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Effects of Jiawei Sijunzi Decoction on migrating myoelectric complex in 8.0 Gy irradiated rats

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Abstract

AIM: To investigate the changes of small intestinal migrating myoelectric complex (MMC) and regulatory effect of Jiawei Sijunzi Decoction in 8.0 Gy irradiated rats.

METHODS: The MMC of the intestine of rats was recorded using chronically implanted electrodes at different parts of the small intestine to analyse duration of four phases of MMC and its cycle before and after irradiation and to investigate the regulatory effect of Jiawei Sijunzi Decoction.

RESULTS: From 1 h to 7 d after 8.0 Gy irradiation the MMC cycle in most of rats disappeared and only phase II existed with minute' s rhythm. From 1 h to 3 d after irradiation, the MMC cycle appeared in a few rats with the duration of phase II shortened significantly ($P < 0.05$). Results of observation on effects of Jiawei Sijunzi Decoction on MMC after irradiation showed that the changes in phase and cycle of MMC were normalized basically by medication.

CONCLUSION: Jiawei Sijunzi Decoction can improve the intestinal disturbances caused by radiation, and this might be one of the reasons for its alleviating effect on radiation induced diarrhea.

Key words: Myoelectric complex; Sijunzi Decoction; Radiation, ionizing; Small intestine

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INTRODUCTION

Diarrhea induced by ionizing radiation is one of the gastrointestinal reactions occurring in radiotherapy of tumors (especially tumors of the lower abdomen) and in acute radiation sickness[1]. Investigation of pathophysiology of the motor function of the small intestine during diarrhea bears significance for adopting therapeutic measures. For this reason, we took migrating myoelectric complex (MMC) of the small intestine as an index to study its change during diarrhea induced by irradiation with ^{60}Co γ-rays and the regulatory effect of Jiawei Sijunzi Decoction on it.

MATERIALS AND METHODS

Materials

Sixteen Wistar male and female rats, aged 10-12 wk and weighing 200-240 g, were provided by the Animal Center of the Academy of Military Medical Sciences.

Jiawei Sijunzi Decoction is composed of Radix Astragali seu Hedysari, Radix Codonopsis Pilosulae, Poria, Rhizoma Atractylodis Macrocephalae, Radix Glycyrrhizae, Pericarpium Citri Reticulatae, and Semen Cuscutae. The decoction was prepared by adding the above-mentioned herbs in proportion to water for boiling, then dry extract powder was made from the decoction (1 g of the powder equivalent to 5 g crude drugs). The powder was dissolved in distilled water for use in experiments.

Methods

One pair of needle-shaped electrodes made of platium wire were implanted each in the muscular layer of the duodenum, jejunum, and ileum of a rat narcotized by conventional method used in this laboratory[2]. Seven days later the experiment was begun to be carried out.

MMC of the small intestine of normal rats was first recorded, then the animal was irradiated with 8.0 Gy of ^{60}Co γ-rays (dose rate, 104.8 r/min). The irradiated rats were randomly divided into a treatment group (n = 7) and a control group (n = 9). Jiawei Sijunzi Decoction was administered intragastrically (1.6 g/kg) to rats of the treatment group immediately and on days 1, 2, and 3 after irradiation, once daily. Equal amount of distilled water was given intragastrically to rats of the control group. MMC of the small intestine was recorded on the day of irradiation and on days 1, 3, 5, and 7 after irradiation. Recording was done after fasting for 16-24 h and lasted 60 min each time. The instrument used was a Model RM-6000 Multichannel Recorder. The time constant was 0.01 s, and the frequency of filtered wave was 10 Hz. Data of the same group

Table 1 Effect of Jiawei Sijunzi decoction on various phases and duration of cycle of duodenal migrating myoelectric complex of rats irradiated with 8.0 Gy (min, mean ± SD)

Group	Time		No. of rats	MMC				Duration of cycle
				I	II	III	IV	
Control	Before irradiation		9	3.8 ± 0.2 (4)	15.5 ± 4.7 (33)	2.6 ± 0.7 (27)	0.6 (1)	11.9 ± 4.5 (21)
	After irradiation	1 h	9 [3]	2.4 ± 0.9 (6)	6.3 ± 2.7 (20)*	3.1 ± 0.6 (19)	0.6 ± 0.3 (3)	9.4 ± 1.8 (5)
		1 d	9 [1]	-	14.7 ± 2.7 (4)	1.7 ± 0.7 (3)	-	18.4 ± 1.8 (2)
		3 d	7	60 (1)	60 ± 0 (6)	-	-	-
		5 d	3	60 ± 0 (2)	60 (1)	-	-	-
		7 d	1	-	60 (1)	-	-	-
Treated	Before irradiation		6	1.6 ± 0.24 (4)	9.8 ± 2.8 (29)	2.4 ± 0.5 (26)	0.6 ± 0.3 (3)	10.4 ± 3.6 (20)
	After irradiation	1 h	6 [3]	-	21.2 ± 17.4 (7)	2.8 ± 0.6 (6)	-	9.8 ± 23 (3)
		1 d	6	60 (1)	60 ± 0 (5)	-	-	-
		3 d	6 [2]	-	37.5 ± 27.6 (5)[a]	1.7 ± 0.1 (4)	-	15.6 ± 1.8 (2)
		5 d	6 [2]	-	26.7 ± 11.2 (2)[a]	2.1 ± 0.6 (2)	-	37.0 ± 4.5 (2)[b]
		7 d	1		60 (1)	-	-	-

Note: Compared with pre-irradiation: [a]$P < 0.05$, [b]$P < 0.01$; [ ]: No. of animals showing MMC cycle; ( ): Appearance time; MMC: Migrating myoelectric complex.

Table 2 Effect of Jiawei Sijunzi decoction on various phases and duration of cycle of jejunal migrating myoelectric complex of rats irradiated with 8.0 Gy (min, mean ± SD)

Group	Time		No. of rats	MMC				Duration of cycle
				I	II	III	IV	
Control	Before irradiation		9	3.2 ± 1.3 (11)	10.0 ± 4.2 (41)	3.1 ± 0.5 (35)		15.8 ± 5.8 (26)
	After irradiation	1 h	9 [3]	2.5 ± 0.4 (17)	3.5 ± 0.9 (20)[a]	3.9 ± 1.0 (18)	0.6 (1)	8.8 ± 1.3 (15)
		1 d	9 [7]	3.1 ± 0.9 (16)	11.9 ± 7.4 (31)	2.7 ± 0.7 (26)		12.7 ± 1.9 (20)
		3 d	6	60 (1)	60 ± 0 (5)	-	-	-
		5 d	3	-	60 ± 0 (3)	-	-	-
		7 d	1	-	60 (1)	-	-	-
Treated	Before irradiation		7	2.5 ± 1.0 (15)	9.5 ± 4.2 (29)	2.9 ± 0.6 (29)	0.6 ± 0.2 (5)	14.5 ± 5.1 (26)
	After irradiation	1 h	7 [3]	2.4 ± 0.6 (6)	14.7 ± 12.4 (11)	2.8 ± 0.5 (10)	0.5 ± 0.2 (5)	13.0 ± 5.5 (8)
		1 d	7 [4]	1.8 ± 0.1 (6)	14.5 ± 9.1 (16)	2.3 ± 0.4 (15)	0.9 ± 0.3 (2)	14.4 ± 6.8 (11)
		3 d	6 [2]	-	18.8 ± 12.3 (7)	2.2 ± 0.4 (6)	-	12.0 ± 5.2 (4)
		5 d	6 [1]	2.9 ± 1.3 (2)	9.9 ± 3.7 (4)	3.3 ± 0.3 (4)	-	13.4 ± 1.5 (3)
		7 d	1		60 (1)	-	-	-

Note: Compared with pre-irradiation: [a]$P < 0.05$; [ ]: No. of animals showing MMC cycle; ( ): Appearance time; MMC: Migrating myoelectric complex.

Table 3 Effect of Jiawei Sijunzi decoction on various phases and duration of cycle of ileal migrating myoelectric complex of rats irradiated with 8.0 Gy (min, mean ± SD)

Group	Time		No. of rats	MMC				Duration of cycle
				I	II	III	IV	
Control	Before irradiation		5	3.5 ± 1.2 (2)	25.2 ± 5.3 (12)	5.8 ± 1.7 (7)	0.7 (1)	23.0 ± 11.9 (5)
	After irradiation	1 h	5 [2]	-	7.8 ± 1.2 (11)	3.0 ± 1.1 (9)	-	10.2 ± 5.2 (6)
		1 d	5 [2]	5.6 ± 1.7 (2)	24.3 ± 2.2 (4)	4.1 ± 0.2 (4)	-	32.0 ± 6.3 (2)
		3 d	4	-	60 ± 0 (4)	-	-	-
		5 d	3	60 (1)	60 ± 0 (2)	-	-	-
		7 d	1	60 (1)	-	-	-	
Treated	Before irradiation		3	0.8 (1)	20.5 ± 6.2 (8)	3.2 ± 0.3 (7)	0.8 ± 0.2 (2)	29.4 ± 11.9 (5)
	After irradiation	1 h	3 [1]	-	18.4 ± 16.1 (3)	2.8 ± 0.5 (2)	-	13.1 (1)
		1 d	3 [2]	13.2 ± 8.8 (2)	18.3 ± 7.8 (4)	3.3 ± 0.7 (2)	-	35.2 ± 2.9 (2)
		3 d	3 [1]		26.0 ± 0.1 (2)	3.1 ± 0.1 (2)	-	28.9 (1)
		5 d	1 [1]	-	18.1 ± 12.5 (3)	2.5 ± 0.1 (2)	-	15.3 (1)
		7 d	1	60 (1)	-	-	-	-

[ ]: No. of animals showing MMC cycle; ( ): Appearance time; MMC: Migrating myoelectric complex.

were subjected to *t*-test.

RESULTS

The effects of Jiawei Sijunzi Decoction on small intestinal MMC of rats irradiated with 8 Gy are shown in Tables 1-3. Compared with pre-irradiation, the rat small intestine of the control group exhibited an excitatory state during the first three days after irradiation, which was manifested as follows: (1) The cyclic pattern of small intestinal MMC disappeared and was replaced by phase II in the majority of rats; (2) In isolated rats showing MMC cycle, time duration of phase II was significantly reduced ($P < 0.05$) and the number of cycles increased; and (3) Appearance of minute's rhythm in the phase II occurred in some rats. All MMC cycles disappeared beginning from the third day after irradiation in the survived rats and only phase I or II remained. At that time diarrhea occurred in most rats with an incidence of 93%. In rats of the treatment group, the small intestine also showed an excitatory state similar to that of the control group during the first 2 d after irradiation. However, starting from the third day, MMC cycle still appeared in a part of survived rats. Besides the phase II of the duodenum was still different from that of preirradiation ($P < 0.05$), all other parameters were normalized. The number of rats suffering from diarrhea was remarkably reduced (incidence, 60%).

DISCUSSION

MMC of the small intestine is composed of four phases, among which phase II can effectively transport the content of the small intestine into the large intestine. When the duration of phase II prolongs too much, water and nutrients in the small intestine cannot be absorbed sufficiently and are pushed into the large intestine. Too much water entering lager intestine will readily induce diarrhea. Phaes III has the action similar to that of an "house-keeper". It

contracts the small intestine violently with certain intervals of time to clean up thoroughly the food, secreted substances, and exfoliated cells remaining in the small intestine, and pushes them into colon. Lack of phase III wave will facilitate hyper-proliferation of bacteria in the small intestine, and thus diarrhea occurs. Duration of phase II of rat small intestine MMC prolonged evidently and phase III disappeared starting from the 3rd day after irradiation with 8.0 Gy. These could be the causes of occurrence of diarrhea. The mechanism for obvious disturbance in small intestinal MMC, especially disappearance of phase III is not yet clarified. It could be related with damage to smooth muscle cells caused by radiation to change their electrophysiological activities, or disorder in vegetative nerve function induced by radiation[3].

After treatment of 8.0 Gy-irradiated rats with Jiawei Sijunzi Decoction, MMC cycle of the small intestine reappeared starting from the 3rd day. Except that there was still difference in phase II of the duodenum from that before irradiation, all other parameters had been normalized and the number of rats suffering from diarrhea evidently was reduced. This finding indicates that: (1) Jiawei Sijunzi Decoction can promote normalization of the small intestine lacking in MMC and regulate motor function of the small intestine; and (2) Reduction of the number of diarrheal rats supports indirectly the concept of phase III of MMC has house-keeper function and lacking of it can induce diarrhea[4]. The regulatory action on small intestinal MMC by prescriptions having the function of strengthening the spleen and stomach such as Jawei Sijunzi Decoction could be related to acetylcholine receptors in the intestinal tract or they could act as the antagonists against M1 receptor or as the agonists for the M2 receptor as reported in the literature[5]. Further studies are needed to clarify these.

REFERENCES

1 **Deguchi H**. [An experimental study on the effect of irradiation on motility of the small intestine]. *J Smooth Muscle Res* 1991; **27**: 35-54 [PMID: 1824059 DOI: 10.1540/jsmr.27.35]

2 **Chen GZ**, Wang GY, Liu ZH. A preliminary investigation on mechanism of delayed gastric emptying after –irradiation (in Chinese). *Zhongguo Yingyong Shenglixue Zazhi* 1986; **2**: 115-121

3 **Chen GZ**, Huang SY, Wang GY. Changes of the intestinal myoelectrical activity of ginea pig after 800 rads and 1500 rads gamma irradiation. *Junshi Yixue Kexueyuan Yuankan* 1984; **1**: 17-23

4 **Zhang JJ**, ed: Physiology of digestive tract. Guangzhou: Sun Yat- Sen University Press, 1st ed. 1990: 172-173

5 **Murakuni H**, Ozawa T, Seimiga S, Tsugu Y. Effect of Rikunshi-to for interdigestive migrating complex in dogs. *Jap J Orient Med* 1992; **43**: 15-22

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