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Detection of Anti-Nuclear Antibody in Patients with Acute Kidney Injury Attending Gezira Hospital for Renal Disease and Surgery, Sudan (2022)

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Abstract: Introduction*: Acute kidney injury (AKI) is a common and serious clinical syndrome with diverse etiologies, including possible autoimmune mechanisms. Anti-nuclear antibodies (ANA) are hallmark biomarkers of systemic autoimmunity and may indicate underlying autoimmune pathology in AKI patients. Anti-Nuclear Antibodies (ANA) are found in many disorders, as well as some healthy individuals.* ***Aim:*** *The aim of the study was to detect Anti-Nuclear Antibodies in patients with acute kidney injury.* ***Methodology****: This was a case-control study conducted at Gezira Hospital for Renal Disease and Surgery from February to October 2022. A total of 60 blood samples were collected from participants with different ages and both sexes (40 samples from patients as cases and 20 from healthy controls). Antinuclear antibodies were tested by ELISA. Data were analyzed by statistical package for social sciences program (SPSS version 22).* ***Results****: Comparing the means of Anti-Nuclear Antibody between cases and controls showed significant differences (P value = 0.048) with an increase in patients more than healthy people. A significant difference also occurred in some other parameters such as hemoglobin, total white blood cells, urea, and creatinine (P value = 0.001, 0.004, 0.000, 0.000 respectively). Additionally, ANA test comparing with gender and age groups showed no significant differences (0.989, 0.935, 0.074 respectively).* ***Concussion:*** *ANA titers were elevated in AKI patients in compare with healthy control group. The detection of ANA test should be done as a routine confirmatory test for patients attending the hospital*.

Keywords: Anti-Nuclear Antibody, Acute Kidney Injury, ELISA, Case-Control Study, Sudan

Introduction:

Acute kidney injury (AKI) represents a clinical syndrome defined by an abrupt decline in renal function, typically manifesting within hours to days. It is commonly diagnosed in conjunction with acute systemic illnesses and is prevalent among critically ill patients. Pathophysiologically, AKI is characterized by the retention of nitrogenous waste products, dysregulation of fluid and electrolyte homeostasis, and acid–base disturbances. In addition to these primary renal effects, AKI is associated with systemic consequences including immunosuppression and dysfunction of extrarenal organs (1). The incidence, clinical course, and prognosis of AKI are influenced by its severity, the clinical context in which it occurs, preexisting comorbidities, and geographical and institutional factors. Accumulating evidence indicates that AKI contributes to significant short- and long-term adverse outcomes, such as elevated morbidity and mortality, increased risk for progression to chronic kidney disease (CKD), and substantial healthcare resource

utilization, thereby establishing AKI as a critical global public health concern (2).

Etiologically, AKI arises from a variety of insults to the renal parenchyma. These may include hypoperfusion (e.g., due to systemic hypotension), nephrotoxic exposure, intrinsic renal inflammation (e.g., glomerulonephritis), or obstructive uropathy impeding urine outflow. Diagnostic criteria rely primarily on biochemical markers, such as elevated serum creatinine and blood urea nitrogen (BUN), or reduced urine output (oliguria/anuria), as per consensus guidelines (3-4).

AKI can precipitate several systemic complications, including metabolic acidosis, hyperkalemia, uremia, fluid imbalance, and multisystem organ failure, with potential progression to death. Moreover, survivors of AKI episodes exhibit an increased risk of developing CKD. Therapeutic strategies focus on addressing the underlying etiology and providing supportive care, including fluid management and renal replacement therapy when indicated (5-6).

Antinuclear antibodies (ANAs), also referred to as antinuclear factors (ANF), are autoantibodies directed against nuclear antigens. In healthy individuals, the immune system discriminates between self and non-self-antigens; however, the production of autoantibodies in certain individuals reflects a breakdown in immune tolerance (7).

Detection of ANAs is performed using assays such as indirect immunofluorescence (IIF) and enzyme-linked immunosorbent assay (ELISA). These tests are employed in the diagnostic evaluation of autoimmune diseases and in monitoring disease activity. ANA titers, in conjunction with clinical and laboratory findings, can assist in the diagnosis and prognostication of autoimmune pathologies. Nonetheless, the diagnostic utility of a positive ANA test is limited in the absence of corroborative clinical or serological evidence (8).

Early detection of ANA in AKI patients has significant clinical implications. It may facilitate timely diagnosis of autoimmune-mediated renal injury, enable targeted immunosuppressive therapy where appropriate, and potentially improve patient outcomes (9). Moreover, recognizing ANA positivity can assist in risk stratification and prognostication, as autoimmune renal diseases often have distinct management pathways compared to other causes of AKI (10).

This study aims to detect the presence of ANA in patients with AKI and to explore its possible association with clinical and demographic characteristics.

Methodology:

A case-control hospitalized based study aimed to detect ANA in patients with acute kidney injury attending Gezira Hospital for Renal Disease and Surgery. This study included 60 participants with different ages and sex (40 samples from patients as cases and 20 from healthy control) using simple randomized technique. Samples were collected under aseptic conditions in plain and EDTA container and tested for ANA by ELISA. Urea and creatinine level were estimated by a full automated machine (Cobas c311). TWBCs and hemoglobin were measured using the Sysmex XP 300 N automated hematology analyzer (Sysmex, Kobe, Japan).

Ethical clearance was obtained from Ministry of Health, Gezira State. Ethical permission was obtained from Wad Medani Hospital for Renal Diseases and Surgery. The specimens and information were collected from people under privacy and confidentiality and will not be used for any purposes rather than this study. Informed consents were obtained from patients before blood collection procedure. All investigations were carried out for patients free of charge.

Data were collected by questionnaire and analyzed by statistical package for social sciences program (SPSS version 22).

Results:

The study involved 60 participants (40 AKI patients and 20 healthy controls). The demographic distribution was balanced across gender and age. A statistically significant elevation in Anti-Nuclear Antibodies (ANA) was observed in AKI patients compared to the control group. Other blood parameters such as hemoglobin, total white blood cells (TWBCs), urea, and creatinine also showed significant differences. However, ANA levels showed no significant correlation with gender, age, or residence. Platelet counts did not differ significantly between groups.

Table 1: Distribution of cases according to sociodemographic data.

Variable	Category	Frequency (n)	Percentage (%)
Gender	**Male**	20	50.0
	Female	20	50.0
Age	**< 40 years**	22	55.0
	≥ 40 years	18	45.0
Residence	**Urban**	12	30.0
	Rural	28	70.0

Table 2: Compare of ANA between cases and control.

Group	N	Mean	P-Value
Cases	40	33.65	**0.048**
Controls	20	24.20	

Table 3: Compare of ANA between sociodemographic data.

Variable	Category	N	Mean	P-Value
Gender	**Male**	20	20.48	0.989
	Female	20	20.53	
Age	**< 40 years**	22	20.36	0.935
	≥ 40 years	18	20.67	
Residence	**Urban**	12	15.46	0.074
	Rural	28	22.66	

Table 4: Comparison of Hb, TWBCs, Urea and creatinine between cases and control.

Parameter	Group	N	Mean	SD	P-Value
Hemoglobin (g/dl)	**Cases**	40	11.73	2.67	**0.001**
	Controls	20	13.93	1.60	
TWBCs (x10^3/L)	**Cases**	40	8.06	3.67	**0.004**
	Controls	20	5.56	1.10	
Platelets (x10^3/L)	**Cases**	40	273.40	131.66	0.390
	Controls	20	293.75	48.46	
Urea (mg/dL)	**Cases**	40	77.80	6.16	**0.000**
	Controls	20	25.15	4.74	
Creatinine (mg/dL)	**Cases**	40	37.78	15.11	**0.000**
	Controls	20	1.5	0.30	

Discussion:

Acute kidney injury (AKI) is a complex clinical syndrome that adversely affects the prognosis of a considerable proportion of

hospitalized patients. It is characterized by tubular epithelial cell dysfunction and injury, renal inflammation, and post-ischemic microvascular alterations (11).

This research was designed as a case-control study conducted at the Gezira Hospital for Renal Diseases and Surgery from February to October 2021. The objective of the study was to assess the presence of anti-nuclear antibodies (ANA) in patients diagnosed with AKI. A total of 60 venous blood samples were collected from individuals of varying ages and both sexes, comprising 40 samples from AKI patients (cases) and 20 from healthy individuals (controls). Demographic analysis revealed that 45% of the study population were aged below 40 years, while 55% were over 40 years. The gender distribution was equal, with 50% male and 50% female participants. Regarding geographic distribution, 30% of the participants resided in Wad Medani, while 70% originated from other localities.

Comparative analysis of ANA levels between the case and control groups demonstrated a statistically significant elevation in ANA levels among AKI patients (*P value* = 0.048) aligns with findings reported in earlier studies. Aldulaimy and Ali similarly documented elevated ANA levels in patients, suggesting a possible association between autoimmune activity and the disease condition under investigation (12). This elevation in ANA may reflect ongoing immune dysregulation or systemic inflammation, which is common in various autoimmune and inflammatory disorders. Moreover, other studies have supported the diagnostic and prognostic value of ANA, particularly in conditions such as systemic lupus erythematosus, rheumatoid arthritis, and autoimmune hepatitis, where ANA serves as a hallmark serological marker (13-14). The consistency of these findings across different populations reinforces the potential role of ANA as a relevant immunological indicator in disease pathogenesis and progression. However, it is important to note that ANA can also be detected in a subset of healthy individuals, particularly the elderly, which necessitates cautious interpretation of positive results in clinical contexts (15). Their presence in elevated levels, particularly in the context of conditions like AKI, can be indicative of an autoimmune response or related inflammation (16). So The increased ANA levels in AKI patients may suggest an autoimmune component involved in the disease process or could serve as a potential diagnostic marker (17).

The significant differences observed in hemoglobin concentration, total white blood cell count (TWBC), blood urea, and serum creatinine between cases and controls (*P value* < 0.005 for all) suggest notable hematological and renal involvement in the patient group. These results are partially consistent with earlier findings by Nolph et al. who reported hematological abnormalities associated with autoimmune activity and the presence of antinuclear antibodies (ANA) (18). Specifically, they observed reductions in hemoglobin and alterations in leukocyte profiles, which they attributed to chronic inflammation and bone marrow suppression common in autoimmune disorders. However, in the present study, both hemoglobin and TWBC were elevated in patients compared to controls. This divergence might be due to several factors, including regional or genetic differences, variations in disease type or stage, environmental exposures, or compensatory erythropoietic responses, especially in areas of high altitude or chronic hypoxia. Moreover, elevated blood urea and creatinine levels indicate impaired renal function in the patient group, a common feature in systemic autoimmune diseases such as systemic lupus erythematosus (SLE), which often involve glomerular inflammation and decreased filtration capacity (19). Similar renal abnormalities were reported by Mansour et al.**,** who found significantly increased serum urea and creatinine in ANA-positive patients with autoimmune nephropathies (20). These findings collectively underscore the systemic nature of the immune disturbance in such conditions and highlight the utility of these biomarkers in clinical evaluation.

The absence of statistically significant differences in platelet count between cases and controls (p = 0.390), along with the lack of correlation between ANA positivity and demographic variables such as gender, age, and residential location (*P value* = 0.989, 0.935, and 0.074, respectively), is consistent with earlier studies that questioned the influence of demographic and routine hematological parameters on ANA expression. Notably, Nolph et al. concluded that ANA positivity is not significantly determined by sex, age, ABO blood group, or even HLA typing, suggesting that the presence of these antibodies is more reflective of disease-specific immunopathology than demographic predisposition (18). Similarly, Satoh et al. in a large population-based study, found ANA prevalence to be relatively uniform across sexes and age groups, with only a modest increase among older women, which was not statistically significant after adjusting for confounders (21). Regarding platelet count, several studies in autoimmune disease cohorts

have shown variable results. Tincani et al. observed thrombocytopenia in some systemic lupus erythematosus (SLE) patients, though not consistently across all ANA-positive individuals, supporting the idea that platelet abnormalities are more disease-specific than ANA-dependent (22). The lack of association in the present study may reflect the inclusion of a broader, less clinically severe patient population or indicate that platelet involvement is not a common feature in early or subclinical autoimmune states. Collectively, these findings highlight that while ANA is a key serological marker, its presence does not always correlate with basic hematologic parameters or demographic characteristics, underscoring the importance of context-specific interpretation.

Conclusion:

ANA titers were elevated in AKI patients in compare with healthy control group. This study demonstrated significant elevation Anti-Nuclear Antibody (ANA) levels in patients compared to healthy controls which support the role of ANA as a relevant biomarker in immune-mediated disorders and its association with systemic hematological and renal changes. However, the elevated hemoglobin and TWBC levels observed in our patient cohort contrast with some earlier reports, possibly due to regional or environmental differences, lifestyle factors, or population characteristics. Notably, no significant differences were observed in platelet count, nor was ANA positivity significantly associated with gender, age, or residential location. These results further support the notion that ANA expression is more closely linked to underlying immune dysregulation than to demographic or routine hematological parameters. The collective evidence underscores the importance of comprehensive laboratory evaluation in assessing autoimmune activity and highlights the need for context-specific interpretation of ANA and related biomarkers.

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