

脾气虚证患者胃泌酸、胃肠运动和胃肠电活动的变化

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Significant changes of gastric acid secretion, gastroduodenal movement and electrogastrography in patients with spleen-asthenia

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Abstract

AIM: To search for some objective indexes with high specificity and sensitivity to provide new clinical evidence for elucidating the essence of spleen-asthenia syndrome by investigating the gastric acid secretion, gastroduodenal movement and electrogastrography in patients with spleen-asthenia (SA).

METHODS: Patients with SA, stomach-heat (SH) and flaming-up of liver-fire (FULF) according to the theory of traditional Chinese medicine (TCM) were selected, in which breath hydrogen test (BHT) and electrogastrography were examined.

RESULTS: In comparison with clinical normal reference standard, the values of $H_2/excess$ in patients with SA were lowered at 15 min, 30 min, and 45 min (13.16 ± 4.51 , 14.33 ± 4.18 ; $G_{45} 15.57 \pm 4.89$ vs 20-60 ppm, $P < 0.01$), but the groups of SH and FULF were normal. The results of small bowel transit test (SBTT) after oral lactose BHT showed that the time in groups of SH was increased (225.6 ± 21.3 min vs 75-150 min and 60.4 ± 34 min, $P < 0.01$), compared with clinical normal reference standard and the group of FULF. The electrogastrography amplitude and frequency of antrum, cavity, lesser curvature and duodenal bulb reduced

in the group of SA as compared with groups of SH and FULF ($P < 0.01$). There was not difference between SH and FULF groups.

CONCLUSION: In patients with SA, the function of gastric acid secretion is reduced, the small bowel transit time is increased and the amplitude and frequency of electrogastrography are reduced, which may be important objective indexes in the clinical diagnosis and treatment of spleen-asthenia.

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摘要

目的: 观察脾气虚患者胃泌酸功能、小肠传递时间和胃、十二指肠球部电活动, 探讨临床脾气虚证客观可靠、简便易行的辨证施治方法。

方法: 选择中医辨证符合脾气虚证、胃热证和肝火上炎证的患者, 分别进行口服镁盐呼气实验(OMBHT)、口服乳果糖呼气实验(SBTT)及胃电图检查。

结果: 脾气虚组患者OMBHT测定产氢量($H_2/excess$)值各时间点均低于正常值(15 min, 13.16 ± 4.51 ; 30 min, 14.33 ± 4.18 ; 45 min, 15.57 ± 4.89 vs 20-60 ppm); 与正常参考值比较(75-150 min), 脾气虚组(SBTT 225.6 ± 21.3 min)的测定值显著增大, 而肝火上炎组的SBTT为 60.4 ± 34.5 , 且与脾气虚组比较有显著差异($P < 0.01$); 胃肠电图检查显示: 脾气虚组胃窦、胃体、胃小弯和十二指肠球部的平均峰值幅度虽在正常范围内, 但较胃热组和肝火上炎组明显减低($P < 0.01$); 脾气虚组四个部位的主频值均明显低于正常值(胃窦 1.82 ± 0.57 、胃体 1.65 ± 0.36 、胃小弯 0.15 ± 0.03 和十二指肠球部 0.15 ± 0.05 , 正常 2.4-3.7 cpm), 且与胃热和肝火上炎组比较显著减低($P < 0.05$), 尤其是胃小弯和十二指肠球部差距更为明显($P < 0.01$); 此外脾气虚组胃窦部的平均过零频率低于正常值(1.73 ± 0.49 vs 2.4-3.7 cpm), 其他部位的虽在正常值范围内, 但较胃热和肝火上炎组减低($P < 0.05$)。胃热和肝火上炎两组患者上述3项指标的检测值均无明显差异性。

结论: 脾气虚证患者“脾失健运”的客观表现之一为胃泌酸功能减低、小肠运动功能减退和胃电活动紊乱。

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0 引言

脾虚证“脾失健运”时可出现一系列消化、吸收功能障碍的表现^[1-4]。小肠传递时间^[5]和胃电活动^[6-8]在食物的消化、吸收方面有重要作用,其功能的测定对胃酸相关性疾病的诊断、鉴别诊断及治疗过程的动态观察有重要参考价值。有关脾气虚证与胃泌酸功能的关系研究较少见报道。由此我们采用了口服镁盐和口服乳果糖呼氢实验^[9]、胃电图^[7-8]等无创、简便易行的方法,多指标合参地观察脾气虚证患者胃泌酸、胃肠运动和胃肠电活动的变化,以期对脾气虚证的临床辨证提供简便可行的客观指标。

1 材料和方法

1.1 观察对象 2000-04/2003-06期间我校西京医院中医药研究中心和唐都医院消化内科门诊和住院的患者。采用辨病与辨证相结合的分型原则,选择胃镜及西医诊断为慢性胃炎、浅表性胃炎、胃溃疡、胆汁反流性胃炎等而中医诊断为脾气虚、胃热炽盛证者,各证辨证符合“中医虚证辨证参考标准”^[10]及《中医诊断学》的诊断标准。其中辨证符合脾气虚者32(男24、女18)例,年龄31-63(平均 45 ± 7 岁);辨证符合胃热炽盛证者30(男16、女14)例,年龄33-61(平均 46 ± 6 岁)。各组间性别、年龄比较无显著差异性。以上各组均除外糖尿病、肾病、肝病、恶性肿瘤、心血管疾病、呼衰、胰腺疾病所致的消化功能障碍患者。

1.2 方法

1.2.1 口服镁呼气氢试验(OMBHT)测定胃泌酸功能 采用Micro H₂型呼氢测定仪(micro medical limited, ENGLAND)。患者在检查前1d避免食用面食、粗纤维、奶类,禁食、禁烟12h,于第2d清晨空腹坐位检测,测定时用鼻夹子夹住受试者鼻子,口含微量氢气测定仪接口管慢慢呼吸,重复吸气后再重复呼气,直到仪器显示屏上的数值不再升高为止,约需1min,以ppm(parts per million)为单位(1ppm=1 μ mol/L)。空腹时测三次(15min、30min、45min),求其平均值;然后口服金属镁胶囊200mg(100-200目、中国医药公司上海试剂公司),测定3次(时间同空腹)的呼氢值,每次测得的值减去空腹平均值为实测值。临床检验所用正常参考值为20-60ppm;如小于20ppm,提示酸分泌过少,如大于60ppm提示酸分泌过多。

1.2.2 呼氢测定口盲传递时间 采用Micro H₂型呼氢测定仪。受试者在近期末服用任何抗菌药、影响肠蠕动及镇静安眠药,受试前一天禁食奶制品及豆制品,禁吸烟及剧烈运动,低纤维饮食,晚餐后至次晨检查前不再饮水进食。次日晨先测得空腹氢含量(fasting hydrogen, FH₂),检测方法同口服镁呼气氢试验。随即口服乳果糖10g(20ml乳果糖糖浆加80ml温开水混匀,西安第四制药厂),于服糖后3.5h内每隔15min检测一次,个别受试者可延长至4h。判断标准:口服乳果糖至连续

3次呼气氢增长大于5ppm,以其中首次增值的时间为小肠传递时间;如出现双峰者,以第二峰(结肠峰)为小肠传递时间;若为单峰则看最高峰值出现的时间;如空腹的平均值大于15ppm,为小肠细菌过度生长。正常值(临床检验所用参考值):75-150min。

1.2.3 胃肠电图的检测 采用WCDF-4D(合肥爱科医疗仪器有限公司)四导胃肠电分析仪。受试者提前2d忌饮酒、刺激性食物和胃药,禁食6h后记录20min胃肠电图。单极法四导测胃。电极测量点:中点(定位参考点)是剑突与脐连线中点;球部和十二指肠:中点右偏3-5cm,测十二指肠球部和幽门部位的信号;胃体部:中点左偏3-5cm再上1cm,测胃体信号;胃小弯:剑突与中点连线的上1/3或1/4处,测贲门至幽门间的信号;胃大弯近窦部:中点下1cm,测胃体与窦部间的信号。4个测试电极分别安装在上述测量点,即胃窦(antrum)、胃体(cavity)和十二指肠球部(duodenal bulb)在腹壁的体表投影部位;肢体电极放在手腕内侧。经微机处理系统计算出各导联平均峰值幅度(Ap),正常值:50-300 μ v,多数与受试者的胃肠运动是否亢进有关(说明书提供,下同);主频率(Ep),正常值2.4-3.7cpm,即慢波频率,表示平滑肌的电节律;平均过零频率(Fz),正常值2.4-3.7cpm,包括慢的全相出现的自动波和叠加在慢波上的快波,表示胃肠功能的节律;中心频率(Fc,正常值2.4-3.7cpm)和频谱倍率(24-28m);并将正常、过缓和过速的频率范围内的功率值和总功率值用直方图表示,反应节律紊乱指数。

统计学处理 所有数据均以均数 \pm 标准差(mean \pm SD)表示,各组间以双侧t检验进行统计学处理。

2 结果

2.1 口服镁呼气氢试验测定胃泌酸功能 与正常参考值比较,脾气虚组(spleen-asthenia, SA)患者OMBHT测定产氢量(H₂/excess)值各时间点均低于正常值,且较胃热组(stomach-heat, SH)和肝火上炎(flaming-up of liver-fire, FULF)组明显降低(P<0.01),而胃热组(SH)和肝火上炎(FULF)组各时间点的OMBHT产氢量均在正常范围内。见表1。

表1 各病例组患者OMBHT产氢量(mean \pm SD, ppm)

Group	n	15 min	30 min	45 min
SA	32	13.16 \pm 4.51	14.33 \pm 4.18	15.57 \pm 4.89
SH	31	34.21 \pm 6.86 ^a	37.25 \pm 8.27 ^a	39.24 \pm 6.17 ^a
FULF	31	22.35 \pm 5.17 ^{ab}	31.36 \pm 4.84 ^a	34.67 \pm 5.92 ^a
Normal		20-60		

^aP<0.01, vs SA; ^bP>0.05 vs SH.

正常值为临床检验所用参考值(余下均同)。

2.2 口服乳果糖呼氢实验测定小肠传递时间 与正常参考值比较,脾气虚组(SBTT为225.6 \pm 21.3min)的测定

值显著增大,表明小肠传递时间延长,而肝火上炎组的SBTT为 60.4 ± 34.5 ,表明小肠传递时间缩短,且与脾气虚组比较有显著差异($P < 0.01$),见表2.

表2 各组乳果糖呼氢实验结果比较(mean \pm SD, min)

Group	n	SBTT
SA	32	225.6 \pm 21.3
SH	31	93.2 \pm 29.8 ^a
FULF	31	60.4 \pm 34.5 ^{ab}
Normal	75-150	

^aP < 0.01 vs SA; ^bP > 0.05 vs SH.

2.3 脾虚证与胃肠电活动 与正常参考值比较,脾气虚组胃窦、胃体、胃小弯和十二指肠球部的平均峰值虽在正常范围内,但较胃热组和肝火上炎组明显减低($P < 0.01$),后两组表现为胃肠运动亢进;脾气虚组四个部位的主频值均明显低于正常值,且与胃热和肝火上炎组比较有显著下降($P < 0.05$),尤其是胃小弯和十二指肠球部差距更为明显($P < 0.01$),表明脾气虚组胃和十二指肠球部的平滑肌电节律低下;此外脾气虚组胃窦部的平均过零频率低于正常值,其他部位的虽在正常值范围内,但较胃热和肝火上炎组减低($P < 0.05$),说明脾气虚组的胃窦功能节律紊乱.具体数据见表3.

表3 各组患者空腹胃电图结果(mean \pm SD)

Group	SA (n=32)	SH (n=31)	FULF (n=31)	Normal
Antrum	135 \pm 34.33	774 \pm 223.16 ^a	680 \pm 207.34 ^b	
Ap Cavity (cpm) lesser curvature	108 \pm 27.30	355 \pm 97.88 ^a	259 \pm 73.22 ^b	50-300
duodenal bulb	33 \pm 68.44	656 \pm 173.36 ^a	560 \pm 170.46 ^b	
Antrum	94 \pm 13.61	448 \pm 107.38 ^a	405 \pm 15.37 ^b	
Ep Cavity (cpm) lesser curvature	1.82 \pm 0.57	2.70 \pm 0.63	3.00 \pm 1.01 ^b	
duodenal bulb	1.65 \pm 0.36	2.70 \pm 0.78	3.15 \pm 0.93 ^b	2.4-3.7
Antrum	0.15 \pm 0.03	2.55 \pm 0.61 ^a	2.85 \pm 0.81 ^b	
Fz Cavity (cpm) lesser curvature	0.15 \pm 0.05	3.00 \pm 1.04 ^a	3.15 \pm 1.35 ^b	
duodenal bulb	1.73 \pm 0.49	3.10 \pm 2.05 ^a	3.30 \pm 1.16 ^b	
Antrum	2.48 \pm 0.71	3.23 \pm 1.47	2.93 \pm 1.37 ^b	2.4-3.7
Fz Cavity (cpm) lesser curvature	2.40 \pm 0.53	3.00 \pm 1.04	3.23 \pm 1.71 ^b	
duodenal bulb	2.55 \pm 0.58	3.13 \pm 1.47	3.17 \pm 1.08 ^b	

^aP < 0.01, vs SA; ^bP > 0.05 vs SH.

3 讨论

目前,国内应用现代科学理论及技术对“脾气虚证”的本质进行了多方面的研究,涉及消化、神经、内

分泌、免疫及血液等多个系统^[11-21],总体上认为脾气虚证是以消化系统功能障碍为主的多系统功能紊乱的征候群^[3, 22].脾气虚证“脾失健运”时可出现一系列消化、吸收功能障碍的表现,如胃排空延迟^[23]、胃肠运动功能减弱^[24]、胃电活动紊乱、胃蛋白酶和唾液淀粉酶活性降低^[25]等.

近年来,口服镁呼氢实验因其准确性高、重复性好、无需插管、无创伤、无副作用、操作简单而易被受试者接受,作为评价胃泌酸功能的指标已逐渐用于实验和临床^[26].其原理为口服金属镁与胃内的盐酸反应产生氢($Mg+2HCl=MgCl_2+H_2$),产生的 H_2 可经胃黏膜弥散入血而随呼吸排出体外,用微量氢气测定仪可测定;同时,当镁的量足够与受试者胃内全部胃酸反应时,产生的氢气体量与胃液内盐酸的量正相关.因此检测呼气中的氢气含量即可推算出胃酸的含量.国内有研究表明^[27-28]BHT试验结果与胃泌酸功能之间存在显著正相关, $H_2/excess$ 与基础胃酸分泌量(BAO)呈显著正相关($r=0.88$),空腹时的基础呼氢是由肠道细菌产生并存在个体差异,用基础呼氢校正的实验结果,可靠性明显升高.本临床观察发现脾气虚组(SA)患者OMBHT测定产氢量($H_2/excess$)值各时间点均低于正常值,且较胃热组(SH)和肝火上炎(FULF)组明显降低($P < 0.01$),而胃热组(SH)和肝火上炎(FULF)组各时间点的OMBHT产氢量在正常范围内,表明脾气虚患者胃泌酸功能显著减低.

将摄入乳果糖到呼气中出现持续氢浓度增高的时间间隔称为小肠传递时间(small bowel transit time, SBTT).目前应用BHT测定SBTT的判断标准较多,我们经长期临床观察认为选取呼气氢增值大于5 ppm,且强调以连续3次升高值中的首次值为SBTT的止点,这较符合客观实际;另外,如果出现双峰,第一峰是由小肠细菌过度生长所致,即为小肠峰,而第二峰才真正反映了结肠峰.故本实验以此作为判断依据.我们发现:与正常参考值比较,脾虚组(SBTT为 225.6 ± 21.3 min)的测定值显著增大,表明小肠传递时间延长,而肝火上炎组的SBTT为 60.4 ± 34.5 ,表明小肠传递时间缩短,且与脾虚组比较有显著差异($P < 0.01$).国内有学者用X线标志物法观察脾气虚气滞患者的胃肠运动状况,发现其有明显的胃肠运动失调和蠕动减慢,并认为这可能与胃肠植物神经功能紊乱有关^[3, 29],与本研究有较好的一致性.有关脾气虚的临床诊断标准是患者多表现为腹泻或先便秘后腹泻.我们已往的脾虚动物模型(利血平制)研究发现:短期脾虚大鼠(7 d)有腹泻,而长期模型鼠(14 d)为便秘(3-7 d)^[30];在临床上也发现有部分严重脾虚尤其是脾虚老年患者常为便秘,推测脾气虚严重到一定程度时其胃肠运动功能障碍的临床症状为便秘,而小肠传递时间延长是其临床客观表现形式之一.

有研究发现^[26]脾虚患者无论空腹还是进食后胃电波幅均低于正常组,并且与唾液淀粉酶活性比值、D-木糖排泄率一致,三者合参对脾虚证的诊断阳性率达95.

1%, 提示此三项指标合参具有实际意义. 曲氏^[31]的实验表明, 脾气虚动物胃窦运动节律、振幅指数明显低于正常, 其结果导致“肌源性”胃机械运动明显减弱, 四君子汤可纠正. 本实验结果发现脾气虚证患者胃小弯、胃大弯近胃窦处、胃体及十二指肠球部的平滑肌电节律降低, 胃窦部功能节律紊乱, 胃肠运动较胃热和肝火上炎组减弱; 推测脾气虚证患者胃和十二指肠球部电节律紊乱、存在电-机械脱耦联现象.

综合分析本研究所观察的三个临床指标, 表明脾气虚证患者“脾失健运”的客观表现有胃泌酸功能减低、小肠传递时间延长和胃肠电-机械运动减低, 并存在电-机械脱耦联, 这与既往的相关研究报道有很高的一致性. 因此将呼氢试验(测定胃泌酸功能和小肠传递时间)、胃肠电图用于脾气虚证的临床研究, 对其客观诊断具有积极的作用.

4 参考文献

- Liang WJ, Zhang WD. The study advance at the function of digestion and absorption in spleen deficiency symptoms. *Chin J Trad West Med (Piwei)* 1999;7:191-192
- Wang XD. The discussion on the discord of the liver and the spleen. *Gansu J Trad Chin Med* 2002;15:3-5
- Zhang B, Zhang WD, Li LB, Zhang ZS, Zhou DY. The study at stomach motility of patience with spleen deficiency. *Chin J Trad West Med* 1994;14:346
- Zhou YQ, Lai TS, Li ZM. Effects of Zhishi Xiaopi pill on gastric kinetics and gastrointestinal hormones in patients with functional dyspepsia. *J Guangzhou Univer Trad Chin Med* 1999;16:305-308
- Yin W, Xiao Y, Huang C. Determination of food oral-colon transit time with breath hydrogen test. *Chin J Prev Med* 1998;32:306-308
- Huang KM, Xu GM, Zou DW, Li ZS, Yin N. Changes of 24-hour gastric motility and myoelectric activity in patients with functional dyspepsia. *Chin J Dig* 2001;21:537-539
- Zhang JP. Exploration on the relationship between typing of gastroduodenal disease and ECG. *J Shanxi College TCM* 2001;2:25-27
- Chen YM, Zhao S, Wan P, Wang J, Fan H, Luo HM, Long YL, Ma BD. Electrogastrography in patients with uremia. *Huaren Xiaohua Zazhi* 1998;6:979-981
- Zhang LP, Sha ZF, Dong LF, Tu YP, Zhang TC. Clinical significance of lactulose hydrogen breath test for irritable bowel syndrome. *J Capital Univer Med Sci* 1999;20:262-263
- Shen ZY, Wang WJ. The Reference standard of xuzheng bianzheng in traditional Chinese medicine. *Chin J Trad West Med* 1986;6:598
- Guo H, Qu RY, Chang YB, Meng Y, Li LS, Wang W, Zeng WH, Qu BL. Changes of SP and VIP in ileum of experimental spleen deficiency rats. *J Capital Univer Med Sci* 2001;22:199-201
- Wang XQ, Zeng XP, Sheng HW, Wang XC, Yan J. In situ hybridization on somatostatin mRNA expression in gastric mucosa in “experimental spleen deficiency syndrome” rats. *Acta Anatomica Sinica* 1998;29:293-294
- Shen D, Shen L, Wang AL, Yang Y, Yang Y, Wei WY. Study on platelet aggregation function of patients with failure of spleen to control circulating blood syndrome. *Chin J Trad West Med (Xiaohua)* 2001;9:5-7
- Chen ZY, Yan MX, Xiang BK. Study on relationship between TCM syndrome type of irritable bowel syndrome and gut hormones. *Chin J Trad West Med* 2002;22:664-666
- Zhang HX, Ren P, Huang YX, Li Y, Huang X, Liu F. Alteration of D cells in gastric antrum in spleen-asthenia syndrome. *J Fourth Mil Med Univ* 2002;23:1486-1499
- Tao LD, Qin SA. Effect of Fuzheng Jianpi recipe on content of trace element and immune function in children with spleen deficiency anorexia. *Chin J Trad West Med* 2002;22:429-431
- Liu GZ, Wang XZ, Wang P, Lin J, Yang FD. Therapeutic and immunologic study of Jianpi Yishen decoction in patients with Pixu Diarrhoea. *Shiji Huaren Xiaohua Zazhi* 1999;7:285-287
- Yao YL, Song YG, Zhang WD. Spleen asthenia syndrome; gastric mucosa; intestinal mucosa; immunohistochemistry. *Shiji Huaren Xiaohua Zazhi* 1999;7:550
- Liu X, Zhi M, Lei L, Gong J, Nie DL, Chen SS, Dong L. Effects of Chinese herb complex Jianpiwan and Baohewan on gastrointestinal motility in rats. *Shiji Huaren Xiaohua Zazhi* 2003;11:54-56
- Zhou B, Li QG, Ren CB. Determine the emptying function of dyscinesia indigestion of patients with PixuQizhi. *Chin J Trad West Med (Piwei)* 1997;5:84
- Ren P, Huang X, Li YC, Liu F, Zhang L, Wang LL, Feng JH. Somatostatin, cholecyst, tokinin and motilin levels in plasma and tissues in experimental Pixu rats. *Shiji Huaren Xiaohua Zazhi* 2000;8:436-438
- Ceng JX. The review and prospects for study the symptoms of traditional Chinese medicine. *Act Univ Chin Med Pharmacol Biejing* 1998;13:246
- Ren P, Huang X, Zhang L, Wang LL, Li YC, Chen JZ. Relationship between IMC, gut motility and motilin level in Pixu rats. *Shiji Huaren Xiaohua Zazhi* 2000;8:516-519
- Ren P, Huang X, Zhang L, Wang LL, Liu F, Li YC. Effect of Sijunzi decoction on gastric emptying rate in rat model of spleen deficiency syndrome. *Chin J Trad West Med* 2000;20:599-601
- Li CQ, Wang JH. The relationship between the activity ratio of salivary, excretion rate of D-xylose, Electrogastrography and spleen deficiency syndrome. *Huna Zhongyi Xueyuan Xuebao* 1998;18:8-9
- Sack DA, Stephensen CB. Liberation of hydrogen from gastric acid following administration of oral magnesium. *Dig Dis Sci* 1998;30:1127-1133
- Li YQ, Xu CF, Zhao GN, Shun H. Breath H₂ test for gastric acid secretion. *J Fourth Milit Med Univer* 1993;14:150-152
- Li YQ, Xu CF, Zhao GN, Shun H. Oral Mg/breath H₂ test for gastric acid secretion. *J Fourth Milit Med Univ* 1994;15:40-42
- Tan RS, Xu FL, Zhang WD, Zeng XD, Luo R, Huang ZQ, Tang SJ, Chen WG, Shi CS. The preliminary observation of gastrointestinal X-rays in patient with spleen deficiency. *Xin Xiaohabing Zazhi* 1993;1(Suppl 1):43-44
- Liu F, Ren P, Li YC, Huang X. Relationship between spleen deficiency syndrome and cholecystokinin. *Chin J Trad West Med (Xiaohua)* 2002;10:262-264
- Qu RY, Qu BL, Zeng WH, Wang XQ, Yang J, Li LF. The study of electrogastrography in rat model with spleen deficiency syndrome. *Chin J Trad West Med* 1994;14:156-158