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Glomerulonephritis in Children: Epidemiological, Clinical, Paraclinical and Therapeutic Profile

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Abstract **Original Research Article**

***Background*:** Glomerulonephritis (GN) is a rare kidney disease that causes significant morbidity and mortality. They are frequently difficult to treat, and in some cases, no treatment is available, and they can progress to chronic kidney disease (CKD) and end stage renal disease (ESKD). Kidney biopsy is the preferred diagnostic method because it helps determine the precise specific diagnosis, assesses the level of disease activity and severity, and thus aids in proper therapy and prognosis prediction. ***Methods*:** Retrospective review of 40 children under the age of 15 with GN diagnosed between 2019 and 2022. Nephrotic syndrome, sub-nephrotic proteinuria, nephrotic syndrome (NS) with acute kidney injury (AKI), subnephrotic proteinuria plus AKI, isolated hematuria, and unexplained renal impairment were the six clinical syndromes for which a kidney biopsy was performed in 25 patients. Hospital admission records, progression notes, and outpatient follow up were used to collect data. ***Results*:** Acute glomerulonephritis (AGN) with nephritic syndrome (NS) affected 53% of the patients. Patients with AGN-NS were more likely to develop hypertension (48.0% vs. 15.7%) and acute renal damage (32% vs. 10%). 48% of the patients had Acute Postinfectious Glomerulonephritis. 5% of the patients had membranoproliferative glomerulonephritis. 2.5% of patients with ANCA-negative rapidly progressive glomerulonephritis had extramembranous glomerulonephritis, and 2.5% had extracapillary glomerulonephritis. The kidneys of 24 people were biopsied. The most common reason for a kidney biopsy was rapidly progressing glomerulonephritis. ***Conclusion*:** Acute postinfectious glomerulonephritis has been the most common glomerulonephritis in our study over the last three years in our Marrakech department. It manifested as a rapidly progressive glomerulonephritis in twelve of the cases.

Keywords: Glomerulonephritis, Kidney Biopsy, acute postinfectious glomerulonephritis, Rapidly progressive glomerulonephritis.

INTRODUCTION

The glomerulus is a complex capillary network that serves as the kidney's filtering unit. When the glomeruli are damaged, the condition is known as glomerulonephritis (GN). The spectrum of conditions classified as GN ranges from those in which the glomerulus is largely destroyed by massive inflammatory injury to others in which injury is only detectable by sensitive specialist techniques. This is why, in a patient suspected of having GN, a renal biopsy is an essential means of diagnosis. Immunohistochemistry and/or electron microscopy of renal tissue are required for accurate diagnosis in some forms of GN [1].

Patients with GN typically exhibit some or all of the following symptoms:

(1) Haematuria, which can be macroscopic or microscopic; and proteinuria, the severity of which can range from asymptomatic low levels to severe protein leakage associated with the nephrotic syndrome.
(2) Decreased kidney function.
(3) Hypertension.
(4) Associated systemic features, which may differ between GN types [2].

The clinical impact of glomerulonephritis is most visible in its contribution to end-stage kidney failure, which necessitates dialysis or transplantation. Glomerulonephritis is the second most common cause of end-stage renal failure worldwide. Treatment often includes anti-inflammatory and/or immunosuppressive therapy, which can be very effective if started early.

Unfortunately, our understanding of the mechanisms of injury in GN remains woefully inadequate [3].

MATERIAL AND METHODS

The study was approved by the ethics committee of the department of pediatrics in the children's university hospital, Marrakech. This was a retrospective study of the clinical records of 40 selected children and adolescents, aged <15 years, who were newly diagnosed with GN or acute nephritis syndrome between January 2019 and January 2022 in Marrakech hospital.

The Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) equation was used to calculate the estimated glomerular filtration rate (eGFR) from serum creatinine measurements and demographic characteristics. Hypertension was defined as having systolic and/or diastolic blood pressure levels that were higher than the 95th percentile for age, gender, and height. 800 mg/L was defined as a reduced serum complement C3 fraction. A high antistreptolysin-O titer (ASLO) was defined as more than 200 IU/ml. the immunological scanning included anti-nuclear antibody, anti-native DNA, antineutrophil cytoplacmis antibody (ANCA), anti-saccharomyces cerevisiae antibodies (ASCA) and anti-glomerular basement membrane antibodies (anti-GBM). The absence of hematuria, protenuria, hypertension, and normal renal function was defined as recovery. If the patients had a renal biopsy, the histopathology was reviewed by a histopathologist with advanced training.

RESULTS

The study included forty patients, with 25 of them being males. The median onset age was 9 years. All of the patients were diagnosed with GN. NS symptoms were present in 53% of the 40 patients. The majority (85%) came from an urban background.

In terms of clinical features, hypertension was present in 43% of patients, macroscopic heamaturia was present in all patients except one who had microscopic heamaturia, and dieresis was less than 0.5%/kg/h in 13% of patients. According to the pRIFLE classification, the rate of patients with acute renal failure (ARF) is 55%, with a Risk stage of 12.5%, Injury of 10%, and Failure of 32.5%.

Patients with AGN-NS were more likely to develop hypertension (48.0% vs. 15.7%) and acute renal damage (32% vs. 10%).

In terms of laboratory findings, 53% had nephritic proteinuria with a lower level of albumin, 35% had an increased ASLO level, and 50% had a lower C3 fraction. Except for one patient who tested positive for anti-GBM, the majority of patients had negative immunological scans.

Acute postinfectious glomerulonephritis (PIAGN) was diagnosed in 48% of cases, with an episode of upper respiratory tract infection in 50% of cases, a cutaneous infection in 46% of cases, and cervical adenitis in 4%. Positive ASLO titers were found in all of the cases. After 6 weeks of control, all of the patient's C3 levels returned to normal. Renal biopsy was performed on all patients with rapidly progressive glomerulonephritis, and the results were shown in (table 1). Twelve cases of postinfectious glomerulonephritis presented with rapidly progressive glomerulonephritis and were successfully treated with a methylprednisone pulse followed by oral prednisone.

We had 2 cases of idiopatic membranoproliferative glomerulonephritis (MPGN), the immunofluerscence (IF) of one patient was positif to IgG+, C3+, C1q+, Kappa ++ and Lambda ++ which is very common in type I of MPGN and he was treated pulse steroids followed by monthly intravenous cyclophosphamide and daily oral prednisone for 3 months, followed by oral mycophenolate mofetil and reduced dose of prednisone for maintenance. The other patient with MPGN received a pulse of methyprednisone followed by rituximab weekly without improvement, then oral tacrolimus for one month, but his evolution was not favorable and he died.

1 patient had idiopatic extramembranous glomerulonephritis with an IF positive to IgA, who presented with bilateral pulmonary embolisms, and he was treated with steroid's pulse followed by oral prednisone for 3 months (induction dose), then received intravenous rituximab weekly without results, then pulse monthly intravenous cyclophosphamide followed by mycophenolate mofetil orally for 4 months.

We also had one case of rapidly progressive glomerulonephritis associated with an ANCA-negative vascularitis in one patient, who was treated with pulse methylprednisone followed by oral mycofenolate mofetil with a relapse that required the use of tacrolimus. He also had several dialysis sessions with good results.

Angiotension-converting enzyme inhibitors were given to about one-third of the patients.

Table 1: Results of renal biopsy in 24 patients

	Results of renal biopsy	Cases
Postinfectious glomerulonephritis	Endocapillary glomerulonephritis IF : C3 ++	9 cases
	Endocapillary glomerulonephritis with extra capillary croissants	5 cases
	Minimal glomerular lesions	6 cases
Idiopatic membranoproliferative glomerulonephritis	Membranoproliferative glomerulonephritis with 6 extra capillary croissants IgG+, C3+, C1q+, Kappa ++ and Lambda ++	1 case
	Membranoproliferative glomerulonephritis IF: negative	1 case
Idiopatic extramembranous glomerulonephritis	Extramembranous glomerulonephritis stage 1 IF : IgG+++, IgA+++, C3+, C1q+, Kappa +++, Lambda +++	1 case
ANCA-negative RPGN	Extra-capillary glomerulonephritis with a medium caliber arteritis IF: negative	1 case

DISCUSSION

Glomerulonephritis is a source of consternation among medical professionals. Glomerulonephritis occurs more frequently in men than in women [4].

IgA nephropathy (27%), focal sclerosing (14%), rapidly progressive/ crescentic glomerulonephritis (10%, including vasculitis and antiglomerular-basement-membrane disease), membranous (5%), and lupus nephropathy (4%), were the most common types of biopsy-proven glomerulonephritis causing end-stage renal failure. The aetiological description refers to glomerulonephritis that is either primary (aetiology unknown) or secondary (associated with one of several autoimmune, infectious, malignant, or metabolic diseases) [5].

Rapidly progressive glomerulonephritis (RPGN) is a severe clinical syndrome characterized by rapid renal function loss caused by aggressive nephritis. Rapidly progressive renal failure is typically defined as a 50% reduction in glomerular filtration rate (GFR) in a matter of weeks to months. We had 16 children in our series with rapidly progressive glomerulonephritis, 12 of whom had postinfectious glomerulonephritis [6].

This study contributes to understanding the various types of glomerulonephritis in children and their histological pattern. The kidney biopsy is the standard diagnostic test that should be widely used in cases where the diagnosis of renal disease is unknown; it helps to guide management and provides prognostic information.

The APIGN is the most common cause of nephritic syndrome in children, affecting children aged 6 to 10 years old and has been linked to a number of viral or bacterial infections, the most common of which is group A beta- hemolytic streptococcal infection [7].

Membranoproliferative glomerulonephritis is a rare kidney disease marked by mesangial cell proliferation and structural changes in the glomerular capillary walls. It is classified into two types: idiopathic and secondary, which are distinguished by a review of clinical features, laboratory data, and renal histopathology. Pathologic features have defined three types: I, II, and III. This type of glomerulonephritis usually progresses slowly to end-stage renal disease and recurs after renal transplantation [8].

Extramembranous glomerulonephritis in children is a rare but distinct pathologic lesion. The characteristic light, immunofluorescent, and ultrastructural abnormalities in renal biopsy specimens help to confirm the diagnosis. There are two types: idiopathic (rare in children) and secondary (auto-immune, infectious or paraneoplasic) [9].

Symptomatic treatment and strategies to delay progression are available for all cases of glomerulonephritis; immunosuppression is appropriate for selected cases; and renal replacement therapy with dialysis or transplantation is required for a significant minority of patients. Molecular therapies that target key mediators of damage show great promise and are effective in a variety of experimental settings, but they have yet to be translated into the clinic [10].

Corticosteroids can help with several types of glomerulonephritis. Cyclophosphamide has been shown to be effective in membranous nephropathy, focal and segmental glomerulosclerosis, lupus nephritis classes III and IV, and rapidly progressive glomerulonephritis _anti GBM and vasculitis. Mycophenolate mofetil is also effective in the treatment of proliferative lupus nephritis [11]. Humanized monoclonal C5 antibody eculizumab has recently emerged as a treatment option for C3 glomerulonephritis. APIGN should be treated with antibiotics as soon as an underlying bacterial infection is identified. The management of diuretics is frequently beneficial for hypertension, and angiotensin-converting enzyme inhibitors are usually avoided during the acute phase. A low-sodium diet and fluid restriction must be prescribed in all cases of glomerulonephritis [12].

The clinical manifestation of glomerulonephritis is its contribution to end-stage kidney failure, which necessitates dialysis or transplantation. Glomerulonephritis is the second most common cause of end-stage renal failure worldwide [13].

CONCLUSION

In most cases, glomerulonephritis remains undiagnosed, and the epidemiology is unknown, due to asymptomatic illnesses that patients do not recognize. Identification of risk factors and potential causative agents may aid in the diagnosis of these cases. The renal biopsy must be used frequently to aid diagnosis, determine the best course of treatment, and determine prognosis. In terms of treatment, molecule-targeted and cell-targeted therapies can be more effective and reduce the side effects of other molecules.

CONFLICT OF INTEREST STATEMENT

We declare that we have no conflict of interest.

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