Vol. 7

Monographs in Clinical Cytology

Aspiration Biopsy Cytology

Part 2
Cytology of Infradiaphragmatic Organs

Josef Zajicek

S. Karger · Basel · München · Paris · London · New York · Sydney

Aspiration Biopsy Cytology

Part 2: Cytology of Infradiaphragmatic Organs

J. ZAJICEK

Department of Clinical Cytology, Institute of Tumour Pathology and Radiumhemmet, Karolinska Sjukhuset, Stockholm

139 figures comprising 275 single illustrations, 3 colour plates, and 12 tables, 1979

S. Karger · Basel · München · Paris · London · New York · Sydney

Monographs in Clinical Cytology

Vol. 3: STANLEY F. PATTEN, jr. (Rochester, N.Y.): Diagnostic cytology of the uterine cervix. XIV + 336 p., 303 fig., 14 tab., 1978. 2nd revised edition.
ISBN 3-8055-2194-4

Vol. 4: J. ZAJICEK (Stockholm): Aspiration biopsy cytology. Part 1: Cytology of supradiaphragmatic organs. XII + 212 p., 141 fig., 16 tab., 5 cpl., 1974.
ISBN 3-8055-1407-7

Vol. 5: E. VON HAAM (Columbus, Ohio): Cytology of transudates and exudates. VI + 124 p., 200 fig., 8 tab., 1977.
ISBN 3-8055-2625-3

Vol. 6: NELSON D. HOLMQUIST (New Orleans, La.): Diagnostic cytology of the urinary tract. VIII + 88 p., 157 fig., 1977.
ISBN 3-8055-2685-7

National Library of Medicine Cataloging in Publication
Zajicek, J.
Aspiration biopsy cytology. – Basel, New York, Karger, 1974–1979
(Monographs in clinical cytology, v. 4 + 7)
3-8055-2933-3 (pt. 2).
Contents: – pt. 1. Cytology of supradiaphragmatic organs. – pt. 2. Cytology of infradiaphragmatic organs
1. Biopsy, Needle 2. Cytodiagnosis I. Title II. Series
W1 MO587KF v. 4 + 7
ISBN 3-8055-2933-3

Printed in Switzerland by Meier + Cie AG Schaffhausen
ISBN 3-8055-2933-3

Contributors

Tošo Cizelj, MD, Department of Obstetrics and Gynecology, Clinical Center, Ljubljana, Jugoslavia

Olle Kjellgren, MD, FIAC, Professor and Director, Section of Gynecology, Department of Oncology, University of Umeå, Umeå, Sweden

Jule Kovačič, MD, DSc, FIAC, Professor, Department of Obstetrics and Gynecology, University of Ljubljana, Ljubljana, Jugoslavia

Anica Levičnik, BS, Cytologist, Department of Obstetrics and Gynecology, Cytology Laboratory, Clinical Center, Ljubljana, Jugoslavia

Srečko Rainer, MD, DSc, FIAC, Professor, Department of Obstetrics and Gynecology, University of Ljubljana, Ljubljana, Jugoslavia

Nils Stormby, MD, FIAC, Director, Cytology Laboratory, Malmö Allmänna Sjukhus, Malmö, Sweden

Nils Söderström, MD, Professor, Department of Internal Medicine, University of Lund, Lund, Sweden

Curt Wasastjerna, MD, Professor, Department of Internal Medicine Vasa Central Hospital, Vasa, Finland

Tord Ångström, MD, FIAC, Director, Cytology Laboratory, University Hospital, Umeå, Sweden

Acknowledgements

Part 2 of Aspiration Biopsy Cytology has been accomplished with continuous financial support from King Gustav V's Jubilee Foundation and from the Cancer Society in Stockholm.

For assistance in the English presentation of the manuscript I am indebted to Mrs. RAY MCVEIGH KÄLLQVIST. For the secreterial work I am grateful to Miss INGRID EDLUND and Miss LENA WÄRNLÖF.

For assistance with photomicrographs my great gratitude is due to GUY MASSON, and for the drawings to my wife EVA.

The chapter on cytology of benign ovarian lesions is contributed by J. KOVAČIČ, S. RAINER, T. CIZELJ and A. LEVIČNIK, that on the cytology of ovarian carcinomas by O. KJELLGREN and T. ÅNGSTRÖM, on the cytology of the liver by C. WASASTJERNA, on the cytology of the pancreas by N. STORMBY and on the cytology of the spleen by N. SÖDERSTRÖM. I gratefully acknowledge this assistance.

Preface

Recent years have seen spectacular developments in radiologic techniques such as selective angiography, lymphography, radioisotopic scanning, ultrasound, computerized tomography, etc. that can be used to detect lesions in intra-abdominal or intrapelvic organs. These advances in diagnostic radiology have extended the indications for diagnostic fine-needle aspiration cytology from solely palpable lesions to those radiologically visualized. The scope of this book does not include discussion of the various radiologic procedures that can be used to define targets for aspiration biopsy in infradiaphragmatic organs. The intention has been only to describe the cytologic findings in needle aspirates from various lesions of these organs and to correlate them with clinical findings, and above all with the histologic picture.

In the preface to Part 1 the opinion was expressed that the work of aspiration cytology must be entrusted to cytopathologists and cannot be delegated to cytotechnologists. Experience in recent years at Karolinska Hospital, however, has shown that cytotechnologists can make substantial contributions in this diagnostic field. They can help inexpert clinicians to prepare cytologic smears of the requisite quality. By using quick-staining methods they can also give valuable information on the representativeness of the aspirated material, or even a preliminary assessment of its type. This has proved particularly useful in departments of diagnostic radiology. When radiologically visualized lesions are needled, a preliminary evaluation of the aspirate may prevent an unnecessary repetition of the biopsy and thus minimize the patient's exposure to hazards, including those of irradiation. Should, on the other hand, the aspirate be judged as non-representative, this will prompt a repetition of the puncture in order to obtain diagnostic material. In this way, examination procedures are reduced to a minimum, which saves time and costs for the patient and for the hospital.

Since this volume aims also to assist in the teaching of needle aspiration cytology to cytotechnologists, many basic concepts of anatomy, histology and tumour pathology have been included. To cytopathologists who may find these passages too elementary, the writers express their apologies.

To Dr. PIER-LUIGI ESPOSTI, my friend and collaborator of many years

Contents

1. Kidney and Renal Pelvis

Current concepts of renal pathology are based mainly on the structural details as they appear in tissue sections and less on the morphology of the individual cells. For this reason the study of needle aspirates has not yet made any special contribution to the diagnosis of kidney disease in general. Cytologic biopsy of the kidney and of the renal pelvis is at present used almost exclusively in the diagnosis of neoplasms which have been detected by radiologic methods (nephrotomography, urography, selective renal angiography, retrograde pyelography), by radioisotopic scanning or by ultrasound.

General Remarks

The kidneys are responsible for the elimination of waste products in the blood and for concentrating them in the urine. According to ALLEN [1], about 180 litres of tissue fluid are filtered off from the blood every 24 h. Most of this fluid is returned to the bloodstream after filtration, so that only about 1.5 litres of urine leaves the kidneys per 24 h. The filtration and reabsorption take place in some 3,000,000 epithelial tubules – the nephrons.

Microscopic Structure

The blind end of the nephron has an invagination known as Bowman's capsule, which surrounds a tuft (glomerulus) of capillaries (fig. 1, 6). This structure, called Malpighian or renal corpuscle, is responsible for the formation of the filtrate, i.e. the urine. Blood from afferent vessels is filtered through the basement membrane between capillary endothelium and the epithelial cells of the kidney, the podocytes. The podocytes are the source of erythropoietin, a humoral factor which stimulates erythropoiesis [6, 7]. Erythropoietin has been demonstrated in extracts from some renal carcinomas, which may explain the polycythaemia that is occasionally associated with this disease [16, 35].

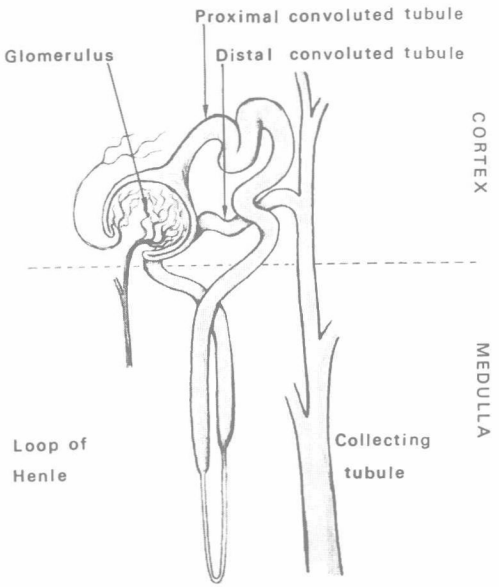

Fig. 1. Schematic presentation of the relationships of various segments of mammalian nephron to the cortex and medulla of the kidney.

About 99% of the filtrate formed in the renal corpuscles is reabsorbed via subsequent segments of the nephron – the proximal convoluted tubule, the loop of Henle and the distal convoluted tubule. The rest empties as urine via the collecting tubules into the pelvis of the kidney.

The proximal convoluted tubules are about 15 mm long and pursue a tortuous course in the immediate vicinity of the renal corpuscle. They are lined with cytoplasm-rich cells which display numerous mitochondria. Electron microscopy has shown that the cell surface is covered with tightly packed microvilli. These form the brush border seen at light microscopy. More than two-thirds of the filtrate is reabsorbed through the proximal tubules. The microvilli clearly serve to increase the surface area for reabsorption. Tightly packed villi are not seen in other parts of the nephron. Since such villi can be seen by electron microscopy in the cells of renal adenocarcinoma, it has been suggested that these tumours derive from the cells of proximal convoluted tubules [10, 27].

The renal corpuscles and the proximal convoluted tubules occupy the proximal part of the kidney – the cortex. The nephron then runs towards

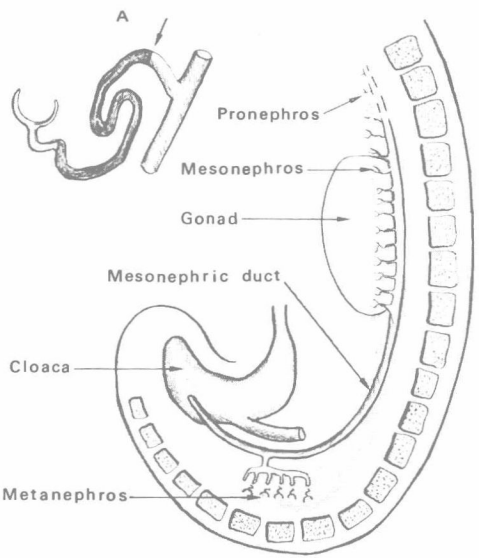

Fig. 2. Embryology of the kidney. Schematic presentation of various segments of the nephrogenic cord (pronephros, mesonephros and metanephros) in relation to the mesonephric (Wolffian duct). While the pronephros and the cranial part of mesonephros disappear, a few of the caudal tubules of the mesonephros participate in the formation of the gonads (cf. also fig. 20). An outgrowth of the mesonephric duct (ureteric bud) penetrates the metanephros and there forms the collecting tubules of the kidney. The excretory units of the kidney (the nephrons) develop from metanephric blastema. In the insert A an arrow indicates the connection of a nephron with its collecting tubule proceeding from the mesonephric duct. (Modified from HAMILTON *et al.* [15].)

the centre of the kidney – the medulla – before looping back to the renal corpuscle. This segment of the nephron is called the loop of Henle (fig. 1). Its first, descending part is a straight continuation of the proximal convoluted tubule. The lumen of the loop narrows abruptly, but enlarges again in its path back into the cortex. The cells of the narrow portion of the loop of Henle are of low cuboidal type.

After returning to its renal corpuscle, the nephron again becomes tortuous, and from this distal convoluted tubule the formed urine runs into a collecting tubule. The cells of the distal convoluted tubules and of the enlarged portion of the ascending loop of Henle appear in tissue sections smaller than those in the proximal convoluted tubules. Their cytoplasm is less eosinophilic and they lack the brush border of the proximal convoluted tubules.

Each nephron empties its urine into an arched collecting tubule (fig. 1). Groups of arched tubules run into a straight collecting tubule. This in turn drains into a larger duct that runs to a medullary papilla, where it empties into the calyces of the ureter. The cells in the collecting-duct system are columnar with homogeneous cytoplasm and well-defined borders.

Embryogenesis

The kidney is formed from the caudal part of the nephrogenic cord – the metanephros (fig. 2). The nephrogenic cord may, as regards embryonal development, be divided into the pronephros (cranial part), the mesonephros (middle) and the metanephros (caudal part). The pronephros degenerates. The tubules that arise in the mesonephros communicate with the mesonephric (Wolffian) duct. Some of them degenerate and others participate in the formation of the gonads, forming the efferent ductules of the testes. The embryonic tissue (blastema) of the metanephros differentiates into stroma cells and nephrogenic cells. The stroma cells give rise to the interstitial tissue of the kidney and from the nephrogenic cells the nephrons are formed.

The collecting tubules derive from the ureter, which is an outgrowth of the mesonephric (Wolffian) duct. After penetrating the metanephros, the collecting tubules fuse with the nephrons formed from the cells of the metanephric blastema (fig. 2a). Some nephrons may not fuse in this way. Such blind nephrons may secrete urine and form cysts. In severe degree this condition presents as congenital polycystic kidney. Lesser degrees possibly account for some of the isolated cysts found in adult kidneys [15]. These solitary cysts are probably the most common of the clinically detected renal masses that must be distinguished from true neoplasm.

As the kidney maturates it migrates upwards from the region of the fourth to that of the first lumbar vertebra. The left kidney is slightly higher than the right. The superior left renal pole may lie as high as the level of the tenth thoracic vertebra or as low as the second lumbar vertebra. The kidney is surrounded by fascia which adheres to the diaphragm. The kidney therefore moves synchronously with the diaphragm during respiration (fig. 4).

Aspiration Biopsy

The targets for aspiration biopsy of the kidney and the renal pelvis are, as already mentioned, lesions visualized by radiologic techniques, including scintiscan and ultrasound. Such lesions are usually larger than 3 cm. At