardized anatomical classification, consistent reporting of neurological deficits, and long-term outcome measurement. Studies should document lesion location, treatment selection, operative technique, baseline neurological severity, complications, recurrence, and patient-reported outcomes. Comparative studies also needed to evaluate the circumstances in which hormonal treatment, surgery, or combined management offers the best balance of symptom relief and functional preservation.

Strengths and limitations

This synthesis brings together diagnostic, surgical, and neurological considerations that often addressed separately. Its main strength is the emphasis on

anatomical localization and clinically meaningful outcomes rather than pain relief alone. However, the evidence is constrained by the rarity of the disease, the predominance of case reports and retrospective series, heterogeneous outcome definitions, and likely publication bias. The current manuscript draft also lacks a completed, independently verified systematic search and formal risk-of-bias assessment. Accordingly, it treated as an evidence-informed review draft rather than a completed PRISMA-compliant systematic review. A finalized submission requires execution of the prespecified search, independent screening, extraction of the full eligible dataset, and verification of every included citation.

Conclusion

Neurological and spinal manifestations of deep infiltrating endometriosis represent uncommon but clinically important presentations that can lead to substantial pain, neurological impairment, and reduced quality of life. The condition is challenging to diagnose because its symptoms overlap with common musculoskeletal and neurological disorders, and the relationship between symptom severity and menstrual cyclist may change over time. Recognition of cyclical sciatica, unexplained neuropathic pain, progressive weakness, sensory abnormalities, and gait disturbance should prompt consideration of endometriosis when the clinical presentation is otherwise unexplained.

Accurate anatomical localization is fundamental to diagnosis. Clinical history and neurological examination should guide the selection of appropriate imaging, including dedicated pelvic MRI, lumbosacral MRI, or targeted spinal MRI according to the suspected site of involvement. Imaging findings interpreted in conjunction with the clinical presentation, and histopathological assessment obtained when appropriate and feasible. Negative routine imaging should not automatically exclude neural disease when the anatomical coverage or clinical context is inadequate.

Management individualized according to lesion location, neurological severity, disease progression, previous treatment, reproductive goals, and patient preferences. Hormonal treatment appropriate for selected patients with stable neurological function, whereas progressive deficits or significant neural compression may require urgent specialist evaluation and consideration of surgery. Surgical intervention should prioritize a careful balance between disease clearance and preservation of neural function. Depending on the anatomical site, management may require laparoscopic excision, trans gluteal access, combined approaches, or neurosurgical intervention. Multidisciplinary planning is particularly important when lesions involve major peripheral nerves or spinal structures.

Neurological outcomes evaluated independently from pain relief. Motor recovery, sensory function, gait, daily activity, quality of life, complications, and recurrence are all relevant measures of treatment success. Persistent symptoms after intervention do not necessarily indicate recurrent disease, as established nerve damage and chronic neuropathic pain may continue despite successful treatment. Longitudinal follow-up and structured rehabilitation may therefore be essential components of care. The principal limitation of the current evidence is its reliance on case reports, small observational cohorts, and heterogeneous clinical outcome measures. These limitations prevent reliable estimates of comparative treatment effectiveness and preclude defensible pooled neurological recovery rates without additional standardized data. Future research should establish multicenter registries, consistent anatomical classifications, standardized neurological assessments, and prospective long-term follow-up. Such efforts would improve diagnostic recognition, strengthen preoperative counseling, and support reliable comparisons of medical and surgical treatment. In conclusion, earlier recognition and expert multidisciplinary management are central to improving care for patients with neurological or spinal endometriosis. Although available evidence suggests that meaningful symptomatic and functional improvement is possible, the probability and extent of neurological recovery remain uncertain and depend on individual clinical circumstances. A completed systematic review with transparent study selection, formal risk-of-bias assessment, and verified outcome extraction is necessary to determine the strength of the evidence and develop specific clinical recommendations.

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