

Evaluation of the Efficacy of Alanyl-Glutamine for Nutritional Support in Septicemia

Xiulan Hu*, Hongfeng Yang, Chun Wang, Lu Bai

The First People's Hospital of Zhenjiang City, Zhenjiang 212000, Jiangsu, China

*Corresponding author: Xiulan Hu, hxl1306@163.com

Copyright: © 2024 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: *Objective:* To evaluate the therapeutic efficacy of alanyl-glutamine (Ala-Gln) in the nutritional support of sepsis. *Methods:* 120 cases of sepsis patients admitted to the hospital in the past three years were selected and grouped by randomization method, Group A was treated with Ala-Gln, and Group B was treated with conventional nutritional support therapy, and the therapeutic effects were compared. *Results:* Before treatment, there was no difference in nutritional indexes, immune function indexes, and inflammatory factors between the two groups ($P > 0.05$). After treatment, the nutritional indexes of Group A were higher than those of Group B, the immune function indexes were higher than those of Group B, and the inflammatory factors were lower than those of Group B ($P < 0.05$). Except for mortality, the regression of group A was better than that of group B ($P < 0.05$). *Conclusion:* Ala-Gln can improve the nutritional indexes of septicemia patients during the treatment period, enhance their immune function, reduce the inflammatory response of the body, and promote the regression of the disease.

Keywords: Alanyl-glutamine; Sepsis; Nutritional support; Immune function index; Regression

Online publication: June 24, 2024

1. Introduction

Septicemia is caused by severe infections, shock, or burns, and manifests as a systemic inflammatory response that involves multiple organs, with extremely rapid progression and a high risk of death^[1]. During the development and progression of the disease, the overproduction of oxygen free radicals and the decline of immune function are the main mechanisms of the disease, which may cause nutritional imbalance or metabolic disorders, so nutritional support is needed to maintain cellular metabolism and provide sufficient nutritional substrates and energy to protect organ function or structure, and then enhance immunity. Ala-Gln is a commonly used antioxidant, which is capable of Ala-Gln is a more commonly used antioxidant that can improve immune function, exert therapeutic antioxidative effects, and enhance the efficacy of nutritional support. In this study, 120 patients with sepsis were selected to evaluate the therapeutic efficacy of Ala-Gln.

2. Materials and methods

2.1. General information

A total of 120 patients with sepsis who were admitted to the hospital from October 2020 to October 2023 were selected and grouped by randomization method. A total of 60 cases were allocated to Group A, with 35 male patients and 25 female patients aged between 35 and 74 years and a mean age of 56.26 ± 2.47 years. There were 21 cases with the site of infection at the abdomen, 28 at the lungs, and 11 at the other sites. A total of 60 cases were allocated to Group B, with 37 male patients and 23 female patients aged between 34 and 71 years and a mean age of 56.38 ± 2.21 years. There were 20 cases with the site of infection at the abdomen, 29 at the lungs, and 11 at the other sites. The data between the groups were comparable ($P > 0.05$).

2.2. Methods

- (1) Group A received Ala-Gln treatment: the daily dose was 0.5 g/kg, mixed into the intravenous nutrition infusion bag (3 L) along with other nutritional fluids, and administered continuously via central vein infusion. This treatment also continued for 14 days.
- (2) Group B received conventional nutritional support therapy: the daily calorie intake was set at 25 kcal/kg. Isocaloric and isonitrogenous therapy was administered to maintain a non-protein calorie-to-nitrogen ratio of 120 kcal:1 g. Intravenous nutritional support was provided. Once the patient's gastrointestinal function had largely recovered, enteral nutrition support was added. This treatment continued for 14 days.

2.3. Observation indexes

- (1) Nutritional indexes: Before and after 7 days of treatment, fasting venous blood was drawn, centrifuged, and analyzed for albumin (ALB), prealbumin (PA), and transferrin (TF) using an automatic biochemical analyzer.
- (2) Immune function indexes: Immunoglobulin A (IgA), IgM, and IgG were measured at the same time and using the same method as the nutritional indexes.
- (3) Inflammatory factors: After blood sampling, tumor necrosis factor alpha (TNF- α), high-sensitivity C-reactive protein (hs-CRP), and high mobility group protein B1 (HMGB1) were measured by enzyme-linked immunosorbent assay (ELISA).
- (4) Regression: The duration of ventilator treatment, the duration of antimicrobial use, the mortality rate, and the incidence of multiple organ dysfunction syndrome (MODS) were recorded.

2.4. Statistical analysis

Data were processed using SPSS 28.0 software. Measured values were compared using the *t*-test, while counted values were compared using the chi-square test (χ^2). A *P*-value less than 0.05 was considered statistically significant.

3. Results

3.1. Comparison of nutritional indicators between the two groups

Before treatment, there was no difference between the groups when compared to the nutritional indicators ($P > 0.05$). After treatment, the nutritional indicators of group A were higher than those of group B ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of nutritional indicators between the two groups before and after treatment (mean \pm SD)

Group	n	ALB (g/L)		PA (mg/dL)		TF (g/L)	
		Before	After	Before	After	Before	After
Group A	60	33.45 \pm 3.19	36.98 \pm 3.37	11.15 \pm 1.42	15.94 \pm 1.82	1.38 \pm 0.34	1.94 \pm 0.49
Group B	60	33.41 \pm 3.21	34.87 \pm 3.35	11.18 \pm 1.40	13.81 \pm 1.80	1.40 \pm 0.36	1.71 \pm 0.45
<i>t</i>	-	0.068	3.440	0.117	6.445	0.313	2.678
<i>P</i>	-	0.946	0.001	0.907	0.000	0.755	0.008

3.2. Comparison of immune function indexes between the two groups

Table 2 shows that Before treatment, there was no difference between the groups when compared to the immune function indexes ($P > 0.05$). After treatment, the immune function indexes of Group A were higher than those of Group B ($P < 0.05$).

Table 2. Comparison of immune function indexes between the two groups before and after treatment (mean \pm SD, g/L)

Group	n	IgA		IgM		IgG	
		Before	After	Before	After	Before	After
Group A	60	1.84 \pm 0.34	1.99 \pm 0.51	2.31 \pm 0.55	2.87 \pm 0.61	12.81 \pm 1.58	18.59 \pm 1.76
Group B	60	1.83 \pm 0.32	1.75 \pm 0.43	2.32 \pm 0.51	2.49 \pm 0.55	12.78 \pm 1.56	15.06 \pm 1.70
<i>t</i>	-	0.166	2.787	0.103	3.584	0.105	11.174
<i>P</i>	-	0.869	0.006	0.918	0.000	0.917	0.000

3.3. Comparison of inflammatory factors between the two groups

As shown in **Table 3**, there were no significant differences in the levels of inflammatory factors between the two groups before treatment ($P > 0.05$). However, after treatment, the levels of inflammatory factors in Group A were significantly lower than those in Group B ($P < 0.05$).

Table 3. Comparison of inflammatory factors between the two groups before and after treatment (mean \pm SD)

Group	n	TNF- α (pg/mL)		hs-CRP (mg/L)		HMGB1 (ng/mL)	
		Before	After	Before	After	Before	After
Group A	60	154.85 \pm 16.32	104.65 \pm 11.84	137.95 \pm 14.20	28.06 \pm 1.53	43.65 \pm 4.12	12.51 \pm 1.57
Group B	60	154.74 \pm 16.50	119.75 \pm 12.06	137.49 \pm 14.18	40.65 \pm 4.91	43.69 \pm 4.20	17.97 \pm 1.63
<i>t</i>	-	0.037	6.921	0.178	18.963	0.053	18.688
<i>P</i>	-	0.971	0.000	0.859	0.000	0.958	0.000

3.4. Comparison of the regression of the two groups

Except for mortality, the regression of Group A was better than that of Group B ($P < 0.05$), as depicted in **Table 4**.

Table 4. Comparison of the regression of the two groups [mean \pm SD, *n* (%)]

Group	<i>n</i>	Duration of ventilator therapy (d)	Duration of antimicrobial drug use (d)	Mortality rate	Incidence of MODS
Group A	60	4.71 \pm 0.61	5.28 \pm 0.74	0 (0.00)	3 (3.33)
Group B	60	7.94 \pm 1.35	9.61 \pm 1.40	2 (3.33)	10 (16.67)
<i>t</i> / χ^2	-	16.889	21.180	2.034	4.227
P	-	0.000	0.000	0.154	0.040

4. Discussion

Septicemia arises as a secondary complication to infectious diseases, affecting individuals across various demographics. However, high-risk groups include patients with conditions such as diabetes mellitus, severe trauma, and leukemia, which can readily lead to serious consequences like respiratory distress syndrome and shock [2]. This condition compromises patients' coagulation function, diminishes their immunity, and triggers multi-system pathology, inciting a systemic inflammatory response characterized by vasodilation and generalized edema, among other symptoms [3]. Poorly managed sepsis or delayed treatment promptly activates the body's defense mechanisms, resulting in the formation of numerous microthrombi and exacerbating tissue hypoxia/ischemia, ultimately precipitating septic shock. Early nutritional support is a standard therapy for this condition, aiming to regulate the body's immune system and provide essential nutrients to maintain organ function while reducing the inflammatory response [4].

In patients with sepsis, there is a significant decrease in both intraplasma and intramuscular glutamine concentrations, resulting in a 50% reduction in glutamine-free concentration within muscle tissue. This decline is typically attributed to rapid metabolism or excessive efflux of glutamine [5]. Furthermore, the specific demand for glutamine in sepsis patients far exceeds the synthesis of endogenous glutamine, leading to a notable decrease in its extracellular distribution. This reduction directly interferes with protein metabolism and hinders the growth of immune cells.

Ala-Gln belongs to a group of specialized nutrients that, as essential amino acids, have the ability to synthesize nucleic acids and proteins. They serve as crucial precursors for several biomolecules and play a role in regulating the growth of the small intestines. Additionally, Ala-Gln serves as a vital precursor for protein synthesis and regulates the functioning of organs such as the small intestine, kidneys, and skeletal muscles [6]. This drug can supply a substantial amount of energy to immune cells, with macrophages and lymphocytes exhibiting a high utilization rate of the substance. This utilization accelerates the rate of protein synthesis and promotes the proliferation of lymphocytes, thereby aiding in the repair of damaged macrophage RNA and enhancing immune function. Furthermore, the drug facilitates protein synthesis, corrects nitrogen imbalance, and possesses antioxidant properties, metabolic regulation, and immune enhancement functions [7].

The results revealed that following treatment, the nutritional and immune function indicators in Group A surpassed those in Group B, while inflammatory factors were lower than those in Group B ($P < 0.05$). With the exception of mortality, the regression of Group A was superior to that of Group B ($P < 0.05$). This suggests that Ala-Gln can enhance the nutritional status and immune function of septicemia patients, mitigate the inflammatory response, and exhibit a more favorable effect on disease regression.

The rationale behind this lies in Ala-Gln's active supplementation of glutamine, which provides immunonutrients to various cells, enhances lymphocyte synthesis, and thereby boosts immune system function [8]. Upon continuous infusion, the drug breaks down into glutamine and alanine components in the body, offering stable efficacy and

prolonged therapeutic effects, leading to significant improvements in patient outcomes. Moreover, when Ala-Gln is administered intravenously, it swiftly breaks down into glutamine and other effective components in the body, releasing a variety of nutrients and storing them in bodily tissues. Subsequently, it follows the body's metabolic processes to carry out effective metabolism^[9,10]. With a half-life ranging from 2 to 4 minutes and a plasma binding rate of 1.6 to 2.7 L/min, Ala-Gln exhibits relatively high bioavailability, resulting in remarkable therapeutic effects post-treatment, thereby improving disease regression.

In conclusion, the efficacy of Ala-Gln treatment for septicemia patients is excellent, positioning it as a viable option for standard treatment of septicemia.

Disclosure statement

The authors declare no conflict of interest.

References

- [1] Huang Z, He L, Huang Y, et al., 2023, Effectiveness of Alanyl-Glutamine Intensive Nutritional Support in Patients with Intestinal Obstruction. *Northwest Journal of Pharmacy*, 38(5): 130–134.
- [2] Xu C, Li B, Xing M, et al., 2021, Protective Effect of Growth Inhibitor Combined with Alanyl-Glutamine on Intestinal Function in Patients with Sepsis. *Journal of Clinics and Pathology*, 41(5): 7.
- [3] Liang H, Ge J, Liu T, et al., 2023, A Randomized Controlled Clinical Trial Comparing Different Concentrations of Alanyl-Glutamine for Parenteral Nutrition in Postoperative Patients with Gastrointestinal Tumors. *Chinese Journal of General Surgery*, 32(10): 1539–1551.
- [4] Shan L, Chen J, Xiao J, et al., 2019, Effects of Alanyl-Glutamine-Assisted Enteral and Parenteral Nutrition on Gastrointestinal Hormones, Inflammatory Cytokine Levels and Growth and Development in Very Low Birth Mass Children. *China Maternal and Child Health*, 34(24): 4.
- [5] Zhou Q, 2024, Observation on the Effect of Alanyl-Glutamine Used for Sepsis Nutritional Support. *Clinical Rational Drug Use*, 17(1): 101–103.
- [6] Lv Z, Lin X, 2021, Clinical Efficacy of Nutritional Support Combined with Alanyl-Glutamine in the Treatment of Sepsis and Its Effect on GSH and Gln. *Straits Pharmacology*, 33(8): 150–152.
- [7] Li Y, 2021, Effect of Probiotics Combined with Alanyl-Glutamine on Acute Intestinal Mucosal Injury and Glutathione and Glutamine Levels in Sepsis. *Heilongjiang Medicine*, 45(3): 283–285.
- [8] Min T, Gao H, Qu D, et al., 2019, Effectiveness of Alanyl-Glutamine in Nutritional Supportive Therapy in Patients with Sepsis. *China Healthcare Nutrition*, 29(22): 314.
- [9] Freitas AKL, Silva MTB, Silva CMS, et al., 2020, Alanyl-Glutamine Protects the Intestinal Barrier Function in Trained Rats Against the Impact of Acute Exhaustive Exercise. *Braz J Med Biol Res*, 53(5): e9211. <https://doi.org/10.1590/1414-431X20209211>
- [10] Ping W, Wang Z, Chen L, et al., 2020, Effects of Alanyl-Glutamine Dipeptide and Mannan Oligosaccharides on Intestinal Morphology and Microflora Structure in Weaned Piglets. *Chinese Journal of Animal Nutrition*, 32(10): 4862–4872.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.