

Chronoenterography: Monitoring of Circadian Rhythm of the Intestinal Evacuatory Function

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A new method for studies of circadian rhythm of the bowel evacuatory function in humans is proposed: chronoenterography. The existence of optimal and pessimal phases in the circadian rhythm of enteral evacuatory activity was proven using this method. The optimal phase is associated with 3-4-fold reduced chronorisk of enteral arrhythmia. A new classification of enteral arrhythmia and its stages and severity is proposed.

Key Words: *circadian rhythm; optimal and pessimal phase; chronorisk; enteral arrhythmia*

A new chronobiological and chronomedical concept of evacuatory function as a true circadian rhythm, manifesting even *in vitro* [2-4,8], appeared in recent years, but the phase structure of circadian rhythm of enteral activity in humans is still unclear. High prevalence of irregular evacuatory function of the intestine (occurring in about 50% adult population) [1,6, 7,14] necessitates a scientific approach to this problem. Development of a graphic chronomedical method is essential for solving the problem of enteric dyskinesia, a proven risk factor for colorectal cancer, one of the leaders among cancers [5,13]. In addition, monitoring of disorders in the circadian rhythm of the enteric evacuatory function is as important as monitoring of other vital functions.

MATERIALS AND METHODS

Chronoenterography is a new method for graphic representation of chronophysiological data on the circadian rhythm of enteral evacuatory activity. In fact, chronoenterography is monitoring of circadian rhythm of defecation in real time with consideration for the frequency (number of defecation days per week) and acrophase (period of the maximal probability of manifestation of this function).

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A total of 376 subjects of both sexes considering themselves healthy were examined: 294 aged 16-28 and 82 aged 60-75. All of them noted the exact time (morning 06.00-12.00, day 12.00-18.00, or evening 18.00-24.00) of realization of the evacuatory function of the intestine in specially designed tables for autorhythrometry [10,11]. Days on which this function was not realized were specially noted. Chronoenterograms were plotted on the basis of filled autorhythrometric tables. On these chronoenterograms a wave corresponded to a single defecation act, double wave to two defecations, and isoline to absence of defecation. Regular defecation rhythm with defecations on each of 7 days of the week was taken for eurhythmoenteria, rare defecations were considered as enteral bradyarrhythmia. Three degrees of enteral bradyarrhythmia were distinguished: I) 5-6, II) 3-4, and III) 1-2 defecations/week.

The probability of enteral bradyarrhythmia or risk of constipation was estimated as the ratio of the number of subjects with irregular defecation to the total number of examined subjects. The significance of differences in the mean values was evaluated by the range of values at 95% reliability.

RESULTS

Analysis of chronoenterograms (Fig. 1) showed that the risk of constipation depended on the phase of defecation rhythm. This risk was minimum in young (aged

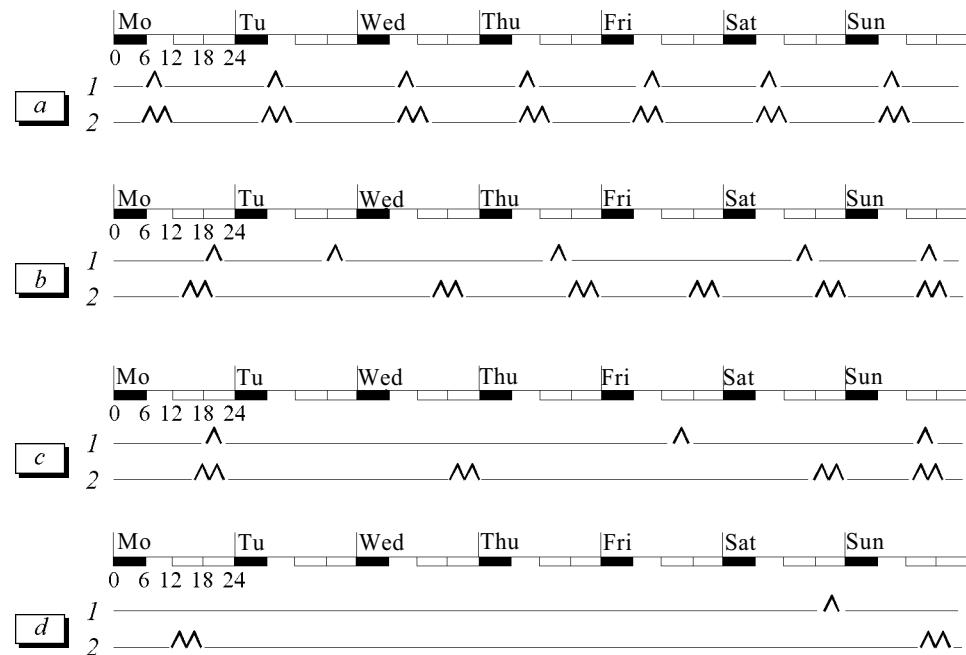


Fig. 1. Variants of chronoenterogram in normal rhythm (7 days with defecation per week, a) and constipation (b-d): b) I degree (5-6 days with defecation per week), c) II degree (3-4 days with defecation/week), and d) III degree (1-2 days with defecation/week). 1) one defecation; 2) two defecations.

under 28 years) subjects with the morning (optimal) phase, while in subjects with afternoon (pessimal) phase of this rhythm chronorisk of constipation increased 4-fold (Table 1).

A similar relationship between chronorisk of constipation and the phase of defecation rhythm was observed in elderly (60-75 years) subjects (Table 2).

The risk of constipation in elderly subjects with morning defecation phase was almost 3-fold lower than in those with the afternoon phase of this rhythm.

Hence, chronoenterography revealed a new chronobiological relationship between risk of disorders in enteral activity rhythm and actual acrophase of this circadian rhythm. The earlier defecation, the lower is the risk of constipation.

Variants of chronoenterograms presented here indicate that the chronomedical approach and analysis of circadian rhythms in health and disease can be used for creating a new classification of constipation. This

classification is based on circadian rhythm of enteral evacuatory activity, and its criterion is a quantitative characteristic — the frequency of the rhythm of enteral evacuatory function.

The new classification of the severity of arrhythmia of enteral evacuatory function based on chronoenterography data will help to quantitatively diagnose constipation (K 59.0, ICD-10).

Chronoenterography demonstrates advantages of chronomedical approach (in comparison with traditional approach) to the problem of constipation. This method proved that bowel evacuatory function can be optimal (with minimum risk of disease) or pessimal (with high risk of disease), depending on the phase of its rhythm. The method proved that circadian rhythm with everyday defecations is physiological, as it ensures regular defecation. Hence, the traditional opinion that constipation is diagnosed in cases with less than 3 defecations a week [9,12] should be revised.

TABLE 1. Relationship between the Risk of Constipation and Phase of Defecation Rhythm in Young Subjects

Parameter	Acrophase of defecation rhythm		
	morning (6.00-12.00)	afternoon (12.00-18.00)	evening (18.00-24.00)
Number of examinees	114	82	98
Number of subjects with enteral arrhythmia	12	34	38
Chronorisk of constipation, %	~10.5	~41.4	~39.7
Phase characteristics	Optimal	Pessimal	Pessimal

TABLE 2. Relationship between the Risk of Constipation and Phase of Defecation Rhythm in Elderly Subjects

Parameter	Acrophase of defecation rhythm		
	morning (6.00-12.00)	afternoon (12.00-18.00)	evening (18.00-24.00)
Number of examinees	56	26	82
Number of subjects with enteral arrhythmia	13	19	32
Chronorisk of constipation, %	23.2	73.0	39.0

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