Special Article*

Clinical Considerations on Abdominal Pain

Toshio KUROKAWA, M. D.

President, Tohoku University

I. Introduction

Abdominal pain is one of the complaints most common in daily life and is also one of the problems most difficult to detect its cause. I have been particularly interested in gastroenterology for years, and it is my common observation that most patients with gastrointestinal diseases see doctors to complain of their abdominal pain only after they have actually felt and suffered from the pain.

Abdominal pain is originated from diseases in every abdominal organ, and it is often difficult to discern what organ is responsible for abdominal pain, since the abdominal organs overlap one another in the abdominal cavity. To make the matter more complicated, abdominal pain occurs not only in the gastrointestinal diseases but also in the beginning of acute pneumonia, myocardial infarction, and diseases of the central nervous system.

It is also known that abdominal pain occurs not only in the organic diseases of abdominal organs but in the functional disorders. So the diagnosis of abdominal pain is one of the most difficult clinical problems. Though brief, I will outline the developmental mechanism and classifications of abdominal pain, and statistical observations on patients made by the Medical Department of Prof. Kurokawa and Prof. Yamagata, and will present a few examples of suggestive and unique cases.

* Lecture given at the 59th Annual Meeting of the Japanese Society of Internal Medicine, April, 1962, in Tokyo.

II. Developmental mechanism of abdominal pain

Abdominal pain is an important sign of diseases in the abdominal organs and it is important to find out what organ is responsible for the pain. There are many explanations how one feels as abdominal pain from diseases in 1) skin, 2) serosa, 3) vessels, 4) capsules of parenchymal organs, 5) muscle and bone, 6) organs in the abdominal cavity and 7) referred pain. It is known that a cut in the intestines at surgery causes no significant pain but outward pulling of the intestines and stomach causes pain. It is also experimentally proved that the elevation of pressure in the gallbladder through a fistula causes colic pain just as one in cholelithiasis. In this connection, there are some researchers who are exterminating feeling or symptoms related with the autonomic nerve system, such as nausea, vomiting, cold sweat, hypersecretion of saliva and vascular spasm. There have been some theories and experiments that take a serious view of the relations between the development of abdominal pain and the autonomic nerve system for a long time.

The sympathetic nerve, parasympathetic nerve and the sensitive fibers of cerebrospinal nerve are distributed in the abdominal cavity. It is understood that the autonomic nerves include the centripetal nerve fibers from the digestive tract, and the ones in the parasympathetic nerve transmit chiefly reflectory impulses, the ones in the sympathetic nerve do chiefly sensitive impulses related with pain and these nerve fibers are included in the splanchnic nerves.

The parietal peritoneum is innervated through the sensitive fibers of cerebrospinal nerve and the end-apparatus of the sensitive fibers of cerebrospinal nerve are widely distributed to the organs in the abdominal cavity. Despite many investigations so far, there are several aspects in the developmental mechanism of abdominal pain still to be clarified. At the present stage, it is recognized that the parietal peritoneum, mesenterium and diaphragm are innervated through the sensitive fibers of cerebrospinal nerve, and the abdominal pain due to its stimulation is somatic pain (parietal pain, cerebrospinal pain), in which the location is well defined. On the contrary, there is visceral or splanchnic pain, in which the location is not well defined and rather diffuse, and the centripetal

fibers are within the sympathetic nerve bundles.

As to the location of abdominal pain, the visceral pain is usually on the midline and is not one-sided, and the somatic pain is characteristically one-sided according to the location of disease.

While the visceral pain is on the midline, the pain occurs in the epigastrium in diseases of the stomach, duodenum and pancreas, in the umbilical area in diseases of the small intestines, ascending colon and transverse colon, and in the lower abdomen in diseases of the descending colon, sigmoid and rectum. In diseases of the kidney and ureter, the pain is one-sided. The somatic pain is, through the defence reaction, that is, increased secretion of epinephrine, accompanied by tachycardia, elevation of blood pressure and vascular spasm, but the visceral pain, on the contrary, is often accompanied by decrease in pulse rate and blood pressure, nausea and vomiting.

In diseases of abdominal organs, sites of pain, tenderness and hyperesthesia are often noted in certain distant areas such as subcutaneous tissue and muscles. This is called referred pain and is due to Mackenzie's viscerosensory reflex. This is regarded as the characteristic feature of visceral pain.

On the contrary, the spinal nerve innervating the abdominal wall is stimulated on the half way of its distribution and the resulting somatic pain causes abdominal pain. The example is the ileocaecal pain in acute pneumonia. This sometimes leads to misdiagnosis of acute appendicitis.

There are ordinarily marked individual differences in the nature of pain. According to Libman, approximately 20% of people are insensitive to deep tenderness, and this is the case with the somatic pain and visceral pain, too. Let us consider what kind of stimulation may cause abdominal pain. Spastic contraction in the non-parenchymal organs, such as stomach, intestines, gall-bladder, bile duct, urinary bladder and ureter causes severe colic pain. Inflation of the stomach and intestines or sudden swelling of the parenchymal organs also causes abdominal pain. This is called as tension pain. If an inflammation is present, a pulsatile pain occurs. This may account for absorption of toxic substance by inflammation and alterations of pH of body fluids, besides spastic pain, and is called

inflammatory pain. Pain due to vascular spasm in the abdominal cavity is called as vascular spastic pain.

Abdominal pain occurring from the stomach and intestines in patients with tabes dorsalis is called as neurogenic pain, and there are other kinds of abdominal pains that occur from mechanical stimulation, such as volvulus of the stomach and intestines, intestinal invagination, torsion of pedicle of tumor and movable caecum.

Abdominal pain in the stomach perforation is due to chemical stimulation by stomach juice poured into the peritoneum, and the pain is so severe that patients feel as if they were pierced through with a red hot poker or poured with molten lead.

III. Classification of abdominal pain

There have been many classifications of abdominal pain such as Naegeli's and Orthner's for years, but I will classify abdominal pain in the following way.

A) Character of pain:

- 1) acute, 2) subacute, 3) chronic, 4) continuous, 5) radiating, 6) mild or severe, 7) expressed in other words.

B) Primary lesions:

- 1) stomach and duodenum, 2) small intestines, 3) appendix, 4) colon, 5) bile duct, 6) liver, 7) pancreas, 8) genito-urinary organs, 9) retroperitoneal organs.

C) Localization:

- 1) whole abdomen, 2) upper abdomen, 3) right upper quadrant, 4) left upper quadrant, 5) umbilical area, 6) right lower quadrant, 7) left lower quadrant, 8) midlower abdomen.

IV. Systemic diseases

- 1) collagen diseases, 2) infectious diseases, 3) poisoning, 4) metabolic disorders, especially electrolyte imbalance, porphyrinuria, 5) neurogenic diseases, 6) blood diseases.

V. Psychic diseases

VI. Statistical observations on patients with abdominal pain in our department

In the first place, I will speak about acute abdomen. Acute abdomen is a disease with severe abdominal pain, but the cause of the pain is not immediately diagnosed. It is usually accompanied by exterminating feeling, nausea, vomiting, cold sweat, coldness of extremities and increased pulse rate. Most of them are often very serious if left untreated and need urgent operations.

The causes of acute abdomen are, as shown in Table 1, perforation of the stomach and intestine, localized or diffuse peritonitis, ileus, torsion of pedicle, mesenterial emboli and large hemorrhage

Table 1. Cause of Acute Abdomen

1. Perforation
 - a. Perforation of stomach and duodenum due to ulcer.
 - b. Ascariasis.
 - c. Tuberculous diseases.
 - d. Cancer of stomach and intestines.
 - e. Appendicitis.
 - f. unspecific enterocolitis (including ileitis terminalis and appendicitis fibroplastica).
 - g. Cholecystitis (including cholelithiasis).
 - h. Typhoid fever.
 - i. Ulcerative colitis or Meckel's diverticulitis.
2. Localized peritonitis (especially perityphlitic abscess due to appendicitis).
3. Diffuse peritonitis
 - a. Due to perforation
 - b. Pneumococcal
 - c. Due to other pyogenic bacteria.
4. Colic attack in cholelithiasis (including purulent cholecystitis and cholangitis).
5. Nephrolithiasis and perirenal abscess.
6. Ileus (every strangulated intestinal obstruction).
7. Acute pancreatic necrosis (including pancreatic apoplexia, pancreatitis and pancreatic edema).
8. Torsion of pedicle
 - a. Ovarial cyst.
 - b. Undescended testicle.
 - c. Major omentum.
9. Embolus or vascular spasm in mesenteric vessels.
10. Intraperitoneal hemorrhage
 - a. Rupture of spleen, liver and kidney.
 - b. Rupture due to ectopic pregnancy.
11. Gastric crisis of tabes dorsalis

into the peritoneal cavity and gastrointestinal tract. When acute abdomen occurs, there is little time to have X-ray examinations or even blood and urinary examinations given to the patient, so the differential diagnosis should be immediately considered before initiating treatment.

Our statistical observations on patients with abdominal pain indicate that severe abdominal pain occurs frequently in the following order, that is, perforative peritonitis, acute pancreatitis, ileus,

Table 2. Incidence of Severe Abdominal Pain

Disease	No.	%	Disease	No.	%
Perforative peritonitis	14	100.0	Movable sigma elongatum	3	42.8
Acute pancreatitis	11	100.0	Cancerous peritonitis	4	40.0
Ileus	8	100.0	Polyp of stomach	4	40.0
Intestinal stenosis	6	100.0	Splanchnic ptosis	5	38.5
Acute appendicitis	6	100.0	Stomach ulcer	152	36.6
Ileitis terminalis	2	100.0	Duodenal ulcer	83	36.5
Gall-bladder diseases	93	73.2	Lymphosarcomatosis	3	30.0
Nephrolithiasis	6	66.8	Acute gastritis	14	28.0
Intraperitoneal abscess	4	66.7	Cancer of bile duct	5	27.8
Subphrenic abscess	2	66.7	Intestinal tuberculosis	5	26.3
Hepatic clonorchiasis	2	66.7	Cancer of pancreas	2	25.0
Hepatic abscess	3	60.0	Tabes dorsalis	2	22.2
Duodenal diverticulum	3	60.0	Cancer of intestine	5	21.7
Acute colitis	6	54.5	Cancer of liver	8	20.0
Ascariasis	34	51.6	Others	96	
Stomach torsion	2	50.0	Total	596	15.0
Hepatitis	3	42.8			

intestinal stenosis, acute appendicitis, ileitis terminalis, gall-bladder disease and renal stone (Table 2).

Statistics of abdominal pain in the gastrointestinal diseases (Fig. 1, 2, 3, 4). Of 304 patients with stomach cancer, 45% complained of abdominal pain. Of these, 79.4% were epigastric pain. Of 270 patients with stomach ulcer, 88% of patients, who had abdominal pain, complained of epigastric pain. Of 1,732 patients with gastritis, epigastric pain occurred most frequently (77.9% of total) and 66.4% of patients with splanchnic ptosis complained of epigastric pain. All of 35 patients with cancer of the esophagus had epigastric pain. Patients with movable caecum had pain in the right lower quadrant most frequently (53.5% of total), 54.9% of 42 patients with movable sigma elongatum had lower abdominal pain, 45.5% of 82 patients with hepatitis had epigastric pain and 54.5% the right upper quadrant pain. Of 32 patients with cancer of the liver, 33.5% had epigastric pain and 55.6% the right upper quadrant pain.

Of 69 patients with cholelithiasis, 41.8% had epigastric pain and 49.2% the right upper quadrant pain, 37.3% of 247 patients

Fig. 1. Abdominal pain in G.I. diseases (1).

Fig. 2. Abdominal pain in G.I. diseases (2).

Fig. 3. Abdominal pain in G.I. diseases (3).

Fig. 4. Abdominal pain in G.I. diseases (4).

with dyskinesia of gall-bladder had epigastric pain and 57.2% the right upper quadrant pain, 46.5% of 58 patients with pancreatitis had epigastric pain and 28% the left sided abdominal pain. Of 23 patients with cancer of the pancreas, 59.8% had epigastric pain,

20% lower abdominal pain and only 10% the left sided abdominal pain.

Thus, the abdominal pain seems generally to occur in the location, under which the primary disease of abdominal organ is present, and the epigastric pain is very frequently encountered in diseases of every abdominal organ, so the differential diagnosis of epigastric pain is most important.

Abdominal pain in each disease

1. Peptic ulcer (Fig. 5, 6, 7)

Questionnaire on peptic ulcer in 191 medical and surgical departments in Japan in 1956 indicate that 90.2% of 3,130 patients with peptic ulcer had abdominal pain. Special attention should be paid to the fact that approximately 10% of patients had no pain. This is called as X-ulcer, while hemorrhagic ulcer is called as B-ulcer.

Of 2,621 cases, continuous pain occurred in 20.4%, transient pain in 44.0% and irregular pain in 35.6%.

Nocturnal pain did not occur in 61.0% of 1,906 cases and did occur in 39.0%. Therefore, absence of nocturnal pain does not always deny diagnosis of peptic ulcer. Epigastric pain appeared in 77% of 2,678 cases.

Fig. 5. Abdominal pain in peptic ulcer (1).

Fig. 6. Abdominal pain in peptic ulcer (2).

Fig. 7. Abdominal pain in peptic ulcer (3).

Of these, 72% had abdominal pain related to meals and 27.6% had pain not related to meals. As to time interval of pain occurrence after meal, 32.3% had pain 2-3 hours later, 24% over 3 hours later, 18.4% 1-2 hours later and 17.8% within 1 hour. This time interval depends on the location of ulcer and it seems that the pain appears sooner, when an ulcer is located nearer the cardia and the pain appears later when an ulcer is located in the lower part of the stomach.

Effects of meals on the abdominal pain in peptic ulcer were found that the pain disappeared after meals in 57.3%, was unchanged in 31.2% and was aggravated in 11.5%.

The abdominal pain in peptic ulcer was non-radiating in 62.6% and radiating in 37.4%, of which 68.6% was radiating to the back and 16.3% to the lumbar area.

Seeing that 41.5% of the ulcer pain were left untreated, it can be said the pain is not too severe. Of patients 31.6% had medicine, 11.2% had meals and only 12.4% had to have shots to relieve pain. Those figures suggest that the abdominal pain in peptic ulcer is not severe.

2. Stomach cancer (Fig. 8, 9)

Of 640 cases with stomach cancer, 90.4% had epigastric pain. Only exceptionally those patients complained of abdominal pain in other parts.

Fig. 8. Abdominal pain in stomach cancer (1).

Fig. 9. Abdominal pain in stomach cancer (2).

Of them, 35% had abdominal pain not related to meals, 30% had pain over 2 hours after meal and 20.7% within 30 minutes after meal.

As initial symptoms of stomach cancer, pain over the stomach appeared in 31.6%, sensation of fullness and discomfort in the stomach in 19.4% and others in 24%.

The degree of abdominal pain in stomach cancer naturally varies with progression of the disease; 47.2% lacked any pain and 38.8% had only mild pain.

3. Gastritis (Fig. 10)

Correlations between abdominal pain and types of gastritis indicated that abdominal pain occurred in 75% of 44 cases with normal gastric mucosal biopsy, in 64.8% of cases with superficial gastritis and in 69.3% of atrophic gastritis.

Fig. 10. Abdominal pain in gastritis.

VII. Presentation of cases

The representative cases of acute abdomen and other various diseases, such as appendicitis with abnormal course, incarcerated hernia, perforation of the stomach due to peptic ulcer, gall stone, pancreatitis, volvulus of the stomach, chronic invagination of the intestines, disease of the adrenal glands, aneurysm of the abdominal aorta etc., were presented. The details are omitted here.

VIII. Summary

The developmental mechanism and classification of abdominal pain and statistical observations on patients with abdominal pain were discussed. A few examples of instructive cases were also presented. In fact, abdominal pain is an important sign of diseases in the abdominal organs, no matter how it may be in degree or what it may be in nature. So, careful observation on abdominal pain and then appropriate laboratory examinations are most important for clinicians to find its essential nature.

Recent developments in medicine may often make us to establish a diagnosis through only many laboratory examinations. Developments in the mechanics, however, sometimes appears to make a physician become a thoughtless operator of machines in the labora-

tory. I am so sure it is most important that a physician should have meticulous physical examination and exert his own judgements before having appropriate laboratory examinations. Thus, the importance of detailed check-up of patient's history and clinical examinations, including inspection, palpation etc., can not be too over-emphasized to make a correct diagnosis, as the first step. This is naturally true in every field of medicine.