



Original article

Ultrasonography analysis of gallbladder motility in patients with functional dyspepsia



Nikola Milinić^{a,b}, Branka Filipovic^{a,b,*}, Tamara Lukić^a, Olivera Marković^{a,c}, Nemanja Milisavljević^a, Milan Gajić^{a,d}, Branislav Filipovic^{a,e}

^a Faculty of Medicine, University of Belgrade, Serbia

^b Department of Gastroenterohepatology Clinical and Hospital Center "Bezanijska Kosa," Belgrade, Serbia

^c Department of Hematology Clinical and Hospital Center "Bezanijska Kosa", Belgrade, Serbia

^d Institute for Medical Statistics, Belgrade, Serbia

^e Institute of Anatomy "Niko Miljanic," Belgrade, Serbia

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ABSTRACT

Background: Gallbladder motility has been studied in patients with functional gastrointestinal disorders, such as functional dyspepsia, irritable bowel syndrome and biliary disorders without gallstones and results of these observations are often inconclusive and conflicting.

Methods: The investigation was performed on 180 therapy-naïve newly diagnosed patients with functional dyspepsia (97 females and 83 males), aged 20–79 in which we have investigate ultrasonographically parameters of gallbladder motility.

Results: Bonferroni *post hoc* correction stressed that fasting gallbladder volume and ejection fraction were significantly distorted in individuals with postprandial distress syndrome, although, the residual gallbladder volume was significantly lower in patients with epigastric pain syndrome comparing with other examinees. Ejection fraction of the gallbladder negatively correlated with body mass index.

Conclusion: The impaired contractibility of the gall bladder in patients with functional dyspepsia, based on the results of this study, is illustrated by the changes in the ejection fraction, which was more pronounced in patients with the postprandial distress syndrome.

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1. Introduction

Gallbladder motility has been studied in patients with functional gastrointestinal disorders, such as functional dyspepsia, irritable bowel syndrome and biliary disorders with and without gallstones and results of these observations are often inconclusive and conflicting [1–3]. Impaired gallbladder motility is the most common in patients with biliary calculosis and is important in the pathogenesis of primary or recurrent cholesterol gallstones [4,5]. In the available literature, results about abnormal gallbladder motility in patients with functional dyspepsia are contradictory and rather inconsistent: authors are equivocal about the relationship between functional dyspepsia and abnormal gallbladder motility [2,6].

The most of factors that modify gallbladder kinetics have been identified. Body habitus is believed to impact the biliary motility, for obese patients have significantly greater fasting and residual gallbladder

volume, with slower gallbladder emptying rate when compared with normal nourished subject [6–8].

We have hypothesized that gallbladder volume variations and gallbladder emptying differ between the studied groups of patients with functional dyspepsia and with peptic ulcer and that body mass index specifically influences ejection fraction of the gallbladder.

2. Materials and methods

The investigation was performed on 180 therapy-naïve newly diagnosed patients with functional dyspepsia (97 females and 83 males), aged 20–79 (Table 1), which referred to the gastroenterology unit of the Clinical and Hospital Center "Bezanijska Kosa" in 6 month period.

Patients with functional dyspepsia satisfied the following inclusion criteria:

1. older than 18 years,
2. no previous gastroenterology medications,
3. presence of dyspeptic symptoms for at least 3 months with the onset being at least 6 months before clinical visit,
4. no evidence that dyspepsia relieved by defecation or associated with irregularity in stool frequencies and stool form,

* Corresponding author at: Department of Gastroenterohepatology, Clinical and Hospital Center "Bezanijska Kosa," Autoput s/n, 11080 Belgrade, Serbia. Tel.: +381 113010750; fax: +381 113010751.

E-mail address: branka.filipovic3@gmail.com (B. Filipovic).

Table 1
Demographic characteristics of the examined population.

Observed group	Demographic characteristics			
	*Female	Male	†Age years (mean ± SD)	Total in sample
Epigastric pain syndrome (EPS)	46	44	47.80 ± 14.15	90
Postprandial distress syndrome (PDS)	51	39	50.40 ± 15.56	90
Peptic ulcer disease (PUD)	45	45	47.00 ± 14.61	90
Total in sample	152	118	48.23 ± 14.62	270

* $\chi^2 = 0.92$; DF = 2; $p = 0.63$; † t -test - $p = 0.65$.

- no evidence of organic disease on the upper endoscopy examination for functional dyspepsia patients, for peptic ulcer endoscopically confirmed existence of the newly diagnosed ulceration on the stomach and/or duodenum,
- normal findings on abdominal ultrasonography.

Exclusion criteria were:

- prior gastric or gallbladder surgery,
- any kind of metabolic disease, endocrine or systemic disease,
- the presence of biliary abnormalities of any kind: sludge, gallbladder wall thickening, common bile duct dilation, etc.

All the subjects were acquainted in detail with the study procedure and they all signed a written consent. The study was approved by the Ethic Committee of School of Medicine, in Belgrade, Serbia (Decision no. 124-32/09). According to the Rome III diagnostic criteria, all the patients with functional dyspepsia were divided into two subgroups: epigastric pain syndrome (90 subjects) and postprandial distress syndrome (90 patients). The control group consisted of 90 individuals (45 females and 45 males) with endoscopically diagnosed peptic ulcer disease.

All examinations were performed using commercially available static gray-scale scanner with a digital converter equipped with 3.5 MHz transducer. Patients had fasted overnight including water and cigarettes. The gallbladder volume was measured three times:

- before (fasting gallbladder volume), 45–60 min and 90–120 min after (residual gallbladder volume) for meal a.
- before (fasting gallbladder volume), 30–60 min and 60–120 min after (residual gallbladder volume) the intake of liquid fatty meal (meal b).

The administered meals were as follows: a. standard fatty meal which consisting of boiled rice, egg, beef and contained 750 kCal with 32% of fat; b. 500 ml of commercial soup, which contained 1.8 g protein, 0.9 g fat, and 1.1 g carbohydrates (20 kCal).

The meal b was given 1 week after meal a in order two reestablished gallbladder function. Longitudinal and axial cross-sectional images of the gallbladder were made in duplicate, so as to obtain maximal gallbladder length and width. The volume of gallbladder was calculated

by ellipsoid method [9]: $V = (\text{length} \times \text{width} \times \text{depth} \times 0.52)$. These fasting and postprandial volumes of the gallbladder were substituted into the formula to calculate the ejection fraction (EF) described by Wegstapel et al. [10]: (fasting gallbladder volume – residual gallbladder volume)/fasting gallbladder volume, multiplied by 100%.

Body mass index (BMI) was computed for all the examined individuals prior to ultrasound evaluations, using standard formula: weight (kg)/height² (m²). Patients were classified according to BMI as underweight if BMI was lower than 18.5 kg/m², normal if BMI of 18.51 to 25 kg/m², and overweight if BMI was higher than 25 kg/m².

2.1. Statistical analysis

Statistical analysis was performed with a commercially available statistical software program (SPSS 13.0, Inc, Chicago IL, US). Besides usual parameters of central tendency (descriptive statistics: mean, standard deviation [SD]), Pearson's χ^2 and one way analysis of variance (ANOVA) with Bonferroni post-hoc correction test were used to reveal the possible differences in the means of the queues. Student t -test has been applied to evaluate differences between two independent and/or related samples. The eventual correlations have been tested using linear regression model. The predictive potential of analyzed parameters has been evaluated by the analysis of the discriminant function. Entire testing was performed on 95% probability level.

2.2. Theory

Symptomatology of functional dyspepsia and dyspeptic problems in patients with the gallstone disease are frequently overlapping, and represents a challenge in differential diagnosis [5,11]. Existence of a variety of common symptoms indirectly points out to the eventual involvement of the gallbladder dyscontractibility and its influence to the symptoms severity [12], possibly because of the dysfunction of the smooth muscular layers of the stomach and the gallbladder.

3. Results

Demographic characteristic was shown on Table 1.

No significant difference has been revealed in the age and gender distribution among the examinees (Table 1).

One way analysis of variance outlined significant differences for all gallbladder motility variables between functional dyspepsia subgroups and subjects with peptic ulcer disease. Bonferroni *post hoc* correction stressed that fasting gallbladder volume and ejection fraction were significantly distorted in individuals with postprandial distress syndrome, although, the residual gallbladder volume was significantly lower in patients with epigastric pain syndrome comparing with other examinees. The same trend appeared when a liquid meal has been administered (Table 2). t -Test for the related samples did not reveal significant difference in ejection fractions of the gallbladder in any of

Table 2
Distribution of gallbladder motility parameters obtained (mean ± SE).

Parameter	Observed group			Statistics (ANOVA)
	Epigastric pain syndrome	Postprandial distress syndrome	Peptic ulcer disease	
Meal a	Fasting volume in cm ³	24.29 ± 1.21*	19.25 ± 0.97†	$F = 5.29$; $p = 0.006$
	Postprandial volume (45–60 min) in cm ³	8.09 ± 0.52	14.10 ± 0.81*	$F = 25.56$; $p = 0.00$
	Postprandial volume (90–120 min) in cm ³	6.12 ± 0.54	12.05 ± 1.04	$F = 23.11$; $p = 0.00$
Meal b	Postprandial volume (30–60 min) in cm ³	9.54 ± 1.36	13.87 ± 3.32	$F = 24.38$; $p = 0.000$
	Postprandial volume (60–120 min) in cm ³	8.74 ± 0.89	11.12 ± 2.53	$F = 22.36$; $p = 0.000$
	Ejection fraction a (EF, %)	67.32 ± 2.18*	29.38 ± 1.74*	$F = 126.61$; $p = 0.00$
	Ejection fraction b (EF, %)	65.22 ± 4.18*	32.38 ± 3.54*	$F = 96.61$; $p = 0.00$

Legend: DF (degrees of freedom) between groups = 3; in groups = 268; Total = 270. Bonferroni *post hoc*: * highly significant differences $p \leq 0.01$; † significant differences $p < 0.05$.

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