GYNAECOLOGICAL RADIOLOGY

G. H. WHITEHOUSE

MB, BS, MRCP, FRCR, DMRD, AKC
Professor of Diagnostic Radiology
University of Liverpool

BLACKWELL SCIENTIFIC PUBLICATIONS
OXFORD LONDON EDINBURGH
BOSTON MELBOURNE

Blackwell Scientific Publications
Editorial offices:
Osney Mead, Oxford, OX2 0EL
8 John Street, London, WC1N 2ES
9 Forrest Road, Edinburgh, EH1 2QH
52 Beacon Street, Boston
Massachusetts 02108, USA
214 Berkeley Street, Carlton
Victoria 3053, Australia

First published 1981

Printed in Great Britain by
Butler & Tanner Ltd, Frome and London

DISTRIBUTORS

USA
Blackwell Mosby Book Distributors
11830 Westline Industrial Drive
St Louis, Missouri 63141

Canada
Blackwell Mosby Book Distributors
120 Melford Drive, Scarborough
Ontario, M1B 2X4

Australia
Blackwell Scientific Book Distributors
214 Berkeley Street, Carlton
Victoria 3053

British Library
Cataloguing in Publication Data

Whitehouse, G. H.
Gynaecological radiology.
1. Diagnosis, Radioscopic 2. Generative organs, Female – Diseases – Diagnosis
3. Radiography in gynecology
I. Title
618.1′0757 RG107.5.R3

ISBN 0–632–00726–5

GYNAECOLOGICAL RADIOLOGY

Preface

Gynaecological radiology has developed over the last sixty years with the introduction of techniques specific for the diagnosis of the female genital tract. Some of these techniques have remained useful while others have, at least in part, been supplanted by other diagnostic methods. Other widely used radiological procedures such as urography, barium studies and angiography reveal manifestations of diseases of gynaecological origin, especially when they affect other systems of the body. While gynaecological radiology is covered to some extent in several standard text books of gynaecology and radiology, some atlases depicting hysterosalpingographic appearances, and occasional specific articles in radiological journals, there have been few attempts to encapsulate the whole subject in one text book.

The aim of this book is to remedy this deficit. As well as covering the more specific investigations which pertain to the genital tract, I have attempted to show how other standard radiodiagnostic procedures may be applied to the gynaecological patient. It is hoped that this monograph will be useful to both radiologists and gynaecologists, including those in training.

Spectacular advances have occurred over recent years in other methods of organ imaging. Ultrasonography and computed tomography (CT scanning) have particularly extended the role of the radiologist in the investigation of gynaecological disorders, and have provided him with tools which give information impossible to obtain by conventional radiology. I am indebted to Dr Carl Wright for his chapters on ultrasonography and CT scanning, which give an up-to-date appraisal of the role of these modalities in the context of gynaecology.

I also wish to express my gratitude to those who have been closely involved with the production of this book, in particular Miss Mary Hynes who typed the manuscript in its several forms, Messrs David Adkins and Roy Crosby for producing the illustrations, and Miss Jean Dutton and Miss Carol Sausman who as successive Senior Radiographers at the Women's Hospital in Liverpool were very helpful in the gathering of case material. Finally, I wish to thank my family for their cheerful forbearance during the long gestation of this book.

Graham Whitehouse

Contents

CHAPTER 1

Radiological Techniques I: Plain Radiographs

The first documented application of radiography in gynaecological practice was a case described by Lewers in 1903, in which a hairpin was located within the uterine cavity. Ludlow in 1909 was able to demonstrate calcification within uterine fibroids by means of X-rays.

TECHNIQUE

For a general view of the abdomen, the film should be of sufficient size to include both the diaphragm above and the pubic symphysis in full expiration. Routinely, the patient should be recumbent and in the supine position. An additional radiograph in the erect position is taken when there is a suspicion of intestinal obstruction, pneumoperitoneum, or ascites.

The pelvic cavity may be shown to better effect by angling the X-ray tube 20°–25° towards the feet, with the central ray entering the patient at 5 cm above the pubic symphysis. Usually an 18 × 24 cm film is of sufficient size. Sometimes a lateral radiograph may be required to aid the localization of foreign bodies, including contraceptive devices, and calcifications within the pelvic cavity.

It is important that the bladder is emptied immediately before radiography, because a full bladder may be confused with a pathological pelvic soft tissue mass (Fig. 1.1).

NORMAL APPEARANCES

A full description of the radiographic appearances of the whole abdomen is beyond the scope of this monograph, but awareness of the soft tissue shadows seen within the pelvic cavity is of prime importance. An anteroposterior radiograph of the pelvic cavity will normally show the ovoid shapes of the bladder and uterus separated by a radiolucent cleavage plane due to surrounding adipose tissue (Fig. 1.2). Characteristically, the uterus, unless it is retroverted, has a lenticular shape on an anteroposterior radiograph, and indents the centre of the bladder dome. The crescentic outlines of the levator ani muscles are sometimes seen directed backwards from the symphysis pubis while the obturator internus muscles, which are likewise delineated by overlying fat, lie lateral and posterior to the levator ani. The sacrospinous ligaments may occasionally be seen between their origin on either side of the coccygeal and lower sacral segments and their insertions onto the ischial spines (Fig. 1.2). The sacrotuberous ligaments are rarely visible, but may form an obstacle to parturition when they occasionally calcify (Levene & Kaufman, 1958). The rectum and sigmoid colon are delineated by the faeces and gas contained within them. However, a circular soft tissue density 2–3 cm in diameter on the left side of the pelvic cavity may be mistaken for a pelvic tumour, but is due to a contracted and empty portion of the sigmoid colon seen in tangential projection (Beranbaum, 1951). On lateral films of the pelvis, cleavage planes due to fatty tissue define the rectum, bladder and space of Retzius.

ABNORMAL APPEARANCES

A large round or ovoid soft tissue pelvic mass is likely to be due to an abnormality of the female genital tract, such as an enlarged uterus or an ovarian cyst or tumour (see Fig. 8.1), only when the bladder is seen as a distinct soft

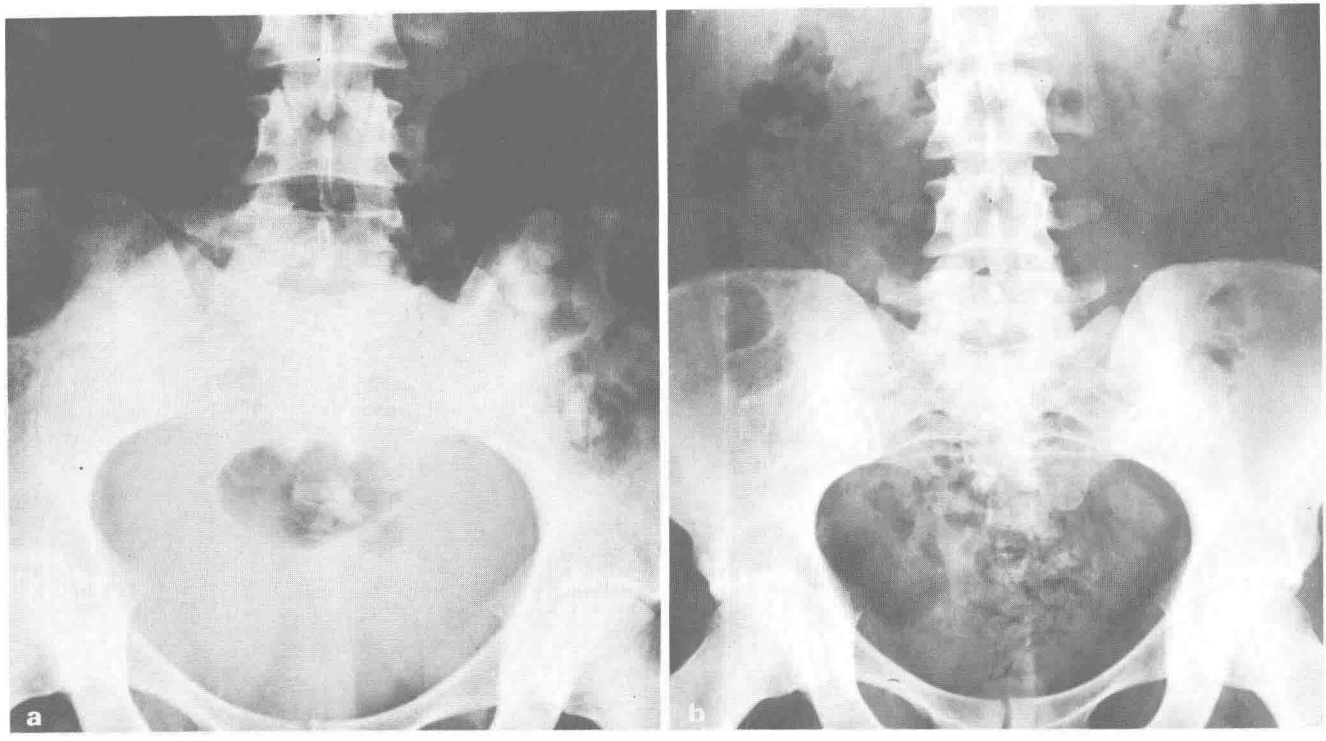


FIG. 1.1 (a) A rounded soft tissue mass extends out of the pelvic cavity into the abdomen. (b) The 'mass' is no longer apparent after micturition, and was due to a distended bladder.

tissue tumour. Bryk (1966) found a detectable uterine shadow on plain radiography in over half the cases in a series of ovarian masses. A lobulated pelvic mass is far more likely to be due to uterine fibroids than an ovarian lesion (see Fig. 7.1). Difficulty in distinguishing between a uterine and ovarian mass may be due to the obscuring of the pelvic organs by fluid-filled loops of bowel or by ascites. Pelvic infection may obscure the fat planes between the pelvic organs, so that they have a homogenous density on the plain radiograph. Extra-luminal gas collections may occasionally be associated with acute pelvic infections (see Fig. 11.7). Bowel gas shadows may be displaced by a large mass rising out of the pelvic cavity.

Calcified pelvic phleboliths (Fig. 1.2), which are present in a quarter to one third of all European adults and may increase in number with age, are especially diffuse in the female because of their frequent presence in the broad ligament as well as in the rectal and vesical venous plexi. It has been observed by Steinback (1960) that phleboliths may be displaced by pelvic masses. Midline masses may displace phleboliths laterally, while more laterally situated masses may deviate them in a medial direction. Depending on the position of the pelvic mass, phleboliths may also be displaced upwards or downwards. Serial radiographs may show progressive positional changes of phleboliths in the presence of an actively expanding mass lesion.

Uterine artery calcification (Fig. 1.3) is especially common in diabetic women, and this association is more frequent under the age of 60 years (Fisher & Hamm, 1975).

Calcification in a pelvic mass is an important radiological sign and its diagnostic significance is considered in detail in Chapters 8 and 9.

Uterine fibroids frequently calcify (see Figs. 7.1 and 7.2), and calcification may be visible in a variety of ovarian lesions including cystadenoma and cystadenocarcinoma, dermoid cysts, gonadoblastoma and fibroma

(Chapter 8). Ovarian calcification, and even true bone formation, may occasionally occur in corpora albicantia either in the form of clusters of small foci 0.5 cm in diameter (Buckrow *et al.*, 1966) or as coarser 'popcorn' calcification (Puckette *et al.*, 1969). Complete calcification of the ovary of unknown aetiology is extremely rare, but cases were presented at the Chicago Gynaecological Society in 1921 and have been described by Kamniker (1928) and Coors (1942). Lester & McAlister (1970) reported calcification occurring in a spontaneously amputated ovary which was shown radiologically to be freely mobile. Tuberculosis sometimes causes calcification within the Fallopian tubes (see Fig. 6.11) and pelviabdominal lymph nodes (Fig. 1.4). Tubal calcification is otherwise extremely rare and of uncertain cause, although most of these cases appear to be related to elongation and compression of the involved tubes by ovarian or uterine tumours or to kinking and constriction by dense adhesions (Kulka, 1942). The differential diagnosis of pelvic calcification also includes urinary calculi, faecoliths, appendicoliths and vascular calcifications.

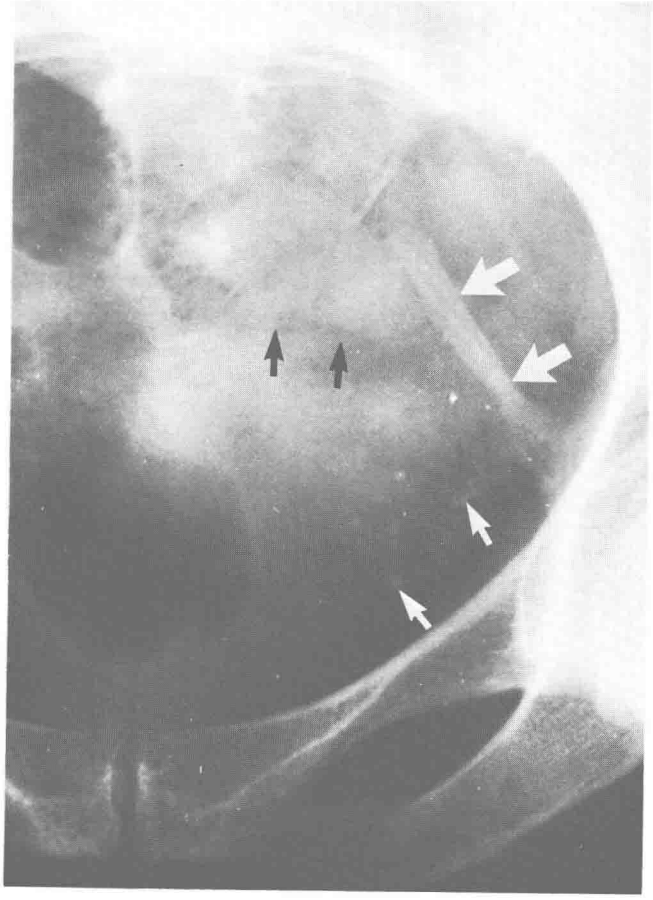


FIG. 1.2 Sacrospinous ligament calcification (large white arrows). The ovoid uterine shadow is separated from the moderately distended bladder by a radiolucent fat line (small black arrows). Phleboliths are present (small white arrows).

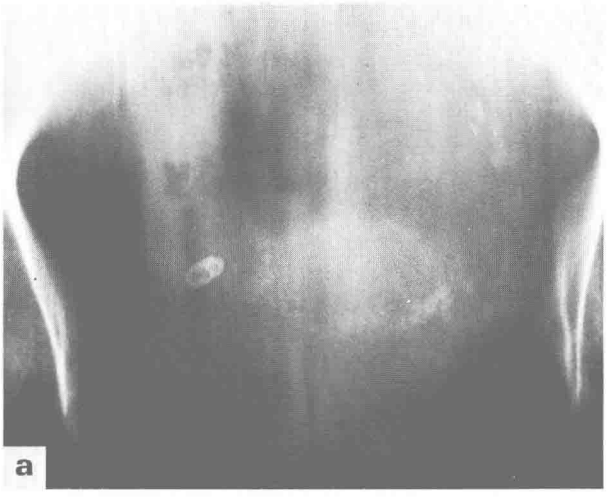
The presence of radio-opaque foreign bodies in the genital tract, most commonly in the vagina of children, and the position of contraceptive devices may be ascertained by anteroposterior and lateral films of the pelvic cavity. Ultrasonography is a useful and accurate means of determining whether or not a contraceptive device is in the uterine cavity. Tampons have a radiolucent rectangular appearance (Fig. 1.5). Bubbles of gas within the wall of the vagina are identified as beaded translucencies in vaginal emphysema.

Ascites frequently occurs in association with ovarian malignancy (Fig. 1.6), usually as a result of peritoneal spread of the tumour, but may also be present in benign ovarian conditions (Chapter 8). A generalized homogenous haziness, often more marked in the lower abdomen and pelvic cavity on erect radiographs, with upward displacement and separation of gas-filled bowel loops, obliteration of extraperitoneal fat lines, elevation of the diaphragm and bulging of the flanks, is seen with ascites. Generalized peritonitis may cause a paralytic ileus, with separation of rather ill-defined and moderately distended loops of bowel, obscuration of the properitoneal fat lines and often radiological evidence of free fluid within the peritoneal cavity. A localized abdominal or pelvic abscess may cause an ill-defined soft tissue mass, displacing adjacent bowel which often shows some ileus. A ruptured tubo-ovarian abscess will often cause marked paralytic ileus.

Rupture of a corpus luteum, in the second half of the menstrual cycle of a young woman, may result in a haemoperitoneum. Abdominal radiographs will show free fluid within the pelvic cavity and lateral gutters between the vertical segments of the colon and the lateral abdominal wall, sometimes with associated paralytic ileus. Culdoscopy will confirm the diagnosis (McCort, 1975). Haemoperitoneum with the same radiological findings may also be caused by a ruptured ectopic pregnancy. Rarely, torsion and infarction of an ovarian

cyst causes intraperitoneal haemorrhage (Taniguchi *et al.*, 1952).

Pneumoperitoneum is a frequent sequel of abdominal surgery and usually disappears within one week of the operation, although it may rarely persist for as long as 24 days (Fig. 1.7). Carbon dioxide is absorbed within a few hours of its introduction into the peritoneal cavity for purposes such as diagnostic pneumography, laparoscopy or tubal insufflation. Air, which disappears more slowly than carbon dioxide, may enter the peritoneal cavity following a vaginal douche with a bulb syringe or effervescent fluid (Walker, 1942; Stilson & Neufeld, 1949). The abnormal patency of the genital tract in the postpartum state may result in a pneumoperitoneum



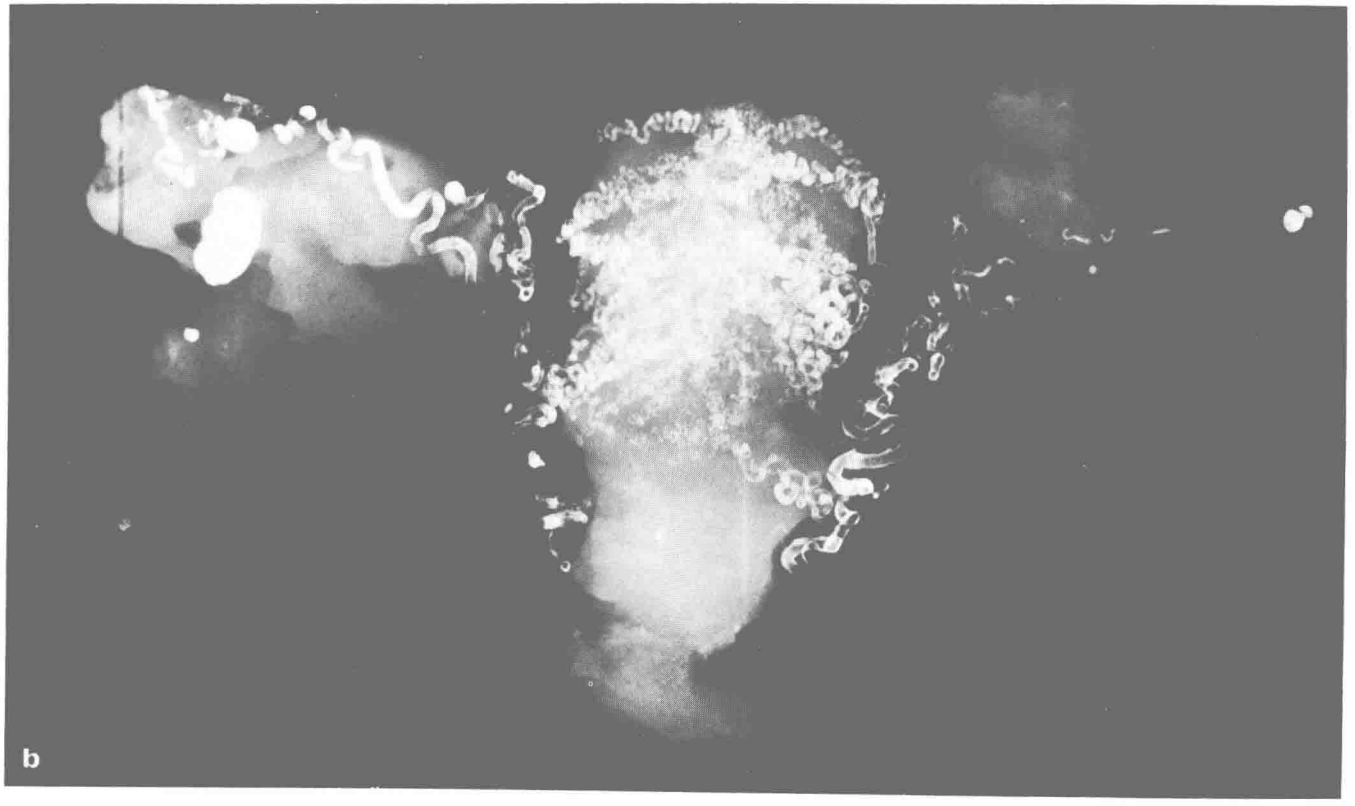


FIG. 1.3 (a) Calcification is seen within the pelvic cavity on this tomogram.

(b) Excised uterus and adnexa show gross uterine artery calcification. The patient was diabetic. Courtesy of *British Journal of Radiology* (1976), **49,** 797–798.

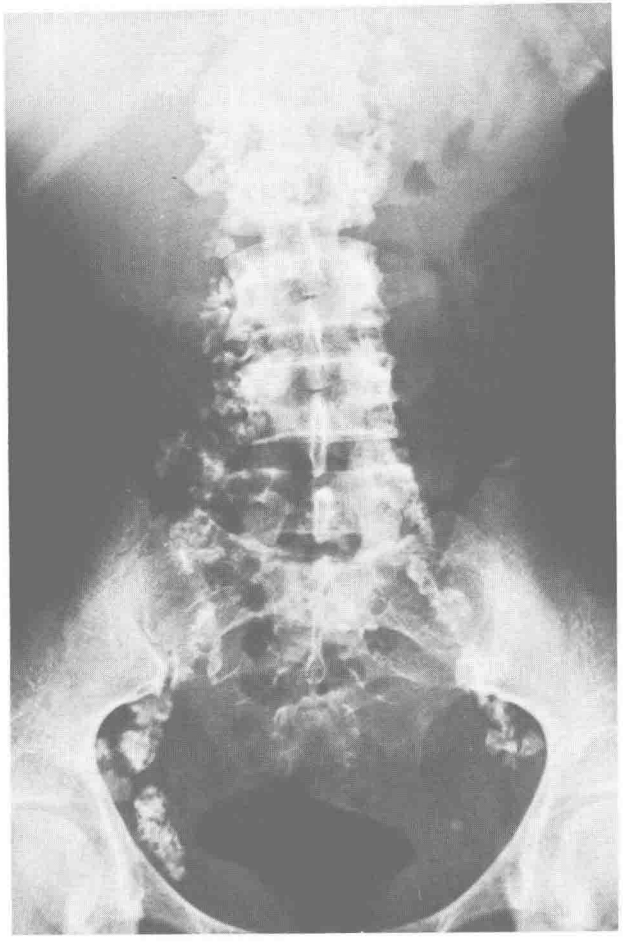


FIG. 1.4 Heavy iliac and para-aortic lymph node calcification, secondary to pelvic or abdominal tuberculosis.

when exercises are performed in the knee-elbow position (Conn & La Fon, 1956). A case has been reported in which air was found to have entered the peritoneal cavity via a tubo-vaginal fistula one year after vaginal hysterectomy (Tabrisky *et al.*, 1972). Pneumoperitoneum due to entry of air per vaginam may occur in female water skiers who do not wear wet suits. Cases of spontaneous pneumoperitoneum have been ascribed to the entry of air from a patulous genital tract in women who have no associated pathological condition (Felson & Wiot, 1973).

THE CHEST RADIOGRAPH

Kindermann (1967) found some abnormality on routine chest radiographs in 356 out of 1000 women prior to gynaecological operations, although some of these were of little or no immediate clinical significance. In a gynaecological context, chest radiography has some specific indications:

1. To detect the presence of possible pulmonary metastases in cases of pelvic malignant disease.
2. A pleural effusion may be present in a variety of ovarian conditions associated with ascites (Meig's syndrome) (see Fig. 8.24). The reason why pleural effusions are found in combination with ascites in hepatic cirrhosis and Meig's syndrome has been explained by Lieberman & Peters (1970). Severe and prolonged distention of the peritoneal sac by fluid stretches the diaphragm, as well as the closely attached parietal peritoneum and pleura, to such an extent that the fibres of the diaphragm are pulled apart. The widened interstices cause the diaphragm to become permeable to fluid.
3. Tuberculosis is a cause of infertility (Chapter 7).
4. Congenital cardiac abnormalities may be associated with severe anomalies of the genitourinary tract.

Catamenial pneumothorax, or recurrent spontaneous pneumothorax associated with the menstrual period, is a rare condition. It is due to the presence of pleural endometriosis, and occurs in the interval between three days prior to and three days after the onset of menses (Ripstein *et al.*, 1959; Shearin *et al.*, 1974). The right side is most frequently involved, although bilateral pneumothoraces have been described (Laws *et al.*, 1977).

THE PITUITARY FOSSA

Raised levels of prolactin have sometimes been found in association with chromophobe adenomas and occasionally craniopharyngiomas (Saxena, 1977). Secondary amenorrhoea and infertility then occur because of inhibition of progesterone production by granulosa cells, and sometimes galactorrhoea is also present. Ginsberg *et al.* (1977) found that a quarter of women with primary amenorrhoea and hyperprolactinaemia had radiological evidence of sellar enlargement, while Haesslein & Lamb (1976) found that a quarter of all patients with secondary amenorrhoea for longer than five years had abnormal

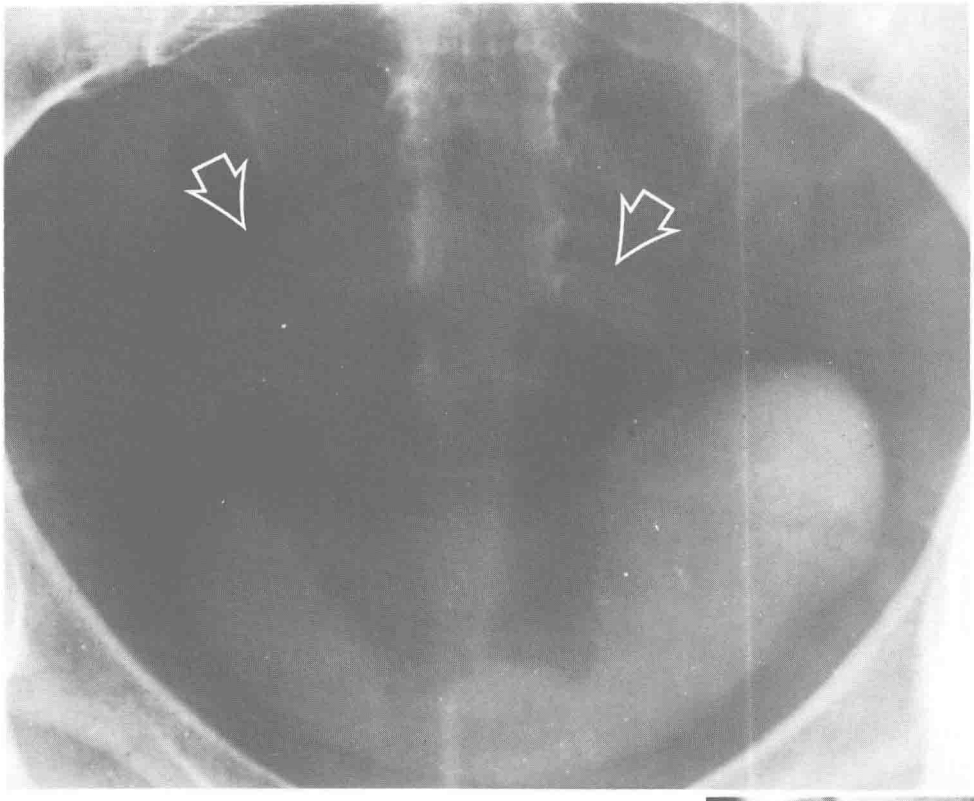


FIG. 1.5 Two tampons within the vagina appear as radiolucent shadows. The bladder is opacified by contrast medium during intravenous urography. The uterus appears as an ovoid soft tissue opacity (arrows) immediately above the bladder.

radiological findings in the sella. Jones & Kemmann (1976) described erosion and enlargement of the pituitary fossa in 3% of anovulatory patients and in 26% when galactorrhoea was associated with absence of ovulation (Fig. 1.8). The use of hypocycloidal tomography in diagnosing prolactin-secreting microadenomas was described by Vezina & Sutton (1974). They found that if these tumours were at least 5 mm and less than 10 mm in diameter, the sella was still of normal size but localized bulging of the anteroinferior wall of one side of the sella was seen with lateralization being an essential criterion. The size of the sella was increased when the adenoma was more than 10 mm in size, the maximum normal length and height being respectively 16 mm and 13 mm.

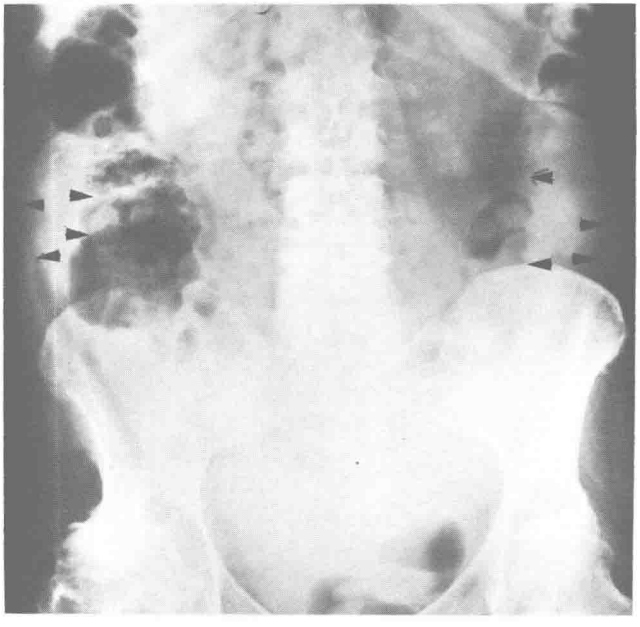


FIG. 1.6 Ascites secondary to ovarian carcinoma. Note the homogenous haziness of the abdomen caused by the ascitic fluid, with distention of the flanks and separation of the properitoneal fat lines from the lateral borders of the colon (arrows).

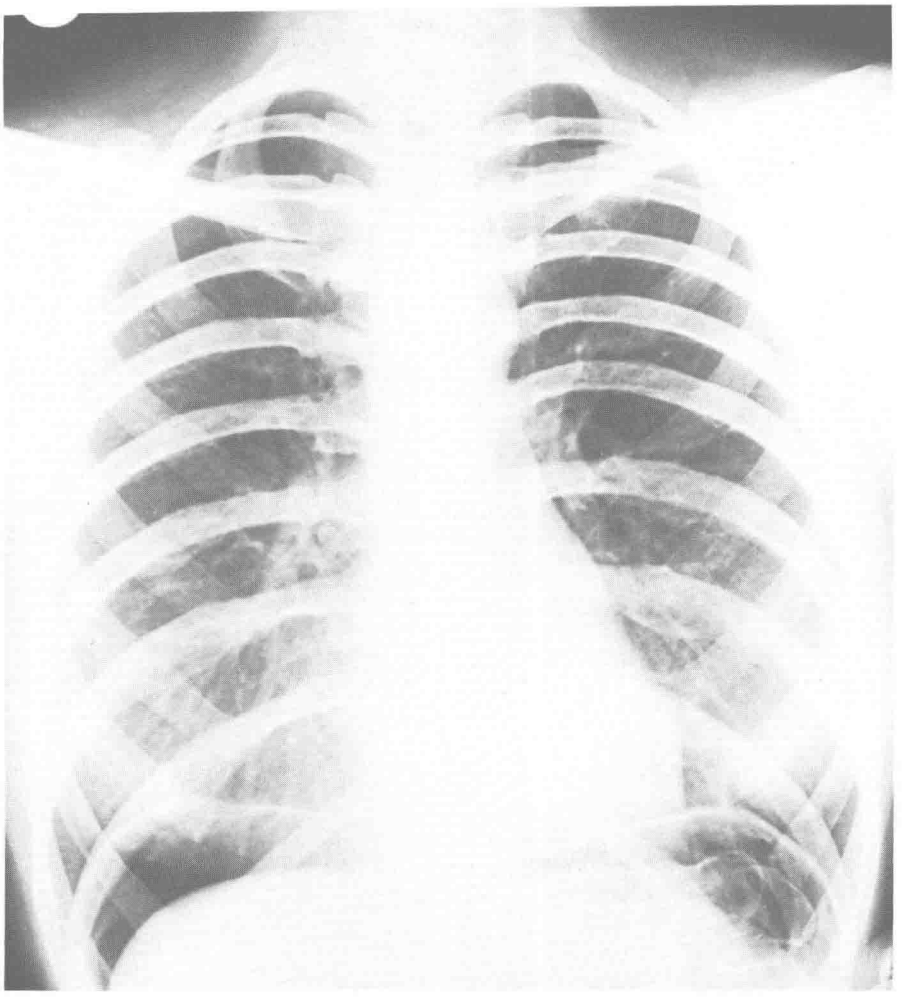


FIG. 1.7 Pneumoperitoneum secondary to laparoscopy.

SKELETON

Bone metastases may occasionally occur secondary to malignancy of the female genital tract, especially from cervical carcinoma.

Deviations of bone age from the normal may be due to gynaecological abnormalities, and can be estimated by the methods of Tanner *et al.* (1975) or of Greulich & Pyle (1959) (Fig. 1.9).

Generalized retardation of skeletal maturation occurs with hypogonadism, for instance Turner's syndrome (Chapter 5), and in hypopituitarism. On the other hand, generalized acceleration of skeletal maturation may be seen in the adrenogenital system, in androgen or oestrogen secreting gonadal tumours, and occasionally with ectopic gonadotropic production from a variety of tumours including teratomas. Accelerated skeletal maturation is also associated with Albright's syndrome, where there is fibrous dysplasia of bone (often unilateral), 'cafe-au-lait' spots, and precocious puberty.

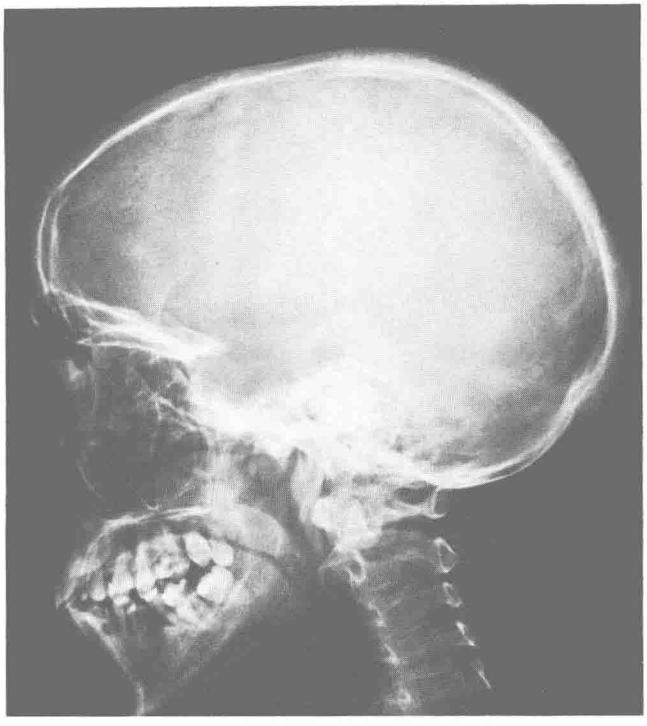


FIG. 1.8 Secondary amenorrhoea in woman aged 34 years. Expanded pituitary fossa with destruction of dorsum sellae.

FIG. 1.9 Bone age estimated as $13\frac{1}{2}$ years in girl aged 22 years with Turner's syndrome.

REFERENCES

BERANBAUM S. L. (1951) Fictitious pelvic mass. *Radiology*, **57,** 554–555.

BRYK D. (1966) Roentgen evaluation of large uterine and ovarian masses. *Obst. Gynec.*, **28,** 630–636.

BUCKROW C. J., CARY T. M. & CLARKE W. E. (1966) Ovarian corpora albicantia calcifications. *Radiology*, **87,** 746–747.

CHICAGO GYNECOLOGICAL SOCIETY MEETING PROCEEDINGS (1922) Completely calcified ovary. *Surg. Gynec. Obst.*, **34,** 686.

CONN H. O. & LA FON W. F. (1956) Recurrent spontaneous pneumoperitoneum. *Amer. J. Obst. Gynec.*, **71,** 1342–1347.

COORS G. A. (1942) Calcification of ovaries. *Amer. J. Surg.*, **56,** 492–494.

FELSON B. & WIOT J. F. (1973) Another look at pneumoperitoneum. *Seminars Roentgenol.*, **8,** 437–443.

FISHER M. S. & HAMM R. (1975) Uterine artery calcification. Its association with diabetes. *Radiology*, **117,** 537–538.

GINSBERG J., SCADDING G. & HAVARD C. W. H. (1977) Primary amenorrhoea: the ambiguous non-entity. *Brit. Med. J.*, **2,** 32–35.

GREULICH W. W. & PYLE S. I. (1959). *Radiographic Atlas of Skeletal Development of the Hand and Wrist.* Stanford University Press, Palo Alto, California.

HAESSLEIN H. C. & LAMB E. J. (1976) Pituitary tumors in patients with secondary amenorrhoea. *Amer. J. Obstet. Gynecol.*, **125,** 759–767.

JONES J. R. & KEMMANN E. (1976) Sella turcica abnormalities in an anovulatory population. *Obst. Gynec.*, **48,** 76–78.

KAMNIKER A. (1928) Calcification of the ovary with ossifications. *Zbl. Gynäk.*, **20,** 21–23.

KINDERMANN G. (1967) The value of chest X-rays and pyelography before gynaecological operations. *Geburtsh. u. Frauenheilk.*, **27,** 22–32.

KULKA E. W. (1942). True bone formation in the Fallopian tube. *Amer. J. Obst. Gynec.*, **44,** 383–398.

LAWS H. L., FOX L. S. & YOUNGER J. B. (1977) Bilateral catamenial pneumothorax. *Arch. Surg.*, **112,** 627–628.

LIEBERMAN F. L. & PETERS R. L. (1970) Cirrhotic hydrothorax: further evidence that an acquired diaphragmatic defect is at fault. *Arch. Intern. Med.*, **125,** 114–119.

LESTER P. D. & MCALISTER W. H. (1970) A mobile calcified spontaneously amputated ovary. *J. Canad. Ass. Radiol.*, **21,** 143–145.

LEVENE G. & KAUFMAN S. A. (1958) The diagnostic significance of roentgenologic soft tissue shadows in the pelvis. *Amer. J. Roentgenol.*, **79,** 697–704.

LEWERS A. H. N. (1903) A case of hairpin in the uterus discovered by x-rays. *Brit. Med. J.*, **2,** 814.

LUDLOW I. (1909) Calcification of fibromyomata of uterus. *Cleveland Med. J.*, **8,** 398.

MCCORT J. J. (1975) Ruptured corpus luteum with haemoperitoneum. *Radiology*, **116,** 65–67.

PUCKETTE S. E., WILLIAMSON H. O. & SEYMOUR E. Q. (1969) Calcification in an ovarian corpus albicans. *Radiology*, **92,** 1105.

RIPSTEIN C. B., ROBMAN M. & WALLACH J. B. (1959) Endometriosis involving the pleura. *J. Thorac. Surg.*, **37,** 464–471.

SAXENA B. B. (1977) Human prolactin. In *Endocrinology of Pregnancy*, 2nd edn., ed. F. Fuchs and A. Klopper, Harper & Row, pp. 222–245.

SHEARIN R. P., HEPPER N. G. & PAYNE W. S. (1974) Recurrent spontaneous pneumothorax concurrent with menses. *Mayo Clin. Proc.*, **49,** 98–101.

STEINBACK H. L. (1960) Indentification of pelvic masses by phlebolith displacement. *Amer. J. Roentgenol.*, **83,** 1063–1066.

STILSON R. D. & NEUFELD O. J. (1949) Spontaneous pneumoperitoneum. *California Med.*, **70,** 269–273.

TABRISKY J., MALLIN L. P. & SMITH J. A. (1972) Pneumoperitoneum after coitus. A complication due to uterine tube prolapse after vaginal hysterectomy. *Obst. Gynec.*, **40,** 218–220.

TANNER J. M., WHITEHOUSE R. H., MARSHALL W. A., HEALY M. J. R. & GOLDSTEIN H. (1975) *Assessment of Skeletal Maturity and Prediction of Adult Height. (TW2 Method).* Academic Press, London.

TANIGUCHI T., KLIEGER J. A. & KUHN M. J. (1952) Surgical emergencies resulting from corpus luteum cysts and hematomas. *Arch. Surg.*, **64,** 516–524.

VEZINA J. L. & SUTTON T. J. (1974) Prolactin-secreting pituitary microadenomas. *Amer. J. Roentgenol.*, **120,** 46–54.

WALKER M. A. (1942) Pneumoperitoneum following a douche. *J. Kansas Med. Soc.*, **43,** 55.

CHAPTER 2

Radiological Techniques II: Hysterosalpingography, Pelvic Pneumography, Vaginography

HYSTEROSALPINGOGRAPHY

The optimum time to perform hysterosalpingography is towards the end of the first week after the menstrual period. At this time the isthmus is at its most distensible and the tubes are most easily filled. The menstrual history must be carefully reviewed so as to avoid investigating a pregnant uterus.

Preparation

Premedication is not required in the majority of cases. The investigation is more likely to be painful, and there is an increased risk of provoking tubal spasm when the patient is very anxious. Reassurance and an explanation of the procedure provide the best form of preparation. When the patient is especially nervous, 5–10 mg of intravenous diazepam is often helpful in allaying anxiety. Morphia, nembutal and pethidine should not be given, as they stimulate the contraction of smooth muscle within the Fallopian tubes (Davids & Weiner, 1950). General anaesthesia, or the emotional distress caused by the thought of it, will often precipitate tubal spasm which will not be relieved under the influence of the anaesthesia (Stallworthy, 1948).

Emptying the bladder immediately prior to hysterosalpingography is of prime importance. A full bladder will elevate the Fallopian tubes and may cause apparent tubal blockage with the spurious radiological appearance of a hydrosalpinx (Bligh & Williams, 1956).

Technique

The patient is placed in the lithotomy position on the screening table and a bimanual pelvic examination is carried out. A vaginal speculum is inserted and the external os is then swabbed with Hibitane or some other suitable non-irritant antiseptic solution. A uterine sound is passed to determine the direction and size of the uterine cavity. Volsellum forceps are placed onto the anterior lip of the cervix. One of a variety of available cannulae is inserted into the external os, followed by the removal of the vaginal speculum.

THE INJECTION CANNULA

The Leech-Wilkinson cannula (Fig. 2.1) has a conical, ridged metallic end which is inserted into the cervical canal with a screwing motion. This action may often be painful, and the junction between cannula and cervix is prone to leakage of the contrast medium. The Green-Armytage type is a popular device, in which a rubber acorn may be altered in its position along the length of the straight metal cannula, and usually provides a fairly watertight junction with the cervix. The plunger attachment of the Green-Armytage cannula is in the form of a screw, one turn of which will cause the injection of 1 ml of contrast medium, thus enabling the operator to know exactly how much of the medium has been injected in a steady flow. There are other varieties of straight or curved metal cannulae with rubber acorns (Figs. 2.2. and 2.3). There are instances where cannulation of the cervix is not possible, such as the presence of tumours deforming the cervix, extensive cervical lacerations and abnormally small cervical canals.

In recent years, the suction type of cannula has come into common usage (Fig. 2.4). Originally described by Kjellman in 1953, this apparatus is generally known in

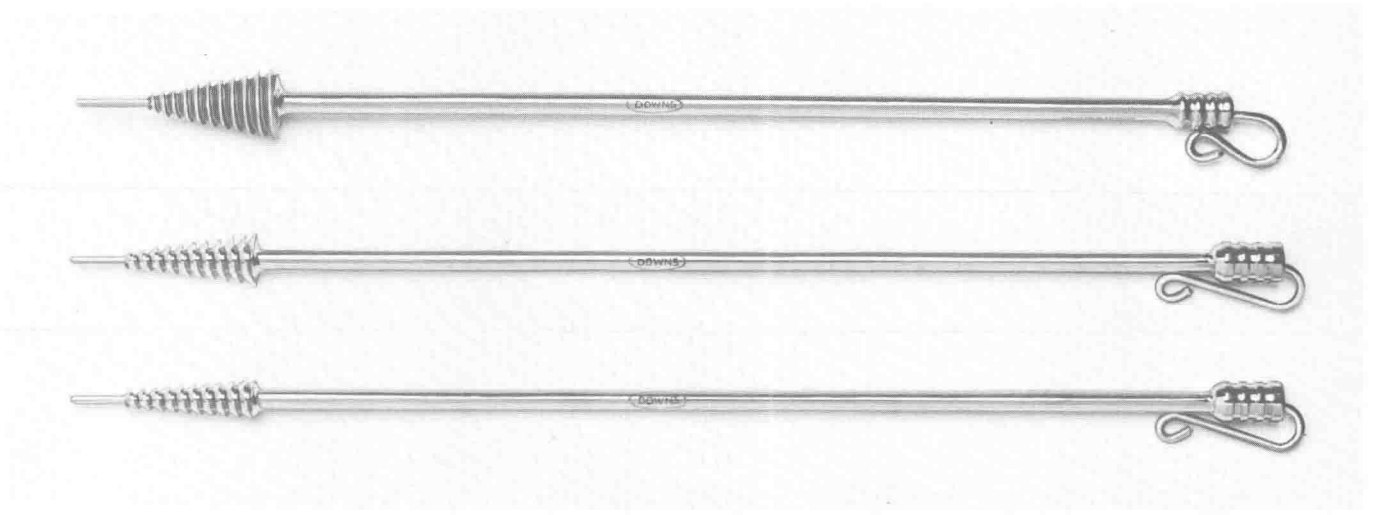


FIG. 2.1 Leech–Wilkinson cannula. Courtesy of Downs Surgical Ltd.

its modified form as the Malström-Westerman vacuum uterine cannula. The technique employed has been well described by both Malström (1961) and by Wright (1961). The special Malström speculum is large enough to accommodate the Malström-Westerman cannula and can be easily removed following insertion of the cannula. Plastic cups, which are in three different sizes, fit over the external part of the cervix. A silicone rubber acorn in the centre of the cup is inserted into the cervical canal. The lumen of the cup is connected by a tube to a unit which will produce a vacuum and consists of a pump, a pressure meter and a vacuum bottle. By establishing a negative pressure of 0.2–0.3 kg/cm^2, the cervix is drawn into the cup when the tip of the acorn is applied to the external os. An adjustment screw allows the distance of insertion of the acorn into the cervical canal to be controlled, usually 1–2 cm along the cannula being sufficient. With the cannula locked into position in the cervix, the negative pressure is increased to 0.6 kg/cm^2. The injection cannula will have been connected via a stopcock to a syringe containing contrast medium prior to its application. The whole injection system must contain contrast medium which is free of air bubbles (Fig. 2.5). The stopcock is then opened to allow the

FIG. 2.2 Hayes–Provis intrauterine cannula with rubber cone. Courtesy of Downs Surgical Ltd.