

Preoperative Analysis of Specific Inflammatory Indexes in Patients with Upper Urinary Tract Calculi Complicated with Systemic Inflammatory Response Syndrome

Jianlin Huo, Yan Liu*

Tangshan, Wenhua Road 27, Hebei 063500, China

*yanliu2001@126.com

Abstract

Upper urinary tract calculi are common in urinary tract calculi. Although the clinical application of lithotomy is good, it is easy to cause secondary infection after surgery, which seriously affects the prognosis of patients. In recent years, clinical findings have shown that close monitoring of relevant inflammatory indicators in body fluids of patients provides important value for evaluating the incidence and severity of systemic inflammatory reactions before and after surgery, and can suggest that early anti-inflammatory and antibacterial intervention therapy can effectively reduce the frequency of postoperative inflammatory reactions in patients. Therefore, this paper comprehensively elaborated the warning effect of preoperative specific inflammatory indicators detection in patients with upper urinary tract calculi complicated with systemic inflammatory response syndrome.

Keywords

Upper Urinary Calculi; Systemic Inflammatory Response Syndrome (SIRS); Inflammatory Markers; Literature Review.

1. Introduction

At present, with the changing lifestyle and diet structure of Chinese people, the incidence of urinary tract stones, especially upper urinary tract stones, is significantly increasing, and the incidence population has a trend of younger and younger people, manifested as hematuria, urinalgia, frequent urination and other symptoms, and in severe cases, renal failure will occur or even seriously threaten life safety. In clinical work, upper urinary tract calculi complicated with infection are more common, especially in patients with preoperatively combined infection after stone removal. At present, there are increasing reports of postoperative complications such as postoperative urinary tract infection and systemic infection, and there are also reported cases of severe systemic inflammatory response syndrome, urogenic sepsis, and even death from septic shock, which seriously affect the postoperative recovery of patients. Among them, the systemic inflammatory response syndrome (Systemic inflammatory response syndrome, SIRS) is removed is common postoperative complications [1]. SIRS infections is mainly due to infection or cause effects on the body and cause the body is out of control of continuous zoom and damage of the systemic inflammatory response, is the multiple organ dysfunction syndrome (Multiple organ dysfunction syndrome, MODS) common pathway, SIRS are currently considered to be early manifestations of Sepsis, with patients suffering from symptoms such as accelerated heartbeat and respiratory rate or hypermetabolic status, which can progress to sepsis and even organ failure or death with the progression of the disease [2]. However, the current clinical treatment of SIRS mainly uses symptomatic measures such as anti-infection, anti-shock and maintaining the body's electrolyte and acid-base balance as the main means, and the control

effect of the disease is not ideal. Therefore, early diagnosis can reduce the risk of such complications and increase the therapeutic effect. Therefore, actively searching for more sensitive and effective indicators to evaluate upper urinary calculi co-infection can, on the one hand, intervene early in the perioperative period to reduce the postoperative secondary infection rate; on the other hand, it can more accurately predict the postoperative secondary infection situation, which has extremely important significance for effectively improving the prognosis of patients.

2. Urine Routine

Preoperative positive urine routine test is an important factor for postoperative SIRS. In general, positive urine routine can better reflect whether a patient has a urinary tract infection before surgery, and in most patients with urinary tract infection, the positive rate of urine routine is significantly higher than that of urine culture [3]. The results of urinary turbidity, urinary leucocyte esterase and urinary nitrite in urine chemical analysis are different between patients with urinary calculi complicated with urinary tract infection and those without complicated with urinary tract infection. Moreover, the detection is convenient and the price is relatively low, which can be used clinically for the auxiliary diagnosis of urinary tract calculi complicated with urinary tract infection. Studies have found that combining Long Yifei et al. [4] with urinary leucocyte esterase, urinary nitrite and urinary sedimentation microscopy has a sensitivity and negative predictive value of 100% for the diagnosis of urinary tract infection, which can be used for rapid clinical screening [5]. However, urine culture is still needed as the gold standard for diagnosing urinary tract infections.

3. Urine Culture

Positive urine culture is the direct evidence of urinary tract infection [6]. However, due to stone obstruction, the positive rate of urine culture detection is generally low. However, urine culture has positive significance in identifying pathogens and guiding the use of antibiotics [3], which is the gold standard for diagnosing urinary tract infections. In addition, multiple positive urine cultures may indicate a large number of bacterial colonies in the patient's urine, which indirectly reflects the degree of urinary tract infection in the patient and is closely related to the occurrence of postoperative urinary sepsis. Ao Juan et al. [7] found through urine culture that *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Streptococcus agalactiae* and *Escherichia coli* were common pathogens in patients with upper urinary calculi combined with urinary tract infection. Therefore, in the clinical treatment of patients with upper urinary calculi combined with urinary tract infection, antibacterial drugs should be rationally selected according to the above pathogens.

4. Blood Routine

Positive preoperative blood tests, CRP, and procalcitonin often indicate the presence of infection.

The count of peripheral white blood cells (WBC) is the most common index of infection. In general, the white blood cell count increases gradually with the aggravation of infection, but its specificity is poor. Many inflammatory reactions of non-bacterial infection can cause the increase of white blood cell count, and the inflammatory response ability of the elderly is decreased. The WBC may not increase significantly when infection occurs, and the WBC may also decrease when there is serious infection. These factors all affect the accuracy of WBC in predicting SIRS, and can only be used as a suggestive indicator of infection, which should be combined with other inflammatory factors for comprehensive judgment.

neutrophil (NEU) is the body's first line of defense against invading pathogens. Under bacterial infection, a large number of mature neutrophils stored in marginal cisterns of endothelial cells in small vessels or in bone marrow enter the circulating blood, resulting in an elevated percentage of neutrophils (percentage of neutrophil, N%), which enter the interstitial space to function under the action of chemotaxis. Tan Leming et al. [8] found that N % of patients with urogenic sepsis increased

significantly, but with the aggravation of sepsis, the change trend became slower. However, the study results of Wu Jianchen et al. [9] showed that N% increased with the aggravation of sepsis. Taking N%=77% as the critical value, the sensitivity and specificity of the diagnosis of sepsis were 93.8% and 69.6%, respectively. However, since N% of the body also increases under stress, trauma, pain and other conditions, it may result in high sensitivity and low specificity of this index.

Neutrophils (Neutrophil to lymphocyte ratio, NLR), lymphocyte ratio is the ratio of the body peripheral blood neutrophils and lymphocytes, is simple and effective to predict the severity of infection index, the evaluation effect is better than the total number of white blood cells, neutrophil count, and CRP. NLR can be used to predict the diagnosis and prognosis of different disease states, and it is related to the occurrence and development of many diseases. Studies have shown that in patients with bacteremia, high NLR often indicates higher mortality in hospitalized patients, and the best accuracy in predicting bacteremia and septicemia is achieved when the cut-off point of NLR is 5.0 [10]. SEN et al. [11] applied NLR to predict the risk of urogenic sepsis in patients with kidney stones after percutaneous nephroscopy, and found that the incidence of postoperative sepsis increased significantly when preoperative NLR > 2.5. The study results of Shi Jianguo et al. [12] showed that preoperative NLR was an independent risk factor for infectious complications after percutaneous nephroscopy. In other words, preoperative NLR levels can be used to predict the occurrence of postoperative SIRS. When the preoperative NLR level was greater than 2.31, it was easy to cause the occurrence of SIRS after surgery. The sensitivity and specificity of SIRS prediction were 72.9% and 75.6%.

C-reactive protein (CRP) is an acute phase protein often used in clinical observation of inflammatory stress. When the body is invaded by microorganisms or tissue damage, the serum level can be significantly increased. With extremely high sensitivity, CRP is considered as the most clinically valuable inflammatory index [13], which can better reflect systemic inflammatory syndrome. As an acute reactive protein, CRP is not affected by age, gender and physical condition, and is of high value for infection evaluation [14]. In recent years, CRP has been commonly used as one of the diagnostic indicators for stone co-infection, which is of great clinical significance because its change is earlier than that of leukocytes and neutrophils in blood during infection [15]. Gao Yongcai et al. [16] found that serum CRP in patients with calculi co-infection was higher than that in patients without calculi co-infection, which proved the diagnostic value of serum CRP in upper urinary tract calculi co-infection before surgery and co-infection after surgery.

Procalcitonin (PCT) is an important protein that can effectively reflect the activity of inflammation in the body. It can well distinguish bacterial infection from non-bacterial infection and is released in large quantities when the body is seriously infected by bacteria, fungi and so on [17]. Among urinary tract infections, Gram-negative bacteria account for more than 60%, and PCT has extremely high clinical significance for the diagnosis of infection caused by Gram-negative bacteria [13]. In addition, because the expression level of PCT is not affected by autoimmune reactive diseases and allergic reactions, it is very low in healthy people, so it can be used as a good objective inflammatory indicator [18]. Most studies have found [17, 19-20] that PCT is of great value in the prediction, early diagnosis, evaluation and treatment of postoperative urinary sepsis and septic shock.

5. Cytokine

Long-term incarceration or retention of stones in the ureter often leads to a series of inflammatory reactions and increases the release of inflammatory mediators in the serum. Studies show that when bacteria infects the body, macrophages quickly secrete massive amounts of cytokines, such as Tumor necrosis factor (TNF) - α , Interleukin (IL-1), and IL-6, which trigger an inflammatory response. IL-6 is a cytokine generated by monocytes and B cells, which can promote immune cells such as B cells, NK cells and T cells to participate in the occurrence and development of autoimmune diseases, increase pro-inflammatory response and maintain inflammation [21]. TNF- α is an important pro-inflammatory cytokine, which can induce leukocyte and endothelial cells to produce adhesion

molecules and promote leukocyte adhesion in capillary endothelium [22]. At the same time, as upstream cytokines that activate CRP, TNF- α and IL-6 change more rapidly when inflammation occurs, and also play an irreplaceable role in the early diagnosis of calculus combined with infection. Therefore, the detection of serum TNF- α and IL-6 levels is of great significance for the diagnosis of early infection [16]. CAI Hongwei et al. [23] found that after lithotomy, IL-1 and TNF- α indexes were significantly decreased, suggesting that the presence of upper urinary tract stones before surgery would increase the release of inflammatory cytokines, which would be improved after lithotomy. Qi Yong et al. [24] found that the diagnostic specificity of IL-6 for urinary calculi combined with infection could reach 86.9%, the sensitivity was 76.1%, and the diagnostic coincidence rate was 86.9%, which proved its value in the diagnosis of calculi combined with infection.

6. Serum Endotoxin (ET)

A lipopolysaccharide that is a component of the cell wall of Gram-negative bacteria and is released into the blood after death. It has a variety of biological effects, causing fever, SIRS, bacteremia, septic shock and other stress reactions. Currently, it has been reported that urinary tract operation lithotomy can lead to the release of bacteria and endotoxins in stones, which increases the chance of bacteria and endotoxins entering the blood, and the incidence of SIRS induced by bacterial endotoxins can reach 34% [25-26], leading to the aggravation of postoperative infection. Therefore, the detection of serum endotoxin before operation is very important to monitor the infection index. The study of Gong Binbin ET al. [1] showed that ET levels measured in the sera of patients with SIRS after flexible ureteral lithotripsy were all increased at different levels, and ET indexes were significantly increased in patients with chills and high fever after reexamination, suggesting that ET has certain clinical significance in early prediction of SIRS after lithotripsy and has certain clinical application value in guiding preoperative and postoperative treatment.

7. Limitation

This paper summarized the advantages of detection of inflammatory indicators commonly used in clinical evaluation of urinary calculi complicated with infection before surgery. However, many clinical patients have difficulty in timely examination of various indicators. On the one hand, due to the rapid onset and obvious symptoms of patients, the results of detection of some indicators, such as urine culture and serum inflammatory cytokines, cannot be obtained before surgery, and early antibacterial intervention is missed. On the other hand, due to the lack of clinical understanding of some inflammatory indicators and the imperfection of relevant clinical studies, clinicians cannot obtain comprehensive examination of patients in a timely and comprehensive manner.

8. Summary

In summary, urine routine, urine culture, blood routine, serum inflammatory factors and ET tests can be effective reference indicators for the diagnosis of patients with upper urinary tract calculi complicated with infection before and after surgery, so as to improve the accuracy of diagnosis, play a positive role in the treatment of upper urinary tract calculi, and provide objective basis for clinical infection evaluation.

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