BEYOND THE STAIN: CLINICAL AND HISTOLOGICAL DISTINCTIONS IN AA AND AL RENAL AMYLOIDOSIS

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Introduction. Systemic amyloidosis is notoriously difficult to diagnose. The problem lies in the silent, extracellular buildup of misfolded protein fibrils, which gradually undermines organ function [1, c. 584]. In clinical practice, renal involvement is common. It often first appears as unexplained proteinuria or a rapid decline in kidney function. When we see a patient with a history of chronic inflammation, such as rheumatoid arthritis or vasculitis, we tend to think of AA amyloidosis. But the AL type forces us to look for an underlying plasma cell disorder like multiple myeloma or monoclonal gammopathy [2, c. 2642].

Clinical clues can be misleading, so the gold standard remains a renal biopsy [3, c. 541]. Although AL amyloidosis is becoming more common in industrialized countries, thanks to better survival and more sensitive testing. AA amyloidosis is actually declining in those same regions because chronic inflammatory conditions are now managed more effectively. Still, AA remains a major problem in developing parts of the world [4, c. 370].

Aim. Our goal was to highlight practical differences between the two amyloid types and compare key points of clinical manifestations and morphological changes in kidney tissue.

Material and methods. We retrospectively analyzed 15 renal biopsies performed at the pathology department. All samples were stained with H&E, PAS, Masson's trichrome, and silver stain. Congo red staining with apple‑green birefringence under polarized light confirmed the presence of amyloid in all of cases (figure 1).

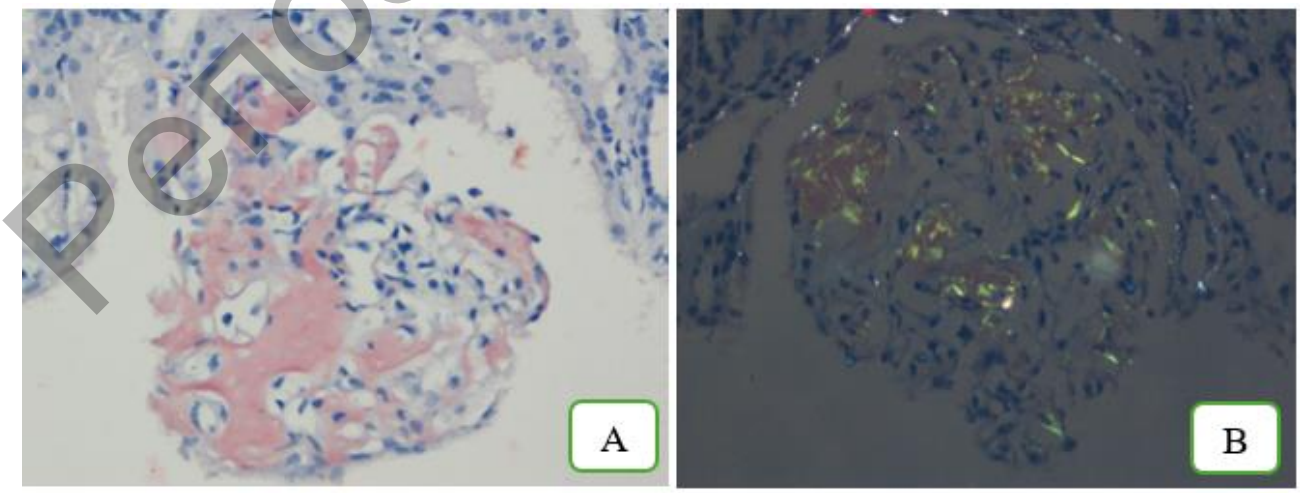

Figure 1 – A: Amyloid deposits in the glomerulus (Congo red stain x200),
B: Apple‑green birefringence under polarized light (x200)

Amyloid subtyping was based on immunohistochemical (IHC) patterns using antibodies against AA amyloid (figure 2), kappa and lambda light chains. We then correlated the histology with each patient's clinical history and laboratory data, including serum creatinine, albumin, 24‑hour proteinuria (or protein‑to‑creatinine ratio), hemoglobin, and other systemic markers. For statistical analysis, we used the Mann‑Whitney U test for continuous variables and Fisher's exact test for categorical variables, with $p<0.05$ considered significant.

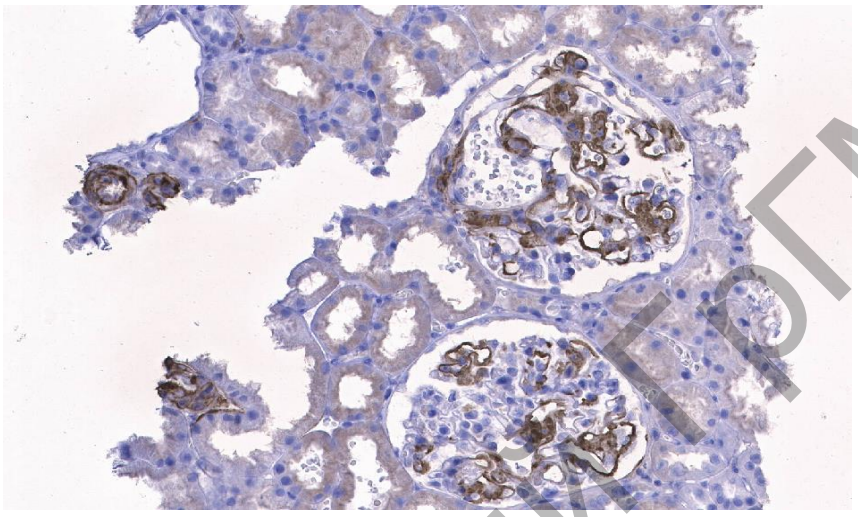

Figure 2 – AA amyloid in the glomeruli and vascular walls (IHC AA amyloid x100)

Results & discussion: Of the 15 patients, 10 (66.7%) had AA amyloidosis, and 5 (33.3%) had AL amyloidosis. Mean age was 59.9±13.4 years, ranged from 42 to 81 years. The AA group had a mean age of 58.0 years; the AL group was slightly older, with a mean of 63.8 years. There was a female predominance in the AA group (6/60%) and a male predominance in the AL group (3/60%), but neither age nor sex differences reached statistical significance ($p=0.46$ and $p=0.60$, respectively). These trends are in line with what we know from the literature: AA tends to occur in younger patients with chronic inflammatory diseases, whereas AL is more common in older adults [4, c. 371; 5, c. 820].

A striking finding was the degree of advanced kidney disease in the AA group. Four of the 10 (40%) AA patients had already reached end‑stage renal disease requiring hemodialysis or having a GFR below 15 mL/min at the time of biopsy. In contrast, only one of the five AL patients (20%) was that advanced. Although not statistically significant ($p=0.60$), this difference stood out to us clinically. Median GFR was 30.0 mL/min in AA versus 50.0 mL/min in AL ($p=0.25$), and 80% of AA patients met criteria for renal failure compared to 40% of AL patients ($p=0.26$). Proteinuria was heavy in both groups–median 3.8 g/day in AA and 3.0 g/day in AL ($p=0.74$). Edema was present in 70% of AA and 80% of AL patients. Anemia was more common in AA (70% vs. 40%, $p=0.33$), likely reflecting the chronic inflammation driving the amyloidosis.

The pattern of amyloid deposition also appeared to differ. Amyloid in glomeruli was seen in 90% of AA cases but only 40% of AL cases ($p=0.10$). Tubular basement membrane involvement followed a similar pattern – 90% in AA versus

40% in AL (p=0.10). These differences did not reach significance, but the trends suggest that AA may involve glomeruli and basement membranes more extensively, possibly because patients present at a later stage of disease.

Chronic irreversible damage was more pronounced in AA amyloidosis. The percentage of globally sclerotic glomeruli was significantly higher in AA (median 26.6%) than in AL (median 17.0%; Mann‑Whitney U=9.0, p=0.03). Interstitial fibrosis (as a percentage of cortical area) was also greater in AA (median 20% vs. 10%), a difference that approached significance (p=0.07). To us, this suggests that AA amyloidosis tends to cause more scarring, likely because the underlying inflammatory conditions-rheumatoid arthritis, psoriatic arthritis, or vasculitis-often go on for years before kidney involvement becomes obvious.

IHC confirmed the subtyping. Among the five AL cases, two showed kappa light chain restriction, one showed lambda restriction (figure 3), and two showed both (mixed pattern). In the AA cases, light chain staining was either negative or showed weak, non‑specific positivity without restriction. Protein casts in tubules were nearly universal (90% of AA, 100% of AL), highlighting that tubular injury is common in both types.

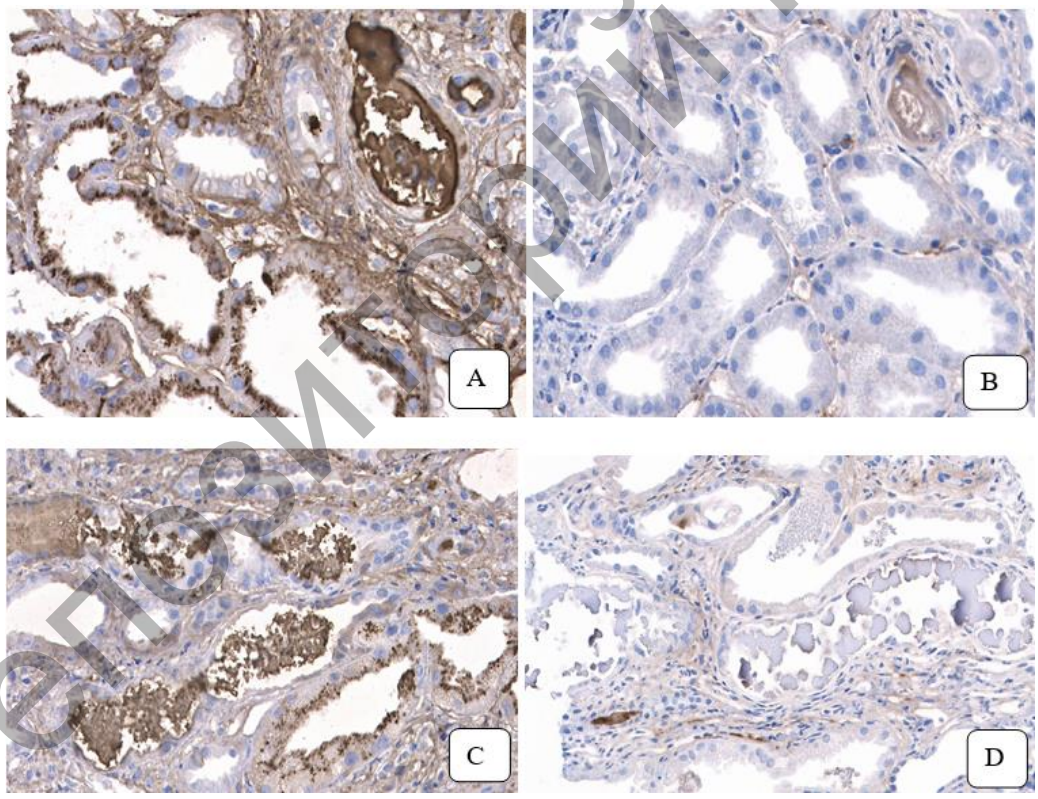

Figure3 – Restriction of lambda light chains: A – lambda expression in the cytoplasm of the tubular epithelium and tubular contents (x200), B – negative kappa (x200), C – lambda expression in the lumen of the tubules (x200), D – negative kappa (x200)

Looking beyond the kidney, we noted that several AA patients had long‑standing inflammatory diseases: three had rheumatoid arthritis, two had psoriatic arthritis, and one had systemic vasculitis. Among AL patients, two had multiple

myeloma and one had monoclonal gammopathy of renal significance. These associations reinforce why accurate subtyping matters–treatment depends on it. In AA, the focus is on controlling the underlying inflammation; in AL, it is about targeting the plasma cell clone.

Conclusion. In this small cohort, AA and AL renal amyloidosis presented with distinct profiles despite sharing the same basic pathology. AA patients were younger but had more advanced chronic kidney disease, more glomerulosclerosis, and a higher likelihood of needing dialysis. AL patients, though older, generally had better preserved glomerular architecture. These differences have real clinical implications: they affect prognosis, guide treatment choices, and underscore the value of a careful histopathological workup. Accurate subtyping–integrating histology, IHC, and clinical context–remains essential for optimal patient management.

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DYNAMICS OF PATENTING INVENTIONS ON THE PROBLEM OF CARDIAC ANATOMY

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Introduction. In the process of studying and analyzing literature on the research topic in authoritative databases (Google Scholar, PubMed, Scopus), more than 13 thousand scientific publications were identified [1-5]. Echocardiography has found wide application in studying the anatomy of the heart in normal and pathological conditions [6, с. 274].

However, no patent information reviews were found in the literature on the research topic. It should be emphasized that patent information is an important part of scientific and technical information, as it reflects the results of research and development work aimed at developing new or improving known methods, devices or substances that are world novel and protected by patents.