

A Study of Colonic Transit Time in Patients With Chronic Idiopathic Constipation

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ABSTRACT

Background: To determine the colon transit time (CTT) in patients complaining of functional constipation and to evaluate the correlation between abnormal transit times and the types of constipation and the correlation with age and sex.

Materials and Methods: The signs and symptoms of 84 patients with infrequent or difficult defecation, 33 males and 51 females, with a median age of 33.7 were recorded by means of a questionnaire. After ingestion of radioopaque material, 20 markers per day for 3 days, abdominal X-rays were taken on days 4 and 7. If more than 5 markers remained in the segment of colon, another X-ray was taken in day 10. The numbers of markers in the X-ray and per segment (right and left hemi-colon and rectosigmoid colon) were counted; the CTT in hours was calculated by multiplying this number by 1.2.

Results: The total CTT was normal in 61 patients (72.6%) and prolonged in 23 (27.4%) ones. The CTT was prolonged in the rectosigmoid colon in 8 patients with an average total CTT of 81.3 ± 21.52 h, in 8 patients in the left colon with an average total CTT of 98.5 ± 40.083 h and in 7 patients in the right colon with an average total CTT of 19.94 ± 19.35 h. Of the patients with a normal total CTT, 41 (67.2%) ones had Rome III criteria for IBS. No statistically significant correlation could be demonstrated between CTT and age or sex.

Conclusion: Functional constipation may be associated with a normal CTT. Disorders of colonic motility and rectal evacuation could be distinguished by measuring the total and segmental colonic transit times.

Keywords: Radio-opaque marker, Colonic transit time (CTT), Idiopathic constipation.

Govaresh/ Vol. 14, No.4, Winter 2010; 262-268

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Received: 30 Feb. 2010

Edited: 19 May 2010

Accepted: 20 May 2010

INTRODUCTION

Constipation is a subjective symptom of various presentations including incomplete, prolonged, difficult, rare or painful defecation, abdominal pain and bloating. It is also the manifestation of a subtype of irritable bowel syndrome (IBS) called constipation-predominant IBS (C-IBS), and it can be the major symptom of functional constipation.

In epidemiological studies, the prevalence rate of constipation is determined to be > 30% in the general population but the rate is different in many reports (1-2).

If a cause of chronic constipation cannot be identified, the constipation is considered to be an idiopathic disorder (2-3). Idiopathic constipation is divided in colonic slow-transit constipation (colonic dysmotility) and constipation of pelvic outlet obstruction (anorectal dysmotility) (3). Colonic transit study provides valuable information when colectomy is considered. The colonic transit time (CTT) study is a simple clinical test for evaluation of the idiopathic constipation (4). Based on radioopaque markers, normal total and segmental CTT have been reported in different populations but the results were conflicting (5-9).

The aim of our study was to assess the abnormalities of subtypes of idiopathic constipation by CTT. To our knowledge, little information is available about subtypes of idiopathic constipation in southern of Iran.

MATERIALS AND METHODS

Population

The study protocol was approved by the institutional Ethics Review Committee (grant NO: 68) and each patient signed an informed consent. The study was done in Ahwaz Jundishapour University Hospitals (AJSUH) from 1 Sept 2001 to 7 Nov 2007. The study group comprised 84 (33 male and 51 female) patients with the complaint of chronic constipation and 41 patients with IBS (Irritable bowel syndrome) according to the Rome III diagnostic criteria. We excluded patients with a history of gastrointestinal surgery or mechanical obstruction, thyroid disease or other systemic diseases, severe laxative dependence and regular use of medications that could affect gastrointestinal motility. We excluded patients with possible colonic and rectal organic diseases

by colonoscopy. Women of childbearing age were not allowed to participate unless they had a negative serum pregnancy test result and practiced approved contraceptive methods.

Procedure

To fulfill the inclusion criteria, a questionnaire on the duration of constipation, pressure on defecation, its intensity and drug history was completed for each patient. Also, a specific questionnaire on IBS was completed for each patient. In this way, 84 patients were enrolled in the study. Sixty sterilized angiography wires of 2-5 mm in length, as opaque markers, were placed in three capsules (each one had 20 markers). In order to conduct CTT, the three-day method was chosen and the capsules were given to the patients, each day, one capsule, at a specific time. Plain abdominal X-rays were taken on the forth, seventh, and tenth days (24 hours after the last marker was ingested). The patients were instructed not to take any medication or laxative affecting bowel motility.

Each radiograph was divided into three areas namely the right, the left and the rectosigmoid colon based on the patterns of large bowel gases explained by Arhan and the number of markers present in each area. (8) (Figure1). Total CTT was calculated using the following formula: $CTT = \frac{SM \times C}{TM}$

Where CTT is total colonic transit time, SM is the sum of the markers observed in the colon on the radiographic pictures, C is the time between radiographic pictures, and TM is the total number of the markers ingested.

Statistics

For statistical analyses, we used SPSS 13 and the data are presented as means \pm standard deviation (SD). Comparison of total and segmental transit times between different age groups and sexes was made by using the ANOVA and chi-square test. The value of $P < 0.05$ was

taken as the level of statistical significance.

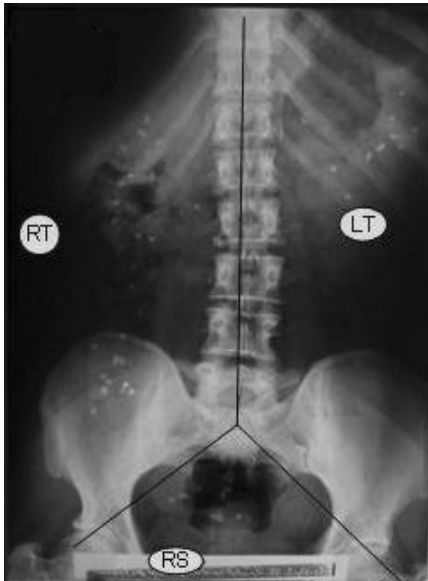


Figure 1: Radiographic picture obtained on day 4 in a study case showing the markers remained in different colonic segments

RESULTS

In this study 84 patients (mean age, 33.76 ± 17.37 years; range, 3 to 75 years) were investigated. Thirty three (39.3%) patients were male, and 51 (60.7%) were female (p=0.202)(Figure 2).

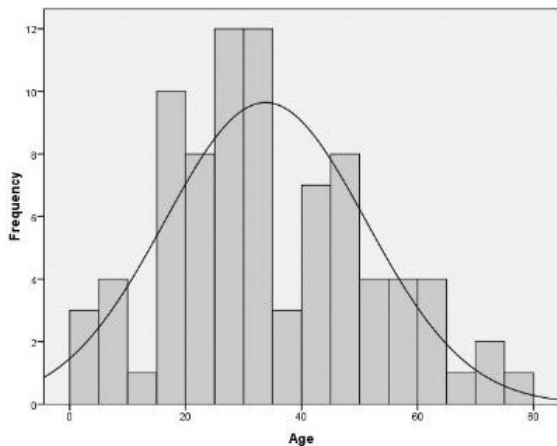


Figure 2: Histogram of patients' age

Sixty four (76.2%) patients had less than three times defecation weekly. Seventy four (88.1%) had constipation for more than six month.

Incomplete evacuation occurred in 80 (95.3%) patients.

IBS was more frequent among the patients between 10 to 40 year-old (p=0.003). Patients were divided into four groups based on their total and segmental CTT. Group A had normal CTT; group B involved patients with abnormal left transit time (LTT); group C included those with abnormal rectosigmoid transit time (RSTT); and group D were patients with abnormal right transit time (RTT) (Table 1). Total CTT in these groups were 19.9 ± 2.4 h, 74.2 ± 14.9 h, 81.3 ± 7.6 h and 98.5 ± 15.1 h, respectively. CTT was not different between the groups B, C and D.

Table 1: Distribution of abnormal CTT in 84 patients

	CTT	N	Total
A	Normal	61(72.6%)	19.9 ± 19.3 h
B	Abnormal LTT	8 (9.5%)	74.2 ± 42.2 h
C	Abnormal RSTT	8 (9.5%)	81.3 ± 21.5 h
D	Abnormal RTT	7 (8.3%)	98.5 ± 40.0 h

CTT was not significantly different in males compared to females and also in different groups (p=0.865 and p=0.196, respectively, Figure 3).

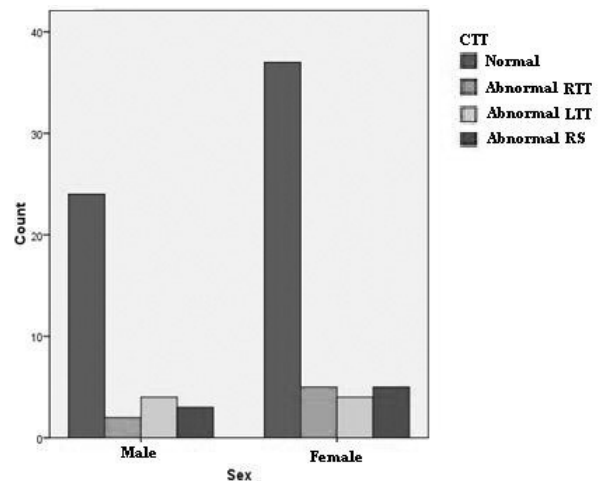


Figure 3: CTT based on the gender of patients

Abnormal LTT and abnormal RSTT were more frequent in patients who had always lumpy or

Table 2: Signs and symptoms of the patients based on their CTT results

Subjects	CTT				Total
	Normal (A)	LTT (B)	RS (C)	RTT (D)	
Lumpy or hard stool					
Always	17	8	6	5	36
Occasional	42	0	2	1	45
Never	2	0	0	1	3
Manual maneuvers					
Always	6	3	3	0	12
Occasional	26	4	4	5	39
Never	29	1	1	2	33
Mucus discharge					
Yes	40	1	2	0	43
No	21	7	6	7	41
Bloating					
Always	22	2	0	0	24
Occasional	36	6	4	4	50
Never	3	0	4	3	10
Laxative Use					
Always	20	7	7	4	38
Occasional	39	1	0	1	41
Never	2	0	1	2	5
IBS					
Yes	41	0	0	1	42
No	20	8	8	6	42

hard stool, but CTT was more frequently normal in patients who had occasionally lumpy or hard stool ($p=.0003$).

Abnormal CTT was more frequent in patients who needed manual maneuvers for evacuation, with no mucus discharge, those who never or occasionally experienced bloating, and subjects who took up laxatives ($p<0.05$). Abnormal CTT was more frequent in patients who did not have IBS (Table 2).

DISCUSSION

Constipation is a frequent clinical symptom, and its diagnostic criteria have been recently revised in Rome III classification (10-11). Until now, there is no study that analyzes the pathophysiological

characteristics of constipation in patients with idiopathic constipation in our area. The CTT measurement used in this study may be helpful to define the pathogenesis of constipation in these patients. It can be accomplished on an outpatient basis and has minimal risk. In addition, by calculating segmental CTT, we could evaluate the exact sites of delay that lead to constipation in our patients. CTT may be normal or prolonged in different segments (right segment, left segment, rectosigmoid segment) in patients. A number of factors have been studied and some are reported to alter the CTT (12).

Several studies have been directed to evaluate the effects of gender on the CTT (13). Metcalf et al (9) have found that men have a shorter CTT,

but others (12-14) have reported no sex difference. It has been suggested that the female sex hormones, progesterone in particular, are responsible for this gender difference, by inhibition of the colon motility (15).

However, there was no significant difference in both sexes in our study. Several studies have shown the effects of aging on the gastrointestinal motility. In one study, the prevalence rate of constipation was 12.5% in the 30-64 year age group whereas this figure reached 23% in patients with 65-93 years of age (16). In the present study, aging was shown to increase the CTT in both men and women.

This is in partial accordance with results of other studies (17). Most of our patients in colonic inertia group (41 patients) were between 42- 60 year-old. With regard to the frequency of defecation in our study, it was seen that most patients (64 persons, 76.2%) defecated less than 3 times a week and among them, 21 patients had abnormal CTT. Also, abnormal CTT was more frequent in patients who needed manual maneuvers for evacuation. The presence of pressure on defecation was unrelated to abnormal CTT. This finding was similar with that of a study by Ansari et al in Iran on 64 patients with idiopathic constipation for the assessment of total and segmental CTT, which showed that 26 (40.6%), 15 (23.4%), and 8 (12.5%) patients had abnormal bowel evacuation in the left colon, rectosigmoid and right colon, respectively.

The evacuation time of the left colonic segment, right colonic segment and rectosigmoid region was abnormal in 12, 1 and 4 patients, respectively. Among 20 patients with an abnormal CTT throughout the colon with pressure on defecation, 11 were found to have abnormal rectosigmoid CTT. Of these patients, only four had pure rectosigmoid transit abnormality.

The presence of pressure on defecation is

unrelated to abnormal CTT especially in the rectosigmoid region (18). In the latter study such as our study, CTT was not significantly different in males compared to females and in different age groups.

The segmental CTT for the right, left and rectosigmoid colon were 21.6, 24, and 42 h, respectively. Normal reference values for CTT, based on radioopaque markers, have been reported from different countries. The normal total CTT was reported to be 67 h in the study of Chaussade et al (18), and <70 h in the studies by Martelli et al (19) and Metcalf et al. (9) Another study performed by Chaussade et al (20) in 91 patients with idiopathic constipation by measuring segmental CTT, showed that 49 cases had normal CTT, 16 cases had increased RTT, 12 cases had increased LTT and 12 cases had delayed rectosigmoid evacuation time. The results were similar to the observations reported by another study (14). Our study did not show any significant difference with these studies.

A study conducted by Li Xing (21) showed that the colonic transit was prolonged in 75% of patients with IBS; and patients with constipation had a prolonged transit time.

This is not similar to the mean CTT found in our study. Constipation can be classified into 3 major categories: normal-transit constipation, slow transit constipation, and disorders of defecatory or rectal evacuation (18-19). In patients with normal transit constipation, constipation is likely to be caused by perceived difficulty with evacuation or the presence of hard stools. In patients with slow-transit constipation, dietary and cultural factors might contribute to minimal delay in colonic transit (22-23).

Patients with more severe slow transit constipation have a poor response to dietary fiber and laxatives and have more delayed emptying of the proximal colon and fewer high amplitude peristaltic contractions after meals (23-27).

We believe that CTT measurement is helpful to

tailor therapy because it helps define the pathogenesis of constipation. However, CTT alone is not helpful in diagnosing the symptom of constipation. Other diagnostic steps, such as anorectal manometry and defecography, also might be as helpful in tailoring therapy in patients with constipation. In general, our patients tolerated this procedure easily without any problem. A limitation of our study was the small sample size of the subgroups and further studies are required. If this test is used in studies including more patients and with longer follow-up, we might not only learn more about success rates but also develop a better understanding of the working mechanism in patients with idiopathic constipation.

CONCLUSION

Most patients with idiopathic chronic constipation (72.6%) have normal CTT. Also, abnormal CTT was more frequent in patients who needed manual maneuvers for evacuation. The presence of pressure on defecation was unrelated to abnormal CTT. CTT was not significantly different in males compared to females and in different age groups. The results of this study suggest that CTT which is a simple test to perform can easily categorize these patients. We believe CTT measurement is helpful to tailor therapy because it helps the clinician define the pathogenesis of constipation.

REFERENCES

1. Stewart WF, Liberman JN, Sandler RS, Woods MS, Stenhagen A, Chee E, et al. Epidemiology of constipation (EPOC) study in the United States: relation of clinical subtypes to sociodemographic features. *Am J Gastroenterol* 1999;94: 3530-40.
2. Higgins PD, Johanson JF. Epidemiology of constipation in North America: a systematic review. *Am J Gastroenterol* 2004;99:750-9.
3. Rao SS. Constipation: evaluation and treatment. *Gastroenterol Clin North Am* 2003;32:659-83.
4. Rao SS, Tuteja AK, Vellema T, Kempf J, Stessman M. Dysynergic defecation: demographics, symptoms, stool patterns, and quality of life. *J Clin Gastroenterol* 2004;38:680-5.
5. Pomerri F, Dodi G, Nardin M, Muzzio PC. Colonic total and segmental transit times in healthy Italian adults. *Radiol Med* 2009;114:925-34.
6. Wu MJ, Chang CS, Cheng CH, Chen CH, Lee WC, Hsu YH, et al. Colonic transit time in long-term dialysis patients. *Am J Kidney Dis* 2004;44:322-7.
7. Chaussade S, Khyari A, Roche H, Garret M, Gaudric M, Couturier D, et al. Determination of total and segmental colonic transit time in constipated patients. Results in 91 patients with a new simplified method. *Dig Dis Sci* 1989; 34:1168-72.
8. Arhan P, Devroede G, Jehannin B, Lanza M, Faverdin C, Dornic C, et al. Segmental colonic transit time. *Dis Colon Rectum* 1981;24:625-9.
9. Metcalf AM, Phillips SF, Zinsmeister AR, MacCarty RL, Beart RW, Wolff BG. Simplified assessment of segmental colonic transit. *Gastroenterology* 1987;92:40-7.
10. Proano M, Camilleri M, Phillips SF, Brown ML, Thomforde GM. Transit of solids through the human colon: regional quantification in the unprepared bowel. *Am J Physiol Gastrointest Liver Physiol* 1990;258:856-62.
11. Diamant NE, Kamm MA, Wald A, Whitehead WE. AGA technical review on anorectal testing techniques. *Gastroenterology* 1999; 116: 735-60.
12. Pomerri F, Frigo AC, Grigoletto F, Dodi G, Muzzio PC. Error count of radiopaque markers in colonic segmental transit time study. *AJR Am J Roentgenol* 2007;189:56-9.
13. Viramontes BE, Camilleri M, McKinzie S, Pardi DS, Burton D, Thomforde GM. Gender-related differences in slowing colonic transit by a 5-HT₃ antagonist in subjects with diarrhea-predominant irritable bowel syndrome. *Am J Gastroenterol* 2001;96:2671-6.
14. Grotz RL, Pemberton JH, Talley NJ, Rath DM, Zinsmeister AR. Discriminant value of psychological distress, symptom profiles, and segmental colonic dysfunction in outpatients with severe idiopathic constipation. *Gut* 1994;35:798-802.
15. Cowlam S, Khan U, Mackie A, Varma JS, Yiannakou Y. Validity of segmental transit studies used in routine clinical practice, to characterize defaecatory disorder in patients with functional constipation. *Colorectal Dis* 2008;10:818-22.
16. Rao SS, Welcher KD, Leistikow JS. Obstructive defecation: a failure of rectoanal coordination. *Am J Gastroenterol* 1998;93:1042-50.
17. Wald A. Slow transit constipation. *Curr Treat Options Gastroenterol* 2002;5:279-83.
18. Ansari R, Sohrabi MR, Roohi S, Mikaeli J, Massarrat S, Tahaghoghi Mehri S, et al. Colonic transit time in 64 Iranian patients with Idiopathic chronic constipation. *Arch Iran Med* 2001;4:5-9.
19. Schiller LR. Review article: the therapy of constipation. *Aliment Pharmacol Ther* 2001; 15:749-63.
20. Rao SS, Welcher KD, Leistikow JS. Obstructive defecation: a failure of rectoanal coordination. *Am J Gastroenterol* 1998;93:1042-50.
21. Muller-Lissner SA, Kamm MA, Scarpignato C, Wald A. Myths and misconceptions about chronic constipation. *Am J*

- Gastroenterol* 2005;100:232-42.
22. Bassotti G, de Roberto G, Castellani D, Sediari L, Morelli A. Normal aspects of colorectal motility and abnormalities in slow transit constipation. *World J Gastroenterol* 2005;11:2691-6.
23. Zarate N, Knowles CH, Newell M, Garvie NW, Gladman MA, Lunniss PJ, et al. In patients with slow transit constipation, the pattern of colonic transit delay does not differentiate between those with and without impaired rectal evacuation. *Am J Gastroenterol* 2008;103:427-34.
24. Zaslavsky C, da Silveira TR, Maguilnik I. Total and segmental colonic transit time with radio-opaque markers in adolescents with functional constipation. *J Pediatr Gastroenterol Nutr* 1998;27:138-42.
25. Lundin E, Graf W, Garske U, Nilsson S, Maripuu E, Karlbom U. Segmental colonic transit studies: comparison of a radiological and a scintigraphic method. *Colorectal Dis* 2007;9:344-51.
26. Kekilli E, Yagmur C, Isik B, Aydin OM. Calculating colon transit time with radionuclide-filled capsules in constipated patients: a new method for colon transit study. *Abdom Imaging* 2005;30:593-7.
27. Wald A, Hinds JP, Caruana BJ. Psychological and physiological characteristics of patients with severe idiopathic constipation. *Gastroenterology* 1989;97:932-7.