SURGERY OF THE ACUTE ABDOMEN

JOHN A. SHEPHERD

SECOND EDITION

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E. & S. LIVINGSTONE LTD
EDINBURGH AND LONDON
1968

FOREWORD

THE diagnosis and treatment of acute abdominal disease have for many years provided serious problems for the surgeon. Success depends not only upon early and correct diagnosis but quite as much on wise judgement and quick decision when faced with unusual conditions and unexpected complications. It is indeed difficult to understand why there are so few monographs devoted entirely to this important subject. It is therefore satisfactory to find that Mr Shepherd has written a volume to serve as a reliable guide to the surgical treatment of acute abdominal disease.

I had the privilege of reading the book before it was published and I was much impressed by the thoroughness of the author's method of dealing with the subject, by the breadth of his views, the wisdom of his judgement and the fairness of his discussions. I know of no other volume which is so likely to be helpful to the young surgeon in deciding on the best treatment in any particular circumstance. The senior surgeon will also find much recent information which will help him to keep in touch with the latest advances in this subject. Excellent references to the relevant literature are provided in each section.

This volume can be cordially recommended to every general surgeon and particularly to those who have to deal with many acute abdominal emergencies.

ZACHARY COPE

London, 1960

PREFACE TO SECOND EDITION

In preparing a second edition of this work I have been influenced greatly by reviews and personal suggestions concerning the first edition. This has proved acceptable to many surgeons and has filled a gap which existed previously in the writings on the acute abdomen. My original purpose was to build up a complete guide to the management of the acute abdomen from my own experience and from the experience of others, and to provide a full reference book for the practising surgeon. I appreciate that for a very practical branch of surgery such as this there are disadvantages in overloading a text-book so that it becomes almost encyclopaedic. It now seems timely to present an abridged and revised version to provide a more compact volume and one more suitable for rapid reference in emergency.

By careful editing the size of the book has been greatly reduced. I have withdrawn the historical notes, personal case reports and much of the detail of cases published by others. Those who are interested in the evolution of modern methods in the management of the acute abdomen may however find it profitable to consult the first edition. The text in becoming more concise also tends to become more dogmatic. I have, however, taken great care to base the opinions stated not only on my own expanded experience but also on a continued and thorough appraisal of the experience of others in the last few years.

Only generalisations are now made concerning the incidence and prognosis of individual conditions but such generalisations are made cautiously from detailed surveys of my own cases and of the published work of others. The etiology and pathology of each condition are discussed mainly with relevance to their recognition pre-operatively and at operation. I have not reduced the amount of detail in reference to the diagnosis and treatment of each abdominal emergency. Whenever possible I have described a set operative procedure for each well recognised condition. Once more I have included the rarities in the belief that the total of so-called rarities encountered by the individual surgeon is remarkably high.

At least one reference has been given, usually of recent origin, for nearly every topic. The references have been selected either to document a new idea or new observation or to provide, when such is available, a recent review with an adequate bibliography. For conditions which have aroused interest only in recent years, e.g. intramural haematoma of the duodenum, and for topics which are

controversial, e.g. the management of acute gastro-intestinal bleeding, the references are more generous. In the first edition a comprehensive bibliography, including historical references, was given for each subject but it has not been thought necessary to continue on this scale as there is much repetition in the rapidly expanding literature on the acute abdomen. For a fairly complete documentation up to 1960 the reader is referred to the earlier volume.

A few additional plates have been added mainly to emphasise the value of radiography in the diagnosis of the acute abdomen. I have not brought up to date the analysis of personal experience published in the first edition. With increasing seniority there is some selection of the cases I now operate upon myself and any new statistics would not therefore be comparable with the original review of 1,179 emergencies operated upon personally.

The surgery of the acute abdomen is by no means static. For this reason many sections have been completely revised, for example, the chapter on acute gastro-intestinal haemorrhage. A few completely new topics have been added in different chapters.

Many acknowledgements were made in the preface of the first edition and if these are not repeated this does not lessen my indebtedness to many individuals. For this edition I wish to express thanks to Mr. Roger Mawdsley, who read the typescript painstakingly and critically, and to Miss Ella Burt, who performed the long task of preparing the typescript with great patience and efficiency.

JOHN SHEPHERD

1968

EXTRACT FROM PREFACE TO FIRST EDITION

THE diagnosis and management of acute abdominal conditions form a large part of the routine duties of the general surgeon throughout his whole career. He undertakes, however, a greater proportion of emergency work in his formative years than in his maturity. The young surgeon who is instructed methodically and patiently by his seniors is at a great advantage for he may be taught how to avoid some of the pitfalls encountered by the previous generation. Even if he is well trained he must read widely to acquire knowledge which will be of value in urgent abdominal surgery. The relatively inexperienced surgeon may encounter difficult problems of management of common conditions or he may quite unexpectedly meet with a rare condition. All too often, after the event, he discovers that such problems and their solution have been recorded previously.

In the general text-books of surgery the descriptions of acute conditions are often incomplete. The abstraction of the large amount of information in journals is a time-consuming task and the trainee can scarcely be expected to read more than a small fraction of the writings on this branch of surgery. As a registrar I found a lack of a suitable work to which I could turn for detailed information concerning the numerous problems I encountered in emergency work. An attempt is made to provide in this volume a comprehensive survey which may be useful not only to the surgical trainee but also to the established surgeon.

The importance of the common acute emergencies is stressed but it has been my intention also to provide details of the uncommon or rare conditions. I have found that the total number of conditions classed as rarities which fall to the individual surgeon is remarkably high. Some of these rarities may be encountered only once or twice in a life-time and if the surgeon is unaware of these conditions he may lose the chance of recognising and managing them safely.

The arrangement of the chapters has been made for easy reference. While there is much to be said (for purposes of differential diagnosis) for grouping the acute abdominal conditions under the headings of inflammation, obstruction, haemorrhage and the like, I have preferred to adopt an arrangement which has largely an anatomical or visceral basis. The first two chapters contain general surveys of the problems of diagnosis and management. The third chapter covers the generalised and local conditions involving the peritoneum (excluding haemoperitoneum). Thereafter in Chapters 4 to 19 the diseases involving particular viscera are discussed. I have found it expedient

to deal with the subject of perforated peptic ulcer in a separate chapter. Internal herniae and allied forms of internal obstruction are dealt with in Chapter 20 and the external herniae in Chapter 21. Acute conditions affecting the diaphragm and abdominal parietes are discussed in Chapter 22. In Chapter 23 the problems of intraperitoneal and retroperitoneal haemorrhage are covered. Chapter 24 is devoted to gastro-intestinal haemorrhage. Finally, in Chapter 25, some of the medical conditions which may present in the guise of the acute abdomen are considered.

Three aspects of the acute abdomen are omitted. Firstly, I have not entered into any discussion of the mechanism or interpretation of abdominal pain. This is a subject concerning which there are already many helpful and authoritative monographs and it cannot be dealt with briefly. Secondly, I have excluded the acute conditions encountered in the neonate. This subject is well covered in specialised text-books and it is appreciated that the emergency surgery of the neonate is in the province of the paediatric surgeon and his special unit. I have, however, dealt with the acute abdominal conditions of childhood as these are seen largely by the general surgeon. Thirdly, I have not discussed war surgery of the abdomen except in so far as the lessons of war are applicable to emergency work in civilian life. For the details of management of penetrating injuries of the abdomen the surgeon may turn to the many reports and reviews following the Wars.

JOHN SHEPHERD

1960

CONTENTS

CHAPTER 1

PRINCIPLES AND METHODS OF DIAGNOSIS

IN the management of the acute abdomen the surgeon should at his initial examination make a real attempt to come to an accurate diagnosis. Many have been tempted to say that the only thing that matters is to know when to open the abdomen and when to desist from this. This is a dangerous and slipshod attitude to adopt. However safe modern anaesthesia and operative technique may appear today a decision for or against operation on this basis is to be condemned. The emergency surgeon will find that the more meticulous he is in the examination of the patient and in the interpretation of the history the more accurate he will become as a diagnostician and he will therefore be in the position, in most cases, to weigh the pros and cons of operation to the best interest of the patient. The practice of writing down a firm diagnosis or a short list of alternative diagnoses before operation has much to recommend it. There are always cases in which accurate diagnosis is impossible without laparotomy but a genuine attempt to come to an exact preoperative diagnosis raises the surgery of the acute abdomen from a mere technical exercise to an art. Apart from the personal satisfaction which accrues from accurate diagnosis it is important to recognise that technical matters such as the choice of incision, the preparation of theatre equipment, the organisation for transfusion may all be foreseen with great advantage to surgeon and patient alike if an accurate diagnosis is made.

In most acute abdominal conditions diagnosis must not be delayed. Many abdominal crises are such that urgent operation is essential to successful management. Cope laid down the useful general rule that 'the majority of severe abdominal pains which ensue in patients who have been previously fairly well, and which last as long as six hours, are caused by conditions of surgical import'.

Most patients sent into hospital with the diagnosis of 'acute abdomen' have already been seen by a general practitioner who either has made this diagnosis after one examination, or has kept the patient under observation for a variable period before seeking a second opinion. Compared with twenty or more years ago it is probable that the general practitioner now tends to send the patient to the surgeon earlier. The practitioner is now more aware of the risks of delay in conditions such as acute appendicitis and acute obstruction. Transport facilities are more rapid and admission of all sections

of the population to hospital is more readily available. Possibly in an era of State medicine the practitioner is less inclined than formerly to undertake the sole responsibility of watching the doubtful case. The general surgeon of the present generation is asked to see a great many more doubtful cases than did his predecessor. It may even be suggested that in the past the majority of acute abdomens seen by the surgeon were advanced and clear-cut as established obstructions or peritoneal inflammations.

In an attempt to establish an exact diagnosis in a patient with acute abdominal signs and symptoms the surgeon must train himself to use routine methods of acquiring the history of the patient and the maximum information from the clinical examination. Such routines may justifiably vary from surgeon to surgeon but the individual must be consistent so that he may provide himself with an accurate basis of comparison of one case with another. In a minority of patients it may be inconsiderate or even impossible to question or examine a patient in the complete manner described below but it is only by meticulous methods that a high proportion of correct diagnoses may be made.

In the ensuing chapters the age groups prone to particular emergencies are emphasised. Generalisations are fairly made, for example, with regard to conditions such as primary intussusception of the small intestine in children or obstruction of the neoplastic colon in the elderly. Women in the child-bearing period may suffer from particular conditions. It must be accepted that the common conditions, such as acute appendicitis, can occur at any age.

HISTORY AND INTERPRETATION OF SYMPTOMS

When the patient is comfortably placed in bed and has had some time to recover from a journey which may have been disturbing mentally and physically, a detailed history must be taken. The examination of a nervous or even frightened patient in the Casualty Department of a hospital is seldom satisfactory although in some hospitals a brief check may be necessary before deciding to which ward a patient should be sent. Age, intelligence, acuity of hearing, degree of co-operation and the severity of pain all may influence successful history-taking. Although a routine series of questions should be adhered to as far as possible the surgeon must accept that the patient may force an alteration of tactics. Thus, with a perforated peptic ulcer, the immediate pain is so intense that the victim is often not in a state to describe previous chronic symptoms and it is therefore wrong to press for the earlier history.

Although almost every patient examined on account of acute abdominal symptoms is suffering, or has suffered, from pain, it is

well to approach the problem by asking the patient of what he complains rather than to assume that pain is present. An admission of pain is almost always forthcoming but this may not be the first symptom complained of by the patient. To acquire information regarding pain the following questions are put. (The exact wording must be varied according to the age and intelligence of the patient.)

1. Have you a pain now?
2. When did the pain start?
3. Is the pain continuous or intermittent?
4. Is the pain diminishing, constant or increasing in intensity?
5. Where did the pain start?
6. Has the pain shifted in position and, if so, to where?
7. Is the pain aggravated by movement?
8. Is the pain related to bowel or bladder function?
9. Has the pain followed abdominal or other injury?
10. Has any medicine been taken or has any injection been given lately?

Absence of pain at the time of examination does not preclude an acute condition. For example, remissions after perforation of an appendix or three or four hours after perforation of a peptic ulcer are well recognised. In intestinal obstruction there may be a quiet phase during which colic is relieved, or a later relief may imply that there is a paralytic ileus. Absence of pain may follow the administration of morphine.

The onset of pain is dramatic in a condition like perforated peptic ulcer and often the patient can give the exact time. Occasionally the onset of pain is related to some muscular action such as coughing or straining at stool. A pain by which the patient is wakened from sleep may be of great significance.

The pain of peritonitis tends to be continuous while that of intestinal obstruction or other colic is intermittent. The colicky pain of an intestinal obstruction tends to increase until such time as perforation or ileus supervenes. The initial colicky pain of appendicitis increases until a crisis occurs such as perforation and may be followed by the more diffuse discomfort of general peritonitis. The pain following perforated peptic ulcer or acute pancreatitis may be unremitting for hours. Remission of pain is not necessarily an index of recovery.

Patients frequently have inaccurate or bizarre anatomical knowledge and will refer to the 'stomach', 'bowel' or 'bladder' quite indiscriminately. In consequence the patient is asked at a later stage to point to the exact location of pain.

Recognition of a shifting pattern of pain, as in acute appendicitis, may be very suggestive. Movement tends to aggravate the pain of

peritonitis but conditions associated with severe colic lead at times to active changes in position. The patient may writhe in agony in an attempt to obtain relief. The adoption of a particular position may be of significance. An inflammatory reaction such as a pelvic abscess in the vicinity of the bladder may be associated with frequency and dysuria. Tenesmus is less often associated with abdominal pain but may be complained of in pelvic abscess.

In assessing the possible influence of a previous injury it must be recognised that the interval between the injury and the development of acute abdominal signs and symptoms may vary from hours to days as, for example, in rupture of the spleen.

In addition to recognising that a previous injection of morphine or a similar drug may modify or minimise signs and symptoms, the surgeon must appreciate that other drugs may aggravate symptoms. Despite numerous attempts at instruction, patients often take or are given purgative drugs for any abdominal pain. Diarrhoea so produced may be unrelated to the acute condition present. At the worst, as in cases of gangrenous appendicitis, perforation and general peritonitis may thus be accelerated.

Having acquired a knowledge of the general pattern of pain and, in doing so, made some assessment of the character of the patient in so far as accuracy of description may be expected, other symptoms are sought by the following direct questions:

1. Have you vomited? When was the vomiting in relation to the pain? How frequent was the vomiting? What did the vomit look like?
2. Do you feel sick (i.e. nausea)?
3. When did you last eat or drink?
4. When was the last bowel action? Has there been any constipation or diarrhoea? Is the motion normal in consistency and colour? Has there been any blood in the motion?
5. Has the urine been normal? Has there been any frequency, pain or difficulty in passing urine? Has there been any blood in the urine?
6. (In the female) When was the last period? Are the periods regular?

Vomiting

Vomiting as a symptom in acute surgical or medical conditions is so frequent that in itself it is of little diagnostic value. Some individuals vomit on very slight provocation and the stimulus may be mental.

The vomiting of intestinal obstruction is repeated and copious. It follows the rapid accumulation of fluid above the level of an obstruction and the failure of such fluid to pass onwards. The passage upwards from the stomach or intestine results from a combination

of reverse peristalsis and simple overflow. In obstructive vomiting the observation of increasing quantities of vomit and alteration in character of the vomit are of great importance. Initially such patients vomit gastric fluid containing partially digested food; then the vomit becomes bile-stained; then foul-smelling and dark in colour. This dark foul fluid is often referred to as 'faecal' but is seldom of colonic origin.

Vomiting may be termed 'reflex'. This is initially a gastric vomit and may occur in the early stages of any acute abdominal condition associated with severe pain, with distension of a hollow viscus, with increased tension of the mesenteries, with torsion of any viscus, with local or generalised acute inflammation or other irritation of peritoneal or retroperitoneal tissues. Reflex vomiting may also be related to acute inflammation occurring in the proximity of the coeliac plexus—one explanation of the persistent and often intractable vomiting liable to occur in acute pancreatitis or in some types of retroperitoneal haemorrhage.

'Toxic' vomiting is recognised if a gross infective condition has developed. Toxic vomiting may follow direct medullary stimulation in such cases but at this stage there is often intestinal dilatation and paralysis sufficient to cause unremitting vomiting.

Vomiting is often closely related to pain. It may be immediate with the onset of the severe pain of biliary or ureteric colic. In intestinal obstruction an initial vomit can be the result of sudden strangulation of the bowel and is of the reflex type. The final vomiting in intestinal obstruction is a true progressive condition. In appendicitis initial vomiting may be reflex in type but is later related to paralytic ileus or more rarely to organic obstruction. Such variations in the relationship of vomiting to pain in the different acute abdominal conditions must be well recognised, otherwise the true significance of the symptom is gravely misinterpreted.

In some patients vomiting is, surprisingly, absent—for example, there may be suggestive signs and symptoms of general peritonitis or intestinal obstruction but no history of vomiting. In such circumstances a gastric or duodenal tube should be passed and the aspiration of large quantities of foul intestinal fluid converts a doubtful clinical picture to one which is a certainty. On occasion the attempt to pass a tube induces the first copious vomit.

There are few acute abdominal conditions in which vomiting never occurs. It is impossible if the lower oesophagus or the stomach is ruptured and it is rare after a perforated peptic ulcer of the stomach or the first part of the duodenum. In the latter conditions the stomach tends to be flaccid and if ileus develops in such cases the excessive small intestine contents tend to well up to the site of leakage and escape from there into the peritoneal cavity.

Nausea

The symptom of nausea is common in any acute illness. In its milder form it is merely a distaste for food; in its most severe it is a distressing feeling that vomiting is imminent. Nausea is found particularly in any acute condition associated with general distension of the abdomen or a local visceral dilatation. The patient does not readily dissociate the feeling of nausea from pain—in fact, 'nauseating pain' is often described. The feeling may be persistent or may come in 'waves' associated with dizzy sensations. Extreme nausea may be complained of in any condition associated with severe loss of blood. This is a common symptom and, like vomiting, it is of no specific diagnostic value but it usually does indicate derangement of gastro-intestinal function.

Previous ingestion of food or drink

Many acute abdominal conditions are preceded by a period of loss of appetite associated with nausea and therefore little food may have been taken for one or two days. The sudden onset of severe pain just after a meal is recognised in some cases of perforated peptic ulcer. The character of a meal preceding an acute abdominal crisis may be of significance; for example, acute pancreatitis occasionally follows excessive indulgence in rich foods or alcohol. Occasionally the ingestion of fish bones or indigestible fruits or vegetables may be admitted and be the cause of intestinal perforation or obstruction.

Bowel function

A recent departure from a previously normal bowel habit either in the form of constipation or diarrhoea may be of a great significance but before conclusions are drawn from such information care must be taken to ensure that the patient understands what is meant by normal and abnormal bowel function. The duration of absolute constipation is obviously important in the diagnosis of acute intestinal obstruction. In inflammatory conditions, such as appendicitis, constipation often precedes the more obvious acute signs and symptoms. The relationship of diarrhoea to other symptoms, such as vomiting and pain, may be of importance: in acute gastro-enteritis vomiting precedes diarrhoea; in pelvic inflammation diarrhoea may be a late development. The patient is seldom able to describe the stool with much accuracy but information regarding the presence of blood and mucus may be of great value. Thus, in infants, the mother's observation of bright blood passed per rectum may suggest intussusception.

Bladder function

The admission of disturbance of micturition may focus attention on the urinary tract—dysuria, frequency, difficulty or retention all being of significance. In pelvic infection the contiguity of an inflammatory process to the bladder may cause such disturbances. The patient may not always have observed the urine accurately and normality should not be assumed from his description. Haematuria is of great importance but a dark, febrile urine is quite frequently thought by the patient to contain blood.

Vaginal bleeding

The relationship of menstruation to acute abdominal symptoms may be of diagnostic importance. For example, mid-menstrual pain may suggest a ruptured follicular cyst. Exaggerated pre-menstrual pain may be related to acute ovarian or tubal disease. If amenorrhoea is admitted the possibility of pregnancy will influence diagnosis and management. Irregular vaginal bleeding may occur with any acute pelvic condition (including ruptured tubal gestation) or in abortion. From a history of a preceding menstrual disturbance an acute abdominal condition may be linked with chronic uterine, tubal or ovarian disease.

Previous history

The following questions must be asked about the previous medical history of the patient:

1. Have you had any attack like this before?
2. Have you had any serious illness?
3. Have you had any operation?
4. Have you had any chronic abdominal pain or indigestion?
5. Have you been X-rayed at any time?
6. (Of women) Have you had any children or miscarriages?

If the answers to any of these questions are positive a further detailed enquiry may have to be made. For example, an acute complication of gall-bladder disease, of peptic ulceration or of colonic diverticular disease is more readily recognised if there has been a typical preceding chronic history. In acute obstruction of the colon an account of the gradual build-up of symptoms to an acute phase is of great assistance. Examples revealing the importance of the previous history may be multiplied indefinitely and are stressed in succeeding chapters.

Interpretation of the history

In many abdominal emergencies the relationship of acute symptoms as revealed in the history may give a strong indication of the

diagnosis. The sudden onset of continuous generalised pain following a perforated peptic ulcer contrasts with the classical, but not inevitable, central pain shifting to the right iliac fossa associated with appendicitis. The intermittent nature of a central colic due to intestinal obstruction contrasts with the persistent discomfort of a progressive local peritonitis.

Some generalisations may be made about the localisation of pain.

1. General peritoneal irritation from effusion of blood, pus or other fluid is usually experienced as pain 'all over the abdomen'.
2. Local irritation from contact of inflamed viscera with the parietal peritoneum is usually felt as pain at that point in the abdominal wall.
3. Pain from colic or local distension of the intestinal tract is usually felt in the midline from above downwards according to the level of the intestine involved. Large intestine colic is experienced below the umbilicus and small intestine colic approximately at the umbilical level.
4. In acute conditions of the biliary tract, urinary tract, pancreas and pelvic viscera particular distributions of pain are recognised and are referred to in the appropriate chapters.

Character of pain

The reaction to pain in the individual varies so greatly that it is difficult to estimate this symptom either qualitatively or quantitatively. Observation of the patient is, of course, of value. There is little doubt as to the severity of pain in the patient who is writhing in uncontrolled agony or lying rigid and terrified to move. Patients may be cowardly or courageous, hysterical or sensible, unresistant or stoical. The threshold of pain in an abdominal crisis must vary from individual to individual. In general, women appear to tolerate pain better than men and many have the yardstick of labour pain as a measure of subsequent pain. In some cases the ready acceptance of operative treatment may confirm that pain is really severe. Conversely, if a patient complains of very severe pain and refuses operation, this may be suggestive evidence that the subjective symptoms are exaggerated.

Even a trained medical observer may find it difficult to define abdominal pain. Pains are frequently described as 'burning', 'stabbing', 'knife-like' or 'boring'. In general the colics are sharp, intermittent, griping pains while the local inflammations give rise to continuous aches uninfluenced by change of posture. In many conditions the pattern of pain is confused as there may be elements due to both colic and local inflammation. In other chapters, for each condition, an attempt is made to enumerate the different

components making up the pain pattern. The diagnostic picture is built up in many instances by an analysis of pain.

From the history it is often possible to make an accurate pre-operative diagnosis but the surgeon must be wary of a perfunctory or a purely local clinical examination based on the information acquired by his questioning. However clear-cut the pattern of symptoms may seem as described by the patient, the general and abdominal examination must be undertaken in a routine order and in as unbiased a manner as possible. Only with the completion of the clinical examination may the essential correlation of objective findings and history be made. It is obvious, however, that because of points elicited in the history the surgeon is justified in paying special attention to particular aspects of the clinical examination.

EXAMINATION AND INTERPRETATION OF SIGNS

Examination must be conducted in a good light and, whenever possible, the patient is placed flat on the back with one pillow under the head and with the legs extended.

General appearance

Direct observation of the patient during the elicitation of the history gives some idea of the degree of pain. In the most severe forms of pain the expression may be anguished and the whole body may be tense. A calm expression does not, however, preclude an advanced abdominal condition. Descriptions of the so-called 'classical facies' of acute disease are popular but of doubtful diagnostic value. The 'abdominal facies' or the 'Hippocratic facies', beloved of early writers, are merely indications of advanced toxaemia, peritonitis or ileus.

The surgeon must observe cyanosis, dyspnoea, jaundice and anaemia—any of which may have a bearing on the acute condition or associated illness. The immediate recognition of rapid respiration with excessive movement of the alae nasi may be the first clue which aids in the differentiation of a thoracic from an abdominal condition.

From the general appearance a rough assessment of shock may be made but this assessment must always be confirmed later by more accurate examination. It is important to remember that the initial shock following an acute intra-abdominal catastrophe may improve greatly with warmth and rest. If the clinical assessment is made in this phase of temporary improvement the surgeon may be greatly misled.

The attitude in bed is noteworthy. The patient with severe local or general peritonitis prefers to lie motionless; this is usual, for example, following a perforated peptic ulcer. Attempts are made