A Programmed Introduction to Upper Gastrointestinal Radiology

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UPPER GASTROINTESTINAL RADIOLOGY

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Little, Brown and Company
Boston

First Edition

Library of Congress Catalog
Card No. 76-22992

ISBN 0-316-30294-5

Printed in the United States
of America

To my father for teaching me the value of hard work.

To my mother for her understanding in my times of trial.

To my wife because I love her.

To my children because they make my life worthwhile.

FOREWORD

I met Dr. Stephen Gammill when he was an assistant professor of radiology at Tulane Medical School, where he was known as an industrious worker and a dedicated teacher always searching for more effective ways of teaching. In this book Dr. Gammill presents the principles of radiologic diagnosis of diseases of the upper gastrointestinal tract in a programmed instruction format. The advantage of learning by this method is that it requires the reader's active participation and thus maintains his attention.

One must applaud Dr. Gammill's efforts to teach more imaginatively some of the basics and some of the intricacies of diagnostic radiology. To maintain the high degree of usefulness and accuracy achieved by this branch of medicine in its relatively brief history, ever increasing numbers of new practitioners must be educated. To visualize a three-dimensional object from a two-dimensional image requires a degree of imagination — especially when the object is a functioning, motile organ that changes in shape, size, and relationship to adjacent structures. In this brief but stimulating survey Dr. Gammill offers a good opportunity for a medical student or resident to learn this difficult skill.

Seymour Fiske Ochsner, M.D., F.A.C.R.

PREFACE

I have long since given up lecturing to residents, interns, and medical students that I teach. It's too boring! Instead, I call individuals to the viewbox and have them interpret roentgenographic examinations. To get around the ever-present danger that one of the audience will fall asleep, I stipulate that everyone is subject to being consulted on each examination. The groups that I teach seem to enjoy themselves and to learn something. At least they stay awake.

After attending the National Convention for Programmed Learning in New Orleans in 1971, I learned that programming is being used in almost every facet of teaching. I also learned not only that methods of writing programmed texts have been remarkably improved during the past decade but that methods of teaching people to write programmed texts also have been remarkably improved. Having been exposed to these facts, I was eager to take the course in "how to program" that was taught by Mr. Joe Mangiaracina, Director of Education and Training at the University of South Carolina Medical School. I met and talked with the vivacious and charming Rita Johnson, coauthor with her husband, Stuart, of the excellent text *Up the Up Staircase.* This book was used in the course I took. Both she and my teacher, Joe Mangiaracina, agreed with me that programmed works are greatly embellished by the addition of some humor. I have therefore embellished this book accordingly.

To me, programmed learning is to reading what participation is to lecturing. Others have proved that programmed learning beats lecturing or prose texts handily when both short-term and long-term recall are considered. In addition, roentgenograms offer the perfect setup for programming because every film can be presented as an unknown. When films are presented to me in this manner, I find it a much more stimulating and challenging method of learning than the usual straight prose describing the roentgenographic characteristics of a disease, with a roentgenogram example to demonstrate the findings pictorially. I have found that I've had to dig harder when examining films with the unknown-answer method and have therefore learned more per unit of time spent than with the classic prose-example method. When roentgenograms are presented as unknowns in a program, a real-life situation is closely simulated, because every roentgenogram that any physician examines in real life is actually an unknown. I have therefore chosen to present this body of knowledge concerning the upper gastrointestinal tract in that manner.

S. L. G.

ACKNOWLEDGMENTS

I would first like to express my undying gratitude to Dr. Charles M. Nice, Jr., Professor and Chairman, Department of Radiology, Tulane Medical School, New Orleans, for encouraging me and guiding me in my endeavors to teach and write. He has been both a good friend and a source of inspiration for me. I believe that he is truly one of the most important figures in radiology, having made many valuable contributions. The help of Dr. Jerry Phillips, Professor of Radiology at the University of Tennessee Medical School, Memphis, in providing a good deal of the case material to photograph, was invaluable to me. The comments, criticisms, and opinions of Dr. Fredrick Fitts, Assistant Professor of Radiology, Department of Radiology, Harvard Medical School, and Dr. Herbert L. Abrams, Philip H. Cook Professor and Chairman, Department of Radiology, Harvard Medical School, who reviewed the manuscript, helped smooth out many of the rough edges and corrected several mistakes. I also owe a debt of gratitude to the many students, interns, residents, and staff physicians who helped form the basis of this book through their advice, criticisms, original ideas, and feedback. The secretaries who patiently typed this manuscript over and over and over deserve a big hand: Thanks Laura McElroy, Sharon Condon, and Janet Dawson. Also, thanks to Kathy Jacobs for her drawings. Without the advice, patience, concern, consideration, and expertise of Lin Richter, my editor, and Diane Faissler, my copyeditor, this book would not have been possible: Thanks a million, Lin and Diane.

Last, but by no means least, thanks to the distillers of scotch. Without them, I could not have maintained my patience to finish the tedious and painstaking parts of this work.

S. L. G.

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THE DISTAL ESOPHAGUS

1 THE DISTAL ESOPHAGUS

INTRODUCTION

When I first thought of writing this book, I decided to write about the stomach and duodenum only. I have not really changed my mind. I do believe that a teaching exercise such as this would not be complete if I omitted the gastroesophageal junction because it is such an integral part of the upper gastrointestinal (GI) tract. I am therefore including a few basic principles and diseases concerning this segment of the GI tract.

Segments of this chapter are in paragraph form and require no answers. The frames that are numbered E1, E2, and so on require one or more answers. Inside the back of the book is a sheet of several strips that can be torn off and used to cover the answer column on the right-hand side of each page until you have written your answer to the question. A blank or space will be present when an answer is required.

You should uncover the correct answer in the answer column after you have written your answer in the blank. This serves to correct any incorrect answers and to reinforce correct answers. If you try to answer the questions in your head instead of writing them, you will, I believe, learn a great deal less from the book.

I am starting this chapter with a simplified anatomic explanation of the esophagus, stomach, and duodenum. The remainder of the chapter is devoted to the distal esophagus and esophagogastric junction.

E1. If you can label Fig. E1, you know the anatomy of the upper gastrointestinal tract well enough to proceed with this text, since we shall be concerned mostly with learning about diseases of the distal esophagus, stomach, and duodenum. If you cannot label the diagram, you should be able to after reading the answers. The second and third portions of the duodenum together are called the duodenal sweep, duodenal loop, or C loop.

We may study the physiology of the stomach under fluoroscopy. Another method is to obtain paired films — films in the same projection taken a few minutes apart. Remember this principle and you'll be able to answer a frame later in the book with the correct diagnosis.

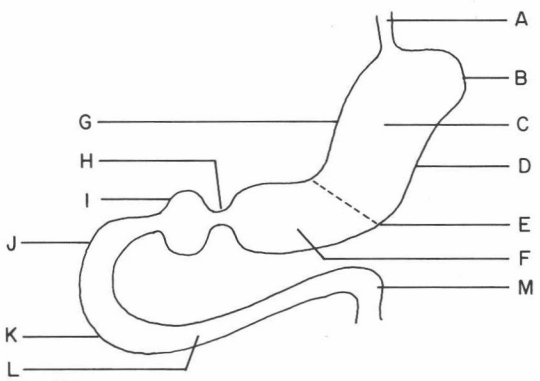


Fig. E1

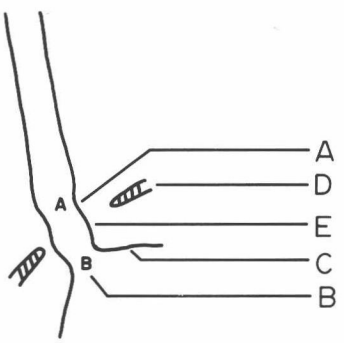
A. Esophagus.
B. Fundus.
C. Body.
D. Greater curvature.
E. Incisura angularis.
F. Antrum.
G. Lesser curvature.
H. Pylorus.
I. Duodenal bulb.
J. Second portion of duodenum.
K. Third portion of duodenum.
L. Fourth portion of duodenum.
M. Ligament of Treitz.

It has been said that the esophagogastric junction represents the quicksand of radiology, implying that you can bog down over your head here before you realize it. I agree. An in-depth analysis of the physiology and roentgenology of this junction can be complicated. Dr. Bernard Wolf has done some fantastic work on this subject and probably understands the esophagogastric junction better than anyone else. I shall attempt to translate some of his work into simplified principles that will, I hope, guide you to a basic understanding of the anatomy of the esophagogastric junction adequate to enable you to recognize normal, variations of normal, and hiatal hernias and that will serve as a springboard from which you can dive deeper into the subject. I also hope to keep us all out of the quicksand!

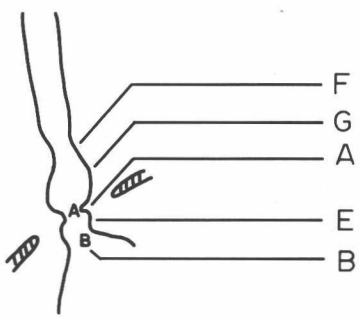
We must first understand the normal anatomy of the esophagogastric junction (EGJ) before we can study the pathology that involves it. I hope the five drawings in Figs. E2 through E6 will suffice to teach you the anatomic principles involved with the EGJ. It is best to study all five illustrations simultaneously. We will then discuss some principles of the EGJ and look at some examples of normal and hiatal hernias.

Richard Schatzki is a famous radiologist who has done a lot of work describing abnormalities of the EGJ. In fact, a distal esophageal ring was named after him: Schatzki's ring [20, 21, 22, 23, 24], which marks the esophagogastric junction. Years later, Dr. Bernard Wolf [29, 30, 31, 32] termed this the B ring and introduced the term A ring; the A ring is above the B ring. If you will notice the relationship of the rings, particularly the B ring, to the diaphragm in Figs. E2 through E6, you will go a long way toward understanding the EGJ and hiatal hernias.

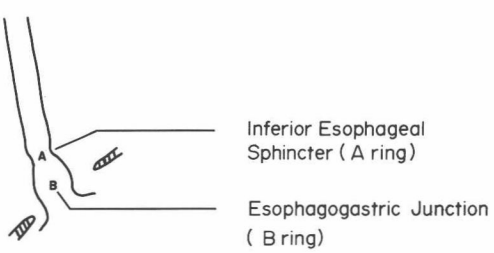
A = A ring
B = B ring
C = fundus of stomach
D = diaphragm
E = vestibule of esophagus
F = normal contraction of esophagus
G = dilated supradiaphragmatic portion of the vestibule



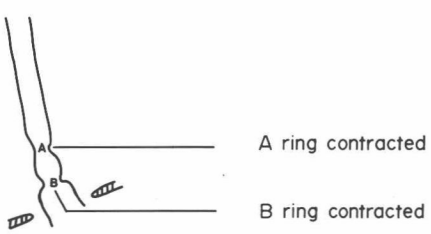
NORMAL
Fig. E2



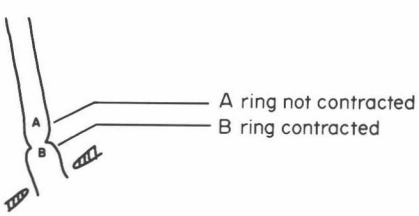
NORMAL
Fig. E3



Hiatal Hernia showing position of A and B rings. The B ring is not contracted.
Fig. E4



Hiatal Hernia with Schatzki's ring. (B ring contracted.)
Fig. E5



Hiatal Hernia- B ring contracted. A ring not contracted.
Fig. E6

It boils down simply to this: B marks the EGJ, and if it's above the diaphragm, you can diagnose a hiatal hernia; if it is not, then there is no hernia. The trick is to tell when it is above the diaphragm and when it is not.

In Fig. E2, notice that the A ring is contracted and is above the diaphragm. The B ring is below the diaphragm and is not contracted. E marks the esophageal vestibule below the diaphragm. In Fig. E3, F marks a contracted segment of esophagus, below which is the dilated supradiaphragmatic portion of the vestibule (G), the inferior limit of which is marked by the A ring. In Fig. E4, note that the uncontracted B ring is above the diaphragm; this is a hiatal hernia. The A ring is contracted in this figure. In Fig. E5, also a hiatal hernia, both the A and B rings are contracted, and, in Fig. E6, the B ring is contracted but the A ring is not. Examine Fig. E7, three films of the esophagus exposed a few seconds apart. The positions of the A and B rings are marked in the middle photograph. Note that the A ring is contracted and only one or two mucosal folds are visible within it crossing the diaphragm. This is a normal EGJ.

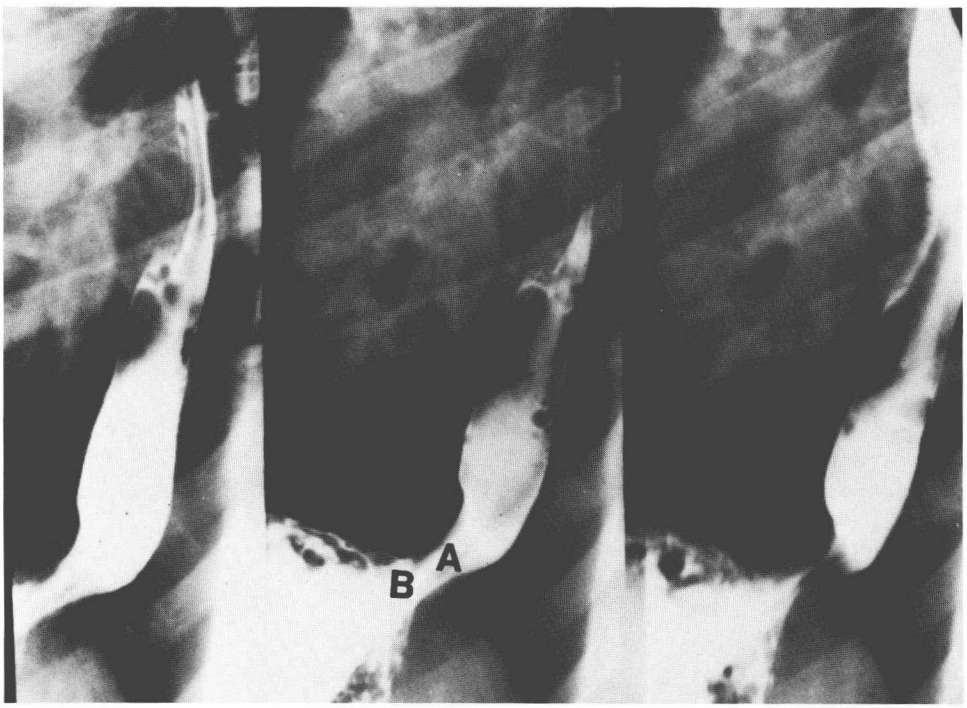


Fig. E7

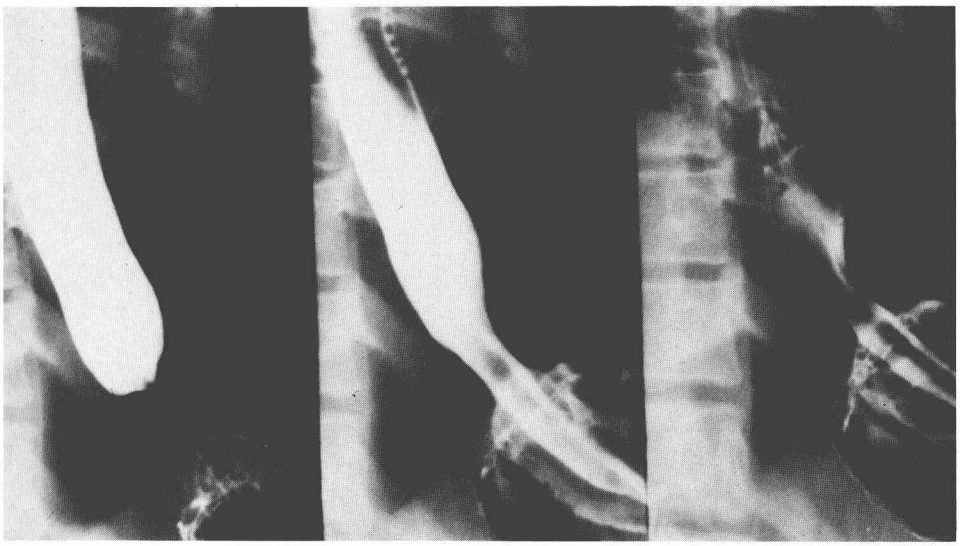


Fig. E8

E2. In Fig. E8, note that the A ring is contracted in the two left-hand films and that in the right-hand film the esophagus above the A ring is contracted, producing a prominent bulge. This bulge is the supradiaphragmatic portion of the vestibule. (*Note:* The supradiaphragmatic portion of the vestibule was previously called the phrenic ampulla. Dr. Wolf suggested that this latter term be discontinued for reasons I shall not discuss [29, 30, 31, 32].)

Note again in Fig. E8 that only one visible mucosal fold crosses the diaphragm. Compare this with Fig. E9, in which several mucosal folds cross the diaphragm. This is a hiatal hernia. So, we can conclude that if you can see only one or possibly two mucosal folds

Fig. E9

crossing the diaphragm and a dilated distal esophagus, then it is the supradiaphragmatic portion of the _____. If several mucosal folds cross the diaphragm, then it's a _____. If you want to know how many mucosal folds must have crossed the diaphragm before you diagnose a hiatal hernia, I guess four is as good a number as any. By the way, in Fig. E9 there is no barium in the esophagus; that is herniated stomach that is filled with barium.

Vestibule.

Hiatal hernia.

E3. Examine Fig. E10. What is the diagnosis and why:

_____

Hiatal hernia with Schatzki's ring (B ring).

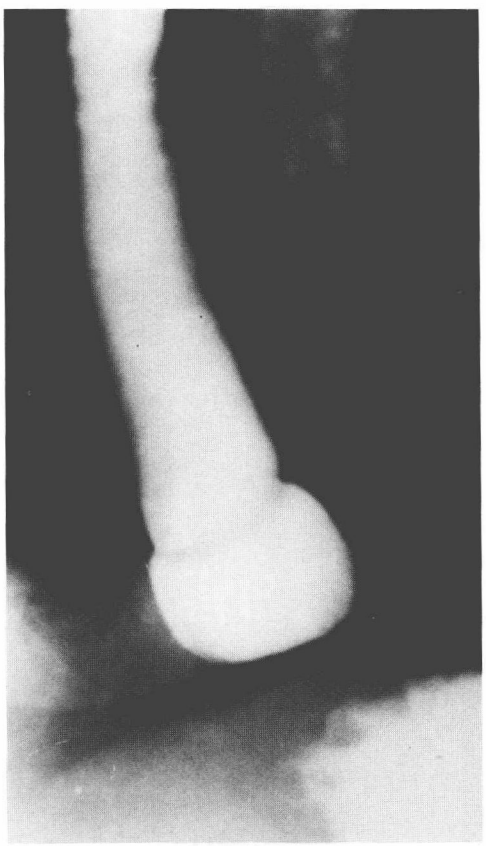


Fig. E10

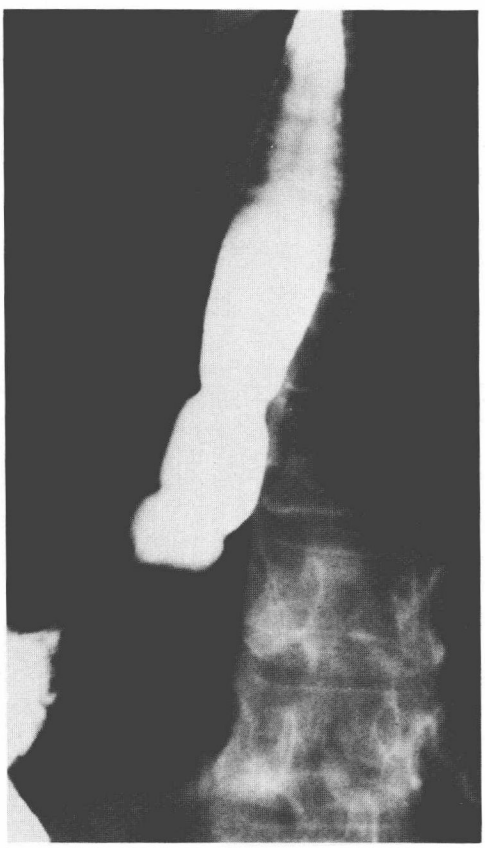


Fig. E11

Fig. E11 is the same thing except that the A ring is also contracted above the B ring. Another name for the A ring is the _____. The B ring marks the _____ junction and, if present above the diaphragm, is diagnostic of a hiatal hernia.

Inferior esophageal sphincter.

Esophagogastric.

The B ring may become quite stenotic and produce severely painful dysphagia. In Fig. E12, note the tightly stenotic B ring, which will not allow a small barium tablet to pass through it (the tablet will eventually dissolve and pass). This is a good way to assess grossly the degree of stenosis of a ring.

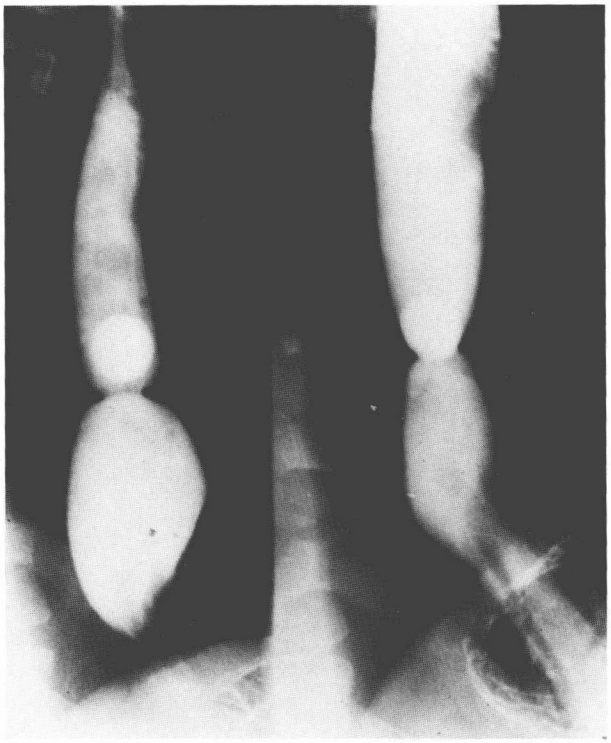


Fig. E12

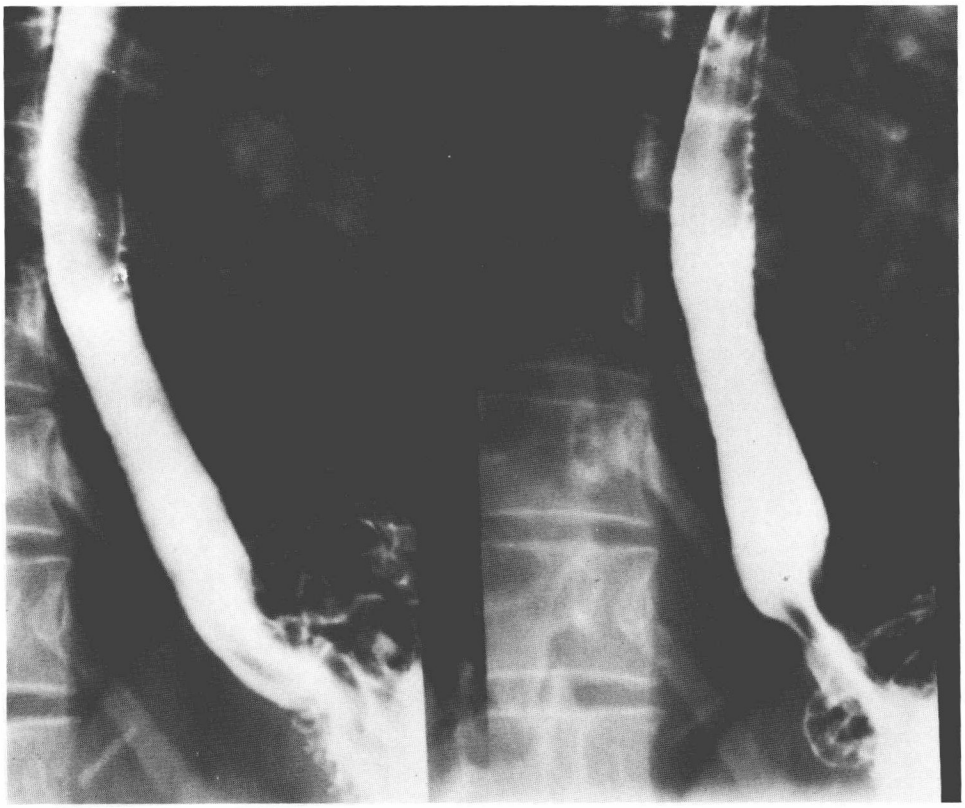


Fig. E13

In Fig. E13, the right-hand film, notice that the inferior esophageal sphincter (A ring) is contracted and that only one mucosal fold crosses the diaphragm. In the left-hand film, however, note that when the inferior esophageal sphincter is not contracted, the esophagus is widely dilated. These are ideal conditions for gastroesophageal reflux, which you can only demonstrate fluoroscopically. This widely dilated esophagus is probably often

associated with the condition of chalasia, absence of contraction of the esophagus at the EGJ, which allows the contents of the stomach to flow freely back into the esophagus.

So, in summary, a hiatal hernia may be present with or without a Schatzki's ring (B ring). The esophagus may be widely dilated as it crosses the diaphragm (patulous esophagus), which is important in that it may lead to esophagogastric reflux. The hiatal hernia by itself may cause clinical symptoms (e.g., dysphagia). Even if no hiatal hernia is present, gastroesophageal reflux may cause dysphagia, reflux esophagitis, and an esophageal stricture. When you do observe reflux, however, you will usually find an associated hiatal hernia.

Fig. E14

E4. Examine Fig. E14 and note that the distal third of the esophagus is narrowed and that the esophagus is quite wide as it crosses the diaphragm. Notice that at the upper end of the stricture, the esophagus gradually tapers from proximal to distal and that no edges of the esophagus overhang at the point where the esophagus narrows. Barium refluxed from the stomach into the esophagus at fluoroscopy. Diagnosis:

Esophageal stricture (without hiatal hernia), caused by a patulous distal esophagus and esophagogastric reflux.