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Research Article

Association of Lumbar Spinal Canal Stenosis with Benign Prostatic Hyperplasia and Neurogenic Bladder Dysfunction: An MRI Study

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Abstract

Lumbar spinal canal stenosis and lower urinary tract dysfunction frequently coexist in older adults, while neurogenic bladder dysfunction associated with congenital spinal abnormalities represents an important urological problem in children. Magnetic resonance imaging provides detailed assessment of spinal canal narrowing, neural compression, degenerative changes, and congenital lumbosacral abnormalities. This prospective observational MRI study evaluated the association between lumbar spinal canal stenosis, benign prostatic hyperplasia, and bladder dysfunction in adults, while additionally characterizing neurogenic bladder-related spinal abnormalities in a pediatric subgroup. A total of 180 patients were included, comprising 140 adults aged ≥40 years and 40 children aged 5–17 years. All participants underwent MRI evaluation of the lumbosacral spine, while adults underwent clinical urological assessment and prostate evaluation. Pediatric participants were evaluated for neurogenic bladder symptoms and congenital or developmental spinal abnormalities. Among adults, benign prostatic hyperplasia was identified in 88 (62.9%) patients, while MRI evidence of lumbar spinal canal stenosis was present in 82 (58.6%). Moderate-to-severe canal stenosis was significantly more frequent among adults with urinary dysfunction than among those without urinary symptoms (71.4% vs. 38.5%, $p < 0.001$). Neurogenic bladder-type dysfunction was identified in 29 (20.7%) adults and 24 (60.0%) pediatric patients. In the pediatric subgroup, tethered cord, spinal dysraphism, and sacral developmental abnormalities were the most frequent MRI findings. Among adults with both BPH and significant lumbar canal stenosis, urinary dysfunction was more frequent than in patients with BPH without significant stenosis (65.5% vs. 34.1%, $p = 0.002$). Increasing severity of lumbar canal stenosis was associated with increasing urinary dysfunction. The findings suggest that lumbar spinal canal stenosis may contribute to lower urinary tract dysfunction in adults with coexisting BPH, while congenital lumbosacral abnormalities

represent an important structural substrate for neurogenic bladder dysfunction in children. MRI can provide valuable anatomical information for identifying patients in whom spinal pathology may contribute to urinary symptoms.

Keywords: Lumbar spinal canal stenosis, benign prostatic hyperplasia, neurogenic bladder, magnetic resonance imaging, urinary dysfunction, spinal dysraphism, tethered cord, pediatric urology.

Introduction

Lower urinary tract dysfunction is a common clinical problem that may result from urological, neurological, spinal, or functional abnormalities. Urinary frequency, urgency, nocturia, incomplete bladder emptying, urinary retention, and incontinence can substantially impair quality of life. In adults, bladder outlet obstruction secondary to benign prostatic hyperplasia is a major contributor to lower urinary tract symptoms, particularly among aging men. However, neurological and spinal disorders may coexist with prostatic obstruction and may contribute independently to urinary dysfunction.[1–3]

Lumbar spinal canal stenosis is a common degenerative spinal disorder characterized by narrowing of the spinal canal and/or neural foramina, potentially resulting in compression of the cauda equina and lumbosacral nerve roots. Patients typically present with low back pain, radicular symptoms, neurogenic claudication, lower-limb weakness, or sensory abnormalities. In advanced disease, compression of the lumbosacral neural structures may also interfere with bladder and bowel function.[4-5]

The relationship between spinal pathology and urinary dysfunction is clinically important because urinary symptoms in patients with lumbar spinal disease may initially be attributed to more common urological conditions. In older men, this distinction becomes particularly relevant because benign prostatic hyperplasia is highly prevalent and can independently produce frequency, urgency, nocturia, weak urinary stream, hesitancy, and incomplete emptying. Consequently, the coexistence of BPH and lumbar spinal canal stenosis may make attribution of urinary symptoms challenging.[6-8]

MRI is the preferred imaging modality for evaluating lumbar spinal canal stenosis because it allows direct visualization of the spinal canal, cauda equina, intervertebral discs, ligamentous structures, and neural compression. MRI can also characterize the degree of central canal narrowing and associated foraminal or lateral recess stenosis. Quantitative and qualitative MRI parameters may therefore help identify patients with spinal abnormalities that could plausibly contribute to bladder dysfunction.

The neurological control of the lower urinary tract depends on coordinated interaction between the cerebral cortex, pontine micturition center, spinal cord, peripheral nerves, detrusor muscle, and urethral sphincter. Lesions involving the sacral spinal cord or cauda equina can impair this complex pathway and produce neurogenic lower urinary tract dysfunction. Severe compression of lumbosacral nerve roots may therefore produce urinary retention, impaired sensation, overflow incontinence, or other bladder abnormalities.[9-10]

The clinical significance of urinary symptoms associated with lumbar spinal disease is particularly high because severe bladder dysfunction may indicate advanced neurological compromise. New urinary retention or loss of bladder control in a patient with significant lumbar canal stenosis may represent cauda equina involvement and requires prompt clinical assessment.

In adults, the interpretation of urinary symptoms becomes more complicated because BPH is common. The presence of BPH does not necessarily explain every

urinary complaint, particularly when symptoms are disproportionate to the degree of prostate enlargement or when neurological symptoms are also present. Evaluating spinal imaging alongside urological findings may therefore provide a more comprehensive explanation of lower urinary tract dysfunction.

Pediatric patients present a fundamentally different clinical context. BPH is not a meaningful diagnosis in children; however, neurogenic bladder dysfunction is an important pediatric problem, particularly in patients with spinal dysraphism, myelomeningocele, tethered cord, sacral agenesis, and related congenital abnormalities. Contemporary pediatric literature identifies spinal dysraphism as a major cause of neurogenic lower urinary tract dysfunction during childhood.

MRI plays an important role in pediatric assessment because it can demonstrate tethered cord, fatty filum, spinal dysraphism, syringomyelia, and other abnormalities associated with bladder dysfunction. Current pediatric guidelines recommend MRI as an important component of anatomical assessment when available, while urodynamic evaluation remains essential for characterizing the functional status of the bladder.

Previous pediatric MRI studies have demonstrated a substantial association between neurogenic bladder dysfunction and lumbosacral dysraphism. In one MRI-based pediatric study of 175 children with suspected neurogenic bladder, spinal dysraphism was identified in a substantial proportion of patients with spinal abnormalities, with myelomeningocele, meningocele, and sacral agenesis among the prominent findings.

The inclusion of both adult and pediatric populations in the present study therefore provides an opportunity to examine spinal contributions to urinary dysfunction across different age groups while recognizing the fundamentally different underlying mechanisms. In adults, the principal clinical question concerns whether lumbar canal stenosis contributes to urinary symptoms in patients who may also have BPH. In children, the focus is on MRI-detectable congenital or developmental lumbosacral abnormalities associated with neurogenic bladder dysfunction.

The distinction between anatomical spinal disease and functional bladder dysfunction is important. MRI demonstrates structural abnormalities but does not by itself establish neurogenic bladder. Functional assessment through clinical evaluation and, where indicated, urodynamic studies is necessary to characterize detrusor function, compliance, sphincter coordination, and bladder pressures. Pediatric guidelines specifically emphasize urodynamics, preferably video-urodynamics where available, in suspected neurogenic bladder.

Despite the clinical importance of both lumbar spinal disease and urinary dysfunction, studies evaluating the relationship between MRI-defined lumbar canal stenosis and lower urinary tract dysfunction in patients with coexisting BPH remain relatively limited. Furthermore, pediatric studies have generally focused on spinal dysraphism and neurogenic bladder rather than degenerative lumbar stenosis.

Therefore, the present study was designed to evaluate the association of MRI-defined lumbar spinal canal stenosis with urinary dysfunction and BPH in adults and to characterize MRI abnormalities associated with neurogenic bladder dysfunction in a pediatric subgroup. The study also aimed to determine whether increasing severity of lumbar spinal canal stenosis was associated with a higher frequency of urinary dysfunction.

Methodology

Study Design and Setting

This prospective observational study was conducted at Rahbar Medical and Dental College / Punjab Rangers Teaching Hospital, Lahore.

The study included both adult and pediatric patients referred for MRI evaluation because of urinary symptoms, lower urinary tract dysfunction, suspected spinal pathology, or combined urological and neurological symptoms.

Study Population

A total of 180 participants were enrolled:

- **Adult group:** 140 patients aged ≥40 years
- **Pediatric group:** 40 patients aged 5–17 years

The adult group was specifically evaluated for the relationship between BPH, lumbar spinal canal stenosis, and urinary dysfunction.

The pediatric group was evaluated for neurogenic bladder and MRI-detectable congenital/developmental lumbosacral abnormalities.

BPH was not assessed as a pediatric diagnosis.

Inclusion Criteria

Adults

Adults were included if they:

- Were aged ≥40 years.
- Had lower urinary tract symptoms or clinical suspicion of urinary dysfunction.
- Underwent MRI of the lumbosacral spine.
- Had adequate imaging quality for assessment of the lumbar spinal canal.
- Had clinical assessment of prostate-related urinary symptoms.

Pediatric Patients

Children were included if they:

- Were aged 5–17 years.
- Had urinary incontinence, recurrent urinary tract infection, urinary retention, abnormal voiding, or suspected neurogenic bladder.
- Underwent MRI of the lumbosacral spine.
- Had adequate MRI visualization of the conus and lumbosacral structures.

Exclusion Criteria

Patients were excluded if they had:

- Previous major lumbar spinal surgery.
- Known spinal cord injury.
- Active spinal infection.
- Incomplete MRI examination.
- Severe motion artifact preventing assessment.
- Known primary renal or bladder malignancy.
- In adults, previously diagnosed neurological disease unrelated to lumbar spinal pathology that could independently explain bladder dysfunction.

Adult Urological Assessment

Adult patients underwent clinical assessment of lower urinary tract symptoms, including:

- Frequency
- Urgency
- Nocturia
- Hesitancy
- Weak urinary stream
- Straining
- Incomplete bladder emptying
- Urinary retention
- Urinary incontinence

The International Prostate Symptom Score (IPSS) was recorded where available.

Prostate size was assessed using ultrasound and/or MRI. BPH was defined according to clinical and imaging findings in conjunction with urological assessment.

Pediatric Urological Assessment

Pediatric participants were assessed for:

- Daytime urinary incontinence
- Nocturnal enuresis
- Urinary urgency
- Urinary retention

- Recurrent urinary tract infection
- Weak or interrupted urinary stream
- Incomplete bladder emptying
- Constipation or bowel dysfunction
- Previous catheterization

Where clinically indicated, urodynamic or video-urodynamic studies were performed.

Urodynamic assessment is particularly relevant in pediatric neurogenic bladder because MRI demonstrates anatomy but does not independently establish bladder functional status. Current pediatric guidance emphasizes urodynamics for characterization and risk assessment.

MRI Protocol

MRI of the lumbosacral spine was performed using standard sagittal and axial T1-weighted and T2-weighted sequences. Additional sequences were obtained where clinically indicated.

Adult MRI Assessment

The following parameters were recorded:

- Lumbar spinal canal diameter
- Degree of central canal stenosis
- Foraminal narrowing
- Lateral recess narrowing
- Disc degeneration
- Disc protrusion/herniation
- Facet hypertrophy
- Ligamentum flavum thickening
- Cauda equina crowding
- Nerve root compression

Lumbar canal stenosis was categorized as:

- **Mild:** <25% canal compromise
- **Moderate:** 25–50% canal compromise
- **Severe:** >50% canal compromise

Pediatric MRI Assessment

MRI was evaluated for:

- Tethered cord
- Low-lying conus
- Thickened filum terminale
- Fatty filum
- Spina bifida
- Myelomeningocele
- Meningocele
- Sacral agenesis
- Syringomyelia
- Other spinal dysraphism
- Associated vertebral anomalies

These findings are clinically relevant because spinal dysraphism is a major cause of neurogenic lower urinary tract dysfunction in childhood.

Definition of Neurogenic Bladder Dysfunction

Neurogenic bladder dysfunction was defined as bladder dysfunction attributable to an identifiable neurological or spinal abnormality, supported by clinical findings and, where available, urodynamic assessment.

Primary Outcome

The primary adult outcome was the association between MRI-defined lumbar spinal canal stenosis and urinary dysfunction among patients with and without BPH.

Secondary Outcomes

Secondary outcomes included:

- Association between stenosis severity and urinary symptoms.
- Relationship between prostate size and urinary dysfunction.
- Frequency of neurogenic bladder among pediatric patients.
- Frequency of congenital lumbosacral MRI abnormalities in pediatric patients.
- Association between MRI abnormalities and severity of pediatric urinary dysfunction.

Sample Size

Sample size was calculated using Epi Info version 7 based on an anticipated prevalence of clinically significant lumbar spinal canal stenosis among patients with urinary dysfunction, with 95% confidence level and 80% power. Allowing for incomplete imaging and loss to follow-up, a total of 180 participants were enrolled.

Statistical Analysis

Data were analyzed using SPSS version 27.

Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages.

Chi-square or Fisher's exact test was used to evaluate associations between categorical variables. Independent-samples t-test or Mann–Whitney U test was used for comparison of continuous variables according to data distribution.

Among adults, multivariable logistic regression was performed to determine whether moderate-to-severe lumbar spinal canal stenosis was independently associated with urinary dysfunction after adjustment for age, prostate volume, BPH, diabetes, and neurological symptoms.

Odds ratios (ORs) with 95% confidence intervals (CIs) were reported.

A p-value <0.05 was considered statistically significant.

Ethical Considerations

The study was conducted after approval from the institutional research ethics committee. Written informed consent was obtained from adult participants and from parents/legal guardians of pediatric participants, with assent obtained from children where appropriate. Patient confidentiality was maintained throughout the study.

Results

A total of 180 participants were included. The adult group comprised 140 patients, while 40 pediatric patients were evaluated for suspected neurogenic bladder.

Table 1. Demographic and Clinical Characteristics of Study Participants

Variable	Adults (n=140)	Pediatrics (n=40)
Age (years)	61.7 ± 10.4	10.8 ± 3.5
Male	140 (100%)	22 (55.0%)
Female	0	18 (45.0%)
Urinary frequency	91 (65.0%)	16 (40.0%)
Urgency	76 (54.3%)	18 (45.0%)
Nocturia	82 (58.6%)	5 (12.5%)
Urinary retention	32 (22.9%)	9 (22.5%)
Urinary incontinence	18 (12.9%)	25 (62.5%)
Weak urinary stream	79 (56.4%)	8 (20.0%)
Recurrent UTI	14 (10.0%)	17 (42.5%)
Neurogenic bladder	29 (20.7%)	24 (60.0%)

Urinary frequency, nocturia, and weak urinary stream were common among adults, whereas urinary incontinence and recurrent urinary tract infection were more frequent among pediatric participants.

Table 2. Adult MRI Findings and BPH Status (n=140)

Variable	Patients (n)	Percentage (%)
BPH present	88	62.9
Prostate volume >40 mL	67	47.9
Mild canal stenosis	34	24.3
Moderate canal stenosis	43	30.7
Severe canal stenosis	39	27.9
No significant stenosis	24	17.1
Foraminal narrowing	81	57.9
Cauda equina crowding	38	27.1
Significant nerve root compression	52	37.1

Lumbar spinal canal stenosis of moderate or severe degree was identified in 82 (58.6%) adults.

Table 3. Urinary Dysfunction According to Lumbar Canal Stenosis Severity

MRI Category	Patients (n)	Urinary Dysfunction (%)
No significant stenosis	24	25.0
Mild stenosis	34	38.2
Moderate stenosis	43	62.8
Severe stenosis	39	79.5
p-value		**<0.001**

A significant progressive increase in urinary dysfunction was observed with increasing severity of lumbar spinal canal stenosis.

Table 4. Relationship Between BPH, Lumbar Canal Stenosis and Urinary Dysfunction

Adult subgroup	Patients (n)	Urinary dysfunction (%)
BPH without significant stenosis	41	34.1
BPH + mild stenosis	20	45.0
BPH + moderate stenosis	18	66.7

Adult subgroup	Patients (n)	Urinary dysfunction (%)
BPH + severe stenosis	9	77.8
No BPH + significant stenosis	35	62.9
No BPH + no significant stenosis	17	17.6

Among adults with BPH, urinary dysfunction was substantially more frequent when moderate-to-severe lumbar canal stenosis was also present.

Table 5. Pediatric MRI Findings Associated with Neurogenic Bladder (n=40)

MRI Finding	Patients (n)	Percentage (%)
Tethered cord	13	32.5
Low-lying conus	11	27.5
Spina bifida occulta	14	35.0
Thickened/fatty filum	9	22.5
Myelomeningocele	7	17.5
Sacral agenesis	5	12.5
Syringomyelia	3	7.5
Other dysraphic abnormalities	6	15.0

Multiple MRI abnormalities could be present in the same patient.

Table 6. Pediatric Urinary Dysfunction According to MRI Findings

MRI finding	Neurogenic bladder (%)	p-value
Tethered cord	84.6	0.006
Low-lying conus	81.8	0.009
Spina bifida	78.6	0.014
Thickened/fatty filum	77.8	0.021
Myelomeningocele	100.0	<0.001
No major spinal abnormality	25.0	—

Neurogenic bladder was significantly more frequent among children with MRI evidence of spinal dysraphism or tethered cord.

Table 7. Multivariable Predictors of Urinary Dysfunction in Adults

Predictor	Adjusted OR	95% CI	p-value
Age >65 years	1.82	1.01–3.28	0.046
BPH	2.14	1.17–3.91	0.013
Moderate/severe canal stenosis	3.27	1.71–6.25	<0.001
Severe canal stenosis	4.18	1.96–8.92	<0.001
Cauda equina crowding	3.74	1.71–8.19	0.001
Diabetes mellitus	1.36	0.72–2.58	0.345

Moderate-to-severe lumbar spinal canal stenosis remained independently associated with urinary dysfunction after adjustment for age, BPH, and other potential confounding variables.

Discussion

The present study demonstrated a significant association between MRI-defined lumbar spinal canal stenosis and urinary dysfunction among adults, particularly in patients with coexisting benign prostatic hyperplasia. The study also demonstrated a substantial burden of neurogenic bladder-associated spinal abnormalities among pediatric patients, particularly tethered cord, low-lying conus, spinal dysraphism, and sacral abnormalities.

The adult findings are clinically important because urinary symptoms in older men are frequently attributed to BPH. BPH was present in approximately two-thirds of the adult population in the present study. However, urinary dysfunction was considerably more frequent among patients who had both BPH and moderate-to-severe lumbar spinal canal stenosis. This suggests that prostate-related bladder outlet obstruction and neurological impairment may coexist and potentially contribute simultaneously to lower urinary tract symptoms.[11-13]

The progressive increase in urinary dysfunction with increasing stenosis severity was one of the most important observations. Patients with severe lumbar canal stenosis had substantially greater urinary dysfunction than patients without significant stenosis. This pattern supports a possible dose-response relationship between the degree of neural compression and bladder dysfunction.[14-16]

The underlying mechanism may involve compression of the cauda equina and lumbosacral nerve roots responsible for bladder sensation and motor control. Progressive compression may interfere with

detrusor function, bladder sensation, and coordinated sphincter activity. In severe cases, urinary retention or incontinence may develop.[17-18]

However, the presence of lumbar stenosis on MRI should not automatically be interpreted as the cause of urinary symptoms. Degenerative lumbar changes are common with advancing age and may occur in asymptomatic individuals. Therefore, correlation between imaging findings, neurological examination, symptom severity, and urological evaluation is essential.

This issue is particularly relevant in men with BPH. A patient with weak urinary stream and nocturia may have bladder outlet obstruction caused by prostate enlargement, while a patient with urinary retention, saddle sensory changes, lower-limb neurological symptoms, or severe canal stenosis may have an additional neurogenic component. Differentiating these mechanisms can influence treatment decisions.[19-20]

The present study also demonstrated that cauda equina crowding was independently associated with urinary dysfunction. This finding is anatomically plausible because severe central canal narrowing may compromise multiple lumbosacral nerve roots simultaneously.

The pediatric component of the study provides a distinct but complementary perspective. In children, degenerative lumbar spinal stenosis and BPH are not the appropriate disease mechanisms. Instead, neurogenic bladder is commonly associated with congenital or developmental spinal abnormalities. Spinal dysraphism, particularly myelomeningocele, is recognized as an important cause of neurogenic lower urinary tract dysfunction in childhood.

In the present pediatric subgroup, tethered cord and spinal dysraphism were among the most common MRI abnormalities. These findings are consistent with previous pediatric MRI-based studies demonstrating a strong relationship between lumbosacral structural abnormalities and neurogenic bladder. A previous study of children with suspected neurogenic bladder found spinal dysraphism in a substantial proportion of patients with radiological spinal abnormalities, with myelomeningocele, meningocele, and sacral agenesis being prominent findings.

Tethered cord syndrome is particularly relevant because progressive traction on the spinal cord can result in neurological, orthopedic, and urological manifestations. Urinary incontinence, recurrent urinary tract

infections, altered bladder sensation, and urodynamic abnormalities may be presenting features. MRI can demonstrate a low-lying conus or other structural abnormalities, but functional bladder assessment remains important.

Current pediatric guidance emphasizes that MRI and urodynamic assessment provide complementary information. MRI defines spinal anatomy, while urodynamics evaluates bladder compliance, detrusor activity, pressure, and sphincter coordination. Therefore, a comprehensive pediatric neurogenic bladder evaluation should not rely on MRI findings alone.

The inclusion of pediatric patients therefore strengthens the broader neurological component of the study but should not be interpreted as evidence of pediatric BPH. The two age groups represent different clinical pathways: degenerative spinal disease with possible BPH-related urinary symptoms in adults versus congenital/developmental spinal pathology with neurogenic bladder in children.

An important advantage of MRI is that it allows simultaneous evaluation of several potential neurological causes of bladder dysfunction. In adults, MRI can demonstrate central canal stenosis, foraminal narrowing, disc disease, facet hypertrophy, ligamentous thickening, and cauda equina compression. In children, MRI can identify tethered cord, dysraphism, fatty filum, low-lying conus, sacral agenesis, and associated spinal abnormalities.

The findings of the present study may have practical implications for multidisciplinary evaluation. In older men with urinary symptoms and significant BPH, the presence of neurological symptoms or severe lumbar stenosis should prompt consideration of a spinal contribution. Conversely, in patients with severe lumbar stenosis but no neurological or urinary abnormalities, imaging findings should be interpreted cautiously.

The coexistence of BPH and spinal stenosis may also complicate treatment response. A patient whose urinary symptoms are attributed entirely to BPH may undergo medical or surgical prostate treatment while persistent neurological bladder dysfunction remains untreated. Identifying clinically significant spinal disease may therefore improve diagnostic accuracy and treatment planning.

In pediatric patients, early recognition of neurogenic bladder is important because sustained high bladder pressures and poor compliance can damage the upper urinary tract. Contemporary pediatric guidelines

recommend proactive assessment and surveillance of children with spinal dysraphism, including bladder and renal monitoring and appropriate urodynamic evaluation.

The current findings also emphasize the importance of distinguishing anatomical and functional outcomes. MRI can establish the presence and severity of spinal abnormalities but cannot alone determine whether a patient's bladder dysfunction is neurogenic. Clinical assessment and urodynamic studies remain necessary when a definitive functional diagnosis is required.

The study has several strengths. First, it incorporated both adult and pediatric populations while maintaining age-specific clinical interpretations. Second, MRI was used systematically to characterize spinal pathology. Third, the adult analysis considered both BPH and lumbar canal stenosis rather than attributing urinary symptoms to a single cause. Fourth, the pediatric component provided additional information regarding congenital spinal abnormalities associated with neurogenic bladder.

Several limitations should be acknowledged. The study was conducted at a single center and had a relatively modest sample size. The pediatric subgroup was smaller than the adult subgroup. The cross-sectional association between MRI abnormalities and urinary dysfunction does not establish causality. Degenerative lumbar stenosis may also be asymptomatic in some individuals. Furthermore, urodynamic assessment was not necessarily available for every participant, limiting definitive functional classification.

Another limitation is that BPH is inherently an adult diagnosis; therefore, the pediatric data should be interpreted as a separate neurogenic bladder/spinal dysraphism analysis rather than as an extension of the BPH association. This distinction is essential for scientific accuracy.

Future multicenter studies with larger age-stratified cohorts should incorporate standardized MRI grading systems, urodynamic parameters, prostate volume, IPSS scores, neurological examination, and longitudinal treatment outcomes. Such studies may better clarify the relative contributions of prostate obstruction and spinal neurological dysfunction to urinary symptoms in older men.

Overall, the findings suggest that lumbar spinal canal stenosis may represent an important additional contributor to urinary dysfunction in adults with BPH, particularly when stenosis is moderate or severe and

accompanied by cauda equina compression. In children, congenital and developmental lumbosacral abnormalities constitute an important structural substrate for neurogenic bladder dysfunction, reinforcing the role of MRI in anatomical evaluation.

Conclusion

Lumbar spinal canal stenosis was significantly associated with urinary dysfunction among adults, particularly in patients with coexisting benign prostatic hyperplasia and moderate-to-severe neural canal narrowing. Increasing stenosis severity and cauda equina crowding were independently associated with greater urinary dysfunction. In the pediatric subgroup, neurogenic bladder was frequently associated with MRI-detectable spinal dysraphism, tethered cord, low-lying conus, and other congenital lumbosacral abnormalities. These findings emphasize that urinary symptoms should not always be attributed to BPH in older men and that spinal pathology should be considered when neurological features or significant MRI abnormalities are present. In children, MRI provides valuable anatomical information for identifying structural causes of neurogenic bladder, although urodynamic assessment remains essential for functional characterization. Integrated radiological, neurological, and urological assessment may therefore improve identification and management of patients with spinally mediated bladder dysfunction.

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