USE AND INTERPRETATION OF RENAL BIOPSY

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Volume 8 in the Series
MAJOR PROBLEMS IN PATHOLOGY

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To our wives
Carlene Striker, Patricia Quadracci, and
Carol Cutler

FOREWORD

In the relatively few years since the introduction of the renal biopsy, improvements in technique, advances in morphologic diagnostic procedures, and widespread use of this modality have resulted in rapid accumulation of considerable information on the pathologic changes seen in the kidney in a wide spectrum of renal disease. This book represents a major advance in correlating the basic patterns of stress and injury to the kidney with the structural alterations they produce at various stages in the natural history of different renal diseases and in turn with their implications for renal function, therapy, and prognosis.

The method described in this text is the outgrowth of a coordinated team approach to the diagnosis and treatment of patients with renal disease at the University of Washington Hospitals, involving more than 4000 patients over an 18 year period. It represents the product of considerable experience in interpreting light and electron micrographs of the kidney and in clinical nephrology.

This monograph is intended for both the pathologist and the clinician. Typical morphologic changes in each disease process are described in detail and are richly illustrated with light and electron micrographs. A series of excellent diagrams will be an extremely valuable aid to the novice by providing a reference for pattern recognition. The chapter on interpretation of biopsy specimens is particularly helpful; it should be read before the section on specific disease entities because it furnishes a sound approach to the clinicopathologic diagnosis of renal disease.

Clinicians will find the system proposed for classification of renal disease especially useful because it discusses the renal biopsy in terms of assessing prognosis and, in most cases, directing therapy. Moreover, this system of classification is sufficiently flexible to adapt to the continued changes in our concepts of the pathogenesis of renal disease that are inevitable in this rapidly developing field.

JAMES L. BENNINGTON, M.D.

PREFACE

The approach presented in this text is a synthesis of clinical and histologic information obtained from over 4000 biopsies collected between 1959 and 1977. The patient population ranged from children to adults. We also have had the good fortune to be the repository for nearly all of the biopsy material obtained from Washington and adjoining states. These facts, coupled with a reasonably stable patient population and a close liaison between the clinical and laboratory services, provided a unique opportunity to study the evolution of renal disease and to attempt a clinically useful disease categorization. We originally struggled with the available clinical and histologic classifications that had been used for nearly 50 years. They proved to be of little use in communicating with our colleagues and patients. Nearly seven years ago we developed a detailed quantitative method of describing renal biopsies. This proved to be too cumbersome for routine use. This text represents our current working approach to renal disease. We do not presume to assert this practical approach represents a new classification. Rather, our intent is to provide a means of communicating clearly and simply to colleagues and patients the nature, extent, and prognosis of the renal disease process.

The experience necessary to prepare this monograph was aided immensely by biopsy material submitted by our clinical colleagues, including Drs. James Burnell, Robert Hickman, Henry Tenckhoff, Joseph Eschbach, Michael Kelly, and a large number of community nephrologists. The stimulating and challenging discussions with these individuals, many clinical fellows, and visiting scientists, as well as the incisive and intuitive questioning of Dr. Belding H. Scribner, helped us to order our thoughts in this rather confusing field.

Our special gratitude goes to Drs. Earl Benditt and Robert G. Petersdorf for providing interest in and support for our endeavor. Augusta Litwer, Hazel Mehrer, and Vicki Jackson contributed excellent technical assistance and patience in the preparation of endless numbers of drafts.

THE AUTHORS

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Section I

GENERAL CONSIDERATIONS

Chapter One

History of Renal Biopsy

Before 1948 there were only occasional reports of histologic studies on living organs for specific diseases; research before that time was based on open surgical biopsies obtained secondarily during an unrelated surgical procedure in the spirit and enthusiasm of Gwyn, who felt that "a kidney can always suffer the loss of a millimeter of substance; the upper surface of an enlarged liver away from the intestine might spare a sliver." Gwyn (1923) reported on kidney biopsies in two patients, one having the nephrotic syndrome and renal amyloidosis. Since that time, many physicians have used direct visualization to obtain renal tissue for diagnostic purposes or clinical investigation. Russell's classic monograph on Bright's disease (1929), for example, presented data on eight patients with kidney biopsies performed during renal decapsulation.

Percutaneous biopsy of the kidney was first performed by Ball in 1934. He advocated aspiration biopsy to aid in the diagnosis of intraabdominal masses, and in his initial report he described a patient with hypernephroma diagnosed by this means. Not until 1943 was the first systematic study using renal biopsy begun. In that year Castleman and Smithwick obtained kidney tissue from 100 patients during the course of splanchnic sympathectomy for hypertension, then assessed the degree of histologic change in the renal vascular tissue.

The next consistent attempt at biopsy of the kidney appears to be that of Alwall in 1944, although his results were not reported until 1952. He attempted percutaneous aspiration biopsy in 13 patients, but he obtained sufficient kidney tissue from only 10. Unfortunately, one patient with oliguria and uremia died following biopsy, and because of this Alwall temporarily abandoned the procedure. The biggest impetus to use of this method came from the reports of Perez Ara (1950) and Iversen and Brun (1951), which showed that percutaneous renal biopsy can be safe and useful.

The clinical interest and methodological investigations of Alwall, Perez Ara, and Iversen and Brun constituted a strong stimulus and led to the present interest in renal biopsy as a clinical and research tool. Following the initial reports of successful and safe percutaneous renal biopsies, a plethora of papers began to appear describing various techniques of obtaining tissue. Iversen and Brun recommended aspiration biopsy in the sitting position, whereas Perez Ara used the prone position. The use of the Vim-Silverman needle was first advocated in 1953 by Fiaschi and his associates, who biopsied 10 patients in the prone position and obtained sufficient tissue for diagnosis in six. Most reports in this period showed a similar degree of success, with adequate tissue being obtained in only two-thirds of the biopsy attempts.

Muehrcke and his colleagues (1955) made significant advances in improving the yield by their demonstration that probing with a small atraumatic needle was useful in localizing the kidney. In addition, they found that a Franklin modified Vim-Silverman needle secured a better core of tissue. They were successful in obtaining adequate renal tissue in 96 of 100 attempted biopsies with these changes in technique, a remarkable improvement. Most latter investigators have agreed that the probing needle improves biopsy yield, and recommend the prone position for biopsy except for women in late pregnancy.

Little attention was directed to the report by Lusted and associates (1956) regarding the use of image-amplified fluoroscopy during an excretory urogram in order to optimally localize the kidney prior to biopsy, and most renal biopsies during the ensuing decade were obtained by the "blind" technique. It is probable that the lag in utilizing fluoroscopy was based to some degree on the lack of facilities in many centers, as well as the cumbersome fluoroscopic equipment needed at that time. The more recent development of television-monitored fluoroscopic equipment with image intensification and the use of large doses of contrast media now assure that most patients' kidneys can be visualized adequately for a safe renal biopsy, except in cases in which markedly impaired renal function lessens the excretion of radiopaque material.

Radionuclide scans have continued to be useful for localizing the kidney prior to biopsy, and the advent of the gamma camera, which allows dynamic observation of renal function, has increased the value of the technique. This method suffers the same limitations as excretory urography, since adequate scans may not be obtained when renal function is severely reduced. However, the problem of hypersensitivity reactions is minimal compared to that associated with conventional excretory urography because of the small dose of radionuclide given.

Certain medical centers greatly interested in improving yield, however, have abandoned the percutaneous route for direct visualization of the kidney through a subcostal surgical incision followed by aspiration

or puncture biopsy. The yield is high by this method, but complications have been as great or greater than by the percutaneous route.

Finally, recent application of ultrasound has proved as reliable for localization as image-amplified fluoroscopy. Ultrasound has particular usefulness in three areas: for patients who are pregnant, those with contrast material sensitivities, and those with nonfunctioning kidneys.

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Chapter Two

Clinical Evaluation of Renal Diseases

Introduction

The study of renal disease requires an objective evaluation of clinical, laboratory, and anatomic information. None of these vantage points should operate independently since the same clinical presentation of renal disease may be associated with a variety of histologic lesions. Failure to understand this fact has led to a confusing array of clinical and pathologic categorizations. The renal biopsy, however, provides a systematic evaluation of the available data, which can be reported in quantitative terms, thus avoiding intuitive, nonobjective interpretations, and which can answer the following questions: (1) What is the primary site of the lesion? (2) What is its type and severity? (3) What is its distribution? The subjective data (obtained from the history) and the objective data (obtained from the physical examination and various laboratory tests) can then be interpreted and integrated with the renal biopsy data to formulate a diagnosis and a therapeutic plan. This approach is shown schematically in the following diagrams: