Renal Barocrinology: The Interface between Obesity and Kidney Health

Sourabh Sharma[1], Sabine Karam[2], Nitin Kapoor[3], Sanjay Kalra[4,]

Abstract

Obesity is been acknowledged to be a major risk factor for chronic kidney disease (CKD), contributing to both its onset and progression. Over past few decades, the obesity epidemic has lead to an increased incidence of obesity-related nephropathy, characterised by glomerular hyperfiltration, hypertrophy, and progressive glomerulosclerosis. This review highlights the need for multidisciplinary action to prevent and manage obesity-related nephropathy. We reiterate the current necessity of routine kidney function screening in people with obesity. We also propose an integrated concept of Renal Barocrinology. This will focus on early screening and preventive strategies, mitigating long-term burden of CKD and its complications, and improving patient outcomes through a collaborative approach.

Keywords: Obesity, Chronic Kidney Disease, Hyperfiltration, Proteinuria, Early Screening, Renal Barocrinology

DOI: https://doi.org/10.47391/JPMA.25-56

Introduction

Obesity is an escalating global health issue, with its occurrence nearly tripling over the last fifty years.[1] Globally, more than 650 million adults, and 340 million adolescents are obese, and the figures are still rising. As per WHO, by 2025, 167 million adults and children will experience deteriorating health because of being obese or overweight.[2,3] Research shows that a high body mass index (BMI) during adolescence significantly contributes to the risk of early CKD in early adulthood, regardless of the presence of diabetes and hypertension. The rising prevalence of obesity-related nephropathy calls for proactive measures, especially since many cases are often undetected until substantial kidney damage has taken place. We propose a comprehensive concept, Renal Barocrinology, to understand and address obesity-related kidney issues, including early detection, prevention, and reduction of long-term impact of CKD and enhance patient results through teamwork and collaboration.

[1]Department of Nephrology, Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India; [2]Division of Nephrology and Hypertension, University of Minnesota, Minneapolis, Minnesota, USA; [3]Department of Endocrinology, Diabetes and Metabolism, Christian Medical College, Vellore, India; Non communicable disease unit, Baker Heart and Diabetes Institute, Melbourne, Victoria, Australia; [4]Department of Endocrinology, Bharti Hospital, Karnal, India; University Centre for Research & Development, Chandigarh University, Mohali, India.

Correspondence: Sanjay Kalra. e-mail: brideknl@gmail.com

ORCID ID: 0000-0003-1308-121X

Concept of Renal Barocrinology

The relationship between obesity and CKD is complex, involving multiple haemodynamic, metabolic, and inflammatory mechanisms. Obesity results in compensatory glomerular hyperfiltration and hypertrophy, which raises glomerular capillary pressure and leads to ongoing glomerulosclerosis.[4] Dysregulation of adipokines, especially the elevated levels of leptin and decreased levels of adiponectin, leads to sodium retention, high blood pressure, and inflammation in the kidneys. Insulin resistance and activation of the renin-angiotensin-aldosterone system (RAAS) worsen renal injury by facilitating sodium retention and fibrosis. Persistent low-grade inflammation and oxidative stress hasten kidney damage by increasing the production of pro-inflammatory cytokines such as TNF-α and IL-6.[4-6]

The emerging field of Renal Barocrinology aims to define these mechanistic interactions more precisely, connecting barocrinology and nephrology to provide comprehensive, personalized interventions while highlighting the significance of preventive strategies such as lifestyle changes, early risk evaluations, and organized weight management programmes. This cohesive strategy ensures that prevention is prioritised rather than treated as an afterthought in the management of obesity-related nephropathy, underscoring the need for a multidisciplinary approach that involves barocrinologists, nephrologists, dietitians, physical therapists, and behavioural counsellors to encourage lasting improvement in health.

Epidemiology

Obesity is a well-documented risk factor for CKD, with global data revealing a strong association between high BMI and kidney dysfunction. A large study involving over 593,660 adolescents demonstrated that those with a high BMI had significantly increased risks of developing CKD by early adulthood. The hazard ratio for CKD in severely obese individuals was found to be 9.4 for males and 4.3 for females, underscoring the sex-specific risk gradient.[7] In

various studies, BMI has been reported to be an independently significant risk factor for development of CKD.[8] The obese individuals have a 2- to 3-fold higher risk of developing albuminuria, and CKD progression rates are significantly faster in this population.[9] A recent metanalysis from general population with normal baseline kidney function reported that there was an increase in relative risk development of low eGFR by 1.28 and albuminuria by 1.51 in people with obesity.[10]

Recent studies indicate that the kidney disease associated with obesity is now one of the primary contributors to the global burden of CKD. In lower- and middle-income countries, where obesity rates are increasing quickly due to changes in lifestyle, CKD linked to metabolic disorders is emerging as a significant public health issue.[11] Given these developments, it is crucial to adopt a multidisciplinary care approach to ensure effective management strategies in this cohort.

Clinical Implications

Obesity accelerates the progression of CKD and complicates its management by increasing proteinuria, exacerbating hypertension and diabetes, and impacting kidney transplantation outcomes. Various autopsy and biopsy studies have depicted the morphological changes in obesity-related nephropathy, which include increased kidney weight and hypertrophy of individual nephrons.[12,13] As compared to nonobese individuals, a three-fold increase in glomerular size and decrease in cortical glomerular density is reported in studies. The number of glomerular capillaries appears to be increased suggesting neovascularisation.[12] The onset of albuminuria in these patients is histopathologically associated with focal segmental glomerulosclerosis (FSGS). The extent of FSGS seems to be different in different stages of obesity, and is accompanied by progressive interstitial fibrosis and tubular atrophy in accordance with loss of kidney function. Also, the metabolic syndrome driven by obesity intensifies hypertension and insulin resistance, creating a self-reinforcing cycle of kidney injury.[12,13] Furthermore, obesity is associated with several risk factors contributing to the higher incidence and prevalence of nephrolithiasis. Higher body weight is associated with lower urine pH and increased urinary oxalate, uric acid, sodium, and phosphate excretion.[14-17]

In the context of kidney transplantation, recipients with obesity are at an elevated risk for delayed graft function, higher rates of rejection, and diminished long-term graft survival. Overall, there is an increased risk of cardiovascular, metabolic, and surgical complications in obese transplant recipients.[21]

Table-1: Renal Barocrinology- Policy Implications: Challenges and Proposed Solutions.

Challenges	Proposed Solutions
Lack of awareness and education on obesity-related nephropathy	Nationwide campaigns promoting kidney health in schools, workplaces, and healthcare settings
Limited access to early screening programmes	Government-subsidized CKD screening initiatives in primary care and community clinics
Insufficient collaboration between nephrologists, endocrinologists, and primary care providers	Implementation of integrated care models that foster interdisciplinary cooperation
Economic barriers to obesity management interventions	Insurance coverage for weight management programmes, bariatric surgery, and pharmacotherapy for high-risk patients
Absence of policy-driven strategies for CKD prevention in obesity	Inclusion of renal screening in obesity prevention policies and workplace wellness programmes

In 1982, Moorhead JF et al[18] proposed lipid nephrotoxicity hypothesis and hypothesised that chronic progressive kidney disease may be mediated by abnormalities of lipid metabolism. Since publication of their hypothesis, various studies have exposed the intricate relationship between lipids and kidney disease, and term "Fatty kidney disease" is often used to represent this pathophysiology.[18-20] Fatty kidney disease with ectopic fat deposition plays a crucial role in kidney pathology and is preventable if diagnosed early.[19,20] Considering the intricacies of obesity-related nephropathy, it is essential to adopt a collaborative, patient-centred strategy to enhance the long-term kidney health outcomes.

Prevention and Early Screening

Proactive measures for early detection of obesity should be established across various environments to ensure thorough outreach to at-risk groups. Educational institutions, including schools and colleges, ought to integrate regular BMI evaluations and kidney function screenings to pinpoint adolescents who may be at risk. Primary care facilities should routinely assess obese patients for renal issues during standard check-ups. Corporate wellness initiatives in workplaces can incorporate assessments for kidney health, while community health centres should implement public health campaigns offering complimentary CKD screenings for obese individuals. Moreover, dedicated renal barocrinology units should concentrate on tailored interventions for those with metabolic syndrome and CKD risk factors. Mandating annual screening programmes that include routine eGFR and albuminuria tests for obese individuals is essential, especially for those with additional risk elements like hypertension and diabetes. These initiatives need to be supported by government regulations that encourage CKD screening as part of obesity prevention efforts

Policy Implications

More studies are required to enhance screening protocols for obesity-related nephropathy and to assess new

pharmacological treatments that target metabolic and inflammatory pathways. Strategies at the population level focussed on preventing obesity can greatly decrease the incidence and impact of CKD. A worldwide initiative is essential to incorporate renal barocrinology into clinical medicine, promoting a cohesive strategy for tackling obesity-related kidney dysfunction. Furthermore, public health campaigns should aim to merge kidney disease awareness with obesity prevention efforts and push for policy-driven measures at both community and governmental levels

Conclusion

Obesity is a significant and modifiable risk factor for CKD, playing a role in the onset of kidney damage and the advancement of the disease. Implementing regular kidney health evaluations for individuals with obesity, in combination with lifestyle changes and medical treatments, can significantly lessen the long-term impact of kidney disease. Renal Barocrinology provides a comprehensive approach to understanding and addressing CKD associated with obesity, promoting a collaborative and multidisciplinary system for ensuring thorough care. Timely detection and prevention are fundamental strategies to safeguard kidney health amidst the worldwide obesity crisis.

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