MANUAL OF UROLOGY

BY

ALEC W. BADENOCH, M.A., M.D., Ch.M. (ABERD.), F.R.C.S.

Surgeon to St. Peter's Hospital for Stone and other Genito-Urinary Diseases; Assistant Surgeon to the Royal Hospital of St. Bartholomew; Visiting Urologist to the Royal Masonic Hospital and to the Samaritan Hospital for Women; Consulting Urologist to the King Edward VII's Hospital for Officers, (Sister Agnes Founder) and to the Association of Retired Naval Officers; Hunterian Professor, The Royal College of Surgeons, 1948; Lecturer in Surgery at the Medical College of the Royal Hospital of St. Bartholomew; Lecturer in Urology at the Institute of Urology, University of London.

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MANUAL OF UROLOGY

TO MY TWO BROTHERS

IAN, killed in France, 1917

GEORGE, killed in Burma, 1944

PREFACE

SEVERAL excellent works on Urology have appeared in this country and in America in recent years, but despite this, I think there is still need for a book which contains the essentials of symptomatology, pathology, investigation, diagnosis and treatment.

With these considerations in mind I have tried to make this work a practical manual, and have detailed my own urological practice based on the traditions of St. Peter's Hospital for Stone. It should appeal to all general surgeons; some may be specializing in Urology, in which case it will provide them with an adequate introduction; for others who continue to embrace the wider general field, it may serve as a useful practical reference.

Surgery and its specialized branch—urology—despite our scientific advances, remains an art. There are often several reasonable ways of treating the same condition and the selected method may depend on the duration of the disease, on its extent or on the presence of a complication. It will be influenced by the age and general fitness of the patient and by his location. It will undoubtedly be affected by the experience of the surgeon and especially by his training, by his equipment and by the team of assistants at his disposal. I have therefore, on occasion, felt it necessary to describe more than one operative procedure, for a single pathological condition. Although I have usually indicated lines of treatment which are fairly widely accepted and which I myself employ, I have occasionally detailed an operation which may be appropriate in isolated surroundings although it may not now be employed in a well equipped and adequately staffed urological unit.

I would like to pay tribute to my teachers and colleagues at St. Peter's Hospital—the late Swift Joly, Mr. A. Clifford Morson and Mr. J. Alban Andrews, and especially to Mr. F. J. F. Barrington and Mr. R. Ogier Ward, both of whom it has been my privilege to assist in and out of hospital for many years. From each of them I have learned much. Mr. Barrington has also read through several sections and his criticisms have always been penetrating. Mr. A. H. Harkness has encouraged me and has greatly helped with the section on genital lesions in Chapter VI. Mr. J. G. Jamieson, formerly lecturer in anatomy and embryology at St. Bartholomew's Hospital, has helped me with Chapter I. Dr. Cuthbert E. Dukes and Dr. George J. Cunningham have given me assistance in the pathology and provided me with histological illustrations.

I would like to acknowledge my debt to that Forum of British Urology, the Urological Section of the Royal Society of Medicine, where I have learned much of what to do and sometimes of what not to do. I have taken due account of the published work in urological journals in this country and overseas especially in America. The authors of some articles, references to which appear at the end of each Chapter, may not be specifically mentioned in the text; but all these sources have been consulted, and are listed with their titles for ease of further study by the reader.

The cystoscopic and operative drawings have been made for me by Mr. Frank Boyle. Many of them were redrawn from personal diagrams and as well as the high artistic value of his work I must acknowledge his painstaking and accurate reproduction. The

photographic and X-ray illustrations have been selected from several thousand collected over a number of years. For many of them I must thank Mr. Norman K. Harrison and the staff of the photographic department at St. Bartholomew's Hospital and Mrs. Janet Mason and Mr. J. McDonnell of St. Peter's Hospital. Some have been lent by colleagues and friends to all of whom I hope I have made acknowledgement in the text. I have to thank Mr. W. J. Bishop who has revised the references and prepared the Index with great care. Mr. G. M. Lunn has read through all the proofs and I am indeed grateful for his diligence and care. I would like especially to thank my secretary, Mrs. Strutt, who has been so helpful throughout. She has typed the whole of the manuscript—so much of it, so many times.

To Mr. J. Johnston Abraham and Mr. Owen R. Evans, of Messrs. William Heinemann Ltd., are due thanks for their generous co-operation and for many helpful suggestions.

Finally, I shall always be grateful to my wife for her forbearance during my preoccupation with this work, and for her helpful encouragement at all times.

A. W. B.

December, 1952.

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CHAPTER I

DEVELOPMENT AND APPLIED ANATOMY

Development of the Kidney and Ureter

In the development of the kidney and ureter, three fœtal excretory systems play a part—the PRONEPHROS, the MESONEPHROS and the METANEPHROS. All three are present at the same time in the first few weeks of fœtal life and are situated on the posterior cœlomic wall.

The Pronephros is a very transient structure. It is found about the fourth week and consists of a few tubules which open into a duct. The tubules are first seen towards the head of the embryo and as a further tubule appears caudally the tubule nearest the head disappears. There are never more than about half a dozen seen at one time, and they are only present over a period of some ten days. The duct, however, does not entirely disappear but remains as the precursor of the mesonephric or Wolffian duct.

The Mesonephros or Wolffian body is also apparent about the fourth week and consists of a number of tubules, extending from the cervical to the lumbar region, which open into a duct. From the latter is formed the excretory system of both the kidney and testis. The upper tubules are in intimate relationship with the early gonad, and five or six of these come to open into an equal number of tubules from the rete testis, thus effecting the urogenital union. The lower group of mesonephric tubules usually disappears, but may remain and form the paradidymis or organ of Giraldès. These tubules may communicate with the epididymis or may be blind at both ends.

The mesonephric duct, which is the continuation of the original pronephric duct, grows caudally and joins the cloaca. From the angle where the duct turns forwards to meet the cloaca, an outgrowth forms which is the ureteric bud (5 mm.). This bud is soon capped by a condensation of mesenchyme, which later differentiates as the metanephros. From the ureteric bud are formed the ureter, pelvis, calyces and collecting tubules, while from the metanephros the nephrons are developed. The terminal segment of the mesonephric duct (*i.e.*, the part between the ureteric bud and the cloaca) is lost in the wall of the urogenital sinus ; the remainder forms the vas in the male. Occasionally it persists in the female as the duct of Gaertner and may become infected, giving rise to a discharging fistula in the vulva. Failure of union between nephrons and collecting tubules has been suggested as the most likely cause of congenital polycystic kidney disease.

The Metanephros, from which is formed the secretory part of the human kidney, has appeared about the fifth or sixth week. It is at this time found under the first sacral and fifth lumbar segments, and is called the nephrogenic cap. By differential segmental growth it ascends to its adult position in the loin.

DEVELOPMENT OF THE BLADDER AND EXTERNAL GENITALIA

In the very early embryo the expanded caudal part of the hind gut forms the cloaca. Arising therefrom and ending blindly in the body stalk is a diverticulum, the allantois.

The latter, evolved from the more primitive urinary bladder of the fishes and amphibia, as a respiratory and reservoir organ in the egg-laying land vertebrates, plays a part in the development of the bladder in Man. Distal to the cloaca, the hind gut ends in the ventrally curved tail. Between tail, gut and allantois the cloacal entoderm is closely applied to surface ectoderm, forming the cloacal membrane, and outlines a shallow depression whose lateral margins are raised by interposed mesoderm as the genital folds. Disappearance of the tail during the third month results in the disappearance of the hind gut. The infra-umbilical portion of the abdominal wall is not seen until the fifth month, and prior to this the cloacal membrane gradually undergoes a caudal migration towards the perineal region, and while so doing is itself subject to continuous change.

Towards the end of the first month, subdivision of the cloaca into urogenital and alimentary components begins, and within two or three weeks the process is complete. A shelf of mesoderm on the ventral surface of the hind gut just proximal to the base of the allantois invaginates the cloacal entoderm and forms the urorectal septum. Continuing to grow distally, this finally meets and blends with the cloacal membrane so that a urogenital sinus and rectum are separately defined. The mesonephric ducts open into the antero-lateral wall of the cloaca so that they now open into the urogenital sinus. They mark the division of the sinus into the proximal vesico-urethral canal and the distal, definitive urogenital sinus, the whole remaining a closed cavity.

Meanwhile, development of the mesonephric ducts and ureteric outgrowths have been proceeding. For a time there is a single channel on each side, between the origin of the ureter and the entry of the mesonephric duct into the urogenital sinus. By differential growth each common excretory duct appears to be taken up into the wall of the vesico-urethral canal, so that the openings of primitive ureter and mesonephric duct come to lie at a distance from each other. Both mesonephric ducts, however, retain a close relationship and continue to open into the vesico-urethral canal near the mid-line, while further growth carries the ureteric openings progressively headwards and laterally. A triangular area is thus outlined within the vesico-urethral portion and constitutes the future trigone of the bladder. By the end of the second month, the vesico-urethral canal shows a dilated proximal portion, the bladder proper and a narrow distal part, the primitive urethra. The latter forms the greater part of the female urethra, but in the male represents only that part of the prostatic urethra which lies proximal to the openings of the common ejaculatory ducts.

The bladder increases in size in an upward direction as mesoderm continues to be laid down between cloacal membrane and body stalk (umbilical cord), but the allantois seems to develop no further. Normally, its lumen is obliterated and in post-natal life the allantois is represented by a fibrous cord, the urachus, which extends from the apex of the bladder to the umbilicus. The cloacal membrane now faces downwards and backwards and with the development of the urorectal septum there is an anterior or urogenital and a posterior, or anal, part. The latter or anal membrane ultimately becomes continuous with the embryonic bowel, and rectum and anal canal are constituted. If development of the urorectal septum is incomplete, the rectum may open into the urethra in the male or the vestibule in the female, and the anus is imperforate. It is important to note that when mesoderm is first laid down between cloacal membrane and body stalk, the membrane then forms the ventral wall of the future bladder. By

condensation within this mesoderm the symphysis pubis is evolved, and in this mesoderm the genital tubercle first appears.

There is a common development of the definitive urogenital sinus in both male and female up to six weeks. The urorectal septum joins the cloacal membrane and the urogenital membrane proper is then defined. Around this membrane there is a further heaping up of mesoderm, which occurs both anteriorly and laterally. This deepens the part between the genital folds, so that "membrane" may now be more accurately described as "sulcus" and the anterior elevation becomes the genital tubercle or primitive phallus. The entoderm of the urogenital sinus, which underlies the sulcus, increases in length and in an antero-posterior direction as the genital tubercle grows and subsequently invaginates the base of that structure. Proliferation of the entodermal

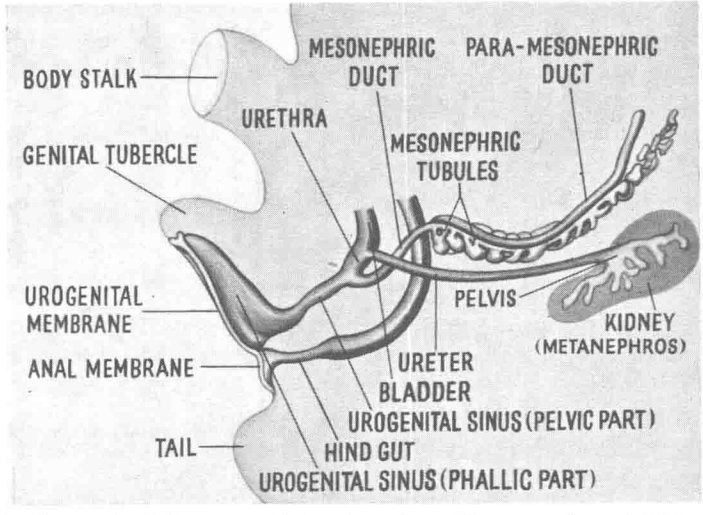


FIG. 1. The development of the urogenital system in a 23-mm. embryo (eight weeks) showing the urogenital sinus completely separated from the hind gut. (After Shikinami.)

cells results in the formation of a solid core of tissue and in the obliteration of the most anterior part of the cavity of the sinus. The overlying ectoderm of the urogenital sulcus is also prolonged anteriorly on to the ventral surface of the tubercle as the urethral plate. Posteriorly, the floor of the sulcus disappears and a communication between the cavity of the sinus and the exterior is established, forming the primitive urogenital orifice. Orifice and urethral plate are continuous between the medial margins of the genital folds and constitute the urethral groove. From this point differentiation of the sexual apparatus begins.

In the male the genital tubercle forms the phallus with the urethral plate extending on its undersurface almost to the tip. On either side of the urethral groove the genital folds become separated into two, the medial being urethral folds and the lateral, scrotal swellings. The urethral folds meet and fuse above the urethral plate, at first just posterior to the urogenital orifice; but as the fusion proceeds this opening is moved gradually forwards towards the tip of the phallus. It is thought that this closed tubular penile urethra ends in the region of the future coronary sulcus and that canalization of the

developing glans penis occurs by an ingrowth of surface epithelium which meets the penile urethra. The proximal end of the latter dilates to form the bulb. The line of fusion of the folds persists as the median perineal raphe. The remainder of the definitive urogenital sinus persists as the distal half of the prostatic and the whole of the membraneous urethra. The scrotal swellings coalesce and form the two compartments of the scrotum.

In the female the changes are simpler. The genital tubercle is shorter and the urethral plate extends only to its base. The margins of the urethral groove become continuous behind the urogenital orifice as the posterior commissure, and extend distally to enfold the genital tubercle as the labia minora. In so doing they outline the vestibule. The tubercle remains to form the clitoris. The vestibule thus comprises both phallic and pelvic portions of the urogenital sinus. The fused paramesonephric (Müllerian) ducts blend with the upper part of the vestibule forming the uterovaginal " canal." The distal ends of the mesonephric ducts disappear and lose their communication with the urogenital sinus. The lateral genital swellings form the labia majora.

Development of the Prostate

The prostate is developed by an outgrowth of the endoderm lining the upper part of the urogenital sinus and from the mesoderm surrounding the sinus. It consists of glandular tissue and stroma.

Development of the Testis and Its Duct

The testis and vas develop independently. The genital ridge appears on the medial side of the mesonephros on the posterior wall of the coelum, and together these structures constitute the urogenital fold. About the beginning of the third month, sex differentiation becomes apparent.

From the beginning the tubules of the Wolffian body and those at the rete testis are in intimate contact and lie wall to wall. The urogenital union takes place when the two open into each other, and when this occurs the tubule becomes the vas efferens. The definitive change in the male begins about the seventh week. The testis is then lying just caudal to the kidney. By differential segmental growth it comes to lie in the iliac fossa close to the future internal ring. This change in position gives rise to the so-called intra-abdominal descent of the testis.

The Descent of the Testis. In the normal full-time infant both testes are in the scrotum at birth. The exact manner by which they reach this position is not entirely understood. The gubernaculum develops as a condensation of mesenchyme in the inguinal fold and grows through the body wall, marking out the track of the future inguinal canal. It is a pathfinder and probably becomes active after the twelfth week. It is a bud-like process forming a solid mass of cells, which produces an invagination at the site of the internal ring and grows until it reaches the subcutaneous tissues in the region of the scrotum. Lockwood suggested that this growing bud has other branches than the scrotal. He described attachments to the pubes, to the root of the penis, to the perineum, to Scarpa's triangle and to the superficial inguinal region, and they have been called the " tails of Lockwood." The gubernaculum reaches its greatest development about the sixth month and then gradually becomes less defined. At birth there is little remaining.

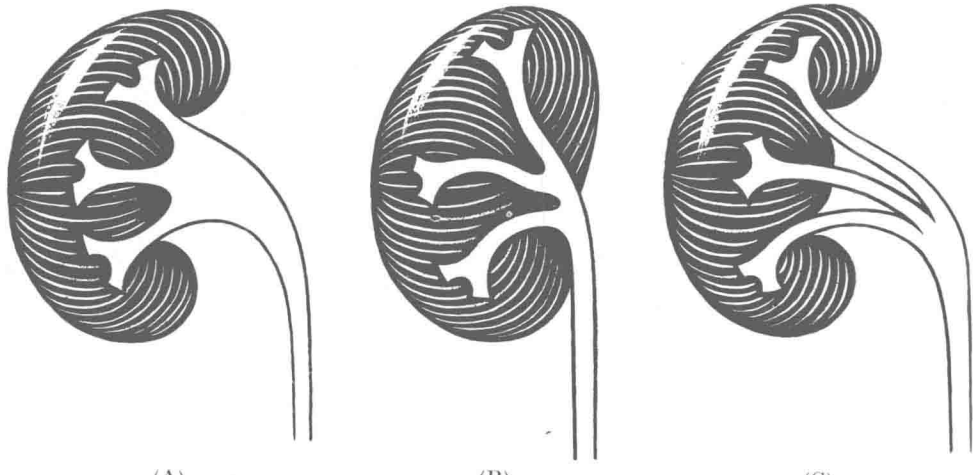
A small dimple of peritoneum, the processus vaginalis, follows the gubernaculum,

and at the seventh month this has reached the aponeurosis of the external oblique. The testis then passes from the abdominal cavity through the internal ring to lie in the abdominal wall. The testis and epididymis retain their previous relationship and the lower pole comes down first. During the next month the testis passes along the inguinal canal and at birth is usually found in the scrotum.

The Process of Migration. This has not yet been accurately determined and there are still several theories. The most tenable is that which depends on a combination of hormone and muscular action. At the seventh month of pregnancy, œstrogen hormones are present in large amounts in maternal and therefore probably in fœtal blood. A relaxation occurs at the internal ring due to these hormones (Burrows, 1933) and the testis passes from the abdomen to the already formed inguinal canal. The female hormones stimulate the interstitial cells of the testis and it increases in size. Possibly, as a result of a " milking action " of the muscles of the abdominal wall on the ovoid testicle, it passes along the canal and reaches the scrotum.

Anatomy of the Kidneys and Ureters

The kidneys are paired symmetrical organs which lie on the posterior wall of the abdominal cavity behind the peritoneum. The kidney is mainly solid but partly hollow in its gross structure and is normally bean-shaped. It weighs a little over 4½ oz. (130 gm.),



(A) (B) (C)

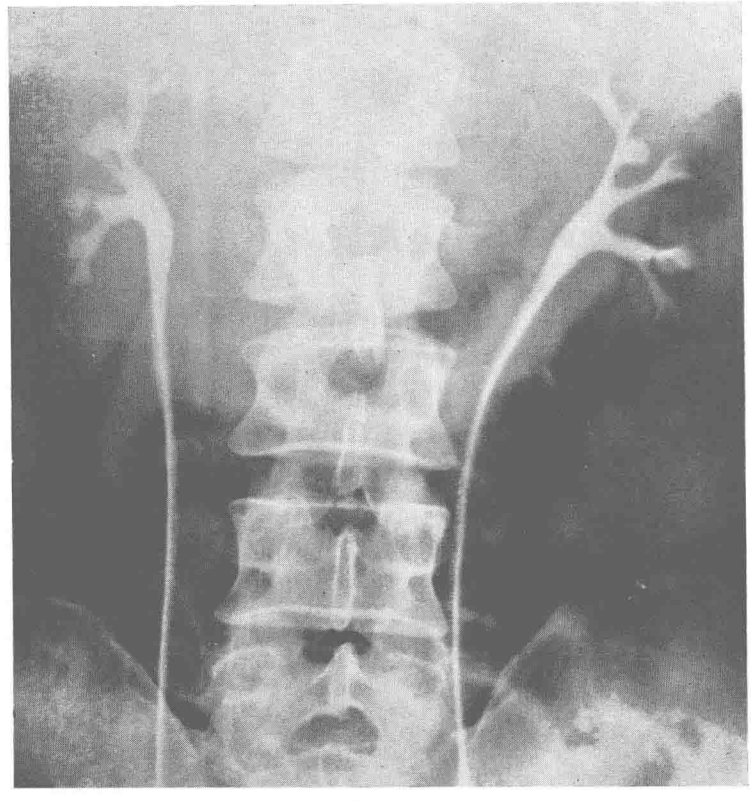
FIG. 2. The relation of the pelvis to the parenchyma of the kidney.

(A) More usual with the pelvis extra renal and the calyces intra renal.
(B) The pelvis is intra renal as well as the calyces.
(C) Part of the calyces as well as the pelvis are extra renal.

is 4½ in. (11 cm.) long, 2½ in. (6 cm.) wide and 1½ in. (4 cm.) thick. It is composed of a large series of nephrons, rather more than a million in number, which are grouped together into lobules and these lobules form the parenchyma or solid part. The lobules are pyramidal in shape and at the apex or papilla of each the collecting tubules of the nephrons come together and open into the renal sinus. The latter is the hollow part of the kidney and consists of a series of minor calyces opening into major calyces, which in turn open into the renal pelvis. The whole of the kidney is covered with a thin, though

strong, connective tissue tunic known as the renal capsule. The long axis of the kidney is nearly vertical and presents rounded upper and lower poles, the latter lying further from the mid-line. Its surface is usually smooth, though occasionally lobulated. (In certain of the lower mammals this lobulation is very much more marked, especially in the bear in which the kidney is completely lobulated.) Anatomically the renal sinus includes the calyces and pelvis, but is generally referred to as the pelvis. In delineation it is

(A)

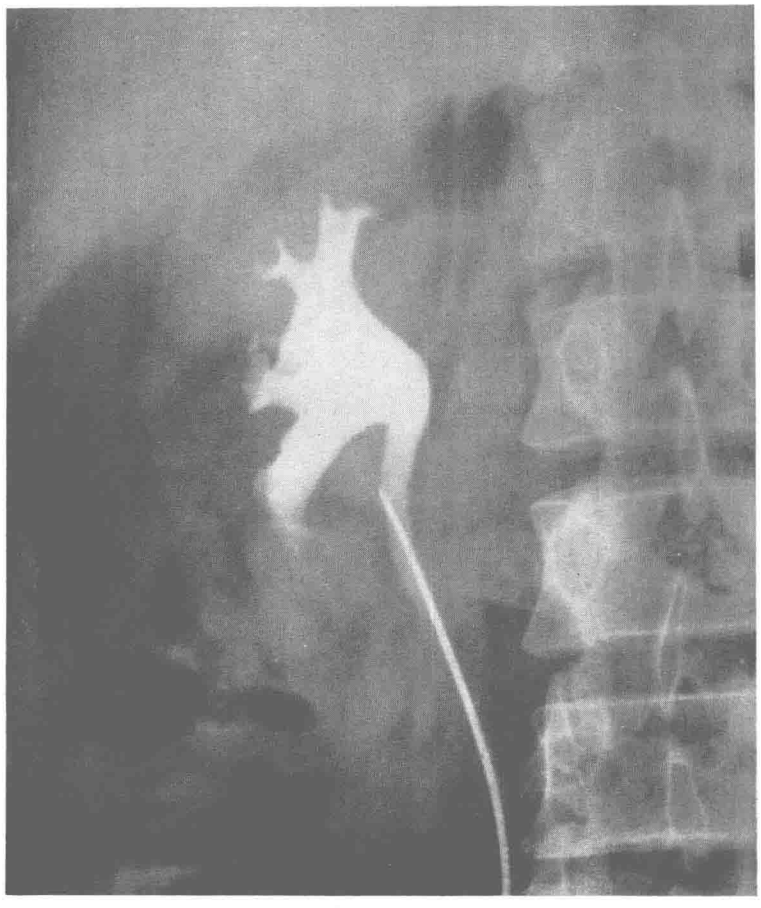


(B)

FIG. 3. The delineation of the renal pelvis.
(A) The average, balanced type.
(B) Pyelogram—balanced type.

liable to great variation. The pelvis proper may be completely outside the parenchyma of the kidney, or may be largely surrounded by kidney. Gradations between these two extremes exist but commonly the greater part of the pelvis lies outside. In addition, either the calyces or the pelvis may predominate. There are three main types of renal pelvis, according to Macalpine. *Type A* is that in which the pelvis is roughly triangular in shape and there are three major calyces, upper, lower and middle, each opening into the pelvis. The upper calyx is almost vertical, the lower extends upwards and medially and the middle opens into the pelvis between the other two. In *type B* the calyces have developed at the expense of the pelvis ; they join each other near the commencement of

the ureter and the cavity of the pelvis itself is quite small. The extreme degree of this type is the bifid kidney or renal duplex. In *type C* the pelvis is over-developed and has largely engulfed the major calyces. The minor calyces then open directly into a pelvis which is much more globular in shape and has a larger capacity than either of the other two types. In both types A and B the major calyces may be very long, and they



(C)

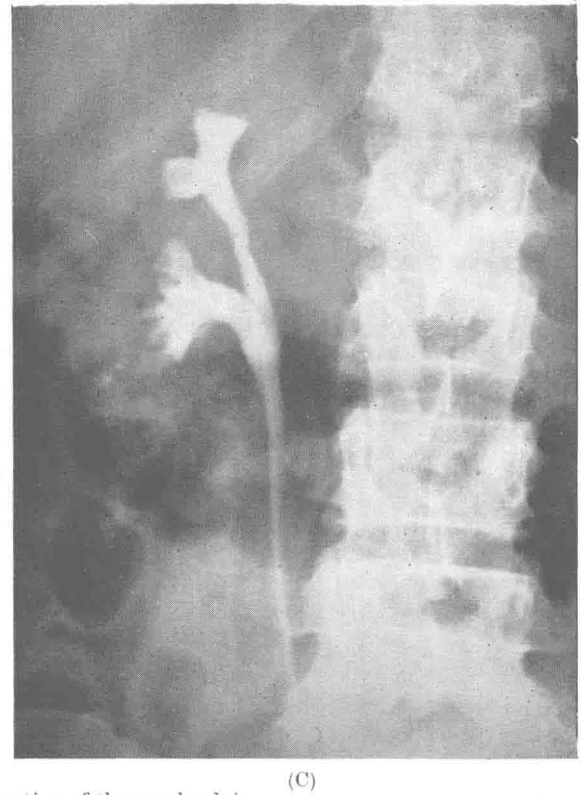
FIG. 3. The delineation of the renal pelvis.
(C) Normal pyelogram—balanced type.

are then usually slender and may have a constriction or neck just above their junction with the pelvis. Alternatively, they may be short, in which case they are more often quite wide and straight. A variable number of minor calyces—usually two or three—open into each of the major calyces. Normally, their ends are cup-shaped and each surrounds the apex of a pyramid or renal papilla.

The outer border of the kidney is rounded, convex and free. The inner is concave with the hilum at the centre. There are three main structures which form the root or

(A)

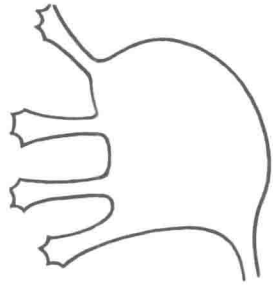
(B)



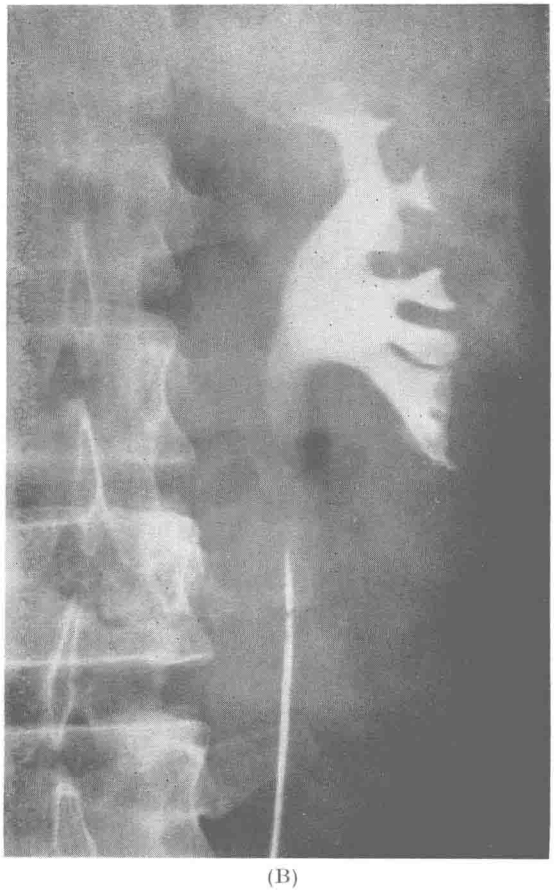
(C)

FIG. 4. The delineation of the renal pelvis.

(A) Calycine preponderance.
(B) Pyelogram—calycine preponderance.
(C) Pyelogram—calycine preponderance.



(A)



(B)

(C)

FIG. 5. The delineation of the renal pelvis.

(A) Pelvic preponderance.
(B) Pyelogram—pelvic preponderance.
(C) Pyelogram—pelvic preponderance.