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Case Report

Infection-Related Glomerular Nephritis: Understanding the Kidney's Immune Battle

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ABSTRACT

Infection-Related Glomerulonephritis (IRGN) is a type of glomerulonephritis, which is a group of diseases that damage the kidneys' filtering units called glomeruli. IRGN specifically occurs as a result of an infection in the body, often caused by bacteria like streptococcus or staphylococcus. These bacteria release toxins that can trigger an immune response against the bacterial infections in the glomeruli, leading to inflammation and kidney damage. Common infections associated with IRGN include throat or skin infections, such as strep throat or impetigo. The immune response causes the glomeruli to become inflamed, impairing their ability to filter waste and excess fluids from the blood properly. As a result, the kidneys may not function efficiently, leading to symptoms like hematuria (blood in the urine), proteinuria (excess protein in the urine), high blood pressure and swelling in the face, hands, legs, or feet. Diagnosis of IRGN involves a physical examination, blood tests, urine tests and sometimes a kidney biopsy to confirm the presence of glomerular inflammation. Treatment typically focuses on managing the underlying infection with antibiotics and addressing the symptoms. In severe cases, especially if kidney function is significantly impaired, additional therapies such as immunosuppressive medications or dialysis might be necessary. It's essential for individuals with symptoms suggestive of kidney problems, especially if they have a recent history of infections, to seek medical attention promptly. Early diagnosis and appropriate management can help prevent complications and preserve kidney function.

Keywords: Glomerulonephritis, Bacterial infections, Immune response, Kidney function, Diagnosis.

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INTRODUCTION

Infection-Related Glomerular Nephritis (IRGN) is a kidney disorder characterized by inflammation in the glomeruli, primarily triggered by bacterial infections, notably streptococcal and staphylococcal bacteria.[1] The immune response, aimed at combating these infections, results in the formation of immune complexes that inadvertently attack the glomeruli, leading to inflammation and damage.[2] Symptoms include hematuria, proteinuria, edema and hypertension, reflecting impaired kidney function.[3]

The pathogenesis of IRGN involves the formation of immune complexes during the immune response to bacterial infections. These complexes deposit in the glomeruli, triggering inflammation and impairing the kidney's filtration function. Clinical manifestations encompass hematuria, proteinuria, edema, hypertension and, in severe cases, renal impairment.[5] Recognizing these manifestations early and initiating appropriate interventions are crucial in preventing complications and preserving kidney function in individuals with IRGN.

CASE PRESENTATION

A 45-year-old female patient has been referred for admission by a consultant due to a cluster of concerning symptoms and a provisional diagnosis of Rapidly Progressive Glomerular Nephritis (RPGN). Over the last 3-4 days, she experienced a noticeable reduction in appetite, accompanied by persistent nausea. Furthermore, she reported breathlessness and a decrease in urine output and burning micturition. Notably, she had encountered with two episodes of fever lasting for 10 days each. Of medical significance, the patient had a history of hypertension and diabetes. Given the complexity of her symptoms and underlying health conditions, a thorough examination and diagnosis were conducted during her admission to uncover the underlying causes and formulate an appropriate treatment plan.

Upon conducting various diagnostic tests (as shown in Table 1), it was revealed that the patient had anemia with Hemoglobin

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(Hb) levels measuring 8.9 mg/dL and notable decrease in RBC levels. Elevated White Blood Cell (WBC) counts and increased neutrophils were observed, suggesting the presence of an infection, commonly associated with Infection-Related Glomerular Nephritis (IRGN).

Renal Function Tests (RFT) showed elevated levels of Blood Urea Nitrogen (BUN) of 33 mg/dL and creatinine levels at 5.44 mg/dL, indicating impaired kidney function. Furthermore, the patient had decreased sodium and bicarbonate levels, while potassium and phosphorus levels were elevated. The Anti-Streptolysin O (ASLO) blood test was positive, indicating the presence of antibodies against streptolysin O, a substance produced by Group A Streptococcus bacterium. This positivity aligns with expectations in cases of IRGN and a biopsy was performed to confirm the same. This conclusive evidence of biopsy, along with the other lab investigations led to the diagnosis of Infection-Related Glomerular Nephritis.

During his hospital stay, the patient was managed with insulin to control his blood glucose levels. The treatment plan also included antihypertensive medications to bring down his elevated blood pressure (Amlodipine). For the treatment of IRGN he was treated with an anti-inflammatory methyl Prednisolone and antibiotic used was Piperacillin+Tazobactam Close monitoring of renal function, blood glucose levels and blood pressure was initiated to assess the response to treatment and prevent further complications.

Diagnostic Assessment/Treatment and Management

Glomerular nephritis refers to inflammation of the glomeruli, the tiny filtering units in the kidneys responsible for removing waste and excess fluids from the blood. This condition can manifest in various forms, each with its unique characteristics. Among them, Infection-Related Glomerular Nephritis (IRGN) stands out as a subtype influenced by microbial infections.

The diagnostic criteria included renal function tests, blood and urine tests, antibody tests (eg. ASLO: Testing for antibodies like 'Anti-Streptolysin O' which is crucial in suspected cases of IRGN (Elevated levels indicate exposure to streptococcal infections), biopsy and imaging studies. During hospital stay, the routine investigations were done and renal parameters were raised. In view of the uremic symptoms with moderate to severe renal failure, the patient was initiated on hemodialysis during the hospital stay and was continued with dialysis. Restricted intake of salt and water, an antihypertensive, insulin and other supportive therapy was provided. In view of the rapid worsening of creatinine with active urine sediment, Intravenous pulse methylprednisolone therapy with antibiotics was provided. The patient gradually improved with urine output of 700 mL/day and was discharged with an advice to continue dialysis twice a week till renal recovery was obtained.

Table 1: Diagnostic Assessment for IRGN.

Hematological test	Test result	Normal range
Hb	8.9	13.5-16.5 g/DL
RBC	4.3	4.2 -5.4 million cells/ mcL
WBC	11,700	4,000-1100/microliter
Renal function test		
Urea	33	20-40 mg/dL
Creatinine	5.44	0.5-1.5 mg/dL
Electrolytes		
Sodium	124	136-145 mmol/L
Potassium	5.05	3.6-5.2 mmol/L
Bicarbonate	28	22-32 mmol/L
Phosphorus	6.8	2.8 to 4.5 mg/dL
ASLO (Anti streptolysin O)	Positive	Anti streptolysin O (ASLO) test is a blood test to measure antibodies against streptolysin O, a substance produced by group A streptococcus bacteria.

DISCUSSION

Infection-Related Glomerular Nephritis (IRGN) is an intricated aspect of nephrology, characterized by the interplay between microbial infections and the renal system. The genesis of IRGN is often linked to bacterial infections, with Group A Streptococcus being a frequent culprit. The immune system's response to these infections triggers a cascade of events that, when dysregulated, can result in inflammation within the glomeruli. Understanding the specific infectious triggers and the immune response is fundamental in comprehending the pathophysiology of IRGN.

IRGN presents a diverse clinical picture, making its diagnosis challenging. Patients may exhibit a range of symptoms, including reduced appetite, nausea, breathlessness and reduced urine output. The overlap of these symptoms with various other renal and systemic conditions necessitates a meticulous approach to diagnosis, often involving an array of laboratory tests and imaging studies.

Diagnosing IRGN can be intricate, requiring a combination of clinical acumen and a battery of diagnostic tests. Blood and urine analyses play a pivotal role, with findings such as elevated white blood cell counts, positive ASLO tests and characteristic renal biopsy results, providing the essential diagnostic clues.[4] However, distinguishing IRGN from other forms of glomerulonephritis and kidney diseases require careful consideration of the clinical context and a nuanced interpretation of diagnostic results.

Management of IRGN revolves around two key principles

Treating the underlying infection and mitigating the immune-mediated renal damage, Antibiotic therapy stands as the primary weapon against the infective agent, aiming to halt the progression of glomerular inflammation. In severe cases, where immune hyperactivity poses a substantial risk, immunosuppressive medications are judiciously employed. Supportive care, encompassing hydration, blood pressure control and dietary modifications, complements the primary interventions, fostering overall renal health and recovery.[6]

Prevention

Preventing IRGN involves timely and effective treatment of bacterial infections. It is crucial to complete prescribed antibiotic courses, especially for streptococcal infections like streptococcal throat. Practicing the good hygiene practices, such as regular handwashing, can also reduce the risk of various infections that might lead to IRGN.

CONCLUSION

Infection-related glomerular nephritis is a serious kidney condition that highlights the intricate interplay between infections and the body's immune system. Understanding its causes, symptoms, diagnosis and treatment options is vital for both healthcare professionals and the general public. Through awareness, early detection and appropriate medical intervention, the impact of IRGN on kidney health can be minimized, emphasizing the importance of prompt and comprehensive healthcare in managing this condition effectively.

Infection-related glomerular nephritis (IRGN) is a kidney disorder with a unique pathophysiology. It occurs as a result of the immune system's response to an infection.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

IRGN: Infection-related glomerulonephritis; **RPGN:** Rapidly progressive glomerular nephritis; **RFT:** Renal function test; **Hb:** Hemoglobin; **WBC:** White blood cell; **ASLO:** 'Anti-Streptolysin O'.

SUMMARY

Infection-related glomerular nephritis, also known as Post-Infectious Glomerulonephritis (PIGN), is a type of kidney disease that occurs as a complication of certain infections, most commonly caused by Streptococcus bacteria, particularly Group A Streptococcus. The infection triggers an immune response in the body, leading to inflammation and damage to the glomeruli, which are the filtering units of the kidneys. This can result in symptoms such as hematuria (blood in the urine), proteinuria (protein in the urine), edema (swelling) and hypertension (high blood pressure). Treatment typically involves managing the underlying infection, controlling symptoms and sometimes using medications to suppress the immune system. Most cases of infection-related glomerular nephritis improve with appropriate treatment, but some may progress to chronic kidney disease if not managed effectively.

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