



Albuminuria as a biomarker for renal dysfunction in pediatric neurogenic bladder

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Received: 29-Mar-2024, Manuscript No. PUCR-24-132330; **Editor assigned:** 01-Apr-2024, PreQC No. PUCR-24-132330 (PQ); **Reviewed:** 15-Apr-2024, QC No. PUCR-24-132330; **Revised:** 22-Apr-2024, Manuscript No. PUCR-24-132330 (R); **Published:** 29-Apr-2024, DOI: 10.14534/j-pucr.20222675646

Description

Pediatric Neurogenic Bladder (PNB) is a common condition characterized by dysfunction of the bladder due to neurological impairment. One of the significant complications associated with PNB is renal dysfunction, which can lead to progressive renal damage and impaired renal function. Albuminuria, the presence of albumin in the urine, has emerged as a valuable biomarker for renal dysfunction in PNB. Albuminuria in PNB results from a combination of factors, including bladder dysfunction, Urinary Tract Infections (UTIs), and increased intravesical pressure. Bladder dysfunction, such as detrusor sphincter dyssynergia or detrusor overactivity, can lead to urinary stasis, incomplete emptying, and increased bladder pressure, predisposing to UTIs and renal parenchymal damage. Chronic UTIs and recurrent pyelonephritis further contribute to renal injury, leading to tubulointerstitial fibrosis, glomerulosclerosis, and impaired renal function. Additionally, increased intravesical pressure during bladder storage and voiding phases can cause Vesicoureteral Reflux (VUR), exacerbating renal damage and albuminuria.

The assessment of albuminuria in PNB involves a

combination of clinical evaluation, urinalysis, and specialized tests. Urinalysis is the initial screening tool for detecting albuminuria, typically performed using dipstick analysis or quantitative measurement of Albumin-To-Creatinine Ratio (ACR) in a spot urine sample. ACR is preferred over urinary albumin concentration alone as it corrects for variations in urine concentration. Persistent albuminuria is defined as ACR ≥ 30 mg/g in two out of three consecutive samples over a 3- to 6-month period. Additional diagnostic tests such as renal ultrasonography, Voiding Cystourethrography (VCUG), and renal scintigraphy may be indicated to assess for structural abnormalities, VUR, and renal parenchymal damage. Albuminuria serves as an important marker of renal dysfunction and disease progression in PNB. It reflects underlying renal pathology, such as glomerular injury, tubular dysfunction, and interstitial fibrosis, and correlates with the severity of bladder dysfunction and UTIs.

The management of albuminuria in PNB aims to prevent or delay the progression of renal dysfunction and improve long-term outcomes. This involves a multidisciplinary approach, including urology, nephrology, and pediatric rehabilitation, tailored to the individual needs of the child. Optimal bladder management strategies, such as Clean Intermittent Catheterization (CIC), anticholinergic medications, and botulinum toxin injections, aim to maintain low bladder pressure, promote complete bladder emptying, and reduce the risk of UTIs and renal damage. Prophylactic antibiotics may be prescribed to prevent recurrent UTIs and minimize the risk of renal scarring and parenchymal damage. However, antibiotic stewardship principles should be followed to minimize the risk of

antimicrobial resistance and adverse effects. Blood pressure monitoring and control are essential in children with PNB and albuminuria to prevent hypertension and reduce the risk of cardiovascular complications.

Regular monitoring of renal function, blood pressure, and albuminuria is essential to assess disease progression and treatment response. Close follow-up with a multidisciplinary team, including urologists, nephrologists, and pediatricians, is recommended to optimize management and outcomes. Children with PNB and albuminuria are at increased risk of developing progressive renal damage, including Chronic Kidney Disease (CKD), End-Stage Renal Disease (ESRD), and renal transplantation. Additionally, albuminuria is associated with poor outcomes, including hypertension, proteinuria, and cardiovascular morbidity and mortality, highlighting the importance of early detection and intervention. Antihypertensive medications such as Angiotensin-Converting Enzyme (ACE) inhibitors

or Angiotensin Receptor Blockers (ARBs) may be indicated to achieve target blood pressure goals.

Conclusion

In conclusion, albuminuria serves as a valuable biomarker for renal dysfunction in pediatric neurogenic bladder, reflecting underlying bladder dysfunction, UTIs, and increased intravesical pressure. Early detection and management of albuminuria are crucial to prevent or delay the progression of renal damage and improve long-term outcomes in children with PNB. A multidisciplinary approach, including bladder management, UTI prophylaxis, blood pressure control, and regular monitoring, is essential to optimize management and reduce the risk of renal complications. Further research is needed to elucidate the pathophysiology of albuminuria in PNB, identify novel therapeutic targets, and improve clinical outcomes for affected children.