History-Taking and the Usefulness Index in the Diagnosis of Functional Dyspepsia

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ABSTRACT: **Background:** The primary diagnosis of functional dyspepsia (FD) is made on the basis of typical symptoms and by excluding organic gastrointestinal diseases that cause dyspeptic symptoms. However, there is difficulty reaching a diagnosis in FD.

Objectives: To assess the efficiency of the Usefulness Index (UI) test and history-taking in diagnosing FD.

Methods: A study on acute abdominal pain conducted by the World Organization of Gastroenterology Research Committee (OMGE) included 1333 patients presenting with acute abdominal pain. The clinical history-taking variables (n=23) for each patient were recorded in detail using a predefined structured data collection sheet, and the collected data were compared with the final diagnoses.

Results: The most significant clinical history-taking variables of FD in univariate analysis were risk ratio (RR): location of pain at diagnosis (RR = 5.7), location of initial pain (RR = 6.5), previous similar pain (RR = 4.0), duration of pain (RR = 2.9), previous abdominal surgery (RR = 4.1), previous abdominal diseases (RR = 4.0), and previous indigestion (RR = 3.1). The sensitivity of the physicians' initial decision in detecting FD was 0.44, specificity 0.99 and efficiency 0.98; UI was 0.19 and RR 195.3. In the stepwise multivariate logistic regression analysis, the independent predictors of FD were the physicians' initial decision (RR = 266.4), location of initial pain (RR = 3.4), duration of pain (RR = 3.1), previous abdominal surgery (RR = 3.7), previous indigestion (RR = 2.2) and vomiting (RR = 2.0).

Conclusions: The patients with upper abdominal pain initially and a previous history of abdominal surgery and indigestion tended to be at risk for FD. In these patients the UI test could help the clinician differentiate FD from other diagnoses of acute abdominal pain.

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KEY WORDS: acute abdominal pain, functional dyspepsia (FD), Usefulness Index (UI), diagnostic accuracy

Functional gastrointestinal disorders are the most common conditions encountered in gastroenterology practice and constitute a significant proportion of primary care visits [1-3]. National surveys in Western countries have estimated that the prevalence of one or more functional gastrointestinal disorders, including functional dyspepsia and irritable bowel syndrome, is about 62%–69% [4,5]. Functional dyspepsia, previously called non-ulcer dyspepsia [6], is "a collection of symptoms" without evidence of an organic disease that could explain the symptoms [7]. FD is estimated to affect about 15–40% of the general population in Western countries [6,8]. It may be accompanied by bloating, belching, nausea, or heartburn [1]. According to American and British national guidelines, the clinical examination is an essential part of the evaluation of patients with FD [9,10].

In 1990, Lavelle and Kanagaratnam [11] introduced the Usefulness Index test to assess the effectiveness of clinical observations. We have previously described the accuracy of the UI test in the clinical diagnosis of acute appendicitis, acute small bowel obstruction, acute renal colic, and non-specific abdominal pain [12-16]. Since the diagnostic accuracy of the UI test has rarely been considered in functional dyspepsia, the aim of the present study was to investigate the contribution of this test to correctly diagnose functional dyspepsia in the clinical situation.

PATIENTS AND METHODS

Criteria for inclusion in this study and the diagnostic criteria were established by the World Organization of Gastroenterology Research Committee (OMGE) [17]. The study group included 636 males (47.7%) and 697 females (52.3%), mean age (± SD) 38.0 ± 22.1 years, with acute abdominal pain of less than 7 days duration. Also included were patients who had been examined clinically by general practitioners and were transferred to the study hospitals. Informed consent was obtained from the patients and study was approved by the Institutional Review Board. The clinical findings in each patient were recorded in detail using a predefined structured data collection sheet [17]. In practice, the structured data sheets were collected by the surgeon in charge, although the same surgeon was responsible for the study and data collection. The selection of patients is described in the OMGE acute abdominal pain survey report [17]. Examinations of the clinical symptoms were conducted using the structured data collection sheets [17] and the clinical symptoms were graded positive (+ = dyspepsia) or negative (- = other diagnosis).

FD = functional dyspepsia
UI = usefulness index

The final diagnosis of acute abdominal pain and FD was reached by considering all symptoms, signs and the results of laboratory tests; the diagnostic criteria are defined elsewhere (OMGE) [17]. The sensitivity, specificity, efficiency, likelihood ratios and predictive values, and the Usefulness Index of the diagnostic methods were calculated [11,18,19]. The UI is defined as d x (d-r), where d is the incidence of the finding in the disease (= sensitivity) and r is the incidence of the finding in a reference population (1 = specificity). It ranges continuously from -1 to 1, and tests where the UI is > 0.35 are regarded as useful [11]. The UI is explained further by Lavelle and Kanagaratnam [11].

The likelihood ratio of a positive test result (LR+) indicates how many times greater the probability of a positive test result is among patients with FD than in subjects without FD. LR+ should always be larger than 1 and LR+ of a good test (diagnostic method) is 10 or more. The likelihood ratio of a negative test result (LR-) is the probability of a negative test result among patients with FD divided by the corresponding probability for subjects without FD. LR- should be less than 1 and the LR- ratio of a good test is less than 0.1.

Efficiency is a measure of the potential discriminating effect of a test before the results of the test are known. Because the efficiency is dependent on the prevalence of disease, the estimated efficiency of the test can only be extrapolated to other populations with a similar prevalence of disease.

When the test result is positive the positive predictive value (PV+) of the test is the probability that a patient has the disease (FD). Likewise, when negative, the negative predictive value (PV-) of the test is the probability that a patient does not have the disease (FD).

A logistic stepwise multivariate regression analysis of the SPSS (Scientific Package for Social Sciences, SPSS, USA) program package was used for calculating the risk ratios of a patient with a given symptom to have FD. The coefficient of the multivariate analysis shows the relative risk of a patient with a given symptom or sign to have FD. All the variables presented in Table 2 were included in the analysis as binary data, e.g., functional dyspepsia (1) and no FD (0).

RESULTS

The present study is based on the clinical presentation of 1333 patients with acute abdominal pain [Table 1]. Of the 27 patients initially considered (in the hospital outpatient unit) to have FD, the final diagnosis of FD was correct in 22 (81.5%). In addition, 28 patients later found to have FD were missed at the initial diagnosis. Thus, the total number of patients with FD was 50 (18 females and 32 males). Sensitivity, specificity, efficiency, LR+, LR-, PV+ and PV- values of the various clinical symptoms and doctors' initial decision in detecting FD are summarized in Table 2. It is of interest to compare the relative "usefulness" of the doctor's initial decision and clinical symptoms; Table 3 shows the variables with a UI greater than 0.10.

In FD the location of the initial pain is usually in the upper abdomen, and in our study the diagnostic efficiency of "the location of initial pain" variable was 0.65 with the UI showing 0.33 and the RR 6.5 [Table 3]. The location of pain at diagnosis was also classified to be in the upper abdomen. In our study the diagnostic efficiency of "the location of pain at diagnosis" variable was 0.67 with a UI of 0.30 and RR of 5.7. About 40% of patients with the diagnosis of FD had nausea and about 60% had vomiting. The vomiting variable had a UI of 0.11 and RR of 2.0. The duration of acute abdominal pain was documented as more than 12 hours in most of the patients with FD (42/50, 84%). The diagnostic efficiency of the duration of pain variable was 0.37 with a UI of 0.19 and RR of 2.9 [Table 3]. The intensity of the pain is usually classified as subjectively weak or moderate in most patients with FD, and in our study 84% of patients (42/50) had subjectively weak or moderate pain. Although the diagnostic sensitivity of the variable for intensity of pain was high, the diagnostic efficiency was only 0.19 with a UI of 0.002 and RR of 1.02.

Previous abdominal disease was recorded in 22/50 patients (44%) with FD, with a diagnostic efficiency of 0.82, UI of 0.12

RR = relative risk

Table 1. Distribution of diagnoses in patients with acute abdominal pain according to physicians' diagnosis, initial diagnosis and final diagnosis

	Diagnosis		
Disease category*	**GP N (%)**	**Initial N (%)**	**Final N (%)**
NSAP (1)	360 (41.1)	552 (41.4)	614 (46.1)
Acute appendicitis (2)	379 (43.3)	402 (30.2)	270 (20.3)
Acute cholecystitis (3)	67 (7.6)	135 (10.1)	125 (9.4)
Small bowel obstruction (4)	15 (1.7)	57 (4.3)	54 (4.1)
Functional dyspepsia (5)	1 (0.1)	27 (2.0)	50 (3.8)
Renal colic (6)	24 (2.7)	59 (4.4)	59 (4.4)
Diverticular disease (7)	0 (0.0)	13 (1.0)	19 (1.4)
Mesenteric lymphadenitis (8)	0 (0.0)	9 (0.7)	11 (0.8)
Acute pancreatitis (9)	18 (2.1)	29 (2.2)	22 (1.7)
Perf peptic ulcer (10)	6 (0.7)	6 (0.5)	9 (0.7)
Urinary tract infection (11)	0 (0.0)	10 (0.8)	22 (1.7)
Acute gyn disease (12)	4 (0.5)	12 (0.9)	15 (1.1)
Miscellaneous (13)	2 (0.2)	22 (1.7)	63 (4.7)
Total	876 (100.0)	1,333 (100.0)	1,333 (100.0)**

*The number in parentheses is the OMGE rank order
** 457 patients with acute abdominal pain presented directly to the hospital for the initial diagnosis

N = no. of patients, GP = general practitioner, NSAP = non-specific abdominal pain, Perf = perforated, gyn = gynecological

LR = likelihood ratio
PV = positive predictive value

Table 2. Clinical symptoms at initial diagnosis of FD: sensitivity, specificity, diagnostic efficiency, LR+, LR-, PV+ and PV-

Symptom	Sens	Spec	Effic	LR+	LR-	PV+	PV-
Location of initial pain (upper vs. other)	0.78	0.65	0.65	2.22	0.34	0.08	0.99
Location of pain at diagnosis (upper vs. other)	0.74	0.67	0.67	2.24	0.39	0.08	0.99
Duration of pain (› 12 hr)	0.84	0.35	0.37	1.30	0.45	0.05	0.98
Intensity of pain (weak/ moderate)	0.84	0.16	0.19	1.002	0.99	0.04	0.96
Progression of pain (same/weaker pain)	0.66	0.29	0.30	0.93	0.48	0.04	0.96
Type of pain (continuous)	0.54	0.45	0.46	0.98	1.02	0.04	0.96
Aggravating factors (yes)	0.28	0.73	0.72	1.04	0.99	0.04	0.96
Relieving factors (none)	0.74	0.33	0.34	1.10	0.79	0.04	0.97
Previous similar pain (yes)	0.66	0.67	0.67	2.00	0.51	0.07	0.98
Vertigo (no)	0.96	0.03	0.06	0.99	1.33	0.04	0.95
Nausea (yes)	0.38	0.57	0.57	0.88	1.09	0.03	0.96
Vomiting (yes)	0.60	0.58	0.58	1.43	0.69	0.52	0.97
Appetite (poor)	0.86	0.27	0.29	1.18	0.52	0.04	0.98
Previous indigestion (yes)	0.44	0.80	0.78	2.20	0.70	0.08	0.97
Jaundice (no)	0.94	0.02	0.06	0.96	2.61	0.04	0.91
Bowel function (abnormal)	0.32	0.74	0.75	1.23	0.92	0.05	0.97
Micturition (normal)	0.96	0.07	0.01	1.03	0.61	0.04	0.98
Drugs for abdominal pain (yes)	0.16	0.96	0.93	4.44	0.87	0.15	0.97
Previous abdominal surgery (yes)	0.56	0.76	0.75	2.33	0.58	0.08	0.98
Previous abdominal diseases (yes)	0.44	0.83	0.82	2.59	0.67	0.09	0.97
Use of alcohol (no)	0.94	0.05	0.08	0.99	1.20	0.04	0.96
Initial diagnosis	0.44	0.99	0.98	110.0	0.56	0.81	0.98

The positive results for FD are in parenthesis

Sens = sensitivity, Spec = specificity, Effic = efficiency, LR = likelihood ratio, PV = predictive value

and RR of 4.0. About two-thirds of the patients with a diagnosis of FD (33/50) had experienced previous similar pain. About one-half of the patients with FD had undergone previous abdominal surgery (UI = 0.18, RR = 4.1).

The sensitivity of the general practitioners' initial decision in detecting FD was 0.44, with a specificity of 0.99 and an efficiency of 0.98 (UI = 0.19, RR = 195.3). The most significant predictors of FD in univariate analysis were: location of pain at diagnosis (upper abdomen vs. other, E = 0.67, UI = 0.30, RR = 5.7), location of initial pain (upper abdomen vs. other, E = 0.65, UI = 0.33, RR = 6.5), previous similar pain (yes, E = 0.67, UI = 0.22, RR = 4.0), duration of pain (> 12 hours, E = 0.37, UI = 0.19, RR = 2.9), previous abdominal surgery (yes, E = 0.75, UI = 0.18, RR = 4.1), previous abdominal diseases (yes, E = 0.82, UI = 0.12, RR = 4.0), and previous indigestion (yes, E = 0.78, UI = 0.11, RR = 3.1). In the stepwise multivariate logistic regression analysis, the independent predictors of FD were the doctor's initial decision (RR = 266.4), location of initial pain (RR = 3.4), duration of pain (RR = 3.1), previous abdominal surgery (RR = 3.7), previous indigestion (RR = 2.2) and vomiting (RR = 2.0) [Table 4].

E = efficiency

Table 3. Initial diagnosis and clinical symptoms in patients with FD: usefulness index (UI) › 0.10, diagnostic efficiency (E), positive likelihood ratios (LR+) and risk ratios (RR)

Symptom	E	LR+	UI	RR (95% CI)
Initial diagnosis	0.98	110.0	0.19	195.3 (66.3–697.0)
Location of initial pain (upper abdomen vs. other)	0.65	2.22	0.33	6.5 (3.2–14.2)
Location of pain at diagnosis (upper abdomen vs. other)	0.67	2.24	0.30	5.7 (2.9–11.9)
Previous similar pain (yes)	0.67	2.02	0.22	4.0 (2.1–7.8)
Duration of pain (› 12 hr)	0.37	1.30	0.19	2.9 (1.3–7.1)
Previous abdominal surgery (yes)	0.75	2.33	0.18	4.1 (2.2–7.6)
Previous abdominal diseases (yes)	0.82	2.59	0.12	4.0 (2.1–7.3)
Previous indigestion (yes)	0.78	2.20	0.11	3.1(1.7–5.8)
Appetite (poor)	0.29	1.18	0.11	2.3 (1.0–6.1)
Vomiting (yes)	0.58	1.43	0.11	2.0 (1.1–3.8)

RR = risk ratio, CI = confidence interval

Table 4. Independent predictors of functional dyspepsia as diagnosis of acute abdominal pain in logistic stepwise multivariate regression analysis

Predictor	B (SE)	RR (95% CI)	*P* value
Doctors' initial diagnosis	5.6 (0.6)	266.4 (83.5–1036.2)	‹ 0.001
Location of initial pain (upper abdomen vs. other)	1.2 (0.4)	3.4 (1.5–8.1)	‹ 0.01
Duration of pain (› 12 hr)	1.1 (0.5)	3.1 (1.3–9.4)	‹ 0.05
Previous abdominal surgery (yes)	1.3 (0.4)	3.7 (1.7–8.3)	‹ 0.01
Previous indigestion (yes)	0.8 (0.4)	2.2 (1.0–4.9)	‹ 0.05
Vomiting (yes)	0.7 (0.4)	2.0 (0.9–4.7)	0.09

B = coefficient of the logistic regression mode standard error, RR = risk ratio, CI = confidence interval

DISCUSSION

Most studies on the value of history-taking in FD have been performed in patients referred for gastroscopy. The diagnostic efficiency of UI has rarely been investigated. One of the most difficult problems in diagnosing FD is the lack of a 'golden standard' [8]. To overcome this problem we calculated the sensitivity, specificity, efficiency, likelihood ratios and predictive values, and the UI of history-taking in FD.

The location of initial pain and at diagnosis is usually in the upper abdomen in FD. Pajala et al. [20] reported that in

77% of patients with FD the location of pain was the upper abdomen. In our study 78% of patients with FD (39/50) had initial pain in the upper abdomen and 70% (35/50) had pain in the upper abdomen at diagnosis.

The duration of acute abdominal pain should be accurately quantified in hours or days. The time of onset of the abdominal pain and whether it has been continuous or intermittent should be noted. If the present episode of acute abdominal pain has lasted for more than one week it may not be an acute abdominal pain episode at all. In our study 84% of patients with a diagnosis of FD had > 12 hours pain duration and a diagnostic efficiency of 0.37 and UI of 0.19.

Acute abdominal pain is usually weak or moderate in FD. In 84% of the patients with FD (42/50) the acute abdominal pain was mild or moderate and only in 16% was the pain severe, i.e., causing the patient to shiver, sweat, roll around, or cry out. The diagnostic efficiency of the "intensity of pain" variable was 0.19. Acute abdominal pain often varies in intensity, but the doctor should note the variation if the pain is clearly the same or decreases/increases over a period of at least an hour or two. Acute abdominal pain was classified to be the same or decreasing in 66% of patients with FD, and the diagnostic efficiency of the symptom progression of pain was 0.30.

In patients with acute abdominal pain the questions on nausea and vomiting should be asked separately although they are usually regarded as well-defined symptoms. In our study only 38% of patients with an FD diagnosis had nausea and the diagnostic efficiency of nausea was only 0.57. Some junior doctors are unaware that a patient can vomit without nausea, and this applies especially to adolescents and children. In our study 60% of patients with an FD diagnosis had vomiting, and the diagnostic efficiency of nausea was only 0.58 with a UI of 0.11.

"Previous similar pain" means similar episodes of acute abdominal pain at some point in the past. The doctor should distinguish between these previous episodes and the present episode of pain and try to determine when the pain occurred and what, if anything, had been done about it. In our study 66% of patients with an FD diagnosis had previous similar pain, with a diagnostic efficiency of 0.67 and UI of 0.22.

If possible, the physician should try to establish where and when any previous abdominal surgery was performed, the reason for the surgery, and whether any problems occurred during or after. In our study 56% of patients with an FD diagnosis had previous abdominal surgery, with a diagnostic efficiency of 0.75 and UI of 0.18.

A history-taking of a patient with acute abdominal pain is not complete without information about medications and previous abdominal diseases. In our study 44% of patients with an FD diagnosis had previous abdominal diseases with a diagnostic efficiency of 0.82 and UI of 0.12.

Some of the terms regarding FD should be considered. Efficiency (E) is the ability to diagnose the disease correctly or incorrectly. Findings with high LRs will achieve that goal. The efficiency is also dependent on the prior probability or prevalence of the disease [16]. Therefore, the most compelling findings of FD are location of initial pain (E = 0.65), previous indigestion (E = 0.78), and previous abdominal surgery (E = 0.75). Each has a positive likelihood ratio > 2.0 with an RR of 3.1–6.5.

In conclusion, the results of this study do not support a strong link between specific clinical symptoms and functional dyspepsia. However, patients with upper abdomen pain initially and a previous history of abdominal surgery and indigestion tended to be at risk for FD. In these patients the Usefulness Index test might be an aid for the clinician to differentiate dyspepsia from other diagnoses.

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