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Clinical Observation of Cefixime Combined with Montmorillonite Powder in Treating Pediatric Bacterial Enteritis

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Abstract: *Objective:* To evaluate the clinical efficacy of cefixime (Cef) combined with montmorillonite powder (MP) in treating pediatric bacterial enteritis. *Methods:* Seventy-two cases of bacterial enteritis in children admitted between October 2021 and October 2023 were selected and randomly divided into two groups. The combination group received Cef treatment alongside MP, while the control group received only Cef treatment. The groups were compared based on overall efficacy, symptom relief time, and other indicators. *Results:* The combination group showed a higher overall efficacy, shorter symptom relief time, lower levels of inflammatory markers post-treatment, and a higher proportion of normal and grade I dysbiosis in the intestinal flora, with significant differences compared to the control group ($P < 0.05$). Conclusion: Cef combined with MP is significantly effective in treating pediatric bacterial enteritis, promoting symptom relief, reducing inflammation, and correcting intestinal flora imbalance.

Keywords: Cefixime; Montmorillonite powder; Pediatric bacterial enteritis; Clinical efficacy

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1. Introduction

Bacterial enteritis is a common infectious disease among children. Due to their young age, immature organ function, poor immunity, and often inadequate hygiene practices—such as improper handwashing and unclean eating habits—children are highly susceptible to bacterial enteritis [1]. Common pathogens include *Escherichia coli* and *Salmonella*, which produce large amounts of endotoxins in the intestine, disrupting intestinal flora balance and causing diarrhea. Currently, antibiotics like cefixime (Cef) are foundational drugs for this condition, providing antibacterial action and reducing intestinal inflammation. However, using Cef alone can impair the physiological barrier function of the intestinal mucosa and may lead to the development of antibiotic-resistant strains, affecting long-term efficacy. Thus, combining Cef with montmorillonite powder (MP) may

help bind and adsorb pathogenic bacteria, ensuring their excretion via feces, thereby regulating intestinal flora and improving prognosis in children. Based on this, the present study selected 72 cases of pediatric bacterial enteritis to analyze the clinical efficacy of Cef combined with MP.

2. Materials and methods

2.1. General information

Seventy-two pediatric patients diagnosed with bacterial enteritis and treated between October 2021 and October 2023 were included. Patients were randomly divided into two groups. The combination group included 36 cases (19 males, 17 females) aged 1–10 years, with a mean age of 5.48 ± 1.47 years and a disease duration of 2–14 days, averaging 7.53 ± 1.48 days. The control group included 36 cases (21 males, 15 females) aged 2–11 years, with a mean age of 5.69 ± 1.53 years and a disease duration of 3–13 days, averaging 7.91 ± 1.62 days. Comparison of baseline data between the two groups showed no significant differences ($P > 0.05$).

Inclusion criteria: Patients met the diagnostic criteria for bacterial enteritis as outlined in "Practical Internal Medicine" [2]; exhibited symptoms such as diarrhea and abdominal pain, with diarrhea occurring ≥ 4 times per day; presented mucus in stools, with pathogenic bacteria detected in stool cultures and a white blood cell count $> 12\times10^9$/L; and had complete basic information available.

Exclusion criteria: Patients were excluded if they had thyroid dysfunction, were allergic to the study medications, had received hormone or antibiotic treatment within the past week, or withdrew from the study mid-course.

2.2. Methods

The control group received Cef treatment at an oral dose of 1.5–3.0 mg/kg, administered twice daily for 7 days.

In the combination group, patients received both Cef and MP treatment. The MP dose was 1.0–3.0 g per oral dose, administered three times daily for 7 days.

2.3. Observation indicators

(1) Symptom relief time and hospitalization duration: Time until the fever subsides, stool frequency and consistency normalize, and vomiting resolves.

(2) Inflammatory markers: Venous blood samples (5 mL, fasting) were centrifuged, and procalcitonin (PCT) levels were measured using an automatic biochemical analyzer via immunoturbidimetric assay; interleukin-8 (IL-8) via enzyme-linked immunosorbent assay; and tumor necrosis factor-alpha (TNF-α) using the same method as IL-8.

(3) Degree of intestinal flora imbalance: Fresh stool samples (2–3 g) were air-dried, Gram-stained, and observed under an oil-immersion microscope. A count of 1,000 bacteria was used as a baseline. Bacteria counts of 501–5,000 per field were considered normal; 101–500 indicated grade I imbalance; 11–100 indicated grade II imbalance; and < 11 indicated grade III imbalance.

2.4. Efficacy evaluation criteria

(1) Markedly effective: Symptoms resolved, and stool normalized after 3 days of continuous treatment.

(2) Effective: Symptoms improved, and stool was mostly normal after 3 days of continuous treatment.

(3) Ineffective: No improvement in symptoms or stool condition after 3 days of continuous treatment.

2.5. Statistical analysis

Data were processed using SPSS 28.0. Measurement data were expressed as mean ± standard deviation (SD), with comparisons tested using the *t*-test; count data were expressed as [*n* (%)], with comparisons tested using the χ^2 test. Results were considered statistically significant at $P < 0.05$.

3. Results

3.1. Comparison of overall effective rate between groups

Table 1 shows that the combination group exhibited a higher overall effective rate than the control group ($P < 0.05$).

Table 1. Comparison of overall effective rate between groups [*n* (%)]

Group	Cases	Markedly effective	Effective	Ineffective	Overall effective rate
Combination	36	19 (52.78)	16 (44.44)	1 (2.78)	35 (97.22)
Control	36	14 (38.89)	15 (41.67)	7 (19.44)	29 (80.56)
χ^2					5.063
P					0.024

3.2. Comparison of symptom relief time and hospitalization duration between groups

Table 2 shows that the combination group demonstrated shorter symptom relief and hospitalization times compared to the control group ($P < 0.05$).

Table 2. Comparison of symptom relief time and hospitalization duration between groups (mean ± SD, days)

Group	Cases	Fever relief time	Stool frequency normalization	Stool consistency normalization	Vomiting relief time	Hospitalization time
Combination	36	1.85 ± 0.39	3.21 ± 0.48	2.94 ± 0.41	2.31 ± 0.44	4.88 ± 0.94
Control	36	2.27 ± 0.45	4.09 ± 0.53	3.69 ± 0.54	3.09 ± 0.49	6.09 ± 0.98
t		4.232	7.384	6.637	7.106	5.346
P		0.000	0.000	0.000	0.000	0.000

3.3. Comparison of inflammatory factor levels between groups

Before treatment, no significant differences were observed in inflammatory factor levels between the groups ($P > 0.05$). After 7 days of treatment, the inflammatory factor levels in the combination group were significantly lower than those in the control group ($P < 0.05$), as shown in **Table 3**.

Table 3. Comparison of inflammatory factor levels between groups before and after treatment (mean ± SD, pg/mL)

Group	Cases	PCT		IL-8		TNF-α	
		Before	After	Before	After	Before	After
Combination	36	9.24 ± 1.53	3.35 ± 0.40	17.85 ± 1.46	10.17 ± 1.30	5.76 ± 0.51	2.09 ± 0.27
Control	36	9.28 ± 1.55	6.17 ± 0.57	17.63 ± 1.52	14.46 ± 1.35	5.78 ± 0.54	3.84 ± 0.31
t		0.110	24.298	0.626	13.734	0.162	25.541
P		0.913	0.000	0.533	0.000	0.872	0.000

3.4. Comparison of the degree of intestinal flora imbalance between groups

Table 4 shows that the combination group showed a higher proportion of normal and grade I imbalance in intestinal flora compared to the control group ($P < 0.05$).

Table 4. Comparison of the degree of intestinal flora imbalance between groups [*n* (%)]

Group	Cases	Normal	Grade I imbalance	Grade II imbalance	Grade III imbalance
Combination	36	21 (58.33)	10 (27.78)	4 (11.11)	1 (2.78)
Control	36	12 (33.33)	3 (8.33)	16 (44.44)	5 (13.89)
χ^2		4.532	4.560	9.969	2.909
P		0.033	0.032	0.002	0.088

4. Discussion

The primary cause of bacterial enteritis is bacterial infection, with contributing factors including environmental contamination, underdeveloped digestive systems in children, and poor hygiene awareness. It frequently presents with abdominal pain, mucus-laden stool, and other gastrointestinal symptoms, peaking in incidence during summer and autumn. Bacterial enteritis can often lead to complications such as electrolyte imbalances and toxin responses [3]. Currently, treatment predominantly involves medication, with Cef orally administered as a primary therapy. As a third-generation cephalosporin, Cef targets a range of bacterial β-lactamases with high selectivity and potent antibacterial properties, clearing inflammatory factors in pediatric patients. Its mechanism involves a specific action on gram-negative bacteria, altering endotoxin structures, blocking the release of inflammatory factors, and accelerating recovery. However, Cef's prolonged oral administration can lead to strong resistance, making bacterial enteritis challenging to cure, hence the need for combination therapy with other drugs like MP. MP, rich in stratified structures, can immobilize bacteria and toxins in the intestines, effectively inhibiting their proliferation. This medication adheres to the intestinal mucosa surface and binds efficiently to mucin glycoproteins, thereby improving the physiological function of mucosal protective agents [4]. Combined, these two drugs restore intestinal microecology balance and protect mucosal function, resulting in superior therapeutic outcomes.

In this study, the overall effective rate in the combination group was higher than that in the control group ($P < 0.05$), aligning closely with the findings of Xie [5]. Symptom relief time and hospitalization duration

were shorter in the combination group, with lower levels of post-treatment inflammatory factors and a higher proportion of normal and grade I imbalance in intestinal flora compared to the control group, all with significant differences ($P < 0.05$). The effectiveness of Cef is attributed to its strong activity against gram-negative bacteria, which disrupts bacterial structures, regulates β-lactamase secretion, inhibits effective cell wall synthesis, and reduces inflammatory factor levels [6,7]. When combined with MP, treatment efficacy is significantly enhanced. MP, being soluble and multilayered, contains core components of dioctahedral montmorillonite particles, which prevent persistent bacterial irritation to the intestines, reduce bacterial toxicity, relieve diarrhea, and assist in anti-inflammatory actions, alleviating inflammation in patients. Additionally, MP improves absorption in intestinal cells, reduces digestive fluid secretion, and enhances mucus cohesion, restoring the mucosal barrier, promoting peristalsis, and correcting flora imbalances [8]. This combined treatment leverages synergistic mechanisms that improve local metabolic capacity and enhance the immune function of pediatric patients, expediting recovery and shortening the treatment course. Furthermore, combined therapy reduces Cef treatment duration, minimizes drug accumulation in children, prevents antibiotic misuse, and mitigates adverse effects such as nausea and vomiting, ensuring high medication safety.

5. Conclusion

In summary, the combined use of Cef and MP offers optimal therapeutic efficacy for pediatric bacterial enteritis, alleviating symptoms, shortening hospital stays, reducing inflammation, and improving pathological manifestations like intestinal flora imbalance, highlighting its high clinical value.

Disclosure statement

The author declares no conflict of interest.

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