SURGERY OF THE ANUS ANAL CANAL AND RECTUM

BY

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FOREWORD BY

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To
Alison,
Jennifer,
Gordon and
Ann.

FOREWORD

I AM indeed privileged to be invited to write the foreword to this book on the Surgery of the Anus, Anal Canal and Rectum, by my friend E. S. R. Hughes of Melbourne, because there are so few modern British works dealing with this branch of Surgery.

This book, conceived in the Southern Hemisphere, by a general surgeon, is a notable addition to the literature of rectal surgery.

The author, a former Resident Surgical Officer at St. Mark's Hospital, reflects the teaching and inspiration of this 'Mecca' of colon and rectal surgery. He has faithfully followed the footsteps of another Australian, Campbell Milligan, Consulting Surgeon to St. Mark's Hospital, whose painstaking anatomical researches in this field have been the basis for much of the advancement in our knowledge and in the treatment of the more common ano-rectal diseases.

The book is up to date, concise, full of practical facts, free from verbosity and garnished by historical illustrations. It is not merely a reproduction of material already in print but contains the carefully considered views of its author.

Mr. Hughes, from his experience in the treatment, by skin cover, of wounds of the perianal region following operation, has reminded us of the value of this procedure with its obvious economic and other advantages. This method has been made possible by the use of sulphonamides and antibiotics and advances in surgical technique.

The line drawings and general arrangement of the text make for clarity and ease in finding the important and salient facts. Not only the practising surgeon, but also the general practitioner and the medical student will find this book of value, and I am confident that the labours of the author will be well rewarded.

149 Harley Street,
London, W.1.

PREFACE

THIS book is not intended as a work of reference as I have neither the desire nor the ability to compete with authors who have made valuable contributions of this nature. Here I describe theory and practice in the surgery of the anus, anal canal and rectum which I have found to be adequate.

To become a specialist the practitioner must pass through three phases. In the first he must be inspired to take a particular interest in the specialty ; in the second, he must receive special training in that work ; and in the third, he must have full facilities to practise his art to allow him to develop his skill.

I am indebted to Mr. John Turner, F.R.C.S., Surgeon to In-Patients at the Royal Melbourne Hospital, for supplying the inspiration to specialise in proctology. Mr. Turner worked under the great W. E. Miles, and when he returned to Melbourne built up an extensive practice in which were a very large number of patients suffering from ano-rectal disorders. This experience gave Mr. Turner an authoritative position in proctology in Australia ; it was the perfection of his teaching which so impressed me. In later years he shared with me his interesting problems in a most unselfish manner.

My training in the specialty was obtained, I am proud to say, at St. Mark's Hospital for Diseases of the Rectum, London. Firstly, I was a clinical assistant to Mr. E. T. C. Milligan and, later, Resident Surgical Officer. This hospital provides unique special experience, partly because of the large numbers of patients seen, but chiefly because of the stimulating teaching and leadership of the staff. I acknowledge with gratitude the work of Dr. Cuthbert Dukes, Mr. W. B. Gabriel, Mr. E. T. C. Milligan, Mr. Naunton Morgan, Mr. O. V. Lloyd-Davies, Mr. J. C. Goligher and Mr. Henry Thompson.

Since I returned to Melbourne I have been fortunate indeed in having the co-operation and goodwill of many doctors which has provided me with every opportunity to continue my study in this specialty. Very generously, a number of my senior colleagues at the Royal Melbourne Hospital have made available facilities for the treatment of certain of their patients suffering from unusual proctological conditions and my special thanks are due to Sir Victor Hurley, Sir Albert Coates, Mr. W. D. G. Upjohn, Mr. Orm Smith, Mr. G. R. A. Syme and Mr. Grayton Brown. In developing operative technique I have been lucky in having assistance and helpful criticism from a number of first-class registrars and house surgeons ; in particular I would like to mention Mr. R. Kernutt, Mr. H. Stanistreet, Mr. Kenneth Cox and Mr. A. R. Waterhouse.

In arranging the subject matter of the book I have followed the orthodox method of classifying disorders into separate sections. This is applicable in

this region because, as a rule, the diagnosis can be made by clinical examination. I have not included chapters on trauma or on congenital abnormalities because my personal experience is limited.

This book would have taken much longer to prepare if it had not been for the tireless energy of my secretary, Miss Jean Lister. She has spent many long evenings and week-ends typing and re-typing the manuscript. The final copy was a beautiful piece of work. She also was responsible for gleaning the information in the Historical Appendix and for much other and considerable help.

I have done the drawings myself and have received every co-operation from the Department of Visual Aids, University of Melbourne, in photographing the drawings as they were completed. Most of the photographs were also my own work and it is a pleasure to acknowledge the assistance I have had from the theatre staffs of the Royal Melbourne Hospital, St. Andrew's Presbyterian Hospital (Sister Johnson), and Bethesda Salvation Army Hospital (Sister Stewart). Most of the pathological specimens have been photographed by Mr. Inglis of the Department of Medical Illustration, the Royal Melbourne Hospital, to whom my thanks are due, whilst Dr. J. D. Hicks very kindly supplied the photomicrographs.

The *Australian and New Zealand Journal of Surgery*, the *Medical Journal of Australia*, the *British Journal of Surgery* and the *British Medical Journal* have very kindly granted permission to reproduce illustrations from my articles which have appeared from time to time.

I wish also to express my sincere thanks to the following for permission to use illustrations:

The *Australian and New Zealand Journal of Surgery* (Freidin 1955) for Figure 22; The University of Leiden, Holland, for Figure 35; The Wellcome Historical Medical Museum for Figure 40; The British Museum for Figures 81 A and 126; *La Press Médicale* for Figure 127; Messrs. G. Bell & Sons Ltd., London, for Figure 273, which is taken from *Rest and Pain* (1950), edited by E. W. Walls and E. E. Philipp; Messrs. Hutchison & Co., Ltd., London, for Figure 274, which is original to *Disciples of Aesculapius* (1900), by Sir B. W. Richardson; Messrs. W. B. Saunders Co., London and Philadelphia, for Figure 275, which appears in *An Introduction to the History of Medicine* (1929), by F. H. Garrison; *The Lancet* and the Anthony Buckley Studios Ltd. for Figure 276.

The manuscript has been read for me by several friends; Dr. Gordon Houseman, Dr. D. G. McLeish, Dr. A. R. Waterhouse and Miss Barbara Stubbs receive my special thanks for this work. Dr. Ian Wood and Professor E. S. J. King have always been generous in their help in these matters and in the preparation of this book I was able to take full advantage of their experience. Professor Maurice Ewing, Professor of Surgery in the University of Melbourne, very kindly gave me some valuable advice.

CONTENTS

Chapter One

SURGICAL ANATOMY OF THE ANAL CANAL AND RECTUM

SOME aspects of the anatomy of the anal canal and rectum are more readily studied in the living. In this region, therefore, the anatomist seeks the aid of the surgeon who has both endoscopic examinations and surgical dissections with which to obtain anatomical information.

THE ANUS, ANAL ORIFICE AND ANAL VERGE

The *anus* is set in the diamond-shaped perineum and on, or just behind, the transverse line which joins the ischial tuberosities (Fig. 1). The anus has

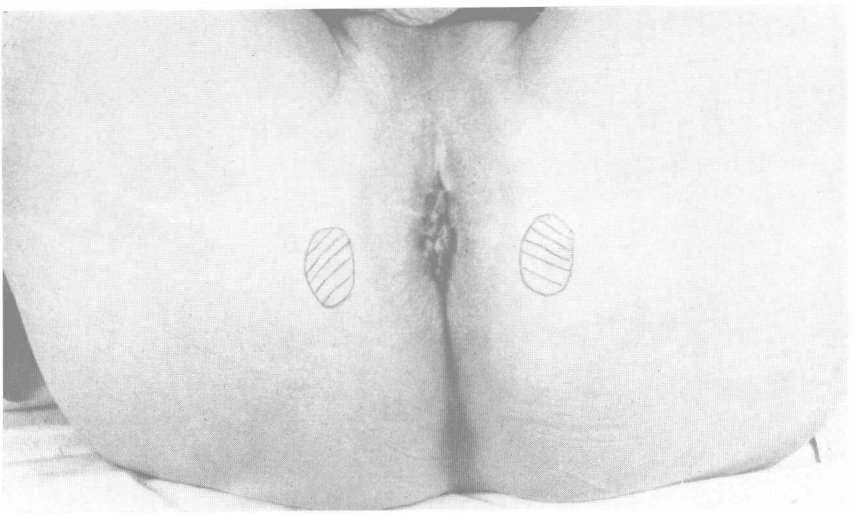

FIG. 1
Anus is situated approximately on line joining anterior edges of ischial tuberosities (marked with skin pencil).

an antero-posterior direction and lies in the natal cleft which may be deep or quite shallow. From the centre of the closed anus radiate folds of pigmented skin, smooth and free from skin tags; the anus is greatly stretched at defaecation and the folds disappear, but they reappear with closure of the anus on account of contraction and elasticity of the corrugator cutis ani muscle (Fig. 2).

The anus is normally closed and remains so even when the patient is deeply anaesthetised. In suitable subjects lateral traction at the anal margins opens the anus widely to reveal the *anal orifice* leading into the anal canal. The edge of the anal orifice is known as the *anal verge* and it is from this

relatively constant level that sigmoidoscopic measurements should be made rather than from the variable level presented by the buttock.

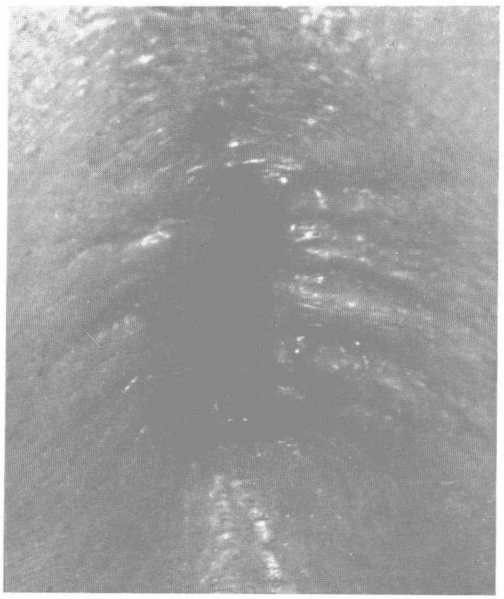

FIG. 2
Normal anus, showing anal orifice, anal verge and radiating folds of skin.

THE ANAL CANAL

The anal canal extends from the anus to the ano-rectal ring and is about three to four centimetres in length. The ano-rectal ring is a strong muscular ring formed by various muscles and represents the upper end of the muscular sphincters which guard the lower end of the large bowel. The ano-rectal ring is not an embryological boundary and may not be acceptable to the anatomist whose material is formalin-hardened, but nevertheless it is a structure which is easily recognised on clinical examination and it possesses considerable clinical significance. The pectinate line represents the upper limit of the *anatomical anal canal* and the ano-rectal ring the upper limit of the *surgical anal canal* (Fig. 3).

The Mucous Membrane of the Anal Canal

The mucous membrane of the upper half of the surgical anal canal has a pink colour; in the lower half it is plum-coloured, changing to bluish-purple just inside the anal verge. The mucous membrane is lined by columnar and cuboidal epithelium and is arranged in longitudinal folds, known as the *columns of Morgagni* (Fig. 4); these columns are joined at their lower ends by delicate semilunar folds known as the *anal valves*. The small pockets between the columns and just above the anal valves are known as the *crypts of Morgagni*. The columns of Morgagni probably possess no special significance other than representing a mechanism whereby the mucous membrane can accommodate considerable stretching in the course of defaecation. The anal valves are believed to be the level of the embryological junction of the post-allantoic gut and

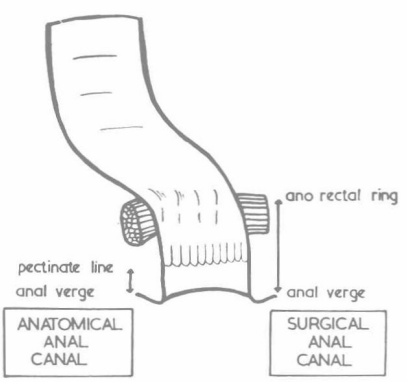

FIG. 3
Difference between anatomical and surgical anal canal.

the proctodael ingrowth and correspond roughly to the transition from glandular to stratified epithelium. It has been suggested that the crypts of Morgagni are concerned with the lubrication of the anal canal, but this is doubtful.

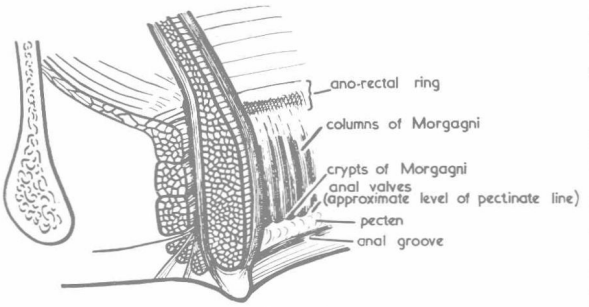

FIG. 4
Anatomical structures in anal canal.

The *pectinate* line is the name given to the level at which typical rectal mucosa changes to the stratified epithelium of the anal skin. As mentioned above, this transition is at about the level of the anal valves, but may be a little above it. In some individuals, *papillae* develop from the tips of the faces of the pectineal indentations and these project into the lumen of the anal canal. These anal papillae do not arise from the valves (Fig. 5).

A constant feature of the living anal canal is the presence of a groove, five to ten millimetres in width, extending around the anal canal just within the anal verge (Fig. 4). It is difficult to identify this groove after the anal

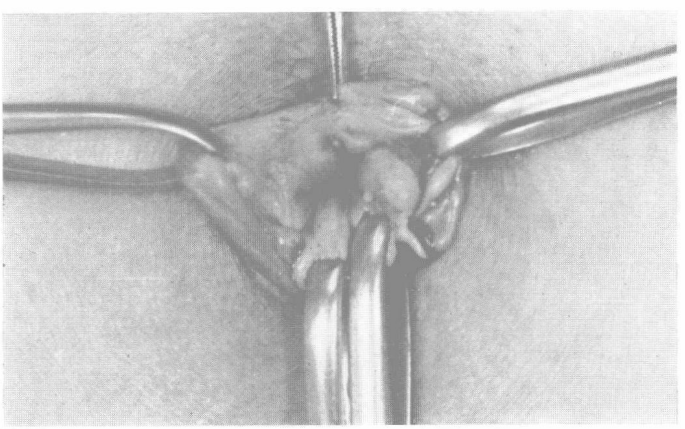

FIG. 5
Hypertrophy of anal papillae.

canal has been removed. A few millimetres above the groove are the anal valves and pectinate line. This groove separates the internal from the external haemorrhoidal zones and corresponds roughly with the band referred to as the *pecten*. Stroud used this term to define the narrow area bounded by the pectinate line above and Hilton's white line below. Ewing (1954) has recommended that the latter term be discarded because it is so unusual to see a 'white line' in the anal canal. This *anal groove* or pecten is covered

by stratified epithelium and has a dense connective tissue matrix with thick muscular and elastic components, suggesting firm support and anchorage of the mucous membrane; it forms a contrast to the mucous membrane of the upper half of the anal canal which is supported by lax areolar tissue and thin and regular mucous membrane.

A special series of anal *glands* opens into the crypts of Morgagni (Fig. 6). There are rarely more than six or eight of these glands in the human, but they appear to be a constant feature and are most concentrated in the posterior segment of the anal canal. They arise only from the narrow transitional circular zone in which the rectal mucosa changes from columnar to stratified

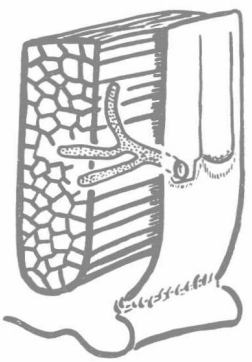

FIG. 6

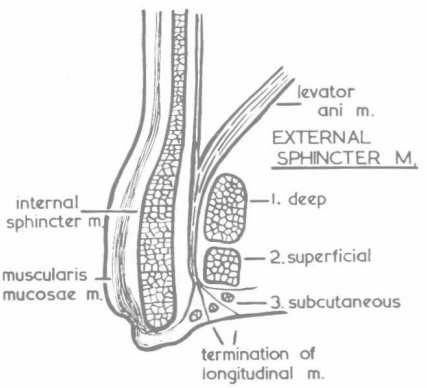

FIG. 7

FIG. 6. Anal gland.

FIG. 7. Components of musculature of anal sphincter. Diagram represents average finding in twenty-three dissected specimens.

epithelium. An *anal gland* possesses a narrow duct and up to six tubular branches which extend into the submucosa nearly always in a direction towards the anus (Walls, 1956). These glands have been traced into the internal sphincter and occasionally have been seen penetrating the longitudinal muscle. They were formerly regarded as morphological rudiments, but more recent investigations suggest some definite function and, in the lower animals at least, it is thought that the glands are connected with sexual activities and that they secrete odoriferous substances.

The Musculature of the Anal Canal (Figs. 7, 8, 9, 10)

The anal canal is surrounded by a complicated sphincter whose muscle structure has been the subject of many investigations. There are both voluntary and involuntary muscle components with smoothly co-ordinated function.

EXTERNAL SPHINCTER MUSCLE.—This muscle is composed of three parts, although fusion of adjacent portions of the muscles makes the subdivision artificial.

1. *Subcutaneous External Sphincter Muscle.*—This portion of the external sphincter overlaps the internal sphincter muscle, but not to such an extent as to form the lower part of the anal canal (Figs. 7, 8, 9). The muscle is a

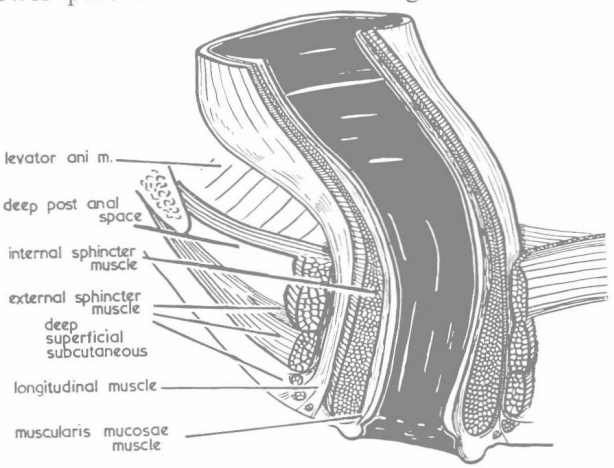

FIG. 8
Components of musculature of anal sphincter.

relatively thin red band encircling the anal canal. The subcutaneous sphincter is separated into fasciculi by prolongations of the longitudinal muscle passing towards the skin. This muscle is only occasionally identified in the course of operations on the anal canal (Goligher, Leacock and Brossy, 1955 ; Hughes, 1956).

2. *Superficial External Sphincter Muscle.*—This portion of the external sphincter muscle is elliptical in shape and lies above and is a little more lateral than the subcutaneous part. The superficial part is incompletely separated from the subcutaneous part by an extension of the longitudinal muscle, termed the ' perianal fascia ' by Milligan and Morgan. The superficial external sphincter muscle is attached to the dorsal aspect of the coccyx ; in fact, it is the only part of the external sphincter muscle which gains insertion into this bone. It also has some fibres passing to the skin over the coccyx. As it passes forwards, the muscle splits towards the central point of the perineum (Figs. 8, 9).

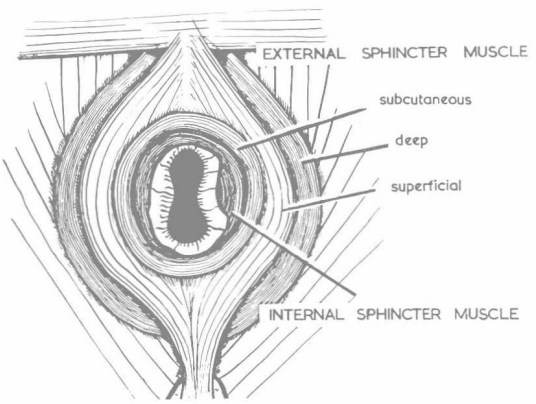

FIG. 9
Musculature of anal sphincter.

3. *Deep External Sphincter Muscle.*—This is the upper division of the external sphincter muscle. Posteriorly, the uppermost fibres intermingle with

those of the pubo-rectalis portion of the levator ani muscle (Figs. 8, 9). Anteriorly the fibres of the muscle decussate and join with the transverse perineal muscles and also merge with extensions from the pubococcygeus muscle which fuse with one another in front of the rectum (Luschka's muscle).

INTERNAL SPHINCTER MUSCLE.—The internal sphincter muscle is a direct continuation of the circular coat of the large bowel (Figs. 7, 8). It is thirty to thirty-five millimetres in length and five to seven millimetres in width. The

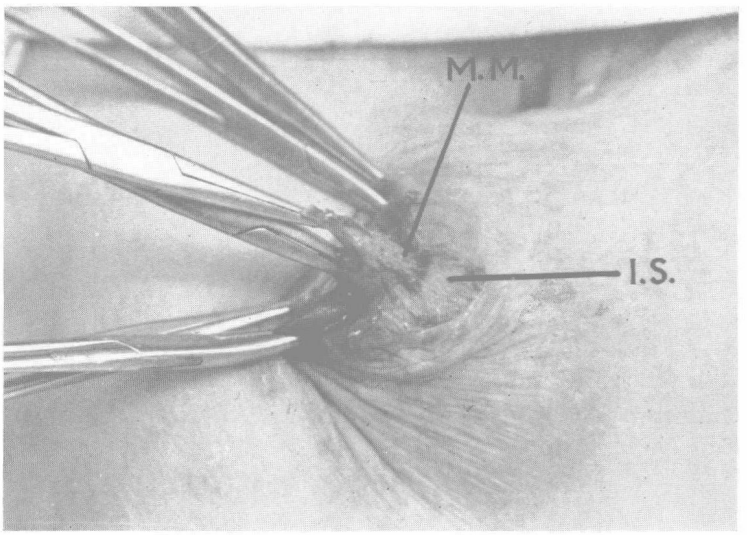

FIG. 10
Lower border of internal sphincter muscle (I.S.) and muscularis mucosa (M.M.) exposed during operation for internal haemorrhoids.

muscle is sharply delineated, bounded on the outer side by a continuation of the longitudinal muscle and on the inner side by the muscularis mucosae, which is also well-defined at this level. Extensions of these two longitudinal muscle layers intermingle around the lower border of the internal sphincter muscle. The pale, compact fibres of the internal sphincter muscle are traversed by thin sheets of tissue passing from the outer longitudinal coat to the inner muscularis mucosae. Because it extends to the anal verge the lower edge of this well-developed muscle has been confused with the subcutaneous portion of the external sphincter muscle (Fig. 10).

LONGITUDINAL MUSCLE.—The longitudinal muscle is reinforced by fibres received from the levator ani muscle, but as this conjoint muscle proceeds distally, the muscle fibres are replaced by fibro-elastic tissue (Figs. 7, 8). Thin sheets and bundles separate off medially and pierce the internal sphincter muscle to join with the muscularis mucosae.

At the level of the lower border of the internal sphincter muscle the longitudinal muscle splits up into numerous sheets (or bundles) which pass

through the subcutaneous portion of the external sphincter muscle, dividing it into fasciculi, and finally merging with the dermis of the skin.

One of these prolongations of the longitudinal muscle passes between the lower border of the internal sphincter muscle and the subcutaneous external sphincter muscle and has been termed the *anal intermuscular septum;* but, apart from its situation, there is nothing to distinguish it from the other terminal sheets of the muscle.

MUSCULARIS MUCOSAE MUSCLE.—As the muscularis mucosae proceeds distally, it receives reinforcing strands from the longitudinal muscle coat which pierce the internal sphincter muscle. The muscularis mucosae becomes a well-defined structure and reaches maximum development in the region of the anal valves and continues in this way to the lower border of the internal sphincter (Figs. 7, 8). At this level many of the fibres are attached to the epithelial layers and appear responsible for the groove attributed by Milligan and Morgan to the attachment of the anal intermuscular septum. Some fibres continue distally immediately under the skin of the anus to form the *corrugator cutis ani muscle.* The more laterally placed fibres mingle around the lower border of the internal sphincter with the inner septa of the longitudinal muscle (Fig. 10).

The muscularis mucosae muscle is so well-developed that it has been given a special name by various investigators. Kohlrausch, in 1854, suggested the term ' muscularis mucosae ani.' The muscularis mucosae muscle forms the dense matrix of the pecten zone of the anal canal.

CORRUGATOR CUTIS ANI MUSCLE.—This term was given by Ellis (1878) to a thin layer of involuntary muscle in the subcutaneous tissue and extending outwards from the anus. This muscle is almost certainly derived from a continuation of the muscularis mucosae muscle and is responsible for the characteristic puckering of the skin of the closed anus (Fig. 2).

THE RECTUM

The rectum is the lowermost portion of the colon; it extends from the recto-sigmoid junction to the ano-rectal ring. The latter is a fixed level and is easily recognised. The recto-sigmoid junction, however, is not marked by muscular sphincters and is difficult to define.

The endoscopist finds that, after passing the sigmoidoscope approximately fifteen centimetres from the anus, he encounters a zone a short distance above the upper valve of Houston, beyond which it is difficult to negotiate; it almost seems that there is a narrowing of the bowel at this site. To the endoscopist, therefore, the recto-sigmoid junction is about fifteen centimetres from the anus (Fig. 11).

The surgeon tends to regard tumours of the bowel situated as high as the promontory of the sacrum as recto-sigmoid in situation, whilst anatomists place the recto-sigmoid junction opposite the third piece of the sacrum. *Here*

the rectum is considered to end at about fifteen centimetres from the anus on sigmoidoscopy, and at the third piece of the sacrum at operation; the two levels correspond roughly.

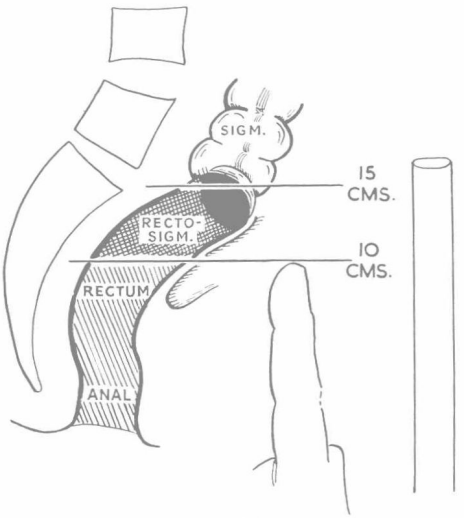

FIG. 11
The finger reaches a level ten centimetres from anus. An important function of the sigmoidoscope is to reach lesions situated in a radiologically blind zone situated between ten centimetres and fifteen centimetres from anus.

The rectum follows the curve of the sacrum. Gorsch (1955) points out that the posterior wall, in contrast to the straighter anterior wall, curves abruptly forwards over the ano-coccygeal raphe; this is responsible for a 'blind spot' in the rectum in the course of endoscopy. The rectum also possesses lateral flexures corresponding with the rectal valves of Houston; there are usually two flexures on the right and one on the left. At the ano-rectal ring the lumen of the bowel curves sharply so that, whilst the lower third of the rectum is directed downwards and forwards, the anal canal proceeds downwards and backwards.

The rectum has a wide, easily distensible lumen. The mucosa, lined by columnar epithelium, is pink and vessels, large and small, can be seen in the submucosa; this is known as the vascular pattern and is lost in certain pathological conditions wherein the mucosa becomes abnormally thickened.

Three folds project into the lumen of the rectum. They were well described by Houston in 1830 and are referred to as the *rectal valves of Houston.* Although there are usually three such valves, they may be absent altogether or there may be as many as five. The lowest of these valves is just above the ano-rectal ring and about five centimetres from the anal verge as measured on the sigmoidoscope (Fig. 12). It is situated in the left posterior quadrant. The middle valve is usually the most prominent and is sometimes called Kohlrausch's plica: it projects into the lumen from the right or right anterior aspect of the anus. This valve is about seven to eight centimetres from the

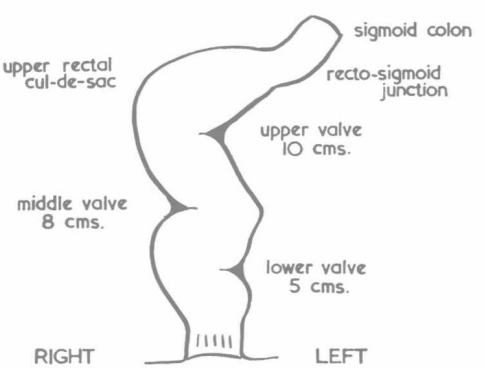

FIG. 12
Valves of Houston.

anus and corresponds very approximately to the level of reflection of the peritoneum off the anterior wall of the rectum. Tumours below this valve lie in the lower half or extra-peritoneal portion of the rectum which has some prognostic significance. The third, and uppermost, valve of Houston, is about ten centimetres from the anal verge and is situated on the left side. Immediately above this level is a cul-de-sac and above this again the relatively narrow sigmoid colon. The rectal valves of Houston contain extensions from both muscle coats and fibrous connective tissue. They are not present in all mammals and their function is not clear. It was once thought that chronic constipation might be caused by prominent Houston's valves and instruments were designed to reduce their size by pressure necrosis.

LEVATOR ANI MUSCLE

(Fig. 13)

The levator ani muscle is intimately related to the rectum and anal canal. It is doubtful if the levator ani has any important role in support of viscera other than the anal canal and rectum because it is largely excised with the rectum and anal canal in radical surgery for carcinoma and complications rarely follow. The levator ani muscle consists of two main parts, the *ilio-coccygeus* and the *pubo-coccygeus;* the latter has a specialised portion referred to as the *pubo-rectalis.*

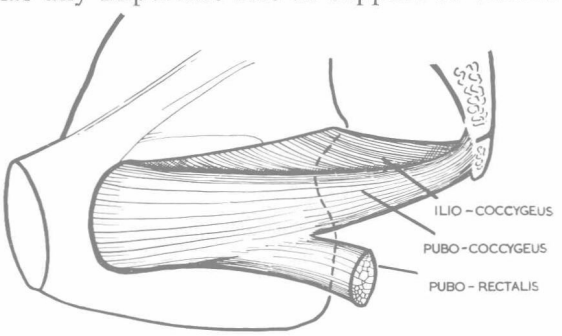

FIG. 13
Levator ani muscle.

Ilio-coccygeus Muscle

This portion arises from the ischial spine and from the lateral pelvic wall, as far forwards as the obturator canal. Its origin is fascial and the whole muscle is usually thin and degenerate, although it may hypertrophy quite considerably during pregnancy. The muscle fibres pass downwards and inwards to gain insertion into the sides of the coccyx and ano-coccygeal raphe.

Pubo-coccygeus Muscle.

This portion of the levator ani muscle arises from the posterior aspect of the pubis, the deep layer of the triangular ligament and from the fascial arch or white line of the levator ani muscle. The fibres pass mainly backwards and slightly inwards and on either side of the visceral canal to join in a V-shaped manner to form a raphe attached to the front of the coccyx and lower sacrum. The muscle fibres of the pubo-coccygeus run in a different direction from those of the ilio-coccygeus; the former run backwards and