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Renal Protective Effect, Role of Vitamin B6 in Sepsis

Sepsis can progress to multiple organ dysfunction syndrome or multiorgan failure. Globally, sepsis-related deaths are estimated at 11 million annually, representing 19.7% of total deaths, with a global age-standardised death rate of 148.1 per 100,000 people. Despite advancements in treatment, the case fatality rate for sepsis remains high at 30% to 70%. Treating sepsis is costly and significantly impacts quality of life and health.

Acute kidney injury (AKI) is a complication of sepsis, prevalent in up to 78% of ICU patients, and increases the risk of death fourfold. Preventing and treating AKI is crucial for improving sepsis outcomes.

Recent studies highlight the critical role of vitamins in biological pathways related to sepsis, including anti-inflammatory and antioxidant effects. Vitamin deficiencies are common during sepsis, and trials suggest that vitamin supplementation improves outcomes in both adults and children with septicemia. Vitamin B6, a water-soluble nutrient found in various foods, converts in the liver to pyridoxal 5-phosphate, which is crucial for immune responses and the metabolism of nutrients. It acts as a coenzyme in amino acid metabolism and neurotransmitter synthesis and helps mitigate oxidative damage by scavenging free radicals.

A recent clinical trial involving 128 sepsis patients across multiple centres explored vitamin B6's impact on inflammatory response, oxidative stress, and renal function when combined with standard treatment compared to standard treatment alone.

The study included patients diagnosed with sepsis and AKI. Study patients were randomly assigned to experimental and control groups, each comprising 64 patients. Both groups received standard treatment for sepsis and specific treatment for their primary illness. The experimental group received daily intravenous injections of vitamin B6 at a dosage of 300 mg per day (administered as 100 mg three times daily), continuing for a week or until the patient's death. The control group received intravenous injections of 0.9% sodium chloride solution at 6 mL per dose. The dosage of vitamin B6 was selected based on clinical practices and the collective experience of participating medical centres.

Serum vitamin B6 concentrations were measured at the beginning of treatment and on the seventh day using bioelectrochemical methods. Inflammatory markers (IL-6, IL-8, TNF-α, and ET-1) were assessed using enzyme-linked immunosorbent assay (ELISA) kits before treatment and after seven days. Oxidative stress markers (SOD, GSH, and MDA) were evaluated before treatment and after seven days using specific methods: xanthine oxidase for SOD, DTNB for GSH, and thiobarbituric acid for MDA.

Renal function parameters (BUN, SCr) and renal resistance index (RRI) were measured before treatment and on the seventh day, with RRI assessed via ultrasound.

Clinical outcomes such as the need for renal replacement therapy, ICU length of stay, total hospitalisation expenses, and 28-day mortality were also recorded.

Findings show no statistically significant differences in gender, age, APACHE II score, qSOFA score, or distribution of primary diseases between the experimental and control groups. Serum vitamin B6 levels did not differ significantly between the groups before treatment and after 7 days of treatment, suggesting uniformity in vitamin B6 impact across different demographic and metabolic profiles.

Regarding inflammatory response markers (IL-6, IL-8, TNF-α, and ET-1), there were no significant differences between the groups before

treatment. However, after 7 days of treatment, levels of these markers were significantly lower in the experimental group compared to the control group. ET-1 levels showed differences related to gender and age. This indicated that vitamin B6 supplementation effectively reduced inflammatory markers in sepsis patients.

Initial oxidative stress markers (SOD, GSH, and MDA) were not significantly different between the groups before treatment. After 7 days, SOD and GSH levels were significantly higher, while MDA levels were lower in the experimental group compared to the control group. Gender differences were observed in these markers after treatment, and age differences were noted in MDA levels.

Renal function indexes (BUN, SCr, and RRI) showed no significant differences between groups before treatment. However, after 7 days of treatment, BUN, SCr, and RRI levels were significantly lower in the experimental group compared to the control group. Age differences were noted in RRI after treatment, indicating improved renal function with vitamin B6 supplementation.

In terms of clinical outcomes, there were no significant differences in the rates of renal replacement therapy or 28-day mortality between groups. However, ICU length of stay and total hospitalisation expenses were significantly lower in the experimental group compared to the control group. This suggests that vitamin B6 supplementation may reduce hospitalisation duration and overall costs, potentially improving quality of life and lessening the economic burden for sepsis patients with AKI.

Overall, the study demonstrated that vitamin B6 supplementation alongside standard treatment effectively attenuated inflammatory responses, improved oxidative stress responses, enhanced renal function, and potentially reduced hospitalisation costs and length of stay for patients with sepsis and AKI. The study also highlighted the role of vitamin B6 in improving renal function in sepsis patients. It demonstrated that vitamin B6 supplementation reduced inflammatory markers and improved oxidative stress markers, which are crucial in mitigating renal damage associated with sepsis-induced AKI.

Source: Shock

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