

Original Article

Curative effects of montmorillonite powder combined with dexamethasone on acute radiation enteritis

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Abstract: Objective: To investigate the curative effects of montmorillonite powder combined with dexamethasone on acute radiation enteritis. Methods: Eighty-six patients with acute radiation enteritis were enrolled in this prospective research, and they were divided into a control group and an intervention group using a random number table, with 43 cases in each group. Patients in both groups received conventional treatment. The control group was treated with montmorillonite powder, and the intervention group was treated with retention enema with dexamethasone based on montmorillonite powder. The grades of mucosal damage, changes in cytokine levels, the efficacy of colonoscopy, and overall curative effects of the two groups before and after treatment were observed. Results: After treatment, the levels of IL-2 and IFN- γ of the two groups were significantly reduced, and the level of IL-10 was significantly increased. The intervention group was significantly better than the control group (all $P < 0.001$). The grades of mucosal damage in the intervention group showed better improvement than that in the control group ($P < 0.01$), and the overall curative effects in the intervention group were significantly better than those in the control group (both $P < 0.05$). Conclusion: Montmorillonite powder combined with dexamethasone is effective in treating patients with acute radiation enteritis, which can effectively alleviate mucosal damage, improve inflammation, and promote patient recovery. It has the value of promotion and application.

Keywords: Montmorillonite powder, dexamethasone, acute radiation enteritis, curative effect

Introduction

Acute radiation enteritis is an intestinal injury disease caused by malignant tumors of the pelvic cavity, abdominal cavity, and retroperitoneum after radiotherapy, which affects the small intestine, colon and rectum, manifesting abdominal pain, diarrhea, intestinal stenosis, pus and blood in the stool, fistula formation, intestinal obstruction, low fever, etc. [1-3]. The occurrence of the disease is related to various factors such as the radiation dose, radiation site, surgical approach, and autoimmunity [4]. Studies have found that high-dose radiation therapy can induce intestinal mucosal damage, resulting in increased permeability, and intestinal flora imbalance, which can seriously cause inflammation in the body and dysfunction in multiple organs, threatening the lives of patients [5, 6]. With no standard treatment plan for radiation enteritis, the currently applied treatment includes drug treatment, enteral administration, and endoscopic hemostasis, which

can often result in disease recurrence and other adverse consequences [7].

The montmorillonite powder is mainly composed of alumina and silicon oxide, with the characteristics of uneven charging and strong ability to cover the intestinal mucosa, which can effectively clear up a variety of pathogenic bacteria, protect the intestinal tract and promote the growth of intestinal epithelial cells [8]. Dexamethasone, a glucocorticoid inhibiting inflammatory response in the body, has therapeutic effects on a variety of inflammatory reactions caused by acute radiation enteritis [9, 10].

At present, medication is a common way for acute radiation enteritis. Clinical studies have revealed that both montmorillonite powder and dexamethasone can separately alleviate the adverse clinical symptoms of patients with acute radiation enteritis to varying degrees, but the combination treatment is rarely studied, and its therapeutic effect remains unclear [11-

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13]. Thus, in this study, montmorillonite powder combined with dexamethasone was applied in patients with acute radiation enteritis to analyze the changes of various indicators, so as to explore its therapeutic effect in the actual clinical practice.

Materials and methods

General data

Eighty-six patients with acute radiation enteritis admitted to Xi'an Daxing Hospital from August 2018 to June 2020 were enrolled in this prospective research. They were divided into a control group and an intervention group with 43 cases each using a random number method. After review and approval by the Ethics Committee of Xi'an Daxing Hospital, all patients signed informed consent voluntarily.

Inclusion criteria: (1) Patients met the requirements of the Diagnostic Criteria of Acute Radiation Enteritis [14]. (2) Mucosal ulceration, bleeding, edema and congestion, and ulcer formation were confirmed by proctoscopy. (3) KPS scores ≥ 60 points [15]. (4) Patients had no mental disorders or history of drug allergy.

Exclusion criteria: (1) Patients had organic rectal diseases such as rectal tumors, ulcerative colitis, internal hemorrhoids, etc. (2) Patients had intestinal cancer metastasis and recurrence. (3) Patients had insufficiency of heart, brain, and kidney, and were at risk of bleeding. (4) Patients had paroxysmal mental disorder, and were unable to cooperate with medical stuff.

Methods

Dose of 3 g of montmorillonite powder (Tongyao Pharmaceutical Group Co., Ltd., China) orally once a day for 2 weeks was used in patients in the control group. They were advised to have a high-protein, high-vitamin diet, avoid spicy and irritating food, and were given fluid infusion and anti-inflammatory treatment.

Patients in the intervention group were given 5 mg dexamethasone sodium phosphate injection (Wuhan Renfu Pharmaceutical Co., Ltd., China) preheated at 37°C combined with 100 mL of 0.9% sodium chloride injection (Zhejiang Guojing Pharmaceutical Co., Ltd., China) plus 3 g of retention enema with montmorillonite powder,

two hours each, once a day for 2 weeks. Fluid infusion and anti-inflammatory treatment were also provided during the treatment period. Patients' symptoms were observed daily to avoid adverse reactions.

Evaluation indicators

Cured, markedly effective, effective and ineffective were used to evaluate the clinical efficacy of patients [16]. The complete disappearance of nausea, diarrhea, and increased bowel movements were regarded as cured. A significant relief of symptoms than before was considered as markedly effective. Relief of clinical symptoms was considered as effective, and no obvious improvement in symptoms was considered as ineffective. The total effective rate of treatment = (the number of cured cases + the number of markedly effective cases + the number of effective cases)/total number of people in this group $\times 100\%$.

The intestinal injury was graded according to the radiation injury classification standard (RTOG/EORTC) [17]. Grade 0: No obvious bowel symptoms. Grade 1: Mild diarrhea, mild intestinal cramps, increased bowel movements, and mild rectal secretions. Grade 2: Moderate diarrhea, accompanied by intestinal colic, stools more than 5 times a day. Grade 3: Intestinal obstruction or bleeding requiring parenteral nutrition support treatment. Grade 4: Intestinal necrosis and intestinal perforation.

Inflammatory factors affect the occurrence and development of radiation enteritis, and the detection of their expression levels is of great significance to clarify the mechanism of radiation enteritis. Therefore, before and after treatment, 5 mL of venous blood of patients on an empty stomach were taken and placed in a refrigerator at 4°C overnight, centrifuged at 1000 r/min for 20 minutes, and then the serum was placed in a refrigerator at -20°C for testing. The serum levels of IL-2, IFN- γ , and IL-10 were measured with IL-2, IFN- γ , and IL-10 enzyme-linked immunosorbent assay kits (Wuhan Boot Biotech Co., Ltd., China), respectively.

Cured, effective and ineffective were adopted for colonoscopy classification [18]. Cured indicates intestinal mucosa returns to normal. Mild edema and hyperemia of the intestinal mucosa is considered as effective. No obvious improvement, or even worsened in intestinal mucosa is

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Table 1. Comparison of general data

Clinical data	Control group (n=43)	Intervention group (n=43)	t/ χ^2	P
Gender			0.427	0.514
Male	26	23		
Female	17	20		
Average age (year)	58.7±2.7	58.1±3.3	0.809	0.421
Tumor distribution			0.937	0.816
Prostatic cancer	9	7		
Cervical squamous cell carcinoma	10	12		
Endometrial adenocarcinoma	4	6		
Colorectal cancer	20	18		

Table 2. Comparison of changes in cytokine levels (ng/mL, $\bar{x} \pm sd$)

Group	IL-2	IFN- γ	IL-10
Control group (n=43)			
Before treatment	34.67±1.90	38.41±2.30	7.97±1.28
After treatment	27.12±1.11###	28.34±2.00###	10.13±1.15###
Intervention group (n=43)			
Before treatment	34.73±2.23	38.88±1.76	8.17±1.01
After treatment	22.87±1.36***,###	21.84±2.52***,###	14.00±1.13***,###

Note: Compared with the same group before treatment, ###P<0.001; compared with control group after treatment, ***P<0.001.

defined as ineffective. The total effective rate of colonoscopy = (the number of cured cases + the number of effective cases) / the total number of cases in the group \times 100%.

Statistical analysis

SPSS 22.0 was used for statistical analysis. Normally distributed measurement data were described by mean \pm standard deviation. Independent t-test was used for comparison between groups, and paired t-test for comparison within groups. The data conformed to skewed distribution were compared by the Wilcoxon Rank-Sum test between groups. Count data were expressed as case/percentage (n, %). Comparison compared by groups was expressed by Chi-square test. Fisher's exact test was adopted when $T \leq 1$ or $n < 40$. The rank sum test analysis was used to compare the grade count data between groups. $P < 0.05$ was considered statistically significant.

Results

Comparison of general data

The general clinical data such as the gender, age, and tumor distribution were compared

between the two groups and they were comparable (all $P > 0.05$). See **Table 1**.

Comparison of changes in cytokine levels

Before treatment, there was no significant difference in the levels of IL-2, IFN- γ , and IL-10 between the two groups (all $P > 0.05$). After treatment, the levels of IL-2 and IFN- γ in the two groups decreased significantly, and the level of IL-10 increased significantly (all $P < 0.001$). See **Table 2** and **Figure 1**.

Comparison of the grades of mucosal damage

Compared with the grades of mucosal damage before treatment between the two groups, there was no statistically significant difference ($P > 0.05$). After treatment, the grades of mucosal damage of the intervention group were significantly better than those of the control group ($P < 0.01$). See **Table 3**.

Comparison of the efficacy of colonoscopy

After treatment, the total effective rate of colonoscopy in the intervention group was 93.02%, and that in the control group was 65.12%. The intervention group had significantly better effi-

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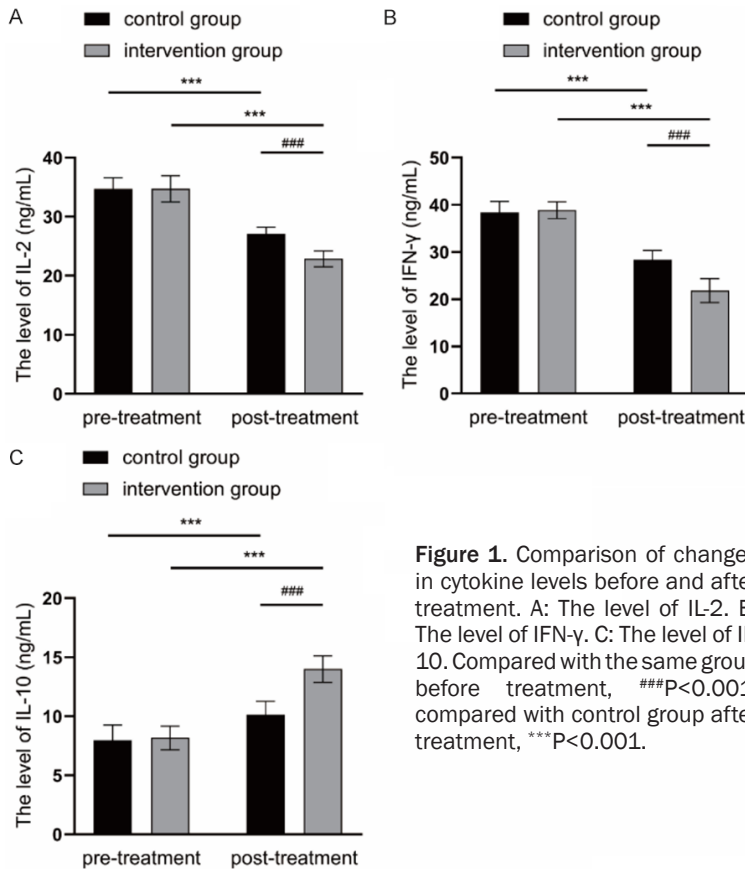


Figure 1. Comparison of changes in cytokine levels before and after treatment. A: The level of IL-2. B: The level of IFN- γ . C: The level of IL-10. Compared with the same group before treatment, ### $P < 0.001$; compared with control group after treatment, *** $P < 0.001$.

Table 3. Comparison of the grades of mucosal damage (n, %)

	Before treatment		After treatment	
	Control group	Intervention group	Control group	Intervention group
Grade 0	0	0	9 (20.93)	20 (46.51)
Grade 1	8 (18.60)	7 (16.28)	13 (30.23)	12 (27.91)
Grade 2	10 (23.26)	11 (25.58)	12 (27.91)	7 (16.28)
Grade 3	12 (27.91)	14 (32.56)	9 (20.93)	4 (9.30)
Grade 4	13 (30.23)	11 (25.58)	0	0
U	0.143		-2.684	
P	0.886		0.007	

Table 4. Comparison of the efficacy of colonoscopy (n, %)

Group	Control group (n=43)	Intervention group (n=43)
Cured	24 (55.81)	31 (72.09)
Effective	4 (9.30)	9 (20.93)
Ineffective	15 (34.88)	3 (6.98)
Total effective rate	28 (65.12)	40 (93.02)
χ^2	10.118	
P	<0.001	

cacy of colonoscopy ($P < 0.001$). See **Table 4**.

Comparison of clinical efficacy

After treatment, the intervention group (97.67%) had significantly better total effective rate than the control group (72.09%), and the difference was statistically significant ($P < 0.001$). See **Table 5**.

Discussion

Acute radiation enteritis is a common complication of patients with abdominal and pelvic tumors undergoing radiotherapy. Acute radiation intestinal injury can inhibit the growth of intestinal mucosal cells in the early stage, resulting in swelling and occlusion of the small arterial wall, intestinal wall ischemia and mucosal ulceration. Intestinal wall fibrosis, intestinal perforation, and intestinal adhesions may occur in the late stage, which seriously affect the treatment of tumor. Improper treatment will affect the progress of radiotherapy, and may even cause permanent and persistent severe radiation damage [19-21]. In this study, montmorillonite powder combined with retention enema with dexamethasone was used to treat patients with acute radiation enteritis based on the clinical symptoms of acute radiation enteritis,

the mechanism of radiation damage and the characteristics of the drug, in order to explore its clinical therapeutic effect.

Acute radiation enteritis is often accompanied by the expression of a large number of inflammatory factors in the human body. It has been reported that the expression of IFN- γ , IL-2, IL-10 and other cytokines are imbalanced in the rat colorectal gamma-ray irradiation model, which leads to immune imbalance in rats and affects

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Table 5. Comparison of clinical efficacy (n, %)

Group	Control group (n=43)	Intervention group (n=43)
Cured	25 (58.14)	31 (72.09)
Markedly effective	5 (11.63)	8 (18.60)
Effective	1 (2.33)	3 (6.98)
Ineffective	12 (27.91)	1 (2.33)
Total effective rate	31 (72.09)	42 (97.67)
χ^2	10.965	
P	<0.001	

the occurrence and development of radiation enteritis [22]. In Liu's experiment, the levels of IL-2 and IL-6 in the irradiated group were significantly higher than those in the control group, suggesting that the expression of IL-2 and other cytokines was related to radiation enteritis [23]. This study found that after treatment, the levels of IFN- γ , IL-2, and IL-10 in the two groups were significantly improved. Among them, IFN- γ and IL-2 in the intervention group were significantly lower than those in the control group, and IL-10 was significantly higher. It was revealed that montmorillonite powder combined with dexamethasone can effectively alleviate the inflammatory response in patients and increase their immunity.

It has been found that retention enema with montmorillonite powder for radiation proctitis can effectively repair the damaged intestinal mucosa and play a role in the local hemostasis [6]. Dexamethasone can reduce the permeability of capillary walls and cell membranes, reduce inflammatory exudation, resist inflammation and reduce intestinal mucosal edema. In this study, montmorillonite powder combined with dexamethasone can significantly reduce the intestinal injury of patients, improve the clinical efficacy and the efficacy of colonoscopy, suggesting that this treatment has a good promotion effect on restoring intestinal function and improving the prognosis of patients.

However, there are still some shortcomings in the study. Small sample size may lead to biased results. Thus, more samples are needed for further research. This single-center study affects the universality of the results, and multi-center studies should be considered in the future to get more precise conclusions.

To sum up, the treatment of montmorillonite powder combined with dexamethasone for

patients with acute radiation enteritis can effectively ameliorate the symptoms of patients, improve the clinical efficacy and quality of life of patients, reduce the pain of patients with radiotherapy, and provide a strong guarantee for the smooth completion of the chemotherapy process.

Disclosure of conflict of interest

None.

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