

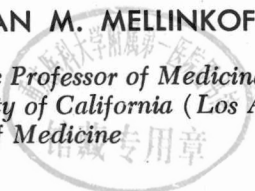


# THE DIFFERENTIAL DIAGNOSIS OF ABDOMINAL PAIN

EDITED BY

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**THE DIFFERENTIAL DIAGNOSIS OF ABDOMINAL PAIN**

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## FOREWORD

During recent years the tendency in didactic postgraduate teaching has been toward the two- or three-day seminar or conference with panel-type discussions and presentations. At these meetings, different aspects of a selected subject are presented and new information and thought in relation to diagnosis and treatment are emphasized.

Here at the U.C.L.A. Medical Center a large number of such conferences have been sponsored by the Division of Postgraduate Medical Education and have become quite popular with the practitioner students. At many of the conferences, invited national authorities participate in the presentations. Early in the program it was noted that the students constantly requested a summary of the proceedings so that they might have "take home" material which could be referred to at a later date. In response to these requests, Medical Extension initiated a policy of having a syllabus prepared to be given to the students at the time of the meeting or shortly thereafter. Since the compilation of these papers represented an up-to-date volume on the subject which was presented, it occurred to us that because reference volumes lagged behind actual research productivity, many of these syllabi would be in demand if they were available as a published book.

At about this time, the Blakiston Division of the McGraw-Hill Book Company suggested the possibility of developing a series of short practical volumes based on these

conferences or symposia, thus making available the latest collective thinking on topics of current importance. After considerable discussion and review, President Robert G. Sproul approved this plan and a committee was appointed in the Medical Center to assist in the selection of the subjects and the publication of the volumes under the general title, "University of California Medical Extension Series, Los Angeles." The committee is composed of myself as Chairman, with Dr. Morton H. Maxwell representing the Department of Medicine, and Dr. Franklin L. Ashley representing the Department of Surgery.

"Differential Diagnosis of Abdominal Pain" is the first volume to be published under the agreement between McGraw-Hill and the Division of Postgraduate Medical Education, University of California Medical Center, Los Angeles. It is planned that four to six volumes will be published yearly. Those now in the process of publication cover such topics as modern therapy in dermatology, sterility, disorders of the fluid and electrolyte metabolism, fractures, and emotional problems. It is our intention to continue selecting topics of current interest and importance, as represented in this volume edited by Dr. Mellinkoff.

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## PREFACE

Failure to recognize a diseased viscus before its rupture has led to peritonitis may cost the patient his life. Right lower quadrant tenderness, without the silent comfort of a McBurney scar, is properly the end of an evening's relaxation. Any possibility of an abdominal catastrophe, however innocent the early signs, demands intelligent vigil until the crisis has been resolved, and surgeons have correctly warned that many such patients must be saved from *medical* intervention. There is, however, an opposite pitfall. It is the repeated and ill-considered response to recurrent abdominal pains by the extirpation of another organ or lysis of another adhesion. Such a policy, leading to the syndrome of the vanishing viscera, is sometimes encouraged by perplexing and unusual causes of abdominal pain, sometimes by the insular blindness of over-specialization, and sometimes by the patient who is addicted to surgery because his emotional problems seem to him more unpleasant than a laparotomy.

Thus, like an ancient mariner, the modern physician is called upon to sail between Scylla and Charybdis, between the dangers of operating too little and too much. In *Alexandreis*, Gautier de Lille wrote in the twelfth century, *Incidis in Scyllam cupiens vitare Charybdim* (You fall into Scylla in seeking to avoid Charybdis). Our intention is to facilitate the physician's escape from this dilemma.

Apart from a few prototypes like appendicitis, no disease

*Preface*

is considered in detail. The aim is rather to assemble the means of recognizing the Scylla and Charybdis of abdominal diseases. Treatment is briefly mentioned only as it becomes inseparable from differential diagnosis.

The authors are most grateful to Miriam Hunter for invaluable assistance.

*Sherman M. Mellinkoff, M.D.*



## CONTENTS

CONTRIBUTORS	v
FOREWORD	vii
PREFACE	ix
1 Basic Considerations in the Study of Abdominal Pain	1
2 Medical Diseases of the Abdomen and Its Parietes	34
3 An Approach to Surgical Diseases of the Abdomen and Pelvis	85
4 Appendicitis, Peritonitis, and Abdominal Abscesses	126
5 Other Painful Abdominal Diseases Requiring Surgery	173
6 Retroperitoneal Causes of Abdominal Pain	255
7 Systemic Illness and Diseases Remote from the Abdomen Causing Abdominal Pain	313
8 An Approach to Chronic or Recurrent Abdominal Pain	367
INDEX	375

## BASIC CONSIDERATIONS IN THE STUDY OF ABDOMINAL PAIN

IN THE PRACTICE OF MOST PHYSICIANS, THE DIAGNOSIS OF THE disease or disorder underlying the majority of cases of abdominal pain can be easily and promptly made. Accumulated experience enables them to identify, by an intuitive appraisal of the clinical picture presented, most of the relevant common conditions and certain of the uncommon entities which have previously impressed them. Yet this empirical diagnostic procedure is not always successful, even in the recognition of common diseases that cause abdominal pain, and medical consultants find that in difficult cases the correct diagnosis is usually suggested by careful reconsideration of the history.

We believe that increasing efficiency in diagnosis cannot come entirely from a broadening awareness of the unusual diagnostic possibilities, but also requires the development of a universally applicable *method* of clinical analysis. The purpose of this chapter is to aid in the development of such a method through reexamining the mechanisms of pain in the

abdomen, the premises upon which a differential diagnosis can be based, and the limits of accuracy of the conclusions drawn.

## SEGMENTAL ORIGIN

The neural segments involved in the experience of abdominal pain can be precisely defined. Complete transection of the spinal cord at the sixth thoracic segment (T6) or any higher level abolishes all sensation below the diaphragm [1]. The mapping of dermatomes (Fig. 1) by Head and Foerster [1] indicates that the lowermost portions of the abdomen are innervated by the first lumbar segment (L1). Thus, allowing for the common variation from these average findings by one segment and the rare variation by two, one may limit the origin of abdominal pain to structures subserved by T6 to L1 (average) or T4 to L3 (range).

## PAIN-SENSITIVE STRUCTURES AND THE MECHANISMS OF THEIR STIMULATION

Within each neural segment, the possible sources of painful stimuli may be catalogued by tracing the course and distribution of afferent neurones (Fig. 2).

### The Dorsal Nerve Root

The dorsal nerve root is an exceedingly sensitive structure, lesions of which cause pain anywhere in the corresponding dermatome. It may be involved by spondylitis, osteoarthritic spurs, herniation of the nucleus pulposus (rare in the seg-

ments under consideration), collapse of vertebrae through osteoporosis or malignant disease, or by extramedullary tumors of the spinal cord. The only recognizable anatomic lesion in tabes dorsalis, to which the abdominal pain in this disorder may be attributed, lies in the dorsal root.

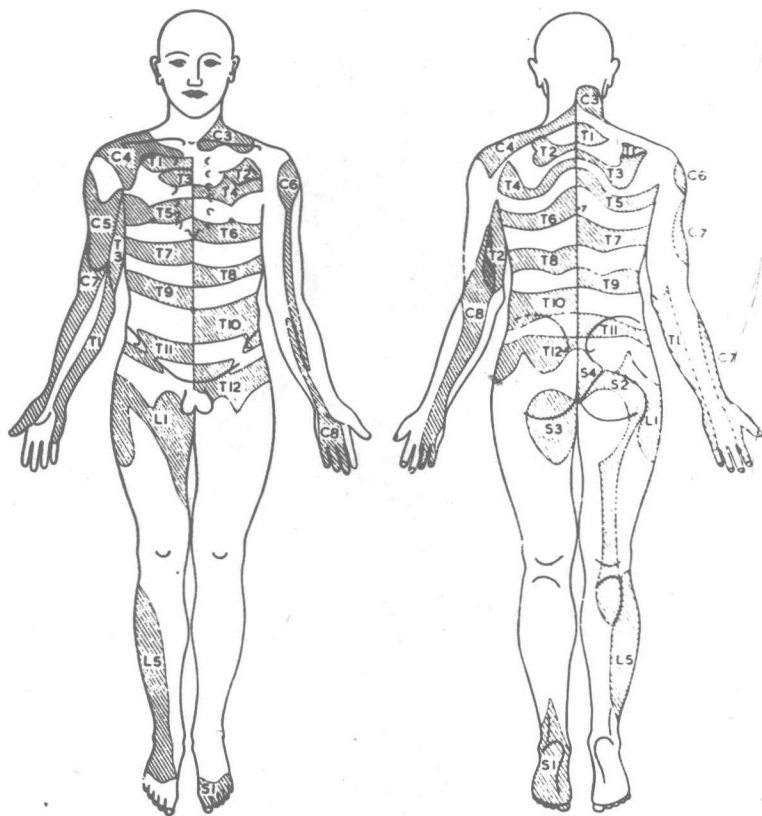


Figure 1A. Segmental innervation of the skin, according to Head. T. Lewis, *Pain*, The Macmillan Company, New York, 1942, by permission of the publisher.)

### The Nerve Trunk

The nerve trunk may be involved in a true neuritis, but those forms which involve the segments of the trunk, such as the Guillain-Barré syndrome, rarely give rise to pain. More often the trunk may be stimulated by a fractured rib, by hematomas of the soft tissues, or by a tumor mass.

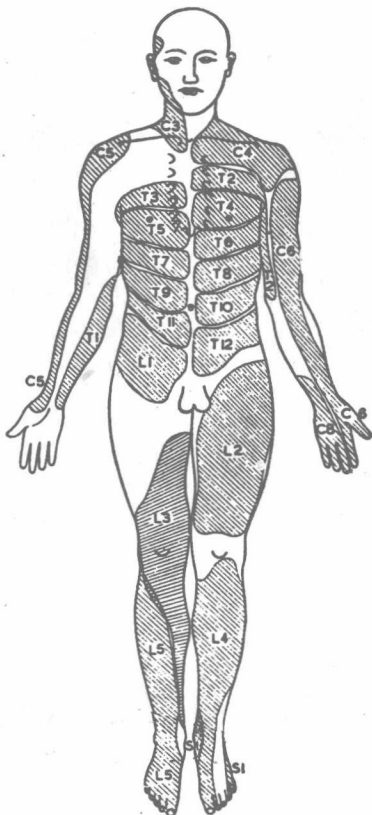


Figure 1B. Segmental innervation of the skin, according to Foerster, (T. Lewis, *Pain*, The Macmillan Company, New York, 1942, by permission of the publisher.)

## The Skin

Of the peripheral structures supplied by the nerve, the skin is most densely provided with pain-sensitive nerve endings. As common experience indicates, it is exquisitely sensitive to pricking, cutting, and burning as well as to



*Figure 2.* Diagrammatic representation of segmental afferent nerve distribution to (from above right) the skin, musculoskeletal system, serous membranes, solid viscera, and blood vessels. The nerve trunk is subdivided in portions suggesting the relative abundance of nerve endings in each structure.

faradic or strong chemical stimulation. Yet very few diseases of the skin are characteristically painful. The best examples are herpes zoster, keloids, and some cases of acute pemphigus.

### The Serous Membranes

The serous membranes—the parietal layers of pleura, pericardium, and peritoneum—are pain sensitive. Capps [2] studied this experimentally by inserting sterile wires through paracentesis needles and thus mechanically stimulating the serous surfaces. He showed that in fully conscious subjects light pressure upon or scratching of the surface of the membrane evoked no sensation. To produce pain he found it necessary to apply heavy pressure sufficient, in the case of the peritoneum, to cause bulging or tenting of the abdominal wall from within at the point of stimulation. Histologically, the nerve endings are found not in the thin mesothelial surface layer, but in the areolar tissue which lies just beneath. Thus the serous membranes appear not to possess tactile sensitivity, comparable to the skin, but rather a high degree of sensitivity to *pressure* or *tension*. The pain produced by needling the parietal peritoneum under inadequate anesthesia occurs during the stretching of the membrane before the needle passes through. The pain of acute pleurisy or peritonitis is apparently related to the increased pressure within the inflamed tissue and the tension upon the membrane produced by adhesions. The mesentery and the lesser omentum are clearly similar to parietal peritoneum in their sensitivity to tension, but the normal visceral peritoneum and pleura as well as the epicardium are virtually insensitive.

### The Blood Vessels

The afferent nerve supply of blood vessels is similarly arranged. The endothelium and deeper intimal layers are apparently anesthetic. Thus an atheroma or a bland thrombus may grow to the point of occluding an artery without pain.

The media of the arterial wall is also virtually devoid of afferent nerve endings, and spasm of an artery is essentially painless, as in the early vasospastic phase of an attack of migraine, characterized by scotomas and not by pain. The adventitia of major arteries and veins is, however, richly supplied with nerve fibers. It has been shown in patients under local anesthesia that traction on an artery causes pain; and in observations during episodes of migraine and of reactive hyperemia, pain has been seen to coincide with the period of exaggerated pulsation and overdistention of the vessel. A true inflammation of the outer coats is also painful, as in thrombophlebitis and in temporal arteritis. The common denominator of these mechanisms would seem to be the development of *tension* in the adventitia of the vessel.

### The Capsules of Solid Viscera

Pressure-sensitive nerve endings are also found in the capsules of solid viscera, where they are stimulated as the viscus enlarges. The degree of pain produced is greater, the less the distensibility of the capsule and the more rapid the enlargement of the organ. Thus the relatively indistensible kidney more readily gives rise to the pain of distention than does the spleen, which has in its capsule an abundance of elastic tissue and even smooth muscle fibers. The liver is painful and tender when it enlarges rapidly, as it may in congestive heart failure or acute hepatitis, but not when enlargement is slow, as in biliary cirrhosis. There are, of course, other mechanisms of pain production within solid viscera. The renal pelvis, for example, is sensitive to distention, and an infarcted area of spleen may become adherent to the parietal peritoneum lining the undersurface of the diaphragm, giving rise to pain in the shoulder



### **The Musculoskeletal System**

The tissues of the musculoskeletal system are variously sensitive to pain. The needling of tendons, ligaments, and dense fascia is painful, whereas needling of skeletal muscle is usually not so, unless it is tightly contracted. A slow intramuscular injection of isotonic sodium chloride solution is much more tolerable than a rapid one. Injection of hypertonic (5 per cent) sodium chloride is a well-established experimental method for inducing pain in the muscles, tendons, and ligaments [1]. It apparently injures the cell membranes and by osmotic action causes accumulation of fluid in the intercellular spaces. Similar accumulations, resulting from inflammation or hemorrhage, are painful, particularly when confined by dense fascia. The analogous situation of subperiosteal hemorrhage, as in scurvy or bone tumor, causes excruciating pain. These observations are best explained by the hypothesis that afferent nerve endings in these structures are sensitive primarily to increases in tension.

### **The Hollow Viscera**

The sensitivity of the hollow viscera of the gastrointestinal and the genitourinary tracts deserves special consideration, as disease or disorder of these organs gives rise to the majority of instances of abdominal pain. Their normal mucosal surfaces are for the most part insensitive to cutting, needling, pinching, burning, or chemical injury, thus contrasting markedly with the sensibility of the skin. One may, for example, excise a rectal polyp and cauterize its base or perform a biopsy of the cervix uteri without using an anesthetic. It may be that the ureters are an exception to this rule, as pain can be evoked in them by faradic stimulation [3].

The walls of the hollow viscera are exquisitely sensitive to