

ORIGINAL ARTICLE

A new Gastropanel quick test for non-invasive diagnosis in dyspeptic patients. The first experience in primary care setting in North East Italy

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Abstract. *Background:* Gastropanel is a non-invasive serological test based on Pepsinogens, Gastrin 17, IgG against Hp. *Aim of the study:* To assess the clinical usefulness of a new Gastropanel quick test in a sample of dyspeptic patients in primary care setting. *Methods:* The GastroPanel® quick test (Biohit Finland), is a rapid lateral flow immunochromatographic POCT test. The results could be available in fifteen minutes. *Patient's Population:* One hundred and eighty-eight (76 M, 112 F) dyspeptic patients were investigated by using serum pepsinogens, gastrin 17 and IgG against (Gastropanel quick Test). *Results:* Patients were singled out as follows: 1) Functional Dyspepsia (72 pts); 2) GERD (40 pts) 3) GERD under PPIs (37 pts), 4) Non-Atrophic Gastritis Hp + (29 pts), 5) Autoimmune Atrophic Gastritis (6 pts), 6) Multifocal Atrophic Gastritis (4 pts). PGI: the greatest increase in patients on PPIs therapy (148.1 mg/L; $p < 0.0001$), a more moderate increase in Hp patients (116.8 mg/L; $p < 0.001$) and a significant decrease in AAG groups (29.4 mg/L; $p < 0.0001$) and MAG (28.5 mg/L; $p < 0.0001$). PGII: an increase in PPIs users (28.2 mg/L; $p < 0.001$) and in Hp positive subjects (26.0 mg/L; $p < 0.001$). G17: low in GERD subjects (1.8 pmol/L; $p < 0.01$). Subjects on PPIs show elevated levels (15.7 pmol/L; $p < 0.0001$). Patients with AAG show increased G17 (9.2 pmol/L; $p < 0.05$), MAG subjects show low levels (2.0 pmol/L; $p < 0.01$). *Conclusion:* This study shows that the new Gastropanel quick test is a reliable method also in a non-laboratory setting. Therefore, it could be proposed as the first approach in primary care. (www.actabiomedica.it)

Key words: dyspepsia, Gastropanel quick test, pepsinogens, gastrin 17, atrophic gastritis

Introduction

Dyspepsia is a widespread gastrointestinal disorder of upper gastrointestinal tract that affects about 30% of the adult population. The diagnosis can be made on the basis of clinical or instrumental criteria. An international consensus called Rome IV identifies various categories of symptoms to single out patients according

to specific subgroups (1-3). For diagnosis, instrumental methods such as gastroscopy or indirect tests such as blood samples can be used, and among these the most important is Gastropanel, also called serological biopsy, introduced into clinical practice since 2000 based on four parameters: Pepsinogen I (PGI), Pepsinogen II (PGII), Gastrin 17 (G17) and antibodies against *Helicobacter pylori* (Hp). In this way, it is possible to

analyze the four analytes to make diagnosis if there is a form of atrophic or non-atrophic gastritis, if Hp infection is present (4-7) or if there is an acid-related disease such as gastroesophageal reflux (GERD) (8-10). Recently, a simplification of the gastropanel has been introduced into clinical practice and can be determined using a capillary blood sample from the finger as well as venous sampling (11). This greatly simplifies the procedures, making it possible to carry out the examination even outside hospital laboratories, for example at the level of pharmacies or doctors' offices. In addition to the lower cost, the examination represents a small revolution in this field due to the possibility of having the diagnosis in 10-15 minutes from the sampling. This is essential to be able to quickly establish the conditions of the upper digestive tract after collecting the patient's symptoms, thus facilitating the diagnostic and therapeutic process. In particular, after carrying out the Gastropanel quick it will be possible to understand for each individual patient whether he needs to perform a gastroscopy or not, if he needs therapy with proton pump inhibitors (PPIs), if he needs therapy to eradicate *Helicobacter pylori* infection. There is a large scientific literature on the possibility for the gastropanel to correctly diagnose the pathologies described above affecting the upper digestive tract. In particular, the major international consensus of the last 10 years, Kyoto, Maastricht and Regain (5, 12, 13) have confirmed that the gastropanel represents "the best non-invasive test" to diagnose some diseases of the digestive system, including the diagnosis of a precancerous stomach condition called atrophic gastritis (14-18). There is also a form of atrophic gastritis localized in the body-fundus of the stomach, called autoimmune gastritis linked to other autoimmune diseases such as Hashimoto's thyroiditis, which can be easily diagnosed by means of the gastropanel (19, 20). It is also possible by means of this examination to reduce the number of inappropriate gastroscopies and to calibrate PPI therapy in the most correct way, excluding, for example, subjects who do not have acid production in the stomach (21).

Aim

The present work aims to collect the first Italian case series of consecutive dyspeptic patients in primary care setting to determine the Gastropanel quick test

and quickly provide a diagnosis of the main diseases of the upper digestive tract. In this way, it was possible to determine the presence of gastric precancers such as atrophic gastritis, conditions related to gastric hypersecretion such as gastroesophageal GERD, the presence of *Helicobacter pylori* infection, functional dyspepsia and the ability of PPIs to act on the gastric mucosa.

Casistics

In a primary care setting, 188 (76 M, 112 F; mean age: 49.8 ys; range: 22-81 ys) consecutive dyspeptic patients were investigated in order to establish the proper diagnosis. The diagnostic workup included a structured questionnaire including type and severity of symptoms and determination of serum pepsinogens, gastrin 17 and IgG against Hp by using Gastropanel quick Test.

Exclusion criteria were chronic gastrointestinal diseases (liver cirrhosis, peptic ulcer disease and GERD, pancreatic and biliary diseases) , neoplasms, neurological diseases, chronic assumption of drugs except for PPIs as well as chronic renal failure. Inclusion criteria were dyspeptic symptoms lasting more than 1 year, related with food ingestion and symptoms like epigastric pain, nausea and/or vomiting, post prandial fullness, early satiation. All patients were addressed to a referral center (apotheker or gastroenterological unit) to assess diagnosis, which was established by a gastroenterologist, in cooperation with general practitioners. Symptoms were collected focusing on four items: epigastric pain, post-prandial fullness, nausea and/or vomiting, early satiation, by means of a structured questionnaire, including a score of severity from zero to four (corresponding to absence of symptoms, mild, moderate, or severe symptoms, respectively).

Patients were divided into six groups as follows:

- a. Functional dyspepsia (FD), according with Rome IV
- b. Gastroesophageal GERD (GERD), based on the presence of typical symptoms (heartburn, regurgitation)
- c. Subjects under PPIs full dose therapy for at least two months
- d. Subjects infected by *Helicobacter pylori* (Hp). Diagnosis confirmed by UBT or HpSA

- e. Autoimmune Atrophic Gastritis (AAG), confirmed by histology and serology for APCA
- f. Multifocal Atrophic Gastritis (MAG), confirmed by histology.

When patients experienced more than one symptom, each symptom was recorded as a separate item. Epidemiological and environmental risk factors like smoking (cut off 10 cigarettes/day), alcohol intake (cut off 20 g/day), obesity (B.M.I >30), drug injection, first degree familiarity for gastrointestinal diseases, concomitant disease(s) were recorded. An upper GI endoscopy was performed in patients with diagnosis of atrophic gastritis. In subjects positive for Hp infection, a direct test (UBT or Stool Antigen Test- SAT) was performed to confirm diagnose and gastric biopsies were taken according to the Kyoto (20) protocol and classified according to OLGA (21) staging. In all patients a serological sample was obtained to measure levels of pepsinogen I and II, gastrin 17 and IgG antibodies against Hp. The new Gastropanel quick test (Biohit, Helsinki, Finland). Normal ranges: PGI: 30-160 µg/L; PGII: 3-15 µg/L; PGI/PGII: 3-20 µg/L; G17: 1.8-7 pmol/L; Hp: 0-25 EIU

Methods

The latest ELISA version of the GP test (unified-GP) harmonizes the laboratory processing conditions of the 4 biomarkers (22, 23). GastroPanel® quick test (GPQT) was developed for point-of care (POC) diagnosis during a single clinical appointment (24). The results of GPQT (a lateral-flow test) are read in 15 minutes with the GastroPanel® Reader instrument (GP reader NT) (25), and their interpretation is based on the same diagnostic GastroSoft® algorithm as in the ELISA versions [18, 22-24, 26].

Preparation for GPQT sampling

Detailed instructions on the pre-sampling preparatory measures were given to the patient at the time of his/her consenting to participate. The patient was instructed to follow a 10-hour fasting overnight [23, 24]. The use of PPIs was recorded (type and dosage) as well as the assumption of anti-acids and mucosal protective agents (22 - 24, 27)

GastroPanel® Quick Test (GPQT)

GastroPanel® Quick Test (GPQT) is a lateral-flow test, based on immunoassay method detecting four biomarkers, PGI, PGII, G-17 and HpAb, from a blood sample (whole blood, plasma, or serum)(24). The capability of the GPQT to provide the test results during a single clinical visit is a major advantage to the GastroPanel® ELISA versions that all need a clinical laboratory (25, 26, 23).

Sample collection for GPQT

For GPQT, the whole blood sample can be obtained from fingertip blood drop. Finger-prick blood samples (2×40µl) are collected with disposable micropipettes and transferred into the sample tubes pre-filled with sample dilution buffer [23].

Sample processing for GPQT

Dispensed samples are transferred with disposable transfer pipettes from the sample tubes into the four sample holes (80µl into each hole) of the lateral-flow test cassette. The cassette is measured after 15 minutes using the GastroPanel® Reader instrument (GP reader NT) (25). Results can be read on the reader screen and also printed. The printed report shows both numerical values of all biomarkers and a written interpretation of the test result (23-26)

Interpreting the GPQT results

The results of the GPQT are interpreted by GastroSoft® application, designed for use with the Updated Sydney System (USS) classification of gastritis (28, 29). Both use the same diagnostic categories: 1) normal stomach mucosa, 2) Hp-induced gastritis (with no atrophy), 3) atrophic antrum gastritis (AGA), 4) atrophic corpus gastritis (AGC) and 5) atrophic pan-gastritis (AGP) (24, 25, 28-31).

Gastroscopy and Biopsies

Esophago-gastro-duodenoscopy (EGD) was performed in patients with diagnoses of atrophic gastritis, following the routine procedures. On EGD, the

gastric mucosal atrophy was evaluated according to the Sydney and OLGA systems (28, 29, 32).

UBT

To perform this test, isotopically labelled urea (^{12}C , ^{13}C , or ^{14}C) is administered into the patient and bacterial urease produced by *H. pylori* into the stomach will be measured. If the urease enzyme is present in the stomach, the urea is broken down into carbon dioxide and ammonia. CO_2 reflects the flow of blood and ex-hale and can be measured with a mass spectrometer.

SAT

Although both monoclonal and polyclonal antibodies can be used in this method, monoclonal antibodies showed a higher sensitivity than another one mainly because of the difficulty in obtaining polyclonal antibodies of consistent quality every time.

Statistical analyses

Statistical analysis was performed by using Fisher test for paired data. The statistical significance was considered as $p < 0.05$.

Results

Table 1 summarises the details of the patients' populations.

Most of the studied patients belong to the functional dyspepsia group in accordance with the chosen criteria. This is followed by the population of subjects suffering from gastroesophageal GERD, then patients under PPIs, patients with documented Hp infection,

and a small group of patients with MAG and with AAG. If we consider the average ages of the subjects of the various groups, we can observe that, as expected, older patients belong to the category of subjects with MAG, because of previous Hp infection. On the other hand, the subjects, almost all females, of the autoimmune atrophic gastritis group belong to a much younger age group. Subjects on continuous therapy with PPIs almost always for GERD, belong to an intermediate range, while subjects with GERD and not yet therapy with PPIs have the typical symptoms, as specified in the methods, and are relatively younger in age. Finally, the largest group represented by patients with functional dyspepsia has a wide age range and an unbalanced gender distribution in favor of the female sex and varies in age from the youngest to the most advanced groups.

The results show some statistically significant differences between the various groups studied, in particular concerning PGI: there is no difference between Functional Dyspepsia and GERD, while the greatest increase is found in patients on PPIs therapy (148.1 mg/L; $p < 0.0001$) a more moderate increase in subjects infected with Hp (116.8 mg/L; $p < 0.001$) and a significant decrease in both atrophic AAG groups (29.4 mg/L; $p < 0.0001$) and MAG (28.5 mg/L; $p < 0.0001$). As far as PGII is concerned, there is no difference between Functional Dyspepsia and GERD (12.7 and 13.6 mg/L respectively) while a statistically significant increase is present in subjects with therapy in PPIs (28.2 mg/L; $p < 0.001$) and in Hp positive subjects (26.0 mg/L; $p < 0.001$). Patients with atrophic gastritis show similar PGII values, i.e. (8.0 for AAG and 8.3 mg/L for MAG; $p < 0.001$). G17 values are normal in the Functional Dyspepsia group (4

Table 1. Patients population: 188 pts (76 M, 112 F) mean age: 49.8 ys

	Functional dyspepsia	GERD	PPIs	Hp	AAG	MAG
Patients n.	72	40	37	29	6	4
Sex (M; F)	26; 46	17; 23	16; 21	13; 16	1; 5	3; 1
Mean Age	49.4	41.9	47.3	65.6	39.8	71.3
Range	27-68	25-63	26-72	38-83	25-47	62-76

Abbreviations: GERD = gastroesophageal reflux, AAG= Autoimmune Atrophic Gastritis, MAG= Multifocal Atrophic Gastritis, PPIs= Patients under Proton Pump Inhibitors therapy, Hp= Patients infected by *Helicobacter pylori*.

Table 2. Gastropanel results according to groups

	Functional dyspepsia	GERD	PPIs	Hp	AAG	MAG
Patients n.	2	40	37	29	6	4
PGI(mg/L)	92.9	93.01	148.1	116.8	29.4	28.5
PGII(mg/L)	12.7	13.6	28.2	26.0	8.0	8.3
G17(pmol/L)	4.6	1.8	15.7	6.7	9.2	2.0
Hp(EIU)	19.3	16.5	18.9	84.9	19.8	21.9

pmol/L) and low in subjects with GERD (1.8 pmol/L; $p < 0.01$). Subjects on PPIs show elevated levels of G17 (15.7 pmol/L; $p < 0.0001$). Patients with AAG show increased G17 (9.2 pmol/L; $p < 0.05$) while subjects with MAG show low levels of G17 (2.0 pmol/L; $p < 0.01$). Levels of anti-Hp antibodies are within normal limits in all groups except in patients with Hp infection (84.9 EIU; $p < 0.0001$) (Table 2).

Discussion

This study represents the first clinical validation in Italy of the new Gastropanel quick test: the new test takes up the methodology of the classic gastropanel that has been currently used in the laboratory, but with some substantial innovations that mainly consist of low cost, speed of execution with results available within 10-15 minutes and with the possibility of confirming all the results already present in the literature. A group of 188 consecutive dyspeptic patients were studied in a primary care setting by using a structured questionnaire for the collection of symptoms and by the execution of the Gastropanel quick test. The patients were divided into different groups according with symptoms and the results of endoscopy with biopsies of gastric mucosa when the serological diagnosis with the gastropanel suggested the presence of MAG or AAG, patients in whom the test showed Hp infection received a direct test such as UBT or SAT to confirm the diagnosis. The results confirm the results already present in the literature by using gastropanel. In particular, the most important results can be summarized as follows: 1) subjects with functional dyspepsia show a normality of the four analytes, 2) patients with GERD are identified by low levels of gastrin 17

as already demonstrated in previous works, 3) subjects under PPIs, mainly affected by GERD, show a significant increase in both PGI and G17 levels as expected, 4) subjects with documented Hp infection show an increase in both the index of non-atrophic gastritis i.e. PGII and antibodies against Hp. Finally, the small but significant group of subjects with gastric precancerosis i.e. atrophic gastritis show a decrease in PGI and a significant increase in G17 as far as the AAG group is concerned. The group of patients with MAG shows an overall decrease in all investigated analytes. Beyond the confirmation of the results obtained with the new test, it is important to underline some points. First of all, the Gastropanel quick test make possible, with the patient still in the clinic, after collecting the symptoms, to analyze all the features on the stomach morphology and function without wasting time and without delays, as was the case in the past when the test was sent to the laboratory. This gives the doctor the opportunity to immediately establish the more appropriate measures, which could be summarized as follows: a) when the Gastropanel quick test shows a diagnosis of MAG or AAG, the indication to perform a gastroscopy with targeted mapping of the stomach and related follow-up, b) when the diagnosis is of Hp infection without MAG or AAG, gastroscopy is not necessary and it is possible to immediately start antibiotic therapy for the cure of the infection, c) when G17 levels are low in accordance with the GERD symptoms presented by the patients, the diagnosis is confirmed and therapy with PPIs can be started and d) for subjects on PPIs therapy, the test shows the increase in G17 and PGI and II, allowing dosages to be modulated in the individual subject, and, finally, e) in a group of patients possibly on PPIs therapy, the absence of gastric acid related to MAG or AAG, gives the indication not to use PPIs in

this category of patients. The results show that the use of the new Gastropanel quick test in outpatient setting or in a point of care such as pharmacies can represent a useful tool to improve diagnostic appropriateness in the functional dyspepsia and to address investigations, establish the most appropriate therapies savings time, resources and unnecessary tests.

Conclusions

The present study collects the first Italian case series on the use of the Gastropanel quick test in current clinical practice. 188 patients with dyspeptic symptoms were enrolled in primary care setting and evaluated with the new test, which allows in a very short time of 10-15 minutes, to obtain a non-invasive both functional and morphological evaluation of the stomach, by measuring the values of PGI, PGII, G17 and levels of anti-Hp antibodies. The results seem similar to those already present in the huge literature on the gastropanel and have made it possible to single out with statistically significant values the group of patients with functional dyspepsia from subjects with typical symptoms of GERD, from subjects on continuous therapy with PPIs, Hp infected and finally from the most important category, because it represents an indication to perform a gastroscopy with targeted biopsies of the gastric mucosa, namely atrophic gastritis both localized to the body-fundus and multifocal. These results are encouraging in proposing the new test in current clinical practice with the possibility, unlike previously, of being able to formulate a correct diagnosis of the presence of atrophic gastritis, Hp infection, diagnosis of GERD directly with the subject in the outpatient clinic, after collecting the medical history, thus allowing the patient to be directed to the best diagnostic choice, avoiding unnecessary invasive tests or addressing patients with atrophic gastritis to perform targeted biopsies. Finally, it will be possible to directly refer patients with Hp infection to eradication therapy with antibiotics and GERD patients to appropriate therapy with PPIs.

Ethics Committee: The study was performed following the declaration of Helsinki and approved by local Ethics Committee (Identifier: 92687).

Conflicts of Interest Statement: FDM declares a consulting agreement with Biohit (Helsinki, Finland). FG declares that it is employed by Biohit (Helsinki, Finland). The other authors declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement, etc.) that might pose a conflict of interest in connection with the submitted article.

Authors Contribution: FDM (Concept, Study Design, Resources, Data Collection, Analysis and Interpretation, Writing Manuscript, Supervision). LF (Analysis and Interpretation, Analysis and Interpretation, Supervision). PC (Analysis and Interpretation, Literature Search, Writing Manuscript). MF (Analysis, Processing, Critical Review). KRC (Analysis, Processing, Critical Review). CP (Data Collection). RV (Data Collection). FG (Blind sampling processing). GB (Analysis and Interpretation). AT (Critical Review). All authors have read and approved the final version of the manuscript.

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