

Investigation of the effect of military stress on the prevalence of functional bowel disorders

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Received: March 21, 2011 Revised: March 1, 2012

Accepted: April 2, 2012

Published online: June 21, 2012

Abstract

AIM: To investigate the morbidity of functional bowel disorders (FBD) under military stress conditions in order to lay foundations for the prevention and treatment of this disease.

METHODS: Four hundred and fifty-seven soldiers who were assigned to specified services and 471 soldiers who were assigned to routine services were enrolled using cluster sampling, with the latter as a control group. They were surveyed using the Rome III FBD standard questionnaire. The FBD symptom questionnaire included FBD-related symptoms, severity, duration or attack time, and accompanying symptoms.

RESULTS: The morbidity of the military stress group (14.6%) was significantly higher than in the control group (9.98%) ($\chi^2 = 4.585, P < 0.05$). The incidence of smoking, abdominal pain and acid regurgitation ($\chi^2 = 4.761, P < 0.05$) as well as the ZUNG anxiety/depression scores ($\chi^2 = 7.982, P < 0.01$) were also significantly higher in the military stress group compared with the control group. ZUNG anxiety ($\chi^2 = 11.523, P$

< 0.01) and depression ($\chi^2 = 5.149, P < 0.05$) scores were higher in the FBD group compared with the non-FBD group. The differences in the ZUNG self-rated anxiety and depression scales between the 2 groups were statistically significant ($\chi^2 = 14.482, P < 0.01$ and $\chi^2 = 6.176, P < 0.05$).

CONCLUSION: The morbidity of FBD was higher under military stress conditions.

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Key words: Military stress; Functional bowel disorders; Soldier; Self-rating anxiety; Depression scale

Peer reviewers: Javier San Martin, Chief, Gastroenterology and Endoscopy, Sanatorio Cantegril, Av. Roosevelt P 13, Punta del Este 20100, Uruguay; Ted Dinan, Professor, Department of Psychiatry and Alimentary Pharmabiotic Centre, University College Cork, Cork C1, Ireland

Yu XZ, Liu HF, Sun ZX. Investigation of the effect of military stress on the prevalence of functional bowel disorders. *World J Gastroenterol* 2012; 18(23): 3004-3007 Available from: URL: <http://www.wjgnet.com/1007-9327/full/v18/i23/3004.htm> DOI: <http://dx.doi.org/10.3748/wjg.v18.i23.3004>

INTRODUCTION

Functional bowel disorders (FBD) is the generic term for disorders of bowel motor and secretory function without organic changes, which are diagnosed according to symptoms after the exclusion of lesions such as inflammation, infection, tumor and other structural disorders^[1-3]. FBD includes 5 diseases, irritable bowel syndrome, functional abdominal bloating, functional constipation, functional diarrhea and unspecified functional bowel disorder. FBD are common clinical diseases which significantly affect the quality of patients' lives and incur considerable medical costs. A large number of studies have proved that

stress is the primary induction factor of FBD. Military stress is the emotional reaction of soldiers under military conditions, and mainly manifests as a state of tension^[4,5]. There are few studies regarding the effect of military stress on FBD^[6], and thus this study investigated the effects of stress by comparing FBD morbidity in soldiers conducting specialized operations with those carrying out regular tasks.

MATERIALS AND METHODS

Objects

Five hundred armed soldiers (mean age 20.7 ± 1.9 years) who were transferred from one province to another in China between April 2009 and May 2010 to handle emergencies were classified as the military stress group; Five hundred armed soldiers (mean age 20.14 ± 1.65 years) from the same province who conducted routine tasks were classified as the control group. All of the soldiers were male and garrisoned in the local area at least 1 year. Both groups were comparable in age, weight, height, the length of military service, education background, duty time, training time and garrison time.

Methods

Questionnaire: The FBD symptom questionnaire including FBD-related symptoms, severity, duration or attack time, and accompanying symptoms, was made with reference to Rome III FGIDs functional gastrointestinal disorder standard questionnaire^[7], and in combination with the practical conditions of the soldiers in the Chinese People's Armed Police. Psychological factors were investigated using the ZUNG Anxiety Scale and ZUNG Depression Scale.

Quality control of the questionnaire: The questionnaires were distributed according to lists of soldiers by responsible persons in every unit, and were filled in immediately after professional staff gave instructions and answered questions. All questionnaires were checked by a specially designated person after their return. The response rate and acceptance rate were 95.20% (476/500) and (452/476), respectively, in the military stress group, and 96.20% (481/500) and (471/481), respectively, in the control group.

Statistical analysis

The results were input into Epi Info 2003 software to establish data library and analyzed by SPSS18.0 statistical software; the χ^2 test was performed on categorical data. It was statistically significant at $P < 0.05$.

RESULTS

Morbidity of FBD

The rates of FBD in the military and control groups were 14.60% (66/452) and 9.98% (47/471), respectively. The difference between the two groups was statistically significant ($P < 0.05$, Table 1).

Prevalence of primary symptoms

There were 14 primary symptoms of FBD in the questionnaire. Individuals in the sampled populations could have one or more gastrointestinal symptoms. The prevalence of the primary symptoms is presented in Table 1.

Comparison of food habits and intake in soldiers with or without FBD

The food habits of soldiers with FBD were significantly different from those without FBD ($P = 0.000-0.001$). The occurrence of bad habits such as engorgement, being particular about food, omophagia, taking cold drinks, eating hot or spicy food, drinking tea and coffee was more frequent in the FBD group than in the non-FBD group (Table 2); the proportion of soldiers who had few or no bad food habits was smaller in the FBD group compared with the non-FBD group ($P = 0.000-0.001$); the proportion of soldiers who ate a lot of vegetables and fruit was smaller in the FBD group compared with the non-FBD group, while the proportion of soldiers who ate few vegetables and fruit was higher in the FBD group compared with the non-FBD group ($P = 0.000$); the proportion of soldiers who ingested many dairy products was higher in the non-FBD group compared with the FBD group, while the proportion of soldiers who ingested few dairy products was smaller in the FBD group compared with the non-FBD group ($P = 0.000$); the proportion of soldiers who drank coffee was higher in the FBD group compared with the non-FBD group, while the proportion of soldiers who drank tea was smaller in the FBD group compared with the non-FBD group ($P = 0.000-0.001$).

Comparison of the ZUNG self-rating anxiety and depression scales

The proportion of soldiers who had a score > 40 in the ZUNG self-rating anxiety scale was higher in the military stress group (11.97%) than in the control group (5.52%), and was statistically significant ($P < 0.01$). The proportion of soldiers who had a score > 40 in the ZUNG self-rating depression scale was also higher in the military stress group (68.29%) than in the control group (58.60%), and was statistically significant ($P < 0.05$).

DISCUSSION

Military stress^[8,9] is a type of emotional reaction appearing in soldiers under military conditions, and mainly manifests as tension. Military stress can be considered as a kind of stimulated or emotional state^[10,11]. Military stress cannot be simplistically considered as a negative reaction. It can be understood as a psychological problem only when stress induces changes in the cognition, emotions and behavior of soldiers to severely reduce their efficiency in military missions, and is mainly manifested by an inability to take part in daily military training, to adapt to the military environment or to join in fighting^[12,13].

In recent years, more studies have focused on the effect of stress on gastrointestinal function^[14], but few have paid attention to the effects of military stress on

Table 1 Comparison of morbidity and prevalence of primary symptoms of functional bowel disorders in the military stress and control groups *n* (%)

	Military stress group	Control group	χ^2	<i>P</i>
Disease name				
Irritable bowel syndrome	28/452 (6.19)	16/471 (3.40)	3.972	< 0.05
Functional abdominal bloating	0/452 (0.00)	0/471 (0.00)		> 0.05
Functional constipation	23/452 (5.09)	20/471 (4.25)	0.443	> 0.05
Functional diarrhea	9/452 (1.99)	8/471 (1.70)	0.108	> 0.05
Non-specific functional bowel disorder	6/452 (1.33)	3/471 (0.64)	1.135	> 0.05
Total	66/452 (14.6)	47/471 (9.98)	4.585	< 0.05
Primary symptom (No. of person with symptoms)				
Nausea	133/452 (29.42)	74/471 (15.71)	24.931	< 0.01
Vomiting	74/452 (15.71)	53/471 (11.25)	5.849	< 0.05
Abdominal distension	145/452 (32.08)	103/471 (21.87)	12.230	< 0.01
Acid regurgitation	113/452 (25.00)	64/471 (13.59)	19.329	< 0.01
Heartburn	61/452 (13.50)	43/471 (9.13)	4.397	< 0.05
Foreign body sensation in throat	85/452 (18.81)	78/471 (16.56)	0.800	> 0.05
Substernal pain	70/452 (15.49)	47/471 (9.98)	6.312	< 0.05
Hiccough	135/452 (29.87)	82/471 (17.41)	19.899	< 0.01
Food regurgitation	101/452 (22.34)	61/471 (12.95)	14.068	< 0.01
Abdominal pain	31/452 (6.86)	13/471 (2.76)	8.483	< 0.01
Constipation	142/452 (31.42)	98/471 (20.81)	13.492	< 0.01
Diarrhea	121/452 (26.77)	86/471 (18.26)	9.602	< 0.01
Encopresis	15/452 (3.32)	9/471 (1.91)	1.808	> 0.05

Table 2 Food intake of soldiers with and without functional bowel disorders *n* (%)

Food habit	Much	Moderate	Less	Little or not	Total
With functional bowel disorder					
Engorgement	10 (15.9)	21 (32.5)	20 (31.1)	13 (20.3)	64 (100)
Omophagia	6 (8.8)	10 (15.7)	23 (34.9)	26 (40.1)	65 (100)
Particular about food	12 (18.9)	19 (29.4)	15 (22.8)	20 (30.3)	66 (100)
Cold drinks	14 (20.6)	22 (33.3)	20 (30.6)	10 (15.2)	66 (100)
Spicy food	22 (33.4)	21 (32.1)	17 (26.3)	5 (7.7)	65 (100)
Dairy products	20 (30.9)	24 (37.2)	15 (24.1)	6 (9.3)	64 (100)
Vegetables	17 (27.6)	33 (51.7)	12 (19.2)	1 (1.6)	63 (100)
Fruit	14 (22.6)	26 (39.5)	18 (28.4)	7 (10.8)	65 (100)
Without functional bowel disorder					
Engorgement	3 (5.1)	10 (16.3)	18 (29.2)	29 (48.3)	60 (100)
Omophagia	3 (5.8)	6 (10.4)	15 (24.9)	35 (59.3)	59 (100)
Particular about food	5 (8.0)	10 (17.8)	11 (19.8)	32 (55.1)	58 (100)
Cold drinks	7 (11.6)	16 (26.3)	17 (28.6)	21 (34.4)	61 (100)
Spicy food	10 (16.4)	16 (27.1)	15 (25.8)	19 (31.7)	60 (100)
Dairy products	16 (25.9)	23 (37.2)	12 (19.1)	11 (17.7)	62 (100)
Vegetables	24 (37.4)	28 (43.7)	6 (9.2)	5 (7.9)	63 (100)
Fruit	22 (34.6)	24 (37.5)	12 (18.7)	6 (9.4)	64 (100)

gastrointestinal function^[15,16]. The results in this study suggested that FBD was significantly higher in the military group (14.60%) compared with the control group (9.98%). Meanwhile, the rates of smoking, abdominal pain, and acid regurgitation, and the ZUNG anxiety and depression scores were also significantly higher in the military group compared with the control group. The increased incidence of FBD under military stress might be due to the dual regulatory effects of the autonomic nervous system and the endocrine system on the movement and secretion of the alimentary tract, which are directly or indirectly affected by the central nervous system^[17,18]. The anatomical structures of the nervous and endocrine system overlap with that of the emotional center^[19,20], thus after tension and emotional changes induced by military stress conditions arrive at the

emotional center, the gastrointestinal regulatory center will also be excited, and therefore, gastrointestinal discomfort will likely occur or be aggravated^[21,22].

It has been reported^[23] that there are significant differences between individuals in the length of time psychological stress is sustained. Overall, although a psychological stress reaction may be alleviated within 10 d in about 85% soldiers, it persists in about 15% soldiers after 10 d. The following measures should be adopted to deal with the increased morbidity of FBD induced by military stress: a focus on daily training activity^[24,25], with simulation of various duty environments, and enhanced quality of psychological and mental preparation for emergencies; the soldiers should actively take part in the handling of an emergency situation, have a specific daily schedule

with adequate rest periods, and be given medical treatment if necessary. Non-combat casualties resulting from illness will be decreased and should guarantee that military duties will be better accomplished^[26].

Overall, FBD is an old problem, but there are still areas in the pathogenesis of the disease to explore, and which may involve a wide range of research, including cell biology, neurophysiology, immunology, endocrinology, behavior and other fields of medicine and psychology. Linking the clinical problem with stress may directly lead to a clinical benefit for all patients.

COMMENTS

Background

Functional bowel disorders (FBD) is a generic name for disorders in bowel motor and secretory function without organic changes, and is diagnosed according to symptoms after the exclusion of lesions such as inflammation, infection, tumor and other structural disorders. It is a common clinical disease which significantly affects the quality of patients' lives and incurs medical costs. A large number of studies have shown that stress is the primary induction factor of FBD.

Research frontiers

There are few studies of the effect of military stress on FBD, and thus this research tried to investigate these effects through comparing the morbidity in soldiers conducting specialized tasks with those undertaking regular tasks.

Innovations and breakthroughs

Four hundred and fifty-seven soldiers who were assigned to specified services and 471 soldiers who were assigned to common services were enrolled using cluster sampling, with the latter as the control group, and then they were surveyed according to the Rome III FBD standard questionnaire.

Applications

To provide foundations for the prevention and treatment of this disease, authors investigated the morbidity of FBD under military stress conditions.

Terminology

FBD: Disorders of bowel motor and secretory function without organic changes, diagnosed according to symptoms after the exclusion of organic lesions.

Peer review

Overall, this is an interesting study which shows clearly that the morbidity of FBD was higher under military stress conditions.

REFERENCES

- 1 Keating E, Lemos C, Monteiro R, Azevedo I, Martel F. The effect of a series of organic cations upon the plasmalemmal serotonin transporter, SERT. *Life Sci* 2004; **76**: 103-119
- 2 Mykletun A, Heradstveit O, Eriksen K, Glozier N, Øverland S, Maeland JG, Wilhelmsen I. Health anxiety and disability pension award: The HUSK Study. *Psychosom Med* 2009; **71**: 353-360
- 3 Nicholl BI, Halder SL, Macfarlane GJ, Thompson DG, O'Brien S, Musleh M, McBeth J. Psychosocial risk markers for new onset irritable bowel syndrome--results of a large prospective population-based study. *Pain* 2008; **137**: 147-155
- 4 Jung IS, Kim HS, Park H, Lee SI. The clinical course of postinfectious irritable bowel syndrome: a five-year follow-up study. *J Clin Gastroenterol* 2009; **43**: 534-540
- 5 Hildrum B, Mykletun A, Stordal E, Bjelland I, Dahl AA, Holmen J. Association of low blood pressure with anxiety and depression: the Nord-Trøndelag Health Study. *J Epidemiol Community Health* 2007; **61**: 53-58
- 6 Hildrum B, Mykletun A, Holmen J, Dahl AA. Effect of anxiety and depression on blood pressure: 11-year longitudinal population study. *Br J Psychiatry* 2008; **193**: 108-113
- 7 Camilleri M, Andrews CN, Bharucha AE, Carlson PJ, Ferber I, Stephens D, Smyrk TC, Urrutia R, Aerssens J, Thielemans L, Göhlmann H, van den Wyngaert I, Coulie B. Alterations in expression of p11 and SERT in mucosal biopsy specimens of patients with irritable bowel syndrome. *Gastroenterology* 2007; **132**: 17-25
- 8 Gaman A, Kuo B. Neuromodulatory processes of the brain-gut axis. *Neuromodulation* 2008; **11**: 249-259
- 9 Boyce PM, Talley NJ, Burke C, Koloski NA. Epidemiology of the functional gastrointestinal disorders diagnosed according to Rome II criteria: an Australian population-based study. *Intern Med J* 2006; **36**: 28-36
- 10 Miao DM. Research on Military Psychology. *Xinli Kexue Jinzhan* 2006; **14**: 161-163
- 11 Sperber AD, Shvartzman P, Friger M, Fich A. A comparative reappraisal of the Rome II and Rome III diagnostic criteria: are we getting closer to the 'true' prevalence of irritable bowel syndrome? *Eur J Gastroenterol Hepatol* 2007; **19**: 441-447
- 12 Drukker CA, Heij HA, Wijnaendts LC, Verbeke JI, Kaspers GJ. Paraneoplastic gastro-intestinal anti-Hu syndrome in neuroblastoma. *Pediatr Blood Cancer* 2009; **52**: 396-398
- 13 Vandvik PO, Lydersen S, Farup PG. Prevalence, comorbidity and impact of irritable bowel syndrome in Norway. *Scand J Gastroenterol* 2006; **41**: 650-656
- 14 Dunlop SP, Jenkins D, Spiller RC. Distinctive clinical, psychological, and histological features of postinfective irritable bowel syndrome. *Am J Gastroenterol* 2003; **98**: 1578-1583
- 15 Zheng PY, Feng BS, Oluwole C, Struiksmas S, Chen X, Li P, Tang SG, Yang PC. Psychological stress induces eosinophils to produce corticotrophin releasing hormone in the intestine. *Gut* 2009; **58**: 1473-1479
- 16 Santos J, Yates D, Guilarte M, Vicario M, Alonso C, Perdue MH. Stress neuropeptides evoke epithelial responses via mast cell activation in the rat colon. *Psychoneuroendocrinology* 2008; **33**: 1248-1256
- 17 Heymann-Mönnikes I, Arnold R, Florin I, Herda C, Melfsen S, Mönnikes H. The combination of medical treatment plus multicomponent behavioral therapy is superior to medical treatment alone in the therapy of irritable bowel syndrome. *Am J Gastroenterol* 2000; **95**: 981-994
- 18 Demaude J, Salvador-Cartier C, Fioramonti J, Ferrier L, Bueno L. Phenotypic changes in colonocytes following acute stress or activation of mast cells in mice: implications for delayed epithelial barrier dysfunction. *Gut* 2006; **55**: 655-661
- 19 Patacchioli FR, Angelucci L, Dellerba G, Monnazzi P, Leri O. Actual stress, psychopathology and salivary cortisol levels in the irritable bowel syndrome (IBS). *J Endocrinol Invest* 2001; **24**: 173-177
- 20 La JH, Sung TS, Kim HJ, Kim TW, Kang TM, Yang IS. Peripheral corticotropin releasing hormone mediates post-inflammatory visceral hypersensitivity in rats. *World J Gastroenterol* 2008; **14**: 731-736
- 21 Rao SS, Hatfield RA, Suls JM, Chamberlain MJ. Psychological and physical stress induce differential effects on human colonic motility. *Am J Gastroenterol* 1998; **93**: 985-990
- 22 Piche T, Barbara G, Aubert P, Bruley des Varannes S, Dainese R, Nano JL, Cremon C, Stanghellini V, De Giorgio R, Galimiche JP, Neunlist M. Impaired intestinal barrier integrity in the colon of patients with irritable bowel syndrome: involvement of soluble mediators. *Gut* 2009; **58**: 196-201
- 23 Yin J, Levanon D, Chen JD. Inhibitory effects of stress on postprandial gastric myoelectrical activity and vagal tone in healthy subjects. *Neurogastroenterol Motil* 2004; **16**: 737-744
- 24 Santos J, Saperas E, Nogueiras C, Mourelle M, Antolin M, Cadahia A, Malagelada JR. Release of mast cell mediators into the jejunum by cold pain stress in humans. *Gastroenterology* 1998; **114**: 640-648
- 25 Mearin F. Postinfectious functional gastrointestinal disorders. *J Clin Gastroenterol* 2011; **45** Suppl: S102-S105
- 26 Meddings JB, Swain MG. Environmental stress-induced gastrointestinal permeability is mediated by endogenous glucocorticoids in the rat. *Gastroenterology* 2000; **119**: 1019-1028

S- Editor Gou SX L- Editor Cant MR E- Editor Zheng XM