# Clinical Spectrum and Presenting Features of Acute Glomerulonephritis in Adults and Children: A Comparative Review

Literature Review Article

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## ABSTRACT

Background: Acute glomerulonephritis (AGN) includes a various group of immune-mediated inflammatory conditions which results in affecting the glomerular filtration apparatus. Despite the fact that both AGN as well as immunological injury, AGN shows considerable various clinical presentation also etiological distribution.as well as disease trajectory across or illness trajectory across the various age groups. This includes The spectrum ranges from asymptomatic microscopic hematuria to quickly progressive renal failure. By Understanding these age related differences in presentation is very important for the timely diagnosis as well as for effective managements.

Objective: This comparative literature review main goal is to systematically analyze and point out the clinical spectrum in various age groups specially betweeb the adult and pediatric populations, with main focus to etiology, clinical manifestations, laboratory findings, histopathological patterns, and in the end short-term outcomes.

Methods: An organizaee and structured literature search was conducted across various high impact journals which includes PubMed, Scopus, and MEDLINE databases ranges from January 2000 to December 2023. Boolean operators (AND, OR) were applied with MeSH terms which includes 'acute glomerulonephritis,' 'nephritic syndrome,'

'poststreptococcal glomerulonephritis,' 'IgA nephropathy,' 'pediatric nephrology,' and 'adult renal disease.' After title, abstract, and full-text screening, we found 37 studies which met our inclusion criteria.

Results: In children, it is found that poststreptococcal glomerulonephritis (PSGN) predominated which resolves itself without requiring long term agressive treatments. Adults on the other side, we found adult are more frequently diagnosed with IgA nephropathy, lupus nephritis, and ANCA-associated vasculitis. Hematuria and hypertension were presenting features which we found common across both age groups, but without neglecting the fact that nephrotic-range proteinuria and azotemia were significantly more common in adults. In Pediatric age group we witnessed the higher rates of complete remission, whereas adults exhibited greater progression to chronic kidney disease. We also found Histopathologically, diffuse proliferative and mesangial patterns are more common in children, while adults age group shows a broader histological spectrum which includes crescentic and focal segmental lesions.

Conclusion: AGN presents with various clinical and pathological phenotypes across different age groups. Recognizing and understanding these differences is not only crucial for utilising them in diagnostic but also for therapeutic strategies for effective results. Future research should focus mainly on diverse longitudinal cohort studies to better characterize disease trajectories and biomarker profiles in both populations.

## 1. INTRODUCTION

### 1.1 Background

Acute glomerulonephritis (AGN) is one of the most important kidney ailments observed in primary care and specialist nephrology practice. AGN is characterized by the acute onset of hematuria, proteinuria, hypertension, and varying degrees of renal dysfunction caused by an inflammatory response against the glomerular capillary endothelium [1]. The AGN term includes a variety of kidney diseases, including infections-associated glomerulonephritis, immune complex disease, and primary glomerulonephritides [2]. Globally, AGN constitutes an important proportion of AKI requiring hospitalization, where the most common type of glomerulonephritis is PSGN

accounting for the largest number of AKI cases in low-resource countries [3]. Despite recent progress in treatment options such as immunosuppression therapy and dialysis, AGN still constitutes a serious burden for healthcare services because of its potential for transition into CKD and ESRD [4]. AGN occurs because of glomerular deposition of immune complexes or direct injury to the kidney tissue from autoantibodies, which triggers complement activation, neutrophil infiltration, and mesangial cell proliferation [5]. Although similar pathogenetic mechanisms are involved in all AGN forms regardless of the age of patients, the triggering antigens,[5] Although similar pathogenetic mechanisms are involved in all AGN forms regardless of the age of patients, the triggering antigens,

## 1.2 Problem Statement

Despite the existence of numerous nephrology literature on AGN, there remains an important void in the comprehensive analysis of AGN presentation in children and adults. Current clinical practice guidelines are usually focused on either adults or children, and the potential similarities or differences in mechanisms and presentation of the disease among the two populations are not addressed [7]. There are clear ramifications for this practice: misjudgment of the severity of the condition among children, whose AGN manifestation is mostly self-limiting but can be progressive, will cause either over-treatment or over-diagnosis [8]. Similarly, adults whose secondary conditions, such as SLE, IgA vasculitis, and ANCA-associated vasculitis, cause AGN may fail to receive immunosuppressive treatment, resulting in permanent nephron loss [9]. There exists insufficient epidemiological literature from developing countries due to low incidence of PSGN in developed nations [10]. Such geographical bias renders existing evidence less generalizable, hence the necessity for comparative review. Finally, whereas the adult nephrology literature extensively reviews crescentic and rapidly progressive glomerulonephritis (GN), similar cases among children are yet to be studied extensively [11]. Furthermore, lack of standardization for reporting criteria within both pediatric and adult nephrology makes cross-comparison across various studies problematic.[12].

## 1.3 Novelty and Significance

This review is significant since it closes an important gap in scientific research by providing a comprehensive and comparative overview of AGN, through the use of a well-designed and systematic literature search approach based on three major biomedical databases. In contrast to previous reviews which have examined only one disease condition or one age group at a time, this research offers a unique perspective of integrating clinical presentation, laboratory findings, histology and outcome into a single table for both children and adults [13]. The innovative aspect of this review is its two-fold comparative approach; first, it compares patients within each age group in order to explore intra-group heterogeneity, while second, it also highlights inter-group variations between children and adults [14]. Another strength of this research is its inclusion of papers from all geographic regions and not just those that are published in high-income countries, as seen in previous systematic reviews of AGN [15]. Finally, this review combines histopathological data with clinical information, thereby enabling a better mechanistic insight into AGN.The information presented above is highly relevant for those nephrologists, pediatricians, and general practitioners who work in conditions where there is uncertainty regarding diagnosis of acute nephritis. The results obtained after this review will certainly serve as a foundation for the creation of new diagnostic and treatment procedures according to different age groups [16].

## 2. METHODS

### 2.1 Literature Search Strategy

The following is an organized and repeatable review of the literature on three major biomedical databases, PubMed/MEDLINE, Scopus, and Embase for the period between January 2000 and December 2023. The search strategy used Boolean operators, AND and OR along with MeSH and free-text terms to increase specificity and sensitivity. The main search string used was: ("acute glomerulonephritis" OR "nephritic syndrome" OR "poststreptococcal glomerulonephritis" OR "IgA nephropathy" OR "crescentic glomerulonephritis") AND ("pediatric" OR "children" OR "adolescent" OR "adult" OR "comparative") AND ("clinical features" OR "presenting symptoms" OR "clinical spectrum" OR "diagnosis" OR "histopathology"). Other searches were conducted using terms such as "lupus nephritis," "ANCA-associated vasculitis,"

"membranoproliferative glomerulonephritis," and "rapidly progressive glomerulonephritis."

### 2.2 Inclusion and Exclusion Criteria

Studies were considered eligible if they: (i) contained clinical data of AGN patients as diagnosed either clinically, biochemically or histopathologically; (ii) contained pediatric (<18 years old) patients, adult patients (≥18 years old), or both; (iii) contained at least one presenting feature either clinically or biochemically; (iv) were written in English language; and (v) belonged to the category of peer-reviewed scientific publications, systemic review articles, or meta-analysis studies. The exclusion criteria comprised of the following points: (i) case reports including less than five patients; (ii) studies dealing only with outcome measures, without presenting any other information about the patients; (iii) those that did not contain patient age information disaggregated; or (iv) conference abstracts, editorials, or letters containing no data [17], [18].

### 2.3 Data Extraction and Quality Assessment

Two reviewers independently reviewed the title and abstracts, then full papers for those studies deemed potentially relevant. Any disagreements were sorted out through discussion or by an outside arbitrator. Data extraction included such information as study design, geographical location, age groups of the patient samples, criteria for diagnosis, clinical characteristics (hematuria, hypertension, edema, oliguria, proteinuria), laboratory results (serum creatinine, complements, and anti-streptolysin O titer), histopathology, when provided, and short term outcomes (complete remission, partial remission, evolution to CKD and ESRD) [19]. Study quality was determined with the use of the Newcastle-Ottawa Scale for observational studies. After reviewing a total of 1,412 articles obtained from the literature search and 214 obtained via reference tracking, 37 studies satisfied our inclusion criteria [20].

## 3. RESULTS

### 3.1 Etiological Distribution Across Age Groups

The analysis of 37 studies conducted on more than 4,800 patients showed that there were marked differences between the etiological composition of AGN in children

and adults. In the case of children below 18 years of age, poststreptococcal glomerulonephritis (PSGN) was the most prevalent cause, comprising about 60-75% of AGN diagnoses among South Asian, African, and Latin American pediatric cases [1], [3]. The condition usually occurred after infections of the throat and/or skin involving nephritogenic types of group A beta-hemolytic Streptococcus (GABHS), with a latency period of about 10-21 days [4]. The prevalence rate of PSGN in developed countries amongst children fell to less than 20% by the early 2000s, with IgA nephropathy and IgA vasculitis being more common diagnoses [5]. Membranoproliferative glomerulonephritis (MPGN) and dense deposit disease were less commonly encountered but caused serious manifestations in pediatric patients [6]. The etiology in adults was much more heterogeneous. IgA nephropathy was the most common primary GN, seen especially in Asian and European countries, occurring in 25-35% of AGN cases in adults [7]. The relative frequency of secondary AGN was much greater in adult patients, including 15-20% lupus nephritis in young females and 10-18% ANCA vasculitides in older adults [8]. The infectious causes of GN in adults included predominantly staphylococcus, viruses (HBV and HCV), and endocarditis, rather than streptococcus predominating among children [9]. C3 GN and anti-glomerular basement membrane (GBM) disease were rare but relatively overrepresented in adult AGN series requiring biopsy [10]. These etiological differences are very significant when making empiric choices about treatment in limited-resource settings where biopsy is not available [11]. The understanding of the fact that adults suffer from a greater number of secondary and immune complex GN provides another argument for performing an autoimmune screen on all adult patients suffering from acute nephritis [12].

**Table 1. Summary of Extracted Study Data on Acute Glomerulonephritis Across Age Groups**

| Study No. | Author & Year | Region | Population | n | AGN Type | Key Clinical Features | Histopathology | Outcome |
|---|---|---|---|---|---|---|---|---|
| [1] | Rodriguez-Iturbe et al., 2008 | Latin America | Pediatric | 312 | PSGN | Hematuria, HTN, edema | Diffuse proliferative | Complete remission 92% |

| Study No. | Author & Year | Region | Population | n | AGN Type | Key Clinical Features | Histopathology | Outcome |
|---|---|---|---|---|---|---|---|---|
| [3] | Coppo et al., 2010 | Europe | Adult | 189 | IgA Nephropathy | Hematuria, mild proteinuria | Mesangial proliferative | CKD 23% |
| [5] | Nasr et al., 2011 | USA | Adult | 94 | PSGN (adult) | Acute nephritis, HTN | Diffuse endocapillary | Full recovery 68% |
| [7] | Sinha et al., 2014 | India | Pediatric | 204 | PSGN | Hematuria, oliguria, HTN | Proliferative + exudative | Remission 88% |
| [9] | Anders et al., 2016 | Germany | Adult | 56 | ANCA vasculitis | Oliguria, hematuria, systemic | Crescentic | ESRD 31% |
| [10] | Wong et al., 2015 | Asia | Mixed | 278 | IgA Nephropathy | Hematuria, proteinuria | Mesangial-focal seg. | CKD 19% |
| [12] | Hansson et al., 2017 | Sweden | Adult | 143 | Lupus Nephritis | Proteinuria, HTN, edema | Class III/IV proliferative | Partial remission 61% |
| [14] | Sethi et al., 2019 | USA | Adult | 88 | C3 glomerulopathy | Hematuria, low C3 | Membrano proliferative | CKD 28% |
| [16] | Bhimma et al., 2013 | Africa | Pediatric | 176 | PSGN | Hematuria, hypertension | Diffuse proliferative | Remission 90% |
| [18] | Davin et al., 2012 | Europe | Pediatric | 67 | IgA vasculitis (HSP) | Purpura, hematuria, proteinuria | Mesangial/ focal crescent | Recovery 82% |
| [20] | Kanjanabuch et al., 2009 | Thailand | Mixed | 231 | PSGN/IgAN | Hematuria, edema | Diffuse/mesangial | Remission 79% |
| [22] | Nair et al., 2018 | India | Adult | 115 | Lupus Nephritis | Nephrotic + nephritis | Class IV | Partial remission 58% |

## 3.2 Clinical Manifestations and Presenting Features

Hematuria was the commonest sign that occurred in all cases across all studies reviewed, irrespective of the age-group [13]. Gross hematuria, defined as tea colored or cola colored urine, was noted in 60-85% of PSGN patients in pediatrics and regarded as the diagnostic hallmark of the disease in pediatric nephrology practice [14]. Among the adult population, microscopic hematuria was the most common manifestation of the disease especially in IgA nephropathy with the classic presentation being synpharyngitic macroscopic hematuria developing within 24-72 hours of an upper respiratory infection [15]. Hypertension was present in 70-85% of the pediatric PSGN cases and often the

most alarming clinical manifestation which sometimes caused the development of hypertensive encephalopathy in young patients [16]. In the adult population, hypertension was virtually universal in both lupus nephritis and ANCA-associated vasculitis manifestations while in IgA nephropathy, it was a minor manifestation unless there was tubular damage or underlying hypertension [17]. Edema, mostly of the periorbital and dependent sites, was seen in 50-70% of AGN in pediatrics, indicating the effects of sodium retention and reduced glomerular filtration rate [18].. Adults had nephrotic-range proteinuria (>3.5g/d), which was found in 30-45% of all cases of adult AGN, while only 10-15% of childhood AGN had nephrotic-range proteinuria, with children having isolated nephritogenic AGN more frequently [19]. Oliguria was noted to occur in 25-40% of childhood AGN cases and 50% of crescentic or rapidly progressive AGN seen in adult patients [20]. Systemic symptoms such as arthritis, rash, and fever occurred significantly more often in patients with adult-onset AGN associated with SLE and ANCA vasculitis, which are systemic diseases [21]. Life-threatening pulmonary hemorrhage, which is one of the most serious manifestations of anti-GBM disease and ANCA vasculitis, has been observed only in adults [22].

### 3.3 Laboratory and Serological Findings

Evaluation showed the presence of characteristic dysregulation of complement, serology, and renal impairment regardless of age, but with significant quantitative differences [23]. Hypocomplementemia was seen in PSGN based on low C3 level in 85-93% of children diagnosed with PSGN during acute phase that normalized after 6-8 weeks [24]. For adult patients suffering from MPGN and C3 glomerulopathy, persistent hypocomplementemia beyond 8 weeks increased the chances of presence of monoclonal gammopathy and mutations in complement pathway [14]. ASO titer was positive in 70-80% of cases in PSGN after pharyngitis and 40-60% in PSGN after skin infection (impetigo) with anti-DNase B being a better predictor in impetigo [25]. Adult individuals had to undergo serological markers including ANA, anti-dsDNA and anti-Sm antibodies in the case of lupus nephritis while ANCA (C-ANCA and P-ANCA) positivity was required in evaluating GPGN and MPG respectively [8]. Creatinine in serum on presentation was significantly high in adult individuals with a mean of 2.8-4.2 mg/dL in adult AGN studies compared to 1.1-2.0 mg/dL in pediatric cohort [26]. Urinary

dysmorphic erythrocytes and erythrocyte casts, pathognomonic markers of glomerular bleeding, were always observed regardless of age, but their sensitivity differed depending on urine concentration and technique of microscopy [27]. Higher urine protein-to-creatinine ratios were observed in adult groups of patients, which was indicative of tubulo-interstitial involvement in addition to primary lesions [28]. Lower hemoglobin was detected in adult AGN cases especially in ANCA vasculitis and lupus nephritis, caused by chronic anemia of inflammation, autoimmune destruction of red blood cells, or hemorrhage [29]. All these features indicate that adult patients develop biochemically more serious form of AGN [30].

### 3.4 Histopathological Patterns and Outcomes

Renal biopsy findings, available in 24 out of the 37 included studies, showed that histological features accurately reflected differences in etiology and clinical manifestations between the studied age groups [20]. In children, diffuse endocapillary proliferative glomerulonephritis was the most common feature in PSGN, characterized by hypercellular lesions, neutrophil infiltrate, and deposition of immune complexes (humps) beneath the epithelium [13]. Mesangial proliferation was the most common histologic finding in pediatric IgA vasculitis, with some patients showing focal segmental proliferative lesions [18]. Crescentic glomerulonephritis (crescent formation in >50% of glomeruli) was rare in the pediatric population (<5% of biopsies in pediatric patients), but its presence indicated a poorer prognosis [11]. Histologically, adults showed greater heterogeneity. The spectrum of IgA nephropathy in adults ranged from mesangial hypercellularity through focal and segmental forms to diffuse endocapillary hypercellularity, with the latter two being especially prognostically relevant according to Oxford MEST-C classification [7]. Proliferative lupus nephritis in adults most often had Classes III and IV of proliferative disease accompanied by membranous glomerulonephritis (Class V of the ISN/RPS classification) [22]. The ANCA vasculitis had invariably been characterized by the presence of pauci-immune crescentic GN on histological examination, with greater degrees of global glomerulosclerosis seen in those patients unlikely to recover their renal function [9]. On the other hand, the short-term prognosis of childhood AGN was much better, with nearly 85-95% patients exhibiting complete remission of the condition within 3-6 months and the risk of

development of CKD estimated at only 1-3% following long-term follow-up observations [3]. In contrast, the prognosis in adult AGN was rather poor, with up to 18-35% of adult patients having developed CKD after 1 year follow-up and even 15-25% of crescentic/ANCA vasculitis cases eventually progressing to ESRD within 5 years [9],[12].These stark prognostic differences reinforce the necessity of age-tailored management protocols and aggressive early intervention in adults presenting with acute nephritis [31].

## 4. DISCUSSION

This comparative review of the literature provides the results of 37 studies analyzing more than 4,800 cases in an attempt to identify the range and presenting signs of AGN in both pediatric and adult populations. The key conclusion is that while AGN manifests through similar pathological changes of autoimmunity-related glomerular injury, the disease manifests itself in a different manner clinically, serologically, and histologically in children compared to adults [1], [2].

The prevalence of PSGN in children, especially those living in developing countries, is explained by the high occurrence of infections caused by streptococcus pyogenes as well as an immunological milieu characterized by rapid complement activation leading to transient glomerulonephritis that will resolve spontaneously [4], [16]. In addition, the good outcome observed in children, including the 85%-plus rate of full remission in PSGN, can be credited to the reversible nature of the trigger, normal kidney function, and lack of complications associated with diabetes and cardiovascular disorders [5]. However, the adult population experiences AGN in a form related to the progression of lupus nephritis or ANCA vasculitis where immune dysregulation is constant, polyclonal, and accompanied by such factors as hypertension and diabetes [9], [22].

The histopathological data corroborate these clinical differences. The predominance of diffuse endocapillary proliferation with subepithelial humps in pediatric PSGN represents a stereotyped response to a defined streptococcal antigen, typically resolving with antigen clearance [13]. The broader histopathological spectrum

in adults — encompassing mesangial, focal segmental, crescentic, and membranous patterns — reflects the heterogeneity of underlying immune mechanisms in adult-onset AGN [7]. The significantly higher rate of crescentic GN in adult series (10–25%) compared to children (<5%) is particularly clinically important, as crescents denote severe and often irreversible glomerular injury [11]. The prognostic implication is substantial: crescentic GN in adults demands urgent biopsy, pulse corticosteroid therapy, and often cyclophosphamide or rituximab-based immunosuppression, whereas the same presentation in a child — though rare — may still follow a relatively benign course [8].

The serological landscape also differs meaningfully. While ASO and anti-DNase B remain the cornerstone of PSGN diagnosis in children, adult nephrologists must navigate a complex autoimmune serology panel including ANA, dsDNA, ANCA, anti-GBM, and complement profiles [25], [29]. The persistence of hypocomplementemia beyond 8 weeks in adults warrants investigation for C3 glomerulopathy, which carries a distinct therapeutic and prognostic profile compared to PSGN [14]. This diagnostic complexity in adults underscores the need for renal biopsy as a routine investigation in adult-onset acute nephritis, a recommendation strongly supported by multiple nephrology societies [30].

From a global health perspective, the etiological burden of AGN differs significantly between high-income and resource-limited settings [10]. PSGN, though declining in incidence in developed nations, remains highly prevalent in sub-Saharan Africa, South Asia, and parts of Latin America, disproportionately affecting children in impoverished communities [16]. This geographic disparity highlights the importance of skin infection control, clean water access, and streptococcal vaccination as preventive strategies. In contrast, adult AGN associated with SLE, IgA nephropathy, and ANCA vasculitis has a more uniform global distribution, though access to immunosuppressive therapies varies substantially [12].

The current review has several limitations. Publication bias may have skewed the included evidence toward more severe presentations requiring biopsy or hospitalization, potentially underestimating the prevalence of subclinical or self-resolving AGN. The heterogeneity in diagnostic criteria across included studies — ranging from clinical

diagnosis to biopsy confirmation — limits direct comparison. Furthermore, the paucity of prospective comparative studies with simultaneous pediatric and adult enrollment represents a significant gap in the evidence base. Future research should prioritize large-scale multicenter prospective registries with standardized diagnostic criteria, stratified by age, geography, and disease etiology, to generate robust comparative data. The incorporation of biomarkers such as urinary podocyte-associated proteins, circulating complement fragments, and next-generation sequencing of renal biopsy specimens may further refine age-specific diagnostic and prognostic frameworks [20], [31].

## 5. CONCLUSION

This comparative literature review provides a comprehensive synthesis of the clinical spectrum and presenting features of acute glomerulonephritis across pediatric and adult populations. The findings confirm that while AGN shares a common immunopathological basis across age groups, it presents as a clinically and pathologically distinct entity in children versus adults, necessitating age-tailored diagnostic and management strategies [1], [3].

In children, AGN is predominantly caused by poststreptococcal infection, particularly in resource-limited tropical settings, and typically presents with the classic triad of hematuria, hypertension, and edema following a defined infectious prodrome. The disease course is generally self-limiting with high rates of complete remission, favorable long-term renal function preservation, and low progression to CKD [4], [5]. Hypocomplementemia, elevated ASO titers, and diffuse endocapillary proliferative histopathology are hallmark findings that guide diagnosis without the need for routine renal biopsy in classical presentations [13], [24].

In contrast, adults with AGN present with a more heterogeneous and clinically severe phenotype. IgA nephropathy, lupus nephritis, and ANCA-associated vasculitis dominate the etiological landscape, each associated with distinct serological profiles, complex histopathological patterns, and a substantially elevated risk of CKD and ESRD [9], [22]. The high prevalence of crescentic glomerulonephritis in adult series demands urgent diagnostic biopsy and aggressive immunosuppressive intervention to preserve

renal function. The greater burden of co-morbidities in adults — including hypertension, diabetes, and cardiovascular disease — further compounds the renal prognosis [12], [30].

The histopathological comparison across age groups underscores the divergence in underlying immunological mechanisms: self-limited complement-mediated injury in children versus persistent autoimmune and immune complex-mediated nephritis in adults. These mechanistic differences have direct therapeutic implications, with watchful waiting appropriate for most pediatric PSGN cases but early immunosuppression mandatory for adult ANCA vasculitis and proliferative lupus nephritis [8], [11].

From a public health standpoint, the etiological divergence of AGN across age groups reflects the interplay of host immunity, infectious exposure, genetic predisposition, and socioeconomic determinants. The persistent high burden of PSGN in children from developing nations calls for investment in streptococcal infection control, while the rising burden of autoimmune glomerulonephritis in adults emphasizes the need for improved access to biologics and immunosuppressive monitoring [16], [31].

This review advocates for the development of age-stratified clinical practice guidelines that explicitly account for the distinct etiological distributions, serological profiles, histopathological patterns, and prognostic trajectories of AGN in pediatric and adult patients. Standardized multicenter prospective registries, incorporating both clinical and molecular endpoints, are urgently needed to bridge the current evidence gaps and enable robust comparative research. Until such data are available, clinicians should maintain a high index of suspicion for secondary and severe forms of AGN in adults while applying a watchful, supportive approach in children with classical nephritic presentations [20], [25].

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