



## Neutrophil Gelatinase Bound Lipocalin as A Predictor of Urinary Tract Infection

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Article History	Abstract
Received: 09 July 2023 Revised: 05 Sept 2023 Accepted: 11 Sept 2023	<b>Aim:</b> This study aimed to examine the Neutrophil gelatinase-associated lipocalin (NGAL) hormone level and some biochemical parameters in a group of (45) males' patients with urinary tract inflammation and (25) males as control. <b>Material and method:</b> The study included measuring the lipocalin hormone and biochemical assays; urea, albumin concentrations as well as creatinine and total proteins. <b>Statistics and Result:</b> The results of the study showed a significant increase ( $P \leq 0.05$ ) of (NGAL), urea concentrations and creatinine concentration in patients' group while the results of the study indicated a significant decrease ( $P \leq 0.05$ ) in the levels of both total proteins and albumin.
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### 1. Introduction

Millions of individuals worldwide are affected by urinary tract infections every year, and these infections may be very dangerous. That organ system that includes the kidneys, ureters, bladder, and urethra (Azubikes et al., 1994).

Urine is composed of water, salts, and toxic compounds that are expelled by the kidneys; it is devoid of bacterial, viral, and fungal contamination. Inflammation of the urinary tract develops when bacteria from the digestive system, which are located in the anus and very near to the urinary tract, make their way to the outlet of this urinary tract and begin to proliferate and grow. While the whole urinary system is fair game, the lower urinary tract—urethra and bladder—are more vulnerable to infection. (Salvatore et al., 2001; Schaeffer, 2001; Takhar, 2011).

The disease affects even children (Emori & Gaynes, 1993), and women are more likely than men to develop urinary tract infections. (Kunin, 1994) Diabetic patients are more susceptible to urinary tract infections due to a change in the immune status, as they decrease, and the same applies to all those suffering from immunodeficiency (Qunibi, 1982), symptoms of urinary tract infection do not appear clearly in both It is infected with it, by necessity, but most of the infected people appear with one or two symptoms, which are represented by a strong and continuous need to urinate, a burning sensation when urinating, the presence of blood in the urine or cloudy urine with a very strong smell, permanent leakage of urine, in small quantities Presence.

Presence of bacteria in the urine (Gratacos, 1995; Sim et al., 2015). NGAL, also known as Lipocalin 2 or Lcn2, is a small molecule protein (25 Kd) that is a member of the family of Lipocalins. These proteins are responsible for transporting tiny hydrophobic molecules (Abdulwahed et al., 2020; Abella et al., 2015; Greco et al., 2022).

Prediction of acute renal damage within two to three hours of its development, as opposed to creatinine, which takes two to three days to increase, has been found to be an advantage of NGAL in studies (Li et al., 2020; Chakraborty et al., 2012; Haase et al., 2011; Choi et al., 2020).

Lipocalin is a protein produced by an injured nephron and is one of the most important markers of kidney injury, in contrast to creatinine and urine output, which are used to measure renal function, neutrophil gelatinase associated with lipocalin is produced only by the affected kidney and then excreted in the urine and blood (Nocona et al., 2014). Therefore, the level of neutrophil gelatinase associated with lipocalin in urine and plasma appears to be a predictive marker for acute kidney injury and mortality (Devarajan, 2008; Rocha et al., 2018).

## 2. Materials And Methods

### Samples

In all, 70 blood samples were taken for analysis, 45 of which were from men in the Samarra area suffering from urinary tract irritation. The age range was (50) to (20) years, and there were 25 total samples of men who were both healthy and disease-free.

### Preparation of Serum

Ten milliliters of blood were collected in sterilized plastic tubes. In order to separate the coagulated portion from the clear solution, a centrifuge was used to spin the mixture at a rate of (5000) revolutions per minute for 10 minutes. The serum, represented by the clear solution, was stored at -20 degrees Celsius so that hormone and Biochemical tests could be measured at a later time.

"Neutrophil gelatinase-associated lipocalin" (NGAL) hormone determination:

Using the pre-made analysis kit and the ELISA method, we calculated the concentration of the hormone in the blood serum. Biochemical tests of blood

urea, albumin concentrations as well as creatinine and total protein Ready-to-use analysis kits were provided by the French company Biolabo.

### Statistical analysis

The data was analyzed statistically using the T-Test at a significance level of ( $p < 0.05$ ) in SPSS, a program designed for social science research.

## 3. Results and Discussion

Table (1) shows a statistically significant improvement in performance for (NGAL) hormone level, urea concentrations and creatinine concentration in patients' group in the research When compared to healthy persons, while the results of the study indicated a significant decrease ( $P \leq 0.05$ ) in the levels of both total proteins and albumin.

**Table 1:** Levels of (NGAL) and biochemical parameters in healthy and Patients

Outcomes	Patients	Healthy	p
(NGAL)	225,43±65,32 b	136,27 ± 24,18 a	$P \leq 0.05$
urea	32.6±10.43 b	15. 2±2.21 a	$P \leq 0.05$
Albumin	3.79±0. 3 b	4.36±0.85 a	$P \leq 0.05$
creatinine	71.05 ±7.0	1.0±54.0	$P \leq 0.05$
total proteins	6.5±0.65 b	8.2±0.86 a	$P \leq 0.05$

Purified from human neutrophils, NGAL is a 25-kDa protein. It is a 198-amino-acid circulatory protein that carries tiny, hydrophobic compounds (such as steroids, free fatty acids, prostaglandins, and hormones) to their proper locations in the body. Cell types as diverse as neutrophils, hepatocytes, lung, bone marrow, adipose tissue, macrophages, thymus, non-neoplastic breast duct, prostate, and kidney cells all contain it (Al jaber et al., 2021)

Normal organs have low levels of NGAL, but when the epithelia are hurt, especially in the lung, colon, and kidney, the levels go up (Sim et al., 2015) It is an important part of the innate antimicrobial immune system, which works mostly by stopping bacteria from getting iron through siderophores in the early stages of an infection. It is also an early sign that granulocyte cells are starting to change, which affects a number of neutrophil functions. NGAL has also been said to speed up nephrogenesis and make it easier for mesenchymal cells to turn into kidney epithelial cells. In fact, NGAL production goes up in kidney tubules when they are hurt by things like ischemia-reperfusion damage. This suggests that this protein plays a major role in tubular regeneration and repair. Recently, NGAL has been proven to be a useful biomarker for diagnosing AKI, tubular necrosis, and tubulointerstitial nephropathy. Children and adults with AKI have very high levels of NGAL, which happens 24 to 48 hours before creatinine levels rise (Greco et al., 2022; Antonucci et al., 2014).

In procedures like cardiopulmonary bypass, contrast injection, and kidney transplantation, the NGAL has been demonstrated to be a valuable marker for early prediction of acute renal injury. where there is a risk of kidney injury in both short-term and long-term kidney damage, LCN-2 expression goes up. Several studies have shown that LCN-2 is a possible early biomarker for kidney injuries. Human and mouse transplantation studies show that damaged nephrons are the source of LCN-2 expression. Neutrophils and macrophages may also make systemic LCN-2, according to research from the last few years. Chronic kidney disease (CKD) is also linked to a big rise in the amount of LCN-2 in tissues and body fluids (blood and urine).

In a diverse pediatric ICU, measurements of NGAL are used as early biomarkers of AKI, and they can predict AKI with high accuracy 1-2 days before the serum creatinine level rises. Studies done recently have shown that NGAL is useful for finding patients with AKI, that is, it can tell the difference between acute pyelonephritis and lower UTI and diagnose UTI in adults in the ICU. So, NGAL can be thought of as a good indicator of kidney function and inflammation, which makes it easier to diagnose AKI.

Few animal studies have shown that NGAL is one of the first genes and proteins to be turned up in the kidney after it has been hurt. The highest levels of NGAL protein were found in tubule epithelial cells that were dividing and repairing themselves. This could mean that the NGAL has a part to play in the repair process (Gavric et al., 2016). In recent years, mechanistic evidence has shown that NGAL is more than just a possible diagnostic biomarker. It is also directly involved in protecting the kidneys from active tubular injury (Greco et al., 2022).

The breakdown of proteins yields urea as a waste product by the elimination of ammonia from amino acids. Urea is produced in the liver from ammonia and is then secreted subtracted (by the kidney, Urea production increases when protein intake increases or when the body is further undermined for proteins (Liano et al., 1996).

Renal filtration is one of the most important functions of the kidneys, where waste products come from metabolic processes through blood to the renal glomeruli, so they filter there and run through the small renal tubes or what is known as the tubes and outward without being reabsorbed, but what happens to urea is that it is partially reabsorbed through the renal tubes, which leads to not relying entirely on urea examination in evaluating the function of renal filtration and resorting to creatine testing, which is fully filtered without being absorbed again by renal tubes (Salazar, 2014), The reason is due to a disturbance in the work of the kidney as it is responsible for subtracting Urea in the urine and in case of a deficit or imbalance and lack of kidney function leads to a decrease incretion of urea, so it accumulates in the blood and its concentration rises (Liu et al., 2022).

Creatinine differs from urea in that its quantity depends on the representation of internal proteins (tissues and muscles) ,while urea depends on external proteins Creatinine in the body consists of creatine, This consists of three amino acids( glycine, arginine, methionine)The clinical importance of creatinine lies in its relationship to kidney diseases of all kinds, such as nephritis, obstruction of the ducts, or inflammation of the prostate and bladder, and since creatinine is not reabsorbed by the small renal tubules, which gives high results in the clearance of creatinine compared to the filtering of urea, which gets partial absorption again (Dixon et al., 2017).

The creatinine clearance test is one of the important tests to study the efficiency of the kidneys, as when creatinine levels in the blood rise above the normal limits, the small renal tubules contribute with the kidney to excrete creatinine, and for this reason, creatinine levels in renal diseases do not usually rise unless there is significant damage to The kidneys, which prevents them from filtering and excreting waste products, meaning that creatinine levels are higher than (2-4) mg / 100 ml of blood serum, indicating the presence of moderate, moderate to severe renal damage (Waheed et al., 2018).The Patients may have a high quantity of creatinine in their blood serum due to the fact that creatinine is a waste product of metabolism. This might be the cause of the patient's condition. that is naturally excreted through the urine,(Perez, 2007).The concentration of both protein and albumin decreases as a result of the damage occurring in the kidney, which leads to leakage of proteins and albumin into the urine due to the smallness of the albumin molecule, so it is lost in large quantities due to the ease of filtering through the glomeruli (Price, 1982) indicated that the reasons for the decrease in the total protein level may be attributed to complications that occur to the kidneys due to many diseases, including heart diseases or diabetes, which lead to what is known as morbidity, Renal (Nephropathy) which is characterized by the loss of total protein through urine),The low concentration of albumin can be considered an indicator of the occurrence of some conditions or pathological factors such as infections and infections (Aratesh et al., 2018).

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