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Features of The Course and Treatment of Glomerulonephritis in Children

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ABSTRACT

Objective: *Glomerulonephritis in children represents a significant medical condition characterized by acute or chronic inflammation of the renal glomeruli, stemming from an infectious-allergic etiology. Understanding its clinical manifestations and establishing precise diagnostic and therapeutic approaches are vital for effective management.* ***Methods:*** *Diagnosis of glomerulonephritis in children involves a combination of medical history analysis, evaluation of clinical symptoms, laboratory testing, ultrasound imaging, and kidney puncture biopsy. Treatment in the acute phase integrates bed rest, a regulated diet, and pharmacological interventions, including antibiotics, corticosteroids, anticoagulants, diuretics, hypotensive agents, and immunosuppressive drugs.* ***Results:*** *The acute form is identified by a triad of symptoms: urinary syndrome (oliguria, anuria, hematuria, proteinuria), edema, and hypertension. Chronic forms may exhibit the predominance of one syndrome or present a latent course. Timely diagnosis and appropriate treatment improve the prognosis, reduce complications, and support recovery.* ***Novelty:*** *This study highlights the critical role of a multifaceted diagnostic approach combining clinical, laboratory, and imaging techniques. Additionally, it underscores the comprehensive pharmacological management strategies tailored to the acute and chronic manifestations of glomerulonephritis in children.*

INTRODUCTION

Glomerulonephritis in children is an immuno-inflammatory lesion of the glomerular apparatus of the kidneys, leading to a decrease in their function [1]. In pediatrics, glomerulonephritis is one of the most common acquired kidney pathologies in children, second only to urinary tract infections [2], [3]. Most cases of glomerulonephritis are recorded in children of preschool and primary school age (3-9 years), rare episodes (less than 5%) - in children of the first 2 years of life. Glomerulonephritis occurs in boys 2 times more often than in girls [4].

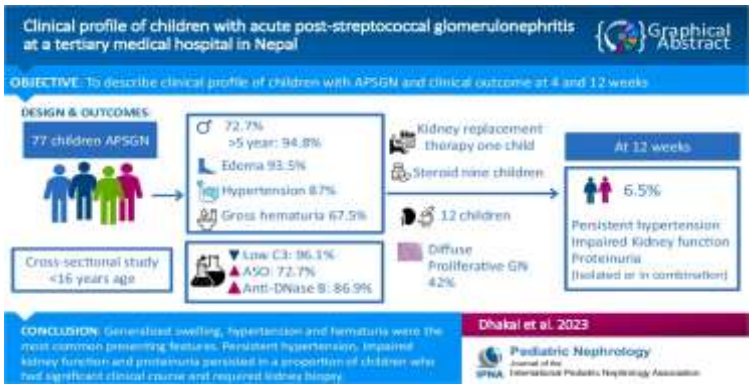

Figure 1. Clinical profile of children.

The development of glomerulonephritis in children is based on non-immune damage to the organ due to infectious allergy (formation and fixation of circulating immune complexes in the kidneys) or autoallergy (formation of autoantibodies), as well as developing hemodynamic and metabolic disorders. In addition to the renal glomeruli, tubules and interstitial tissue may also be involved in the pathological process [5], [6], [7]. Glomerulonephritis in children is dangerous by the risk of developing chronic renal failure and early disability.

RESEARCH METHOD

This study employs a descriptive and analytical approach to examine glomerulonephritis in children, focusing on clinical features, diagnostic methods, and treatment outcomes [8]. Data were collected retrospectively from pediatric nephrology records, including patient demographics, laboratory results, and imaging studies. Cases were selected based on standardized diagnostic criteria, with exclusion of incomplete records and unrelated systemic conditions [9], [10]. The analysis aimed to identify common etiologies, clinical patterns, and the effectiveness of therapeutic interventions to enhance understanding and management of the disease in pediatric populations [11], [12], [13].

RESULTS AND DISCUSSION

A. Reasons

In 80-90% of acute glomerulonephritis in children and in 5-10% of chronic cases, the etiological factor can be identified [14], [15]. The main causes of glomerulonephritis in children are infectious diseases - bacteria (primarily nephritogenic strains of group A β-hemolytic streptococci, as well as staphylococci, pneumococci, enterococci), viruses (hepatitis B, measles, rubella, parasites, malaria agent, toxoplasma) [16[, [17], fungi (candida) and non-infectious factors (allergens - foreign proteins, vaccines, serums, pollen, toxins, drugs). Most often, the development of acute glomerulonephritis in children is preceded by a recent (2-3 weeks ago) streptococcal infection in the form of sore throat, pharyngitis, scarlet fever, pneumonia, streptoderma, impetigo [18], [19].

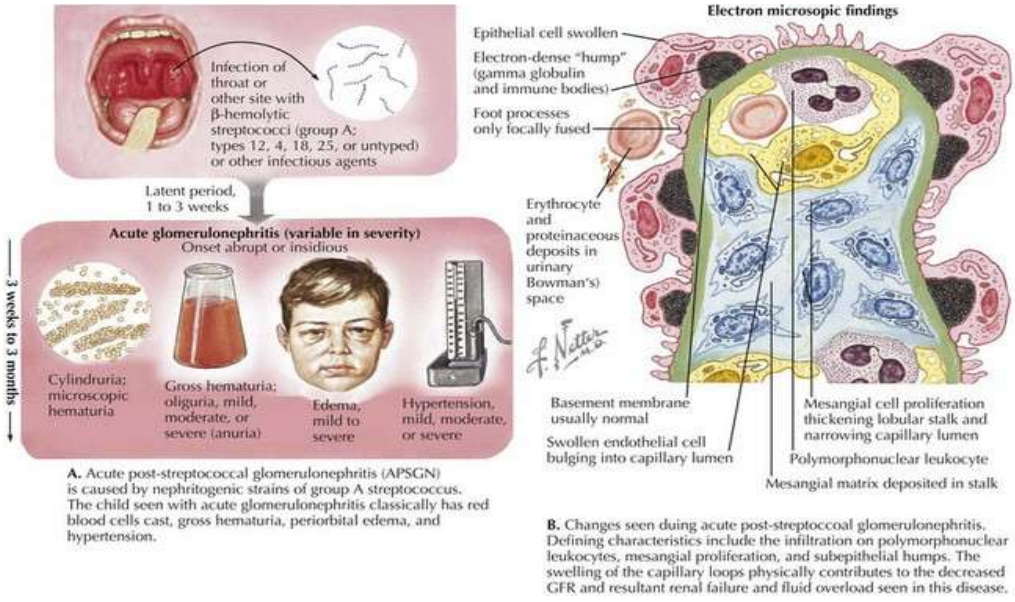

Figure 2. Electronic microscopic findings.

Chronic glomerulonephritis in children usually has a chronic course, it can be a consequence of untreated acute glomerulonephritis; The main role in its development is played by a genetically determined immune response to the action of an antigen specific to a particular individual [20]. The specific immune complexes formed in this case damage the capillaries of the renal glomerulus, which leads to impaired microcirculation and the development of inflammatory and dystrophic changes in the kidneys [21].

Glomerulonephritis can occur in children with various connective tissue diseases (systemic lupus erythematosus, hemorrhagic vasculitis, rheumatism, endocarditis) [22]. The development of glomerulonephritis in children is possible with some hereditary abnormalities: dysfunction of T-cells, hereditary deficiency of complement and antithrombin fractions C6 and C7 [23].

Predisposing factors for the development of glomerulonephritis in children may include: family history, hypersensitivity to streptococcal infection, carriage of nephritic strains of group A streptococcus, or the presence of chronic foci of infection in the nasopharynx and skin. Hypothermia (especially in a humid environment), excessive insolation, and ARVI contribute to the activation of latent streptococcal infection and the development of glomerulonephritis in children [24].

The course of glomerulonephritis in young children is influenced by age-related physiological characteristics (functional maturity of the kidneys), the specific reactivity of the child's body (sensitivity with the development of immunopathological reactions).

B. Classification

Glomerulonephritis in children can be primary (an independent nosological form) and secondary (occurring against the background of another pathology), of defined (bacterial, viral, parasitic) and unknown etiology, immunologically caused (immune complex and antibody) and immunologically unconditioned [25]. The clinical course of glomerulonephritis in children is divided into acute, subacute and chronic [26].

According to the spread of the lesion, diffuse and focal glomerulonephritis are distinguished in children; according to the localization of the pathological process - intracapillary (in the glomerulus of the vessel) and extracapillary (in the cavity of the glomerular capsule); by the nature of inflammation - exudative, proliferative and mixed [27].

Chronic glomerulonephritis in children includes several morphological forms: small glomerular disorders; focal segmental, membranous, mesangioproliferative and mesangiocappillary glomerulonephritis; IgA nephritis (Berge's disease). According to the leading manifestations, latent, hematuric, nephrotic, hypertensive and mixed clinical forms of glomerulonephritis in children are distinguished [28].

C. Symptoms of glomerulonephritis in children

Acute glomerulonephritis in children usually develops 2-3 weeks after infection, most often caused by streptococci. In the usual version, glomerulonephritis in children is cyclical in nature, characterized by rapid onset and severe manifestations: fever, chills, malaise, headache, nausea, vomiting, and back pain [29].

In the first days, the amount of urine excreted is significantly reduced, significant proteinuria, micro- and macrohematuria develop [30]. Urine acquires a rusty color (the color of a "piece of meat"). Swelling is characteristic, especially noticeable on the face and eyelids. Due to edema, the child's weight may be several kilograms higher than usual. There is an increase in blood pressure to 140-160 mm Hg. st, in severe cases it is prolonged. With adequate treatment of acute glomerulonephritis in children, kidney function is restored quickly; full recovery occurs after 4-6 weeks (on average after 2-3 months). In children, glomerulonephritis rarely (1-2% of cases) becomes chronic, which has a very diverse clinical picture.

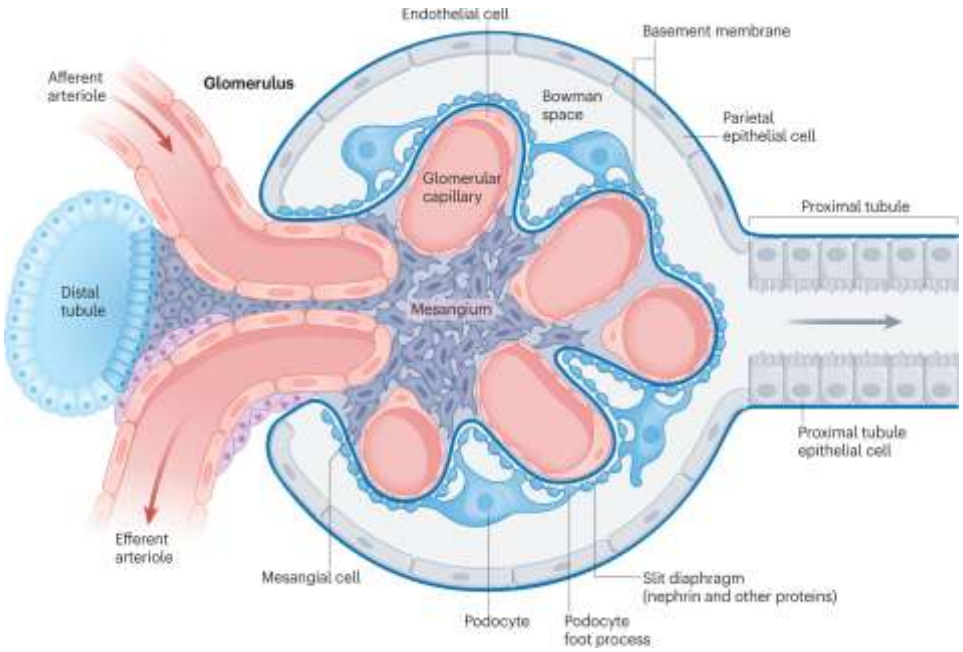

Figure 3. Structure of the renal glomerulus, highlighting the main components of blood filtration.

Hematuric chronic glomerulonephritis is most common in childhood. It has a slow-growing, recurrent or persistent course; it is characterized by moderate hematuria, with exacerbations - gross hematuria. Hypertension is not observed, edema is absent or mild.

Children often show a tendency to a latent course of glomerulonephritis with signs of arterial hypertension and edema, with scanty urine; in this case, the disease can only be detected by a complete examination of the child.

Nephrotic glomerulonephritis in children usually has a wavy, constantly recurring course. Urinary symptoms predominate: oliguria, significant edema, ascites, hydrothorax. Blood pressure is normal or slightly elevated. Massive proteinuria and mild erythrocyturia are observed. Hyperazotemia and decreased glomerular filtration are manifested by chronic renal failure or exacerbation of the disease.

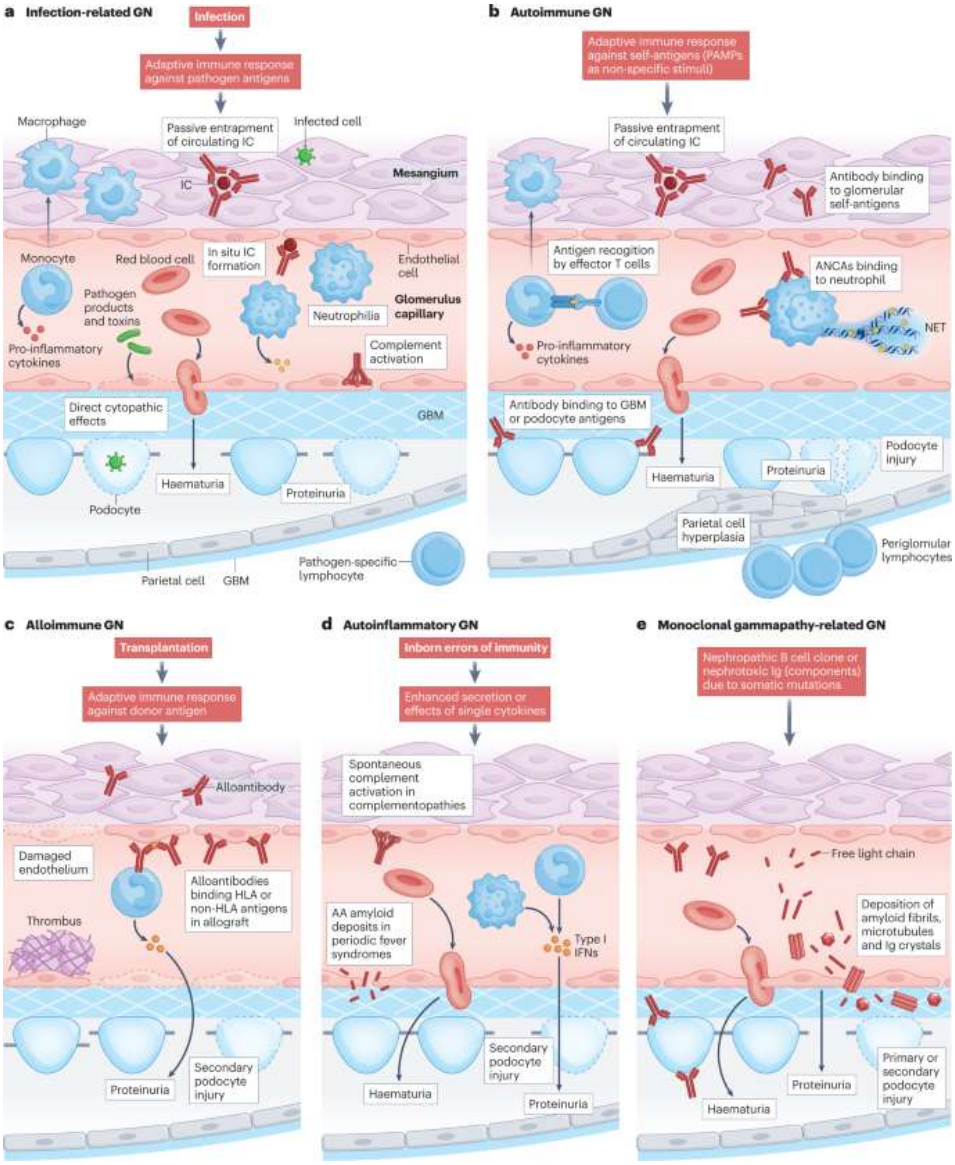

Figure 4. Classifications of glomerulonephritis based on immune responses and damage.

Hypertensive chronic glomerulonephritis is rare in children. The child is worried about weakness, headache, dizziness. It is characterized by persistent, progressive hypertension; urinary syndrome is mild, edema is insignificant or absent.

D. Diagnosis of glomerulonephritis in children

The diagnosis of acute glomerulonephritis in a child is confirmed on the basis of a history of a recent infection, the presence of hereditary and congenital kidney pathology in blood relatives, and a characteristic clinical picture confirmed by laboratory and instrumental studies. A child suspected of having glomerulonephritis is examined by a pediatrician and a pediatric nephrologist (pediatric urologist).

As part of the diagnosis, a general and biochemical analysis of blood and urine, Rehberg's test, Nechiporenko's urine test, Zimnitsky's test are examined. With glomerulonephritis in children, a decrease in diuresis, glomerular filtration rate, nocturia, micro- and macrohematuria, proteinuria and cylindruria are detected. Mild leukocytosis and increased ESR are observed in the blood; a decrease in complement fractions S3 and C5; increased levels of CEC, urea, creatinine; hyperazotemia, increased titer of streptococcal antibodies (ASG and ASL-O).

In acute glomerulonephritis in children, ultrasound examination of the kidneys shows a slight increase in their size and increased echogenicity. To determine the morphological variant of glomerulonephritis in children, prescribe adequate therapy, and assess the prognosis of the disease, a puncture biopsy of the kidneys is performed.

For glomerulonephritis in children, consultation with a pediatric ophthalmologist (with fundus examination to exclude angiopathy of the retinal vessels), geneticist (to exclude hereditary pathology), pediatric otolaryngologist and dentist (to identify and treat foci of chronic infection) is indicated.

E. Treatment of glomerulonephritis in children

For severe manifestations of glomerulonephritis in children (gross hematuria, proteinuria, edema, arterial hypertension), inpatient treatment with bed rest and a special diet (limited salt and protein), etiotropic, symptomatic and pathogenetic therapy is indicated. A strict salt-free diet is required until the edema disappears, and a strict protein-free diet is required until the normal volume of excreted fluid is restored.

In the acute period of glomerulonephritis in children, antibiotic therapy (penicillin, ampicillin, erythromycin) is prescribed. Correction of edema syndrome is carried out using furosemide and spironolactone. Antihypertensive drugs used in children include long-acting ACE inhibitors (enalapril), slow calcium channel blockers (nifedipine), and in adolescence - angiotensin II receptor blockers (losartan, valsartan). Glucocorticosteroids (prednisolone) are used, and in severe forms of chronic glomerulonephritis - immunosuppressive drugs (chlorbutin, cyclophosphamide, levamisole). In severe nephrotic syndrome, anticoagulants (heparin) and antiplatelet agents are prescribed to prevent thrombosis. With a significant increase in the level of uric acid, urea and creatinine in the blood, severe itching of the skin and jaundice, hemodialysis can be used.

After discharge from the hospital, children should be under the supervision of a pediatrician and pediatric nephrologist for 5 years, and in case of relapse of glomerulonephritis - for life. Spa treatment is recommended; prophylactic vaccination is contraindicated.

F. Prognosis and prevention of glomerulonephritis in children

With adequate treatment, acute glomerulonephritis in children in most cases ends in recovery. In 1-2% of cases, glomerulonephritis in children becomes chronic and, in rare cases, death is possible.

Acute glomerulonephritis in children can develop serious complications: acute renal failure, cerebral hemorrhage, nephrotic encephalopathy, uremia, and heart failure are life-threatening. Chronic glomerulonephritis in children is accompanied by a decrease in kidney function with the development of kidney shrinkage and chronic renal failure.

Prevention of glomerulonephritis in children consists of timely diagnosis and treatment of streptococcal infections, allergic diseases, and sanitation of chronic lesions of the nasopharynx and oral cavity.

The clinical manifestations of dacryocystitis in newborns develop in the first days or weeks of life, in premature babies - in 2-3 months of life. Usually, the child has a mucous, mucopurulent or purulent discharge from one or both eyes. Painful swelling in the area of the lacrimal sac, conjunctival hyperemia.

G. Meckel's diverticula in children

Uncomplicated Meckel's diverticulum in children is asymptomatic and may be an incidental finding during laparotomy for another condition or may not be recognized. The clinical presentation of Meckel's diverticulum in children is usually associated with the development of complications: intestinal bleeding, inflammation (diverticulitis), intestinal obstruction.

CONCLUSION

Fundamental Finding : The study highlights that glomerulonephritis in children, a prevalent immuno-inflammatory kidney condition, is largely influenced by infectious agents like streptococcal infections. It can lead to both acute and chronic forms, with symptoms ranging from edema and proteinuria to hematuria and hypertension. Genetic and environmental factors play a significant role in its development. **Implication :** The findings suggest that early diagnosis and treatment are critical in managing glomerulonephritis to prevent complications like chronic kidney failure. Preventive measures such as timely treatment of infections and addressing chronic foci are essential to mitigate risks in susceptible children. **Limitation :** This research primarily focuses on clinical observations and diagnostic methods, without delving deeply into the genetic and molecular underpinnings of glomerulonephritis. Further studies may be necessary to explore genetic predispositions and long-term impacts of treatments. **Future Research :** Future studies should investigate the genetic mechanisms behind the development of

glomerulonephritis in children, as well as the long-term efficacy of current treatment strategies, especially in preventing chronic kidney failure. Investigating potential vaccines or targeted therapies could also improve management outcomes.

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