

Retraction

Retracted: Artificial Intelligence Imaging to Observe the Protective Effect of Hydrogen Sulfide on Acute Kidney Injury Caused by Urinary Sepsis

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] Z. Yu and X. Zhang, "Artificial Intelligence Imaging to Observe the Protective Effect of Hydrogen Sulfide on Acute Kidney Injury Caused by Urinary Sepsis," *Journal of Sensors*, vol. 2021, Article ID 1353270, 13 pages, 2021.

Research Article

Artificial Intelligence Imaging to Observe the Protective Effect of Hydrogen Sulfide on Acute Kidney Injury Caused by Urinary Sepsis

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With the development of medical technology products and the rapid development of computer technology, medical AI has become a hotbed in scientific research and clinical practice. Some medical AI-assisted diagnosis has been applied to the clinic to assist doctors in formulating treatment plans. The traditional method of clinical diagnosis and treatment is that the physician makes an intentional diagnosis and then performs ancillary tests. The clinician performs diagnosis and treatment by identifying clinical symptoms and analyzing auxiliary examination results. Modern medical AI is based on big data collection and analyzes the test results through artificial intelligence and computer algorithms. It can output diagnostic results with high sensitivity and specificity for clinical tests. Acute kidney injury (AKI) is a common clinical emergency. The main clinical features are elevated blood creatinine, decreased urine output, and sharp decline in renal function within a short period of time, and it is a hot spot worldwide. In this experiment, a rabbit sepsis model was replicated by inoculating *E. coli* bacteria into the rabbit's unilateral ureteral lumen and ligation. NaHS was used as an exogenous hydrogen sulfide donor to observe the effects of hydrogen sulfide on UTIs. The protective effect of oxidative stress and inflammatory response in acute kidney injury with hyperemia. In the experiment, the production of endogenous hydrogen sulfide was decreased in the Sepsis group, and the renal CSE activity was decreased, while the content of endogenous hydrogen sulfide in the NaHS group was higher than that of the Sepsis group, and the CSE activity of renal tissue was increased. It can be seen that the plasma hydrogen sulfide and renal tissue SCE levels in septic acute kidney injury increased after NaHS intervention, and the renal tissue damage was reduced, suggesting that hydrogen sulfide is mainly generated endogenously through the action of CSE, which causes damage to the kidneys. The expressions of iNOS and HO-1 in renal tissues of urinary sepsis are increased. H₂S can play a certain protective effect on acute kidney injury in urinary sepsis by down-regulating iNOS and up-regulating the expression of HO-1.

1. Introduction

1.1. Background and Significance. Artificial intelligence has made significant advances in scientific research and industrial applications and is widely used in statistics and data analysis, intelligent image analysis [1], world interaction, and data analysis. Virtual reality, speech recognition and other fields. Its potential in the medical field is gradually being discovered. At present, the application of artificial intelligence in the medical field in our country has shifted from medical data statistics, collection and classification to

auxiliary diagnostic medical imaging, and some results have been achieved [2]. Establish a rabbit model of urinary sepsis, use NaHS and PAG intervention, observe the changes of ET-1, MDA, SOD in kidney tissue, and reveal the effect and mechanism of hydrogen sulfide on uremic kidney damage [3]. Hydrogen sulfide may reduce the release of ET-1 from kidney tissue to septic kidney injury, reduce tissue ischemia and hypoxia, and enhance the antioxidant capacity of kidney tissue, thereby improving the pathological phenomenon of acute renal failure. Hydrogen sulfide can improve renal hemodynamics by improving the contents of MDA and

ET-1 in acute renal insufficiency caused by sepsis. It is of great importance for the regulation of sepsis-induced acute kidney injury, it has been shown to ameliorate the possible mechanisms and effects of hydrogen sulfide of oxidative stress and pyuria in renal failure. Level.

Clinical studies have shown that 43% of uremia is caused by urinary stones. This is because stones can easily cause obstruction of the urinary tract, which can easily lead to the formation of infection and infection can accelerate the growth of stones. These three vicious cycles will eventually cause pathogens and bacteria to enter the bloodstream, leading to sepsis. Uremia is a very dangerous emergency and serious disease in urology. When severe sepsis or MODS has occurred, it is usually difficult to correct, mortality is extremely high and the cost of treatment is expensive. Therefore, early study of the pathogenesis of uremicemia and elimination of the vicious circle are essential to improve the prognosis of patients. Animal models are an indispensable basis for medical experiments and play an important role in the pathogenesis and development of sepsis [4–7].

1.2. Related Work Research. Azizi believes that ischemic damage to the kidney will cause liver tissue changes. Therefore, the morbidity and mortality of patients with acute renal failure (ARF) may be related to liver complications and kidney injury. The purpose of the study is to evaluate the liver changes in different periods of reperfusion after induced renal ischemia [8]. Li believes that platelets in patients with sepsis can be activated and are related to the occurrence of sepsis and sepsis-induced acute kidney injury (SAKI). Using ticagrelor to induce SAKI mouse model through cecal ligation and puncture, it was found that ticagrelor can inhibit platelet activity, reduce serum creatinine level, reduce renal neutrophil infiltration, and reduce renal cell apoptosis. It shows that ticagrelor can protect kidney function by inhibiting inflammation, the recruitment of neutrophils to the kidney and cell apoptosis in kidney tissue, and may provide a new strategy to prevent SAKI [9]. Through experiments, domestic and foreign scholars believe that hydrogen sulfide can reduce the release of ET-1 from renal tissue in acute kidney injury in sepsis, reduce tissue ischemia and hypoxia, and enhance the antioxidant capacity of kidney tissue, thereby improving the etiology and pathogenesis of pus Pathological phenomena of acute kidney injury in toxemia [10].

1.3. Innovation. This article introduces the risk factors, clinical features and prognosis of acute renal failure caused by sepsis. And compare SOFA score and APACHEII score system to predict mortality of AKI patients from sepsis.

This article retrospectively analyzes the clinical data of patients with acute renal insufficiency (AKI) diagnosed in Hospital A, and analyzes the etiology, clinical characteristics, prognosis and risk factors to improve the understanding of AKI.

This article believes that EPO and HBSP may play a protective role in the tissue damage caused by them. Studying the renal protective effect of HBSP on urinary incontinence and its related mechanisms is the key to preventing acute

renal failure and multiple organ failure, and providing clinical applications Scientific basis.

2. Artificial Intelligence Image Observation Hydrogen Sulfide Protection Method

2.1. Artificial Intelligence Image. With the development of artificial intelligence technology, more and more industries and fields have begun to try to use artificial intelligence or computers for automated analysis, trying to automate the data or processed products originally processed by humans in order to reduce human errors and improve work efficiency the goal of [11]. So far, there have been many successful applications in industrial technology [12]. The most famous is the Go game AI “alphaGO”, other more mature examples include payment software facial recognition and artificial intelligence voice recognition.

There are also important discoveries in the application of artificial intelligence in medical treatment. For example, dermatologists and artificial intelligence scientists use neural aggregation networks to detect malignant skin cancer, and their identification results are comparable to those of dermatologists. Ophthalmologists, physicians, physicians, and computer researchers use fundus retinal imaging analysis to determine the risk of malignant diabetic retinopathy [13]. Researchers have found that “unarchived and integrated” data based on big data analysis and computer algorithms can derive similar empirical diagnoses, possibly even exceeding experience. Experience of experienced chief physicians [14, 15]. In recent years, the results of computer-aided imaging research have continued to show that some hospitals even hold doctor contests and smart computers. The calculator has also shown excellent diagnostic features and diagnostic accuracy.

In order to speed up the convergence speed, a hierarchical method is usually used to modify the weight in the back propagation algorithm (see Algorithm 1). Therefore, the output function must be differentiable. For example, the Sigmoid function can be used:

$$f(x) = \frac{1}{1 + \exp(-x)} \quad (1)$$

The input and output of the kth neuron in the output layer are:

$$\begin{aligned} net_h &= \sum_{i=1}^p t_{ih}y_i, h = 1, 2, \dots, m \\ x_i &= f(net_h), h = 1, 2, \dots, m \end{aligned} \quad (2)$$

The input and output of the i-th neuron in the hidden layer are:

$$\begin{aligned} net_h &= \sum_{i=1}^p s_{ih}z_i, h = 1, 2, \dots, n \\ y_i &= f(net_i), h = 1, 2, \dots, n \end{aligned} \quad (3)$$

Usually, the actual network output is different from the expected output, that is, there is an error P , which is defined as follows:

$$P = \frac{1}{2}(d - x)^2 = \frac{1}{2} \sum_{h=1}^m (d_h - x_h)^2 \quad (4)$$

The principle of adjusting the network weight is to continuously reduce the error, so the weight adjustment must be proportional to the negative slope of the error, namely:

$$\begin{aligned} \Delta t_{ih} &= -\eta \frac{\partial P}{\partial t_{ih}} = -\eta \frac{\partial P}{\partial net_h} - \frac{\partial net_h}{\partial t_{ih}}, i = 1, 2, \dots, n \\ \Delta s_{ki} &= -\eta \frac{\partial P}{\partial s_{ki}} = -\eta \frac{\partial P}{\partial net_i} - \frac{\partial net_i}{\partial s_{ki}}, k = 1, 2, \dots, n \end{aligned} \quad (5)$$

At the same time, the error function can be further written as:

$$P = \frac{1}{2}(d - x)^2 = \frac{1}{2} \sum_{h=1}^m \left[d_h - f \left(\sum_{i=1}^n t_{ih} y_i \right) \right]^2 \quad (6)$$

Therefore, the calculation formula used to adjust the weight from the hidden layer to the output layer is:

$$\begin{aligned} \Delta t_{ih} &= \eta (d_h - x_h) f'(net_h) y_i \\ \Delta s_{ki} &= \eta \sum_{h=1}^m \left[(d_h - x_h) f'(net_h) t_{ki} \right] f'(net_i) z_k \end{aligned} \quad (7)$$

If the hidden layer output and the output layer output use the Sigmoid function, the reason is:

$$f'(x) = f(x)[1 - f(x)] \quad (8)$$

Then, the above formula becomes the following format:

$$\begin{aligned} \Delta t_{ih} &= \eta (d_h - x_h) x_h (1 - x_h) y_i \\ \Delta s_{ki} &= \eta \sum_{h=1}^m \left[(d_h - x_h) x_h (1 - x_h) t_{ki} \right] y_i (1 - y_i) z_k \end{aligned} \quad (9)$$

Calculate the total average error after training:

$$P_{AS} = \frac{1}{2R} \sum_{l=1}^R \sum_h e_h^2(l) \quad (10)$$

2.2. Urinary Sepsis. Sepsis is a systemic inflammatory response syndrome (SIRS) caused by infection, which refers to life-threatening organ dysfunction caused by the body's unbalanced response to infection and damage to its own tissues. The revised international definition of sepsis has recently been published. It is defined as life-threatening organ dysfunction caused by the host's specific response to

infection, while SIRS, multiple organ dysfunction syndrome (MODS) and septic shock are considered. It is a manifestation of different symptoms of sepsis, and the high morbidity of patients with sepsis is related to mortality [16]. It is worth noting that compared with the downward trend of all other major causes of death in the United States, the death rate from sepsis has increased in the past decade. There is evidence that the long-term mortality rate of sepsis survivors is significantly higher than that of the general population.

Urinary sepsis is caused by pathogenic bacteria or toxins and enters the blood through the urethra when the body is infected. The disease accounts for 9% to 31% of sepsis, and adult sepsis in urine accounts for about 25% of sepsis patients. In most cases, it is caused by complicated urinary tract infections [17]. The pathogenic bacteria of urinary tract infection is mainly *Escherichia coli*. If the urinary tract infection or urinary tract obstruction is not treated in time, the released bacteria and endotoxin will flow back to the bloodstream in various ways, causing sepsis. When the condition worsens, it may lead to septic shock and MODS. The kidney is one of the most vulnerable organs in MODS, and it often causes acute kidney damage, which is also an independent risk factor for death in patients with sepsis. Clinically, the incidence of sepsis is increasing year by year, and the mortality rate of severe uremia is as high as 30%-40%. Urinary incontinence not only causes severe inflammation, but also leads to dysfunction of the adaptive immune system and decreased antimicrobial immunity. Sepsis is severe, the pathophysiological mechanism is complicated, the disease progresses rapidly, and the mortality rate is high. It is an emergency and critical illness in urology [18, 19].

Sepsis is a systemic syndrome of malignant inflammatory response caused by bacterial infection. It has the characteristics of variable disease and high incidence. The main mechanism of decay is that pathogenic bacteria invade through the bloodstream, spread to various organs and tissues, and eventually form infectious diseases. Bacterial toxins enter the blood, the immune system is fully activated, and a large number of inflammatory factors are released, causing systemic inflammatory damage [20]. The kidney is the main organ most likely to cause organ dysfunction and insufficiency. The mortality of acute renal failure caused by sepsis can reach about 75%, and the mortality of patients without acute renal failure is much lower than the above-mentioned patients. Acute kidney injury has a high incidence and serious illness, and its pathogenesis is obviously related to microcirculation dysfunction, inflammation and oxidative stress.

In sepsis, the released bacteria and toxins activate the host's immune system, first producing a large amount of pro-inflammatory drugs, and then rapidly releasing anti-inflammatory drugs, resulting in alternating peaks in the blood concentration of pro-inflammatory drugs and anti-inflammatory drugs. Therefore, sepsis is very harmful. The disease progresses rapidly and will progress to progressively severe stages such as sepsis, severe sepsis, and septic shock. Unless active and effective measures are taken for treatment, the overall prognosis of the patient is extremely poor. Early diagnosis of sepsis and rapid and effective measures to rule

The steps of the backpropagation algorithm can be summarized as follows:

(1) Initialization

(2) For a specific input sample, please calculate the output of the top-level back unit and the output layer unit from front to back:

$$net_i = \sum_{k=1}^r s_{ki} z_k, i = 1, 2, \dots, n$$

$$y_k = f(net_i), i = 1, 2, \dots, n$$

$$net_h = \sum_{i=1}^r t_{ih} y_i, h = 1, 2, \dots, m$$

$$x_h = f(net_h), i = 1, 2, \dots, m$$

(3) If the training period is over, that is, all samples have participated in the training round, continue to step 4, otherwise, return to step 2 to continue

(4) Calculate the error signal of each level according to the total error

(5) Calculate the weight setting of each layer

(6) Modify the network weight

(7) Check whether the accuracy of the grid meets the predetermined requirements. If it meets the requirements, the training ends, otherwise a new unified training is performed

ALGORITHM 1

out the trend of sepsis to a severe stage are important issues that clinical medical staff urgently need to solve [21, 22].

2.3. Acute Kidney Injury. Acute Kidney Injury (AcuteKidney Injury, AKI) is a group of clinically common primary or secondary renal insufficiency. Renal function drops sharply in a short period of time (a few hours to a few weeks), and the glomerular filtration rate drops, causing hydrops. Electrolyte and acid-base imbalance and the accumulation of nitrogen metabolites are a disease characterized by rapid onset, rapid progression and high mortality. It is one of the common clinical critical diseases. Currently, predicting the recovery of renal function is one of the most popular aspects in AKI research. Accurately predicting whether the renal function of AKI will recover will help doctors distinguish the pros and cons of further treatment [23].

In the past, the early diagnosis and prognosis of AKI were mainly based on the production of creatinine in the blood and urine, but the creatinine in the blood would not only be interfered by the glomerulus itself, but also be effective with age, gender, basic metabolic rate, diet composition, etc. The rapid decrease in circulating blood volume and the use of nephrotoxic drugs are more important causes of changes in blood creatinine levels, and blood creatinine will not increase until the glomerular filtration rate is reduced by more than half [24]. The degree of lag is different, so in recent years, we have focused on different new biological indicators for the early detection of AKI and the evaluation of the prognosis of AKI. Acute lung injury is caused by a variety of complex reasons to damage capillary endothelial cells and alveolar epithelial cells, and is accompanied by hypoxemia and increased ARDS. ALI has the characteristics of high mortality, difficult treatment, and poor prognosis. Finding an effective ALI treatment target is another key problem to be solved in intensive care medicine [25].

2.4. Hydrogen Sulfide. Hydrogen sulfide is a toxic gas with the smell of rotten eggs, suffocating and irritating. Acute hydrogen sulfide poisoning can cause damage to the cardiopulmonary system, accompanied by multiple organ dysfunction, and even death in severe cases. Since it is reported that endogenous hydrogen sulfide in mammalian

cells has a wide range of biological effects, it has prompted extensive and in-depth research on it [26]. Studies in the past decade have shown that hydrogen sulfide has a wide range of pathophysiological effects and plays an important regulatory role in the onset and development of many diseases, as shown in Figure 1.

In addition, hydrogen sulfide can also have extensive and profound effects on the biological behavior of cells by interacting with many signaling molecules [27]. A large number of research materials have shown that endogenous hydrogen sulfide plays an important role in many physiological and pathological processes in the body. Endogenous hydrogen sulfide plays an important role in improving the activity of the human body's endogenous antioxidant enzyme system, as shown in Figure 2.

Recent studies have shown that hydrogen sulfide can regulate the expression of genes related to oxidative stress in mice and inhibit the oxidative stress state caused by broad beans in mice. Studies have confirmed that both endogenous and exogenous hydrogen sulfide can inhibit renal damage caused by ischemia-reperfusion, improve glomerular sclerosis caused by homocysteine, and reduce renal failure caused by the kidney [28].

By deepening the understanding of hydrogen sulfide, humans have discovered that hydrogen sulfide gas can be produced in animals. Researchers have found that in humans and animals, the process of endogenous hydrogen sulfide is inseparable from the combined effects of sulfur-containing amino acids in CBS and CSE. Experiments have found that hydrogen sulfide has a wide range of biological effects on various body systems and is considered to be the third gas signal molecule besides NO and CO [29]. According to literature records, hydrogen sulfide can reduce the amount of TNF- α in the serum, thereby reducing inflammation and tissue damage. On the contrary, reducing the amount of hydrogen sulfide will correspondingly increase the inflammatory response. NaHS can protect gastric mucosal cell damage caused by ischemia-reperfusion through anti-inflammatory, anti-oxidant and anti-apoptotic effects, and reduce acute lung injury caused by sepsis. This article has continued to study hydrogen sulfide for many years and found that the application of exogenous hydrogen

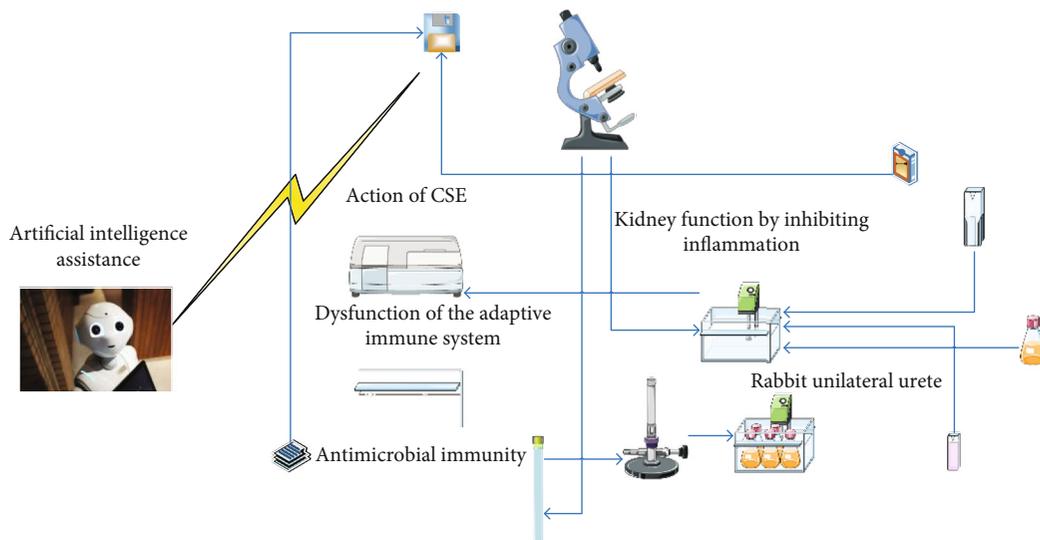


FIGURE 1: Imbalance of hydrogen sulfide homeostasis.

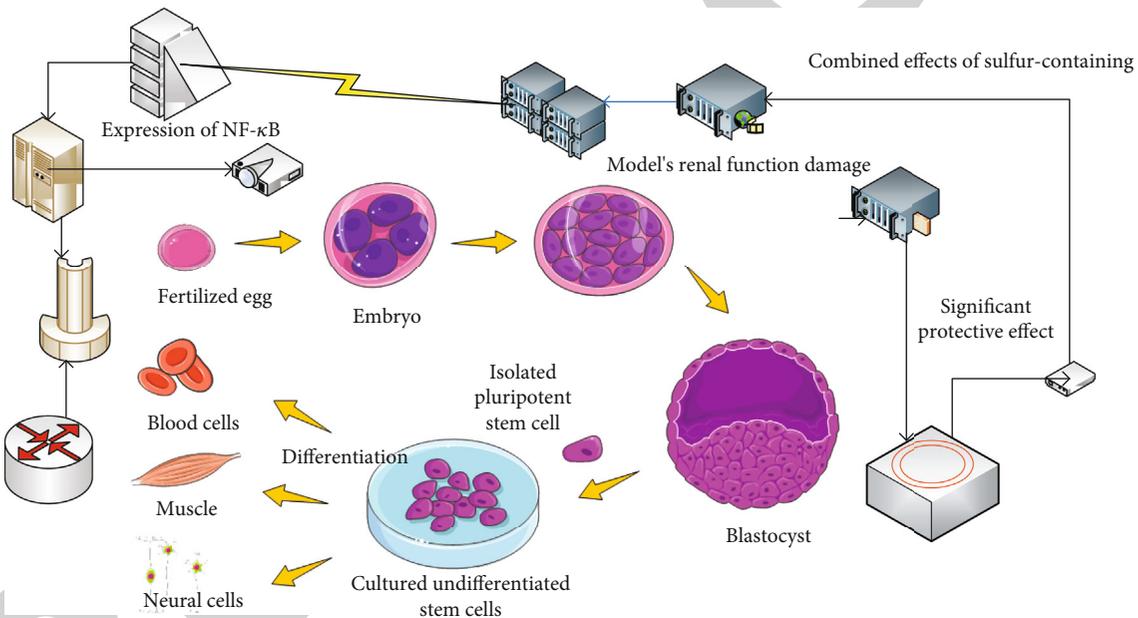


FIGURE 2: Endogenous antioxidant enzyme system.

sulfide (NaHS as a donor) in a uremic model can inhibit the expression of NF- κ B, up-regulate the expression of IL-10, and down-regulate the expression of TNF- α , and ultimately reduce the model's renal function damage. In short, in the studies that have been conducted, hydrogen sulfide has a significant protective effect in reducing the damage of sepsis in the body [30].

2.5. Cecal Ligation. Animal models are an indispensable foundation for medical experiments and play an important role as the research foundation for the pathogenesis and development of sepsis. There are three main types of animal sepsis models: the first type is injection of endotoxin, such as lipopolysaccharide. The second is the change of

the animal's endogenous protective barrier, such as intestinal leakage caused by blind ligation or placement of anode stents. The third is the injection or injection of foreign bacteria. Early and immediate injections of endotoxin will lead to a rapid increase in inflammation mediated by far exceeding human sepsis [31]. The injection or injection of foreign bacteria is usually only performed on large animals, which is time-consuming and time-consuming. Therefore, current animal decay models usually use blind ligation. At present, it is considered to be the most important method for reproducing decay patterns and the gold standard for studying decay. In the initial stage of research, this surgical method is usually used to simulate the establishment of peritonitis.

3. Artificial Intelligence Image Observation Hydrogen Sulfide Protection Experiment

In order to carry out medical research, specifically to study the mechanism and effectiveness of a drug, animal testing and clinical trials must be performed for further verification after confirming the experimental results. Therefore, in order to study the mechanism and effectiveness of drugs, animal experiments are very important. Experimental animals have been artificially raised to control their quality and environment. Their physiological characteristics are very consistent, and their genetic backgrounds are almost the same. Therefore, the continuity of the experimental response can be ensured to a greater extent. This study also uses animal experiments for scientific research.

3.1. Test Subject. The cecal ligation method is currently considered to be the gold standard and the most important method for replicating sepsis model research. At the beginning of the study, this surgical method is usually used to establish a peritonitis model. 45 healthy male rabbits were randomly selected from the Department of Animal Science of University A, with an average weight of 1.85-2.35 kg. During the experiment, all rabbits were fed with pellets and tap water. The room temperature of the animals was 20-25°C with good ventilation [32].

3.2. Test Design

3.2.1. Preparation of Bacterial Liquid. Inoculate the *Escherichia coli* strain (ATCC 25922) into the culture medium by propagation method, culture at 37°C for 18-24 hours, and select the plate with standard positive colonies, and use sterile cotton to collect and dissolve in saline. The concentration of the bacterial solution prepared by this method is 108/ml for later use.

3.2.2. Grouping and Operation Method. According to the method of random grouping, 35 rabbits were divided into 5 groups: normal control group (normally fed pellets and tap water). Sham operation group (during the experiment, intraperitoneal injection of 10% hydrogen chloride solution was used for anesthesia, and the left ureter was examined at the front end of the left psoas muscle. After finding it, the left middle ureter was fully freed with a glass minute needle, and feed pellets were given after waking up. And tap water for normal feeding). Sepsis group (based on sham operation, the prepared $10^8/ml$ *E. coli* solution was injected into the proximal ureteral lumen of the ligation site, the retroperitoneal cavity was completely flushed with 0.9% saline, and the pellets and pellets were taken after suture, using tap water as normal feed). Sodium hydrogen sulfide group (based on sepsis group, the concentration of $NaHS$ 8.4 $\mu mol/kg$ solution was injected through rabbit ear vein according to operation). DL-propargylglycine group (After closing the incision on the basis of the operation in the sepsis group, the rabbits were injected with 50 $mmol/L$ PAG solution into the abdominal cavity and fed normally after the operation).

3.2.3. Specimen Collection and Testing. First, record the general condition of each group of rabbits, rectal temperature (RT), respiration (RR) and heart rate (HR) operations at each time point of 12 hours, 24 hours, 36 hours and 48 hours. Count the blood with a five-point cell counter to determine the white blood cell count and neutrophil count, and an automatic biochemical instrument to detect renal function creatinine and urea nitrogen. Then the kidney tissue was stained with HE, and the morphological changes of the kidney tissue were observed under a transmission electron microscope [33]. After 48 hours, immunohistochemical method was used to detect the expression level of AOPP in kidney tissue, and ELISA was used to detect the level of ROS, SOD and HMGB 1 in kidney tissue:

$$SOD\text{inhibition rate}(\%) = [(A_{\text{Contrast}} - A_{\text{Blank}}) - (A_{\text{Determination}} - A_{\text{Measurement blank}})] / (A_{\text{Contrast}} - A_{\text{Blank}}) \times 100$$

$$SOD\text{ activity} = SOD\text{ inhibition rate} \div 50\% \times \text{Dilution multiple of reaction system} \div \text{Protein concentration of the sample to be tested}$$

$$MDA\text{ content} = [\text{Measuring tube OD} / \text{Control group OD}] \times \text{Standard concentration} \div \text{Protein concentration of the sample to be tested} \quad (11)$$

3.2.4. Draw a Curve. The expression of SOD mRNA in kidney tissue was detected by PCR. Finally, the protein removal method was used to determine the plasma hydrogen sulfide concentration and CSE activity in the kidney tissue. According to the measured absorption value, draw a standard curve to obtain the linear regression equation:

$$\begin{aligned} y &= 0.23512x + 0.26931, R^2 = 0.98337 \\ y &= 0.0067x + 0.00386, R^2 = 0.97966 \end{aligned} \quad (12)$$

3.3. Experimental Results. There was no significant difference

between the control group and the sham operation group in renal tissue CSE activity and plasma hydrogen sulfide content at 48 hours after surgery ($P > 0.05$). The renal tissue CSE activity of the sepsis group and the NaHS group was lower than that of the Control group and the Sham group at 48 hours after surgery, which was statistically significant ($P < 0.05$); the decrease of CSE activity of the renal tissue of the PAG group was significantly lower than that of the sepsis group and NaHS Group ($P < 0.05$), and it was statistically significant. The plasma hydrogen sulfide content of the sepsis group was significantly lower than that of the control group and the Sham group ($P < 0.05$), which was statistically

TABLE 1: Comparison of CSE activity in kidney tissue and H_2S content in plasma.

Group	n	Kidney tissue CSE activity	Plasma H_2S content
Control	7	3.39±0.36	38.32±0.15
Sham	7	3.35±0.35	38.42±0.13
Sepsis	7	2.57±0.17	39.77±0.12
PAG	7	2.10±0.12	39.96±0.15
NaHS	7	2.75±0.13	38.65±0.14

TABLE 2: RT comparison of five groups of rabbits at different time points.

Group	Preoperative	12 h after operation	24 h after operation	36 h after operation	48 h after operation
Control	38.22±0.15	38.19±0.06	38.32±0.15	38.22±0.23	38.25±0.08
Sham	38.09±0.13	38.58±0.05	38.42±0.13	38.38±0.31	38.29±0.22
Sepsis	38.16±0.12	38.36±0.47	39.77±0.12	39.99±0.12	40.11±0.21
PAG	38.18±0.15	38.77±0.12	39.96±0.15	40.51±0.15	41.15±0.13
NaHS	38.16±0.14	38.55±0.11	38.65±0.14	39.41±0.14	39.54±0.07

significant; the plasma hydrogen sulfide content of the PAG group was lower than that of the sepsis group ($P < 0.05$), which was statistically significant [34]. According to the results of Spearman correlation analysis, the CSE activity of the kidney tissue of the five groups of rabbits was positively correlated with the plasma hydrogen sulfide content ($R = 0.605$, $P \leq 0.001$). As shown in Table 1.

4. Hydrogen Sulfide Protects against Acute Kidney Injury in Urinary Sepsis

4.1. Comparison of RT of Rabbits at Different Time Points. The anal temperature, respiratory rate and heart rate before the operation were not statistically significant ($P > 0.05$). Comparing the RT of the sham operation group with the control group at the same time point, the increase was statistically significant at 12 hours and 24 hours after surgery ($P < 0.05$). The RT of the sham operation group gradually decreased at 36 hours and 48 hours, and there was no significant difference in RT higher than the Control group at the same time point ($P > 0.05$). In the sepsis group, the RT and PAG groups started to increase 12 hours after surgery. Compared with the RT group of the control group and the sham operation group at the same time point, the difference was statistically significant ($P < 0.05$). At the same time, the RT of PAG group was higher than that of sepsis group, the difference was statistically significant ($P < 0.05$). Compared with the RT of the control group, sepsis group and PAG group at the same time point, the RT of the NaHS group was statistically significant ($P < 0.05$). As shown in Table 2 and Figure 3.

4.2. Comparison of Changes in Renal Function in each Group at 48H after Surgery. In this experimental study, the renal function and renal pathological changes of the three groups were studied. The sham group and HS-Se group were compared before operation, 24 h, 36 h and 48 h after operation, and the difference was not statistically significant

($P > 0.05$). The two groups were compared with renal function (BUN) after 24 hours, 36 hours and 48 hours, and the difference was not statistically significant ($P > 0.05$). The renal function (BUN, Cr) of the sepsis group at 24 hours and 36 hours after operation was not different from the other two groups ($P > 0.05$), and it was significantly higher than the control group at 48 hours after operation. There was no significant difference in renal function (BUN, Cr) between the groups before operation. There was no difference between the sham operation group and the HS-Se group before operation, 24 hours, 36 hours and 48 hours after operation, suggesting sepsis by hydrogen sulfide hyperemia model did not have a significant effect on the changes in the body's renal function. The renal function (BUN, Cr) of patients in the sepsis group at 24 hours and 48 hours after surgery was no different from the other two groups, but as time goes by, we can see the kidney function of the sepsis group at 48 hours after surgery. The function index function is obviously increased, compared with the sham group and HS-Se, the difference is significant [35]. As shown in Table 3 and Figure 4.

4.3. Comparison of RR of Rabbits at Different Time Points. The preoperative RR of rabbits in each group was compared, and the difference was not statistically significant ($P > 0.05$). In the sham operation group, RR increased slightly within 24 hours after surgery ($P < 0.05$). 36-48 hours after the operation, the RR of the sham operation group tended to be normal, and there was no significant difference from the control group at the same time point ($P > 0.05$). After 24 hours, 36 hours, and 48 hours in the Sepsis group, RR gradually increased at each time point, and at the same time point, it increased faster than the control group and the Sham group ($P < 0.05$). The RR of the PAG group at each time point of 24 hours, 36 hours and 48 hours was significantly faster than that of the Sepsis group at the same time point. During the same period, the RR of the NaHS group at 24 hours, 36

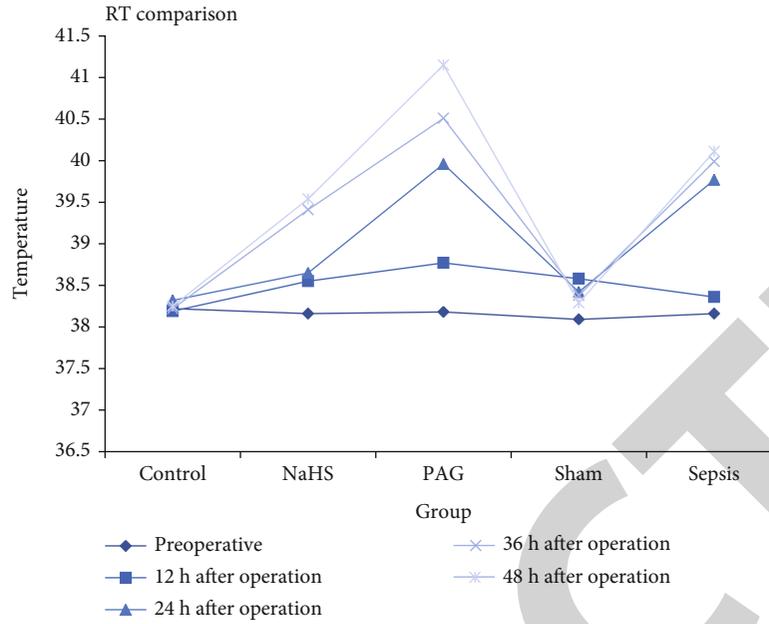


FIGURE 3: RT comparison of five groups of rabbits at different time points.

TABLE 3: Comparison of rabbit serum BUN in each group.

Group	Preoperative	24 h after operation	36 h after operation	48 h after operation
Sham	6.06±0.23	6.05±0.29	6.05±0.27	6.08±0.23
Sepsis	6.01±0.26	6.32±0.31	6.82±0.55	8.91±0.82
HS-se	6.05±0.25	6.28±0.28	6.33±0.34	6.51±0.26

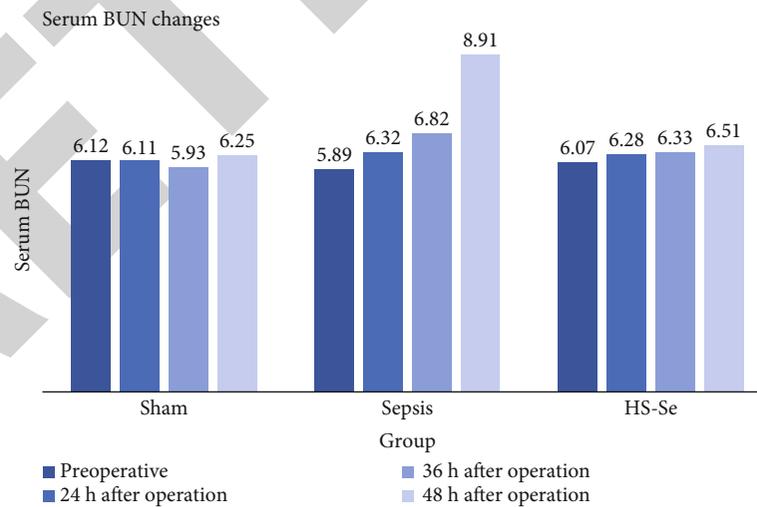


FIGURE 4: Comparison of rabbit serum BUN in each group.

hours and 48 hours was slower than that of the sepsis group ($P < 0.05$). As shown in Table 4 and Figure 5.

4.4. Expression of iNOS Protein and HO-1 Protein in Rabbit Kidney Tissue. The expression of iNOS protein and HO-1

protein in renal tissues of the control group and sham operation group at 48 hours postoperatively was not statistically significant ($P > 0.05$). The expression of iNOS protein and HO-1 protein in the sepsis group was higher than that in the control group and the sham operation group at 48 hours

TABLE 4: RR comparison of five groups of rabbits at different time points.

Group	Preoperative	24 h after operation	36 h after operation	48 h after operation
Control	40.01±2.23	40.52±1.79	40.1±2.05	40.25±2.88
Sham	40.49±2.35	45±2.66	42.11±2.09	41.06±2.3
Sepsis	40.12±2.61	67.3±2.85	72±2.66	76±2.41
PAG	40.41±2.08	70.54±2.28	75±2.39	80±3.02
NaHS	40.26±2.44	60±2.01	60.87±2.83	61.77±2.99

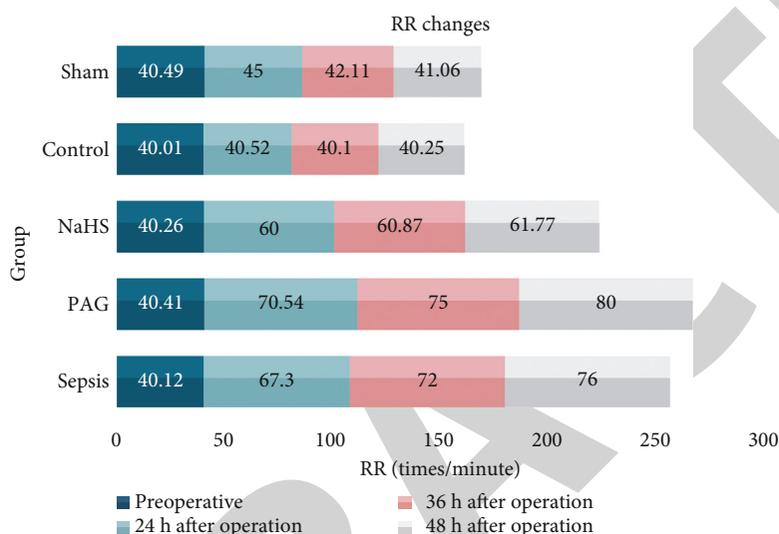


FIGURE 5: RR comparison of five groups of rabbits at different time points.

after surgery [36]. Compared with the sepsis group, the expression of iNOS protein in the PAG group increased at 72 hours after surgery, while the expression of iNOS in the NaHS group decreased, and the difference was statistically significant ($P < 0.05$). Compared with the sepsis group, the expression of HC-1 protein in the NaHS group increased at 72 hours after surgery, while the expression of HC-1 protein in the PAG group decreased, and the difference was statistically significant ($P < 0.05$). As shown in Table 5 and Figure 6.

4.5. Etiology Data. Eligible patients for sepsis received routine sputum culture, bronchopulmonary fluid culture (BALF), blood culture, and pleural fluid culture. A total of 160 cases had bacterial culture results. Gram-positive particles include *Staphylococcus aureus*, *Enterococcus faecalis*, *Staphylococcus epidermidis*, *Streptococcus viridans*, and more. Gram-negative bacilli include *Acinetobacter baumannii* and *Escherichia coli* fungi, *Pseudomonas aeruginosa*, *Stenotrophomonas maltophilia*, *Klebsiella pneumoniae*, etc. Fungi include *Candida albicans*, *Candida albicans*, *Aspergillus*, etc. Etiological results of 109 patients with sepsis-induced AKI: 87 of them had pathogenic effects, 46 were gram-negative bacteria, 35 were gram-positive bacteria, and 4 were fungi. There were 96 cases of non-sepsis and non-AKI patients, 69 cases of pathogenic results, 34 grams of negative bacteria, 30 grams of positive bacteria, and 7 cases of fungi. The distribution of pathogenic bacteria in the

TABLE 5: The expression of iNOS and HO-1 protein in renal tissues of rabbits in each group.

Group	n	iNOS/ β -actin	HO-1/ β -actin
Control	8	0.255±0.079	0.36±0.046
Sham	8	0.26±0.027	0.35±0.05
Sepsis	8	0.618±0.062	0.966±0.086
PAG	8	0.859±0.077	0.655±0.069
NaHS	8	0.476±0.073	1.288±0.162

AKI sepsis group and the non-AKI group is shown in Table 6 and Figure 7.

4.6. Basic Situation of AKI. This article retrospectively analyzed 191 sepsis patients diagnosed with sepsis 3.0 in university hospitals. According to whether it caused AKI, it was divided into AKI group and non-AKI group caused by sepsis. According to the patient's survival 4 weeks after discharge, the sepsis-induced AKI group was divided into the death group and the survival group. Among 191 patients with sepsis, the main site of infection was the most common lung infection, with 109 cases (57.0%). Among patients with lung infection, 53 cases (27.8%) in the AKI group and 56 cases (29.3%) in the AKI group; followed by urinary tract infection, with a total of 35 cases (18.3%). Among them, there were 21 cases (11.0%) in the AKI group and 14 cases

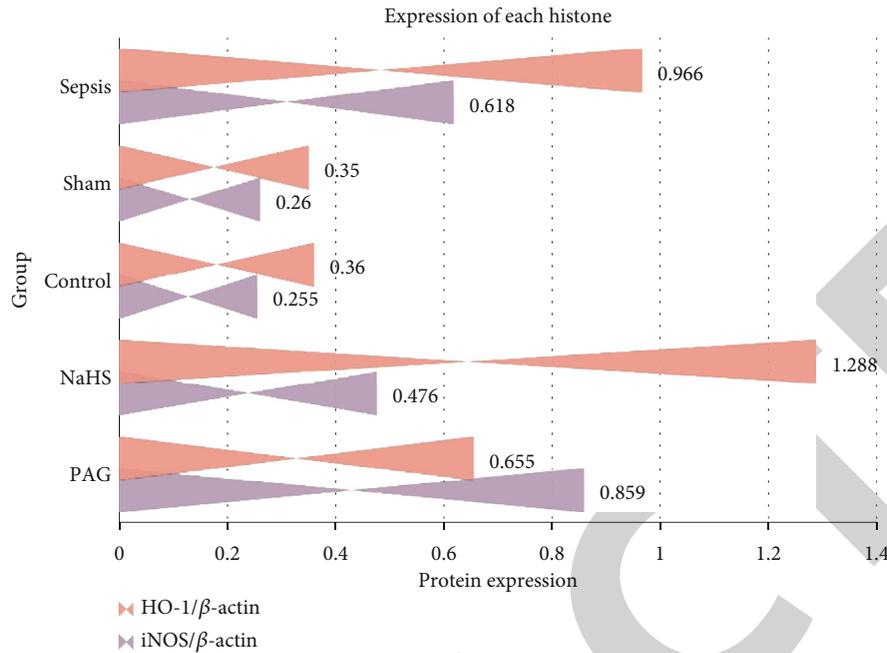


FIGURE 6: The expression of iNOS and HO-1 protein in renal tissues of rabbits in each group.

TABLE 6: Results of bacterial culture in patients with sepsis.

Name	Species
Gram-positive cocci	Staphylococcus aureus, enterococcus faecium, Staphylococcus epidermidis, Streptococcus viridans
Gram-negative bacilli	Acinetobacter baumannii, Escherichia coli, Pseudomonas aeruginosa, Streptomonas maltophilia, Klebsiella pneumoniae
Fungus	Candida albicans, Candida albicans, Aspergillus

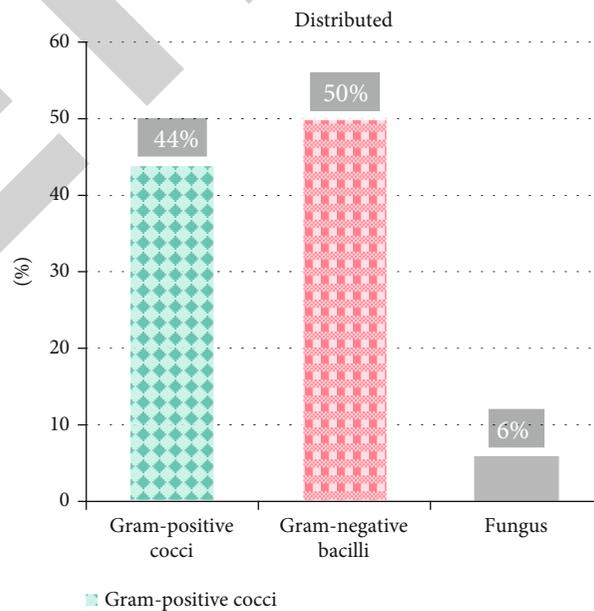


FIGURE 7: Etiology distribution in AKI group.

TABLE 7: Comparison of infection sites between the two groups.

Site of infection	Total number of cases	AKI group	Non-AKI group
Lung infection	109 (57.0%)	53 (27.8%)	56 (29.3%)
Urinary tract infection	35 (18.3%)	21 (11.0%)	14 (7.9%)
Digestive tract infection	22 (11.5%)	12 (6.3%)	10 (5.2%)
Blood-borne infection	6 (3.1%)	4 (2.1%)	2 (1.0%)
Abdominal infection	12 (6.3%)	5 (2.6%)	7 (3.7%)
Endocarditis	3 (1.6%)	2 (1.1%)	1 (0.5%)
Intracranial infection	4 (2.1%)	3 (1.6%)	1 (0.5%)

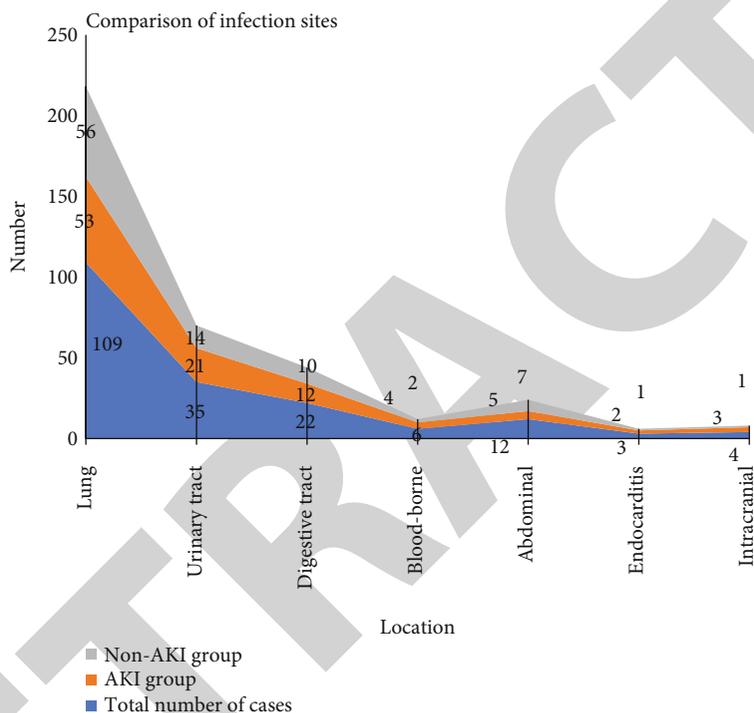


FIGURE 8: Comparison of infection sites between the two groups.

(7.9%) in the non-AKI group; 22 cases (11.5%) of gastrointestinal infections, including 12 cases (6.3%). In the AKI group, there were 10 cases (5.2%) in the group other than AKI. Other infections are not common, including blood infections, abdominal infections, endocarditis and brain infections, internal infections, skin and soft tissue infections, etc. As shown in Table 7, Figure 8.

5. Conclusion

Studies have shown that hydrogen sulfide can reduce the body's response to oxidative stress and is involved in the removal of peroxide anions (O_2) and inhibition of the expression of peroxide anions. Other studies have shown that hydrogen sulfide participates in various inflammatory reaction processes and plays an extremely important role. The supply of exogenous hydrogen sulfide can improve the body's antioxidant capacity. Experimental results show that hydrogen sulfide can reduce the level of oxidative stress

products of AOPP and ROS in urine, increase the activity of antioxidant enzyme SOD, and inhibit the expression of inflammatory factor HMGB1 [37]. Ligation of the left ureter and injection of *E. coli* could successfully reproduce the rabbit urine sepsis model. PAG can exacerbate acute renal failure in uremia, and the application of NaHS to exogenous enhancement can reduce acute renal failure in uremia. H_2S has a protective effect on oxidative stress and inflammation caused by acute kidney damage caused by uremia. The mechanism may involve decreased AOPP levels, decreased ROS activity, increased SOD activity, and inhibition of the inflammatory factor HMGB1.

In this study, the ET-1 content of the NaHS group was lower than that of the PAG group and the sepsis group, and the SOD activity was higher than that of the PAG group and the sepsis group. At the same time, the MDA content is also lower than the two groups. It is proved that hydrogen sulfide can improve renal hemodynamics by improving the contents of MDA and ET-1 in acute renal insufficiency

complicated by sepsis, which is very important for mediating acute renal damage caused by sepsis. The results of this experiment can show that although the expression of MDA in the NaHS group increases in the kidney, the SOD activity decreases in the sepsis group and the PAG group. Therefore, this experiment believes that hydrogen sulfide can reduce ET-1 release from renal tissue to acute renal failure in sepsis, reduce tissue ischemia and hypoxia, improve antioxidant capacity of renal tissue, and improve acute renal failure from etiology and pathogenesis. The pathological phenomenon.

Urinary sepsis refers to a SIRS caused by bacteria or fungi. Bacteria or fungi invade the bloodstream through retrograde infection of the urinary tract to grow, multiply and produce toxins. Urinary tract obstruction combined with infection is a common disease in urology, which usually leads to urinary incontinence. 78% of patients with septic shock caused by urine are related to urinary tract obstruction. Among urinary tract obstruction, obstruction caused by stones is the most common. Stone blockage and infection influence and promote each other, forming a vicious circle, which can promote the formation of decay and make the disease develop rapidly. Especially when the patient's immune function is low or acute obstruction undergoes minimally invasive surgery, pathogens and toxins in the urinary tract can be reversibly infected into the blood in various ways, and cause systemic activation and activation, resulting in urinary sepsis. The condition can further develop to cause MODS.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author(s) declare(s) that they have no conflicts of interest.

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