The Relationship Between Abdominal Pain Regions and Specific Diseases: An Epidemiologic Approach to Clinical Practice

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In order to evaluate the relationship between the patient-identified regions of abdominal pain and the disease diagnosis, a prospective study was conducted at General Medicine Outpatient Clinic, Saga Medical School Hospital. Four hundred eighty-nine outpatients complaining of abdominal pain at the first visit were classified into 10 groups according to the pain region complained of, i.e., whole abdominal, epigastric, right subcostal, left subcostal, right flank, left flank, periumbilical, right-lower, mid-lower, and left-lower; the clinic physicians and authors in joint-participation assigned the groups through studying the medical records. Comparisons were made in order to calculate sensitivity, specificity, and the positive and negative likelihood ratios between the pain regions and disease diagnoses.

In general, the sensitivity of history-taking and physical examination is low, but specificity is high in relation to epigastric pain and gastroduodenal diseases, right subcostal pain and hepatobiliary diseases, and mid lower pain and gynecological diseases (above 0.5).

Comparative analysis between the pain regions complained of by the patient in the initial clinic visit and the medical diagnoses yielded clinically useful information as to the efficacy of medical history-taking and physical examination in the identification of abdominal diseases.

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Unlike imaging techniques such as ultrasonography, radionuclide scanning, and computed tomography, the value of history taking and physical examination, which are not infrequently most important part of diagnostic process, has been rarely evaluated by scientific methods. Recently, however, some researchers have made use of epidemiological methods in evaluating these basic clinical skills in clinical practice¹⁻⁴⁾.

Regarding abdominal pain, textbooks describe that pain in certain abdominal regions ensue in a given certain disease state. However, there are few reports that indicate precisely how we can determine the diseased organ by identifying the pain region. Eskelien et al.⁵⁾ reported that the most significant predictors of acute appendicitis in patients older than 50 years of age were tenderness (relative risk (RR) = 39.4), rigidity (RR = 18.8), and pain at diagnosis (RR = 11.0). The sensitivity of the preoperative clinical decision in detecting acute appendicitis in the elderly patients was 0.87, with a specificity of 0.92. Boulhner et al.⁶⁾ also reported the sensitivity and specificity of rebound tenderness as 0.91 and 0.80, tenderness in the right-lower quadrant as 0.95 and 0.70, pain in the right-lower quad-

rant at presentation as 0.94 and 0.70, onset of pain in the right-lower quadrant as 0.88 and 0.75, rigidity as 0.84 and 0.95, and guarding as 0.87 and 0.76. In another report, Eskelien et al.⁷⁾ found that the most efficient symptoms in diagnosis of acute small-bowel obstruction were previous abdominal surgery (RR=12.1) and type of pain (colic/intermittent versus steady) (RR=2.4). On the other hand, Malone et al.⁸⁾ reported that the unenhanced computed tomography (CT) had a sensitivity of 0.87 and a specificity of 0.97 for the initial examination of patients with suspected acute appendicitis. That is, the accuracy of unenhanced CT was mostly the same as that of rigidity of pain in the right-lower quadrant in detecting acute appendicitis. Davies et al.⁹⁾ found that ultrasonography had a sensitivity of 0.96, a specificity of 0.94 in the acute abdomen. However, Frase et al.¹⁰⁾ reported that non-specific abdominal pain was associated with persisting pain (RR=2.22) but the sensitivity and specificity of questionnaire assessment were too low to be useful in making a clinical diagnosis.

To know the probability of the diseased organ from the pain region complained of, this study prospectively evaluated the

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correlation between the regions of abdominal pain identified by the patients and the diseased organs subsequently diagnosed, using such clinical epidemiological characteristics as sensitivity, specificity, and predictive value.

METHODS

Patients and Doctors

Subjects were selected from the patient population ($n=6021$) who visited the general medical clinic of Saga Medical School Hospital between April 1, 1988, and March 31, 1989. Four hundred and eighty-nine outpatients complaining of abdominal pain at the first visit were examined by 12 general physicians during the study period. The patients' medical histories were recorded by each doctor using a form prepared for this study. There was no protocol established for history taking and physical examination, which were done routinely.

Classification of Abdominal Pain Regions

The subjects were classified into 10 groups according to the pain region complained of, i.e., whole abdominal, epigastric, right subcostal, left subcostal, right flank, left flank, periumbilical, right-lower, mid-lower, and left-lower.

Gold Standard

Three months after the first visit, we evaluated the subjects' medical records regarding final diagnosis based on the results of blood and urine tests, X ray, and imaging techniques such as ultrasonography. Blood and urine tests, X ray, and other imaging tests were not always done in all patients, especially for patients with low probability for significant disease. The number of final diagnosis was made single about abdominal pain.

Gold standards for making diagnoses were as follows. Some of the malignant diseases were diagnosed by either biopsy or operation, but others of those were diagnosed by only imaging techniques such as ultrasonography, radionuclide scanning, and computed tomography. Gastric, duodenal or peptic ulcer, anisakiasis, gastric polyp, and esophageal varices were diagnosed by either barium-swallow gastrointestinal (GI) series or endoscopy. Duodenal diverticula, post-gastrectomy syndrome, post-operative intestinal adhesion, diverticulitis, and ulcerative colitis were diagnosed by either barium-swallow GI series, barium-enema or endoscopy. The diseases of the liver and biliary tract or pancreatitis were diagnosed by both ultrasonography and blood test. The diseases of the cardiovascular system or pleuritis were diagnosed by ultrasonography, X-ray, electrocardiogram (ECG), and blood test. The diseases of the uterus and ovary were diagnosed by ultrasonography, X-ray, and blood test by gynecologist. The diseases of the urinary tract were diagnosed by ultrasonography, intravenous pyelogram, and urine test. According to gastritis, acute enteritis, gas pain, irritable bowel syndrome, upper respiratory infection, and psy-

chological problem, the decision of the clinicians based on the results of blood and urine tests, X ray, and imaging techniques is the gold standard for diagnosis. Neuralgia and musculoskeletal diseases without specific skin lesions were re-determined on the bases of history and follow-up findings.

Analysis

We calculated the sensitivity, specificity, and likelihood ratios of each abdominal pain region with respect to organ disease. Bivariate analysis about the relationship between the patient-identified regions of abdominal pain and the disease diagnosis was calculated using chi-square test and differences in subject characteristics were analyzed by one way layout analysis of variance (ANOVA). Significance levels were set to 0.05. The JUMP statistical package (SAS Inc., USA) was utilized for the analysis.

RESULTS

Twelve physicians (mean post-graduate year, 6.3; range, 2 to 19) saw a total of 489 patients with abdominal pain in a 1-year period (8.1% of patients who visited the general medical clinic).

Patient characteristics were as follows: men, 214; women, 275; mean age $\pm$ standard deviation, 44.4 ± 16.4 ; range of age, 16 to 89. Difference of mean age of subgroups of pain region was not significant for one way layout ANOVA ($P=0.87$). However, sex difference of distribution of subgroups of pain region, epigastric pain, was significant for chi-square ($P=0.01$).

The number of subjects according to pain region as follows: whole abdominal pain, 61; epigastric, 232; right subcostal, 45; left subcostal, 5; right flank, 13; left flank, 18; periumbilical, 7; right-lower, 30; mid-lower, 49; and left-lower, 29. Distribution with respect to the regions of abdominal pain and final diagnoses was shown in Figure 1.

Final diagnoses were as follows: gastroduodenal disease, 39.1%; intestinal disease, 24.5%; hepatobiliary disease, 7.6%; urinary tract disease, 4.1%; gynecological disease, 3.9%; musculoskeletal disease, 3.5%; respiratory disease, 0.8%; skin disease, 0.8%; pancreatic disease, 0.6%; cardiovascular disease, 0.6%; others 14.4%. Distribution of specific disease in these categories was shown in Table 1.

With respect to the etiology about abdominal pain, the number of subjects who had a inflammation was 156, functional disorder 78, ulcer 63, normal findings 55, stone of organs 29, viral or bacterial infection 21, malignant disease 16, psychological problem 12, post-operative disorder 5, unknown origin 2, and others 52.

Table 2 shows the sensitivity, specificity, and positive and negative likelihood ratios of specific pain regions for diseases of the stomach and duodenum, intestine, liver and biliary tract, uterus and ovary, and urinary tract. Likelihood ratios are an alternative way of describing the performance of a diagnostic

test. They summarize the same kind of information as sensitivity and specificity and can be used to calculate the probability of disease after a positive or negative test ³.

Right-subcostal pain related to hepatobiliary diseases, periumbilical pain related to intestinal diseases, and mid-lower

pain related to gynecological diseases had high positive likelihood ratios. On the other hand, epigastric pain related to gastroduodenal diseases, and mid-lower pain related to gynecological diseases had low negative likelihood ratios.

GD: gastroduodenal disease, HB: hepatobiliary disease, PD: pancreatic disease, ID: intestinal disease
 UT: urinary tract disease, GY: gynecological disease, MS: musculoskeletal disease, RD: respiratory disease,
 CV: cardiovascular disease, SD: skin disease, OT: other
 (/) means number of male/female

Figure 1. Patient distribution with respect to the regions of abdominal pain and final diagnoses.

Table 1. Final diagnoses in patients presenting with abdominal pain at the general medical clinic of Saga Medical School Hospital.

Diseases of the esophagus, stomach and duodenum	190	Gastritis	111
		Gastric ulcer	37
		Duodenal ulcer	19
		Peptic ulcer	7
		Gastric cancer	6
		Duodenal diverticula	3
		Anisakiasis	3
		Gastric polyp	2
		Post-gastrectomy syndrome	1
		Esophageal varices	1
Diseases of the liver and biliary tract	37	Gall stone	17
		Hepatitis	8
		Liver tumor	5
		Infection of biliary tract	3
		Gallbladder cancer	2
		Hepatosplenomegaly	2
Diseases of the pancreas	3	Pancreatic cancer	2
		Pancreatitis	1
Diseases of the intestine	119	Constipation (functional)	33
		Acute enteritis	29
		Gas pain	29
		Irritable bowel syndrome	16
		Colon cancer	5
		Diverticulitis	3
		Ulcerative colitis	1
		Appendicitis	1
		Hemorrhoid	1
		Hernia	1
Diseases of the urinary tract	20	Stone of the urinary tract	12
		Infection of the urinary tract	7
		Prostatitis	1
Diseases of the uterus and ovary	19	Pelvic inflammatory disease	7
		Gynecological disease	5
		Menstrual pain	4
		Myoma uteri	2
		Uterine cancer	1
Diseases of the muscle and bone	17	Muscular pain	15
		Neuralgia	2
Diseases of the cardiovascular system	3	Congestive heart failure	1
		Aortic aneurysm	1
		Myocardial infarction	1
Diseases of the respiratory system	4	Upper respiratory infection	3
		Pleuritis	1
Diseases of the skin	4	Herpes zoster	3
		Contact dermatitis	1
Others	73	No abnormality found	55
		Psychological problem	12
		Post-operative intestinal adhesion	4
		Unknown	2
Total	489		

Table 2. Sensitivity, specificity, and the positive and negative likelihood ratio between the pain regions and disease diagnoses.

Diseases of the esophagus, stomach and duodenum.				
	Sensitivity	Specificity	LR+(95%CI)	LR-(95%CI)
Epigastric pain	0.84	0.75	3.30 (2.06-5.29)*	0.21 (0.13-0.34)*
R-subcostal pain	0.02	0.87	0.16 (0.06-0.45)*	1.13 (0.40-3.21)
Whole-abdominal pain	0.10	0.86	0.76 (0.43-1.35)	1.04 (0.58-1.85)
Diseases of the liver and biliary tract				
	Sensitivity	Specificity	LR+(95%CI)	LR-(95%CI)
Epigastric pain	0.41	0.52	0.84 (0.42-1.66)	1.14 (0.58-2.25)
R-subcostal pain	0.51	0.94	8.93 (4.19-19.0)*	0.52 (0.24-1.11)
Diseases of the intestine				
	Sensitivity	Specificity	LR+(95%CI)	LR-(95%CI)
R-lower pain	0.13	0.96	3.11 (1.47-6.57)*	0.91 (0.43-1.92)
Mid-lower pain	0.16	0.89	1.41 (0.78-2.53)	0.95 (0.53-1.71)
L-lower pain	0.10	0.95	2.19 (1.01-4.73)*	0.94 (0.44-2.03)
Periumbilical pain	0.05	0.99	18.66 (2.22-156.7)*	0.95 (0.11-7.97)
Diseases of the urinary tract				
	Sensitivity	Specificity	LR+(95%CI)	LR-(95%CI)
R or L-lower pain	0.45	0.89	4.22 (1.67-10.68)*	0.62 (0.24-1.57)
Mid-lower pain	0.20	0.90	2.08 (0.67-6.49)	0.88 (0.28-2.75)
Diseases of the uterus and ovary				
	Sensitivity	Specificity	LR+(95%CI)	LR-(95%CI)
Mid-lower pain	0.68	0.92	8.93 (3.20-24.9)*	0.34 (0.12-0.95)*

LR+: Positive likelihood ratio, LR-: Negative likelihood ratio. *: $p < 0.05$

DISCUSSION

In general, the sensitivity of history taking and physical examination was low and the specificity high. However, the sensitivity of epigastric pain related to gastroduodenal diseases, right subcostal pain related to hepatobiliary diseases, and mid-lower pain related to gynecological diseases was relatively high (above 0.5) in this study. Men significantly complain of epigastric pain more frequent rate than that of women. On the other hand, women relatively complain of lower abdominal pain more frequent rate than that of men. Therefore, the rate of men's epigastric pain merely might be high in appearance.

Because of the high sensitivity (0.84) of epigastric pain in terms of gastroduodenal diseases, absence of epigastric pain is useful to rule out gastroduodenal diseases.

On the other hand, high specificity (above 0.92) of periumbilical pain makes it possible to confidently diagnose intestinal disease. The same is true for right subcostal pain in hepatobiliary diseases and for mid-lower pain in gynecological diseases.

There were several opportunities for bias to affect the results of our study. Selection bias occurs when comparisons are made between groups of patients that differ in ways, other than the main factors under study, that affect the outcome of the study. Groups of patients often differ in many way- age, sex,

severity of disease, presence of the other disease, and the care they receive. This study was conducted at a general medical clinic in a university hospital. Therefore, it is most likely that there is a limited generalizability of our results. In usual practice most clinicians interview the patient and perform a general physical examination prior to specifically evaluating the abdomen. Verification bias occurs when the study population is constrained to include only selected patients whose severe disease status is verified, and when the selection for the verification test not random¹⁰. Such expectation bias may improve or worsen test operating characteristics by increasing sensitivity or decreasing specificity. Since our study was performed under usual clinical circumstances, we did not study the effect of expectation bias during the history-taking and physical examination. Because this study took place during active routine work periods, participating physicians' maximum clinical performance may not have been reflected.

In summary, we found that the patient's history of some abdominal pain was highly predictive of the presence or absence of the diseases. Comparative analysis between the pain regions complained by the patient in the initial clinical visit and the medical diagnoses yielded clinically useful information as to the efficacy of medical history-taking and physical examination in the identification of abdominal diseases.

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