Acute Glomerulonephritis

Glomerulonephritis is inflammatory damage to the glomeruli. Typical findings are glomerular type hematuria, decreased glomerular filtration rate and often hypertension.[1]

Acute post-streptococcal glomerulonephritis

- 10-20 days after infection with β-hemolytic streptococcus (tonsillitis, pharyngitis, impetigo);
- deposition of antigen-antibody immune complexes in glomerular capillaries (also with complement C3);
- common, especially in primary school-aged children, more so in boys; manifests with hematuria, proteinuria, and edema;
- increased creatinine, ASLO increase and decrease in complement C3 component;
- symptomatic treatment - control of fluid balance; treatment of streptococcal infection with procainpenicillin;
- prognosis is good, microscopic haematuria may persist for up to a year.[1]

Other postinfectious acute glomerulonephritis

- rarer; after parotitis or other bacterial, viral or parasitic infections (staphylococci, klebsiella, salmonella, brucella, leptospira, corynebacteria, campylobacter, rickettsia, hepatitis B viruses, CMV, VZV, EBV, Coxsackie, adenoviruses, toxoplasma, candida, etc.);
- immunocomplex etiology; prognosis is also good.[1]

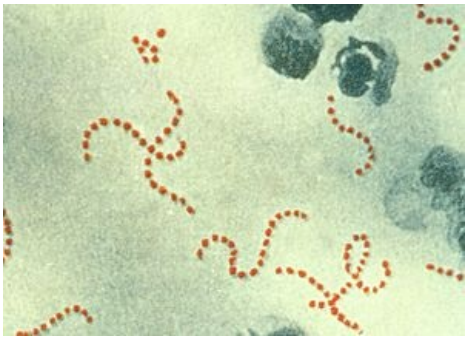
Rapidly progressive glomerulonephritis

- severe nephropathy; impaired renal function from early on; possible progression to chronic renal insufficiency to chronic renal failure.[1]

Acute poststreptococcal glomerulonephritis APGN

Acute glomerulonephritis is a bilateral, sudden-onset renal disease in which all glomeruli are affected by sterile inflammation with cellular proliferation. It is clinically characterized by acute nephritic syndrome. Most acute glomerulonephritis arise as a consequence of infections in the body. Acute post-streptococcal GN must be distinguished from other postinfectious GNs from etiological, clinical, and prognostic points of view. APGN most commonly affects school-aged children 5-12 years of age. In developed countries, the incidence is about 6-20:100,000; in developing countries, the incidence is much higher.

Etiopathogenesis


Streptococcus pyogenes

APGN is caused by hemolytic streptococcus group A, so-called nephritogenic M strains (most commonly types 12 and 49). The disease develops 1-3 weeks after recovery from a streptococcal infection (tonsillitis, pharyngitis, sinusitis, otitis media, scarlet fever, impetigo contagiosa streptogenes, streptococcal foci). Nephritogenic streptococci produce antigens, the most important of which are NSAP-streptokinase (nephritogenic strains associated protein), M-protein, and the so-called endostreptosin. These antigens are then followed by specific antibodies which, after binding with the antigen, form deposits of immunocomplexes on basal membranes of glomerular capillaries. APGN also involves the action of the streptococcal enzyme neuraminidase, which alters the structure of host IgG. The altered IgG thus becomes an autoantigen, the body produces autoantibodies (so-called rheumatoid factors) which leads to forming of **immunocomplexes** which precipitate in cold serum (so-called cryoglobulins). Pathophysiologically, intraglomerular hypertension and hyperfiltration per nephron are present in APGN, although GF and blood flow are reduced. Nowadays, primary renal sodium retention is thought to be the cause of edema - meaning that GN affects glomeruli and tubular cells, or sodium reabsorption in them as well. Pathologically and anatomically, APGN is described as an endocapillary **proliferative'** GN.

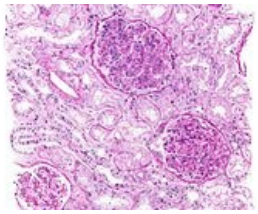
Clinical presentation

Approximately 30% of patients who develop APGN are found to have erythrocyturia as early as pharyngeal infection or pyoderma. An episode of latency follows 1-3 weeks after pharyngitis, and 4-8 weeks after pyoderma. Disease after the latency period begins with **general symptoms**: nausea, inappetence, headache, and vague pain in the lumbar region. Children often have abdominal pain and are often colicky. Often **macroscopic haematuria** is observed by the patient or his parents - the urine is dark, reddish-brown, the colour of *washed-out flesh*. Typical are **swellings'**, which initially appear in the eyelids, fingers, and pretibially. A *pallor* in the cheeks resembling a *doll* may be characteristic. The onset of the disease is usually **oliguria**, less commonly anuria. A common symptom is **hypertension** with systolic BP values ranging from 160-200 mmHg and diastolic values from 110-130 mmHg. A significant proportion of patients have poorly expressed symptoms, others may even be absent - we speak of oligosymptomatic forms.

Diagnosis

Blood in the urine is always detected chemically and by using a microscope. Microscopic hematuria is most commonly found, but macroscopic hematuria may also be present. [Proteinuria]] is usually in the range of 0.5-2 g/24 h. Proteinuria lasts for several days, usually resolving after a week, but sometimes proteinuria can be nephrotic. In further urine examination we detect hyaline, erythrocytic or granular cylinders. The osmolality of urine is high. Complement component C3 is transiently reduced in up to 90% of cases, returning to normal usually within 8 weeks; CH50 may also be reduced. FDP and D-dimer concentrations in serum and urine are elevated. During a dilated eye exam, spasms of small arteries may be found because of hypertension, but significant findings are absent. Sedimentation tends to be elevated, and we may find mild dilutional anemia, leukocytosis and moderate thrombocytopenia in the blood count. Fibrinogen, factor VIII and plasmin activity are elevated. We find mild hypergammaglobulinemia, elevation of IgG and IgM. Cryoglobulinemia can also be demonstrated, and we find RF positivity in about 50% of patients. Evidence of streptococcal infection is done by testing ASLO titer, anti deoxyribonuclease B (anti-DNase B), antihyaluronidase. If a skin infection has been present, then ASLO is usually negative and anti-DNase is more reliable. Erythrocytes in urine have cell membrane changes (irregular thickenings, protrusions) with characteristic findings of > 5-12% acanthocytes. The finding is suggestive of glomerular erythrocyturia. GF tends to be markedly reduced, and creatinine in serum tends to be normal or elevated. Renal biopsy is not indicated in APGN. The diagnostic algorithm opts for it when the course is atypical, e.g. when membranoproliferative GN or rapidly progressive GN (RPGN) is suspected.

Differential diagnosis



Histology of post-infectious glomerulonephritis

In an acute exacerbation of a previously clinically mute chronic GN, the clinical symptoms appear concomitantly with infection, there is no latency period, creatinine concentration is higher, oliguria is more pronounced, decreased GF tends not to correct, and the kidneys on USG tend to be shrunken. To differentiate other causes of hematuria, examination of the C3 component of complement is appropriate in the atypical course of APGN. In prerenal and postrenal (urological) causes, the C3 concentration is always within normal limits. The haemolytic uraemic syndrome has, in addition to haematuria and oliguria, marked thrombocytopenia and characteristic erythrocyte changes in the blood smear. In RPGN, in contrast to APGN, GF values do not improve after an initial decline; on the contrary, they progressively worsen, and patients progress to a state of chronic renal insufficiency. Membranoproliferative GN often begins with the same clinical picture of acute nephritic syndrome, but C3 concentrations do not return to normal even after 8 weeks. Hereditary nephritis is distinguished by family history, presence of hearing and visual impairment, non-significantly increased sedimentation rate and unchanged C3 concentration. The definitive answer is the result of renal biopsy. [Polyarteritis nodosa]] presents with fever, joint involvement, splenomegaly and neuritis in addition to the acute nephritic syndrome. Wegener's granulomatosis usually starts with systemic, pulmonary and ocular manifestations and the nephritic syndrome appears later in the course of the disease. Essential cryoglobulinemia may begin with nephritic syndrome, but arthralgia, exanthema and Raynaud's phenomenon are also present.

Complications

The most serious complication is heart failure from hypervolemia and hypertension. Clinically, it manifests as pulmonary edema, orthopnea, tachypnea, tachycardia, and gallop. With a sudden rise in BP and the development of hypertensive crisis, cerebral edema develops, which manifests as an attack of hypertensive encephalopathy. The clinical symptoms are headache, vomiting, tonic-clonic seizures with visual disturbances, and unconsciousness. Sometimes, even after correction of the clinical symptoms, slight residual proteinuria or erythrocyturia remains for a long time. Microscopic erythrocyturia may still occur after 6 or even 12 months after excessive physical activity or during intercurrent infection in patients who have already had a negative urine finding. In deciding whether microscopic hematuria or proteinuria is still evidence of active form or has already transitioned to a chronic form, we perform a renal biopsy (usually not performed before 12 months) or test for selectivity of proteinuria and C3 complement component concentration.

Therapy

It is recommended that a patient with APGN is hospitalized. The treatment is symptomatic, i.e. only complications are treated. The mainstay of treatment is physical rest, preferably until the symptoms of active disease (resolution of hypertension, oedema, macroscopic haematuria, proteinuria and decrease in sedimentation rate) have disappeared. Diet is another essential point of therapy: in the first days, a carbohydrate diet is prescribed and patients are given only as much fluid in the form of weak tea as the diuresis and perspiratio insensibilis (usually 500-700 ml). As the oliguria subsides, fluid intake is gradually increased and a diet with limited salt and protein intake is given until the most severe symptoms of the disease (hypertension and oedema) disappear. Usually, after 7-14 days, the patient can receive a normal diet. The only exceptions are conditions with the development of renal insufficiency. Streptococcal infection is always re-treated with penicillin. The classical dosing schedule (i.e., "adequate" doses for 10 days) is followed prophylactically with Penclen 2 × 1 tbl. daily or depot PNC (Pendepon 6 months after the onset of illness.) However, other authors do not recommend penicillin as prophylaxis. If allergic to penicillin, macrolides can be given. After the resolution of acute symptoms of the disease, the foci containing streptococci should be surgically removed under the screen of ATB (tonsillectomy, tooth extraction). After such a procedure, a temporary activation of the disease often occurs, which is manifested by an increase in hematuria and an acceleration of erythrocyte sedimentation. Patients with severe disease present to the ICU demonstrating oliguria, heart failure or severe hypertension. In anuria, we restrict fluid intake and administer diuretics. Oligoanuria is induced by local activation of haemocoagulation and blockage of glomerular capillaries by thrombi, therefore heparin 100-300 j/kg slowly i.v. or even more preferably low molecular weight heparin is useful in this indication.

We supplement Anticoagulation therapy with antiplatelet therapy (dipyridamole, ticlopidine). Hypertension is usually influenced by salt and fluid reduction in the diet, pharmacological administration of diuretics or ACE-I preparations. In hypertensive crisis, we prefer nitroprusside, we control convulsions with Diazepam. In heart failure, dialysis is more effective than catecholamines. Corticosteroids are contraindicated in APGN therapy as they may lead to a sudden rise in BP.

Prognosis

APGN is considered to be a benign disease that is cured within 4-6 months in most cases. In some patients, the course is protracted or residual changes remain in the form of microscopic hematuria after exercise or infection. The prognosis is worse in patients with persistent hypertension and proteinuria, which is associated with the development of irreversible glomerulosclerosis.

Acute non-streptococcal post-infectious GN

These are sterile immunopathologic inflammations of the glomerulus that occur after a non-streptococcal infection of the body. The etiology of acute postinfectious GN is heterogeneous. They can be caused by staphylococci, *E. Coli* and other bacteria (e.g. in infected artificial shunts - so-called shunt GN, in subacute infective endocarditis - common in i.v. in drug addicts, in pyoderma and tonsillopharyngitis), viruses (HBV, parotitis, Coxsackie, ECHO, CMV, influenza A, B), other microorganisms (*Listeria monocytogenes*, *Toxoplasma gondii*, *Candida albicans*). Morphologically, in acute non-streptococcal post-infectious GN, more prognostically severe forms of GN are found, e.g. membranoproliferative or membranous GN. In acute post-infectious GN, the clinical and laboratory picture is similar to that of APGN, but there is no evidence of previous streptococcal infection. The prognosis of acute nonstreptococcal postinfectious GN is significantly worse than that of APGN. These GNs usually have a protracted course with a tendency to progress to chronicity and therefore, based on the morphological picture, usually require more intensive treatment than in APGN. Post-viral GNs have the most severe prognosis, whereas many postbacterial GNs will also modify the GN itself once the infection is cured.

References

Related articles

- Glomerulonephritis: Rapidly progressive glomerulonephritis - Chronic glomerulonephritis - Acute glomerulonephritis/case report - Poststreptococcal Acute Glomerulonephritis
- Acute renal failure
- Hemolytic uremic syndrome
- Urinalysis

References

1. LEBL, J – JANDA, J – POHUNEK, P, et al. *Klinická pediatrie.* 1. edition. Galén, 2012. 698 pp. pp. 605-606. ISBN 978-80-7262-772-1.

Source

- MUDr.HAVRÁNEK, Jiří: Akutní glomerulonefritida

Useful information

Glomerulonephritis (Slovak) (https://www.techmed.sk/glomerulonefritidy/)