

CONTENTS

INTRODUCTION	1
1. INTRODUCTION TO CYTODIAGNOSTIC URINALYSIS	3
Background information	3
Definition of cytodiagnostic urinalysis	3
Basic components of cytodiagnostic urinalysis	3
Histopathologic basis of cytodiagnostic urinalysis	4
Sites of lower urinary tract epithelial exfoliation	5
Sites of renal epithelial exfoliation	6
Renal casts	6
Urinary sediment parameters and histopathologic correlation	7
Limitations of routine microscopic urinalysis	7
Advantages of cytodiagnostic urinalysis	8
Clinical utility of cytodiagnostic urinalysis	8
The urine sediment examination: A coordinated approach	9
2. SPECIMEN COLLECTION AND PROCESSING	12
Types of specimens	12
First-morning, clean-catch, voided urine specimen	12
Randomly voided (spot) urine specimen	12
Catheterized urine specimen	12
Bladder irrigations, bladder washings, renal pelvic washings, and ureteral washings	12
Ileal conduit urine specimen	13
Fixatives for urine specimens	13
Specimen triaging	13
Cytodiagnostic urinalysis request/report form	14
3. SPECIMEN PREPARATION	17
Urologic and renal protocols	17
Cytodiagnostic urinalysis preparatory procedure	17
Cystoscopic bladder biopsy protocols	22
Cystoscopic bladder biopsy supernate procedure (formalin-fixed specimens)	22
Modified cystoscopic bladder biopsy supernate procedure	22
Cell blocks	22
Papanicolaou staining	22
Rapid Papanicolaou staining method	23

xii **Contents**

Characteristics of optimal slide preparation	24
Special stains for urine sediment	27
4. MACROSCOPIC URINALYSIS	28
Utility of the macroscopic urinalysis	28
Components of the macroscopic urinalysis	28
Volume	28
Odor	28
Color	28
Character	28
Osmolality and specific gravity	28
Reagent-strip testing	30
Reagent-strip reactions	30
pH	30
Protein	31
Glucose	32
Ketones	32
Bilirubin	32
Blood	32
Nitrite	33
Leukocyte esterase	33
Urobilinogen	33
Confirmatory tests	33
SSA procedure	33
Ictotest procedure	34
Correlation of physicochemical tests and microscopic findings	35
5. MICROSCOPIC EXAMINATION: GUIDELINES AND PROCEDURES	38
General guidelines	38
Cytodiagnostic urinalysis entities	39
Mucus	39
Fibrin	39
Uric acid crystals	39
Triple phosphate crystals	40
Calcium oxalate crystals	40
Lithiasis	41
Neutrophilic leukocytes and normal erythrocytes	41
Dysmorphic erythrocytes	42
Eosinophilic leukocytes	43
Lymphocytes	44
Atypical lymphocytes	44
Histiocytes and macrophages	45
Bacterial urinary tract infection	45
Bacterial pseudocast	45
Candidal urinary tract infection	46
Herpes simplex infection	46
Cytomegalovirus inclusion cells	46
Polyoma virus	46
Degenerative urothelium	47
Normal urothelial fragment	47

Normal urothelial cells	47
Catheterized urothelial fragments	48
Benign urothelial fragment	48
Inflammatory urothelial changes	49
Benign glandular fragment	49
Convoluted renal tubular cells	50
Renal collecting duct epithelial cells	51
Renal epithelial fragments	52
Atypical urothelial fragment suggesting low-grade urothelial carcinoma	55
Papillary urothelial carcinoma	55
Urothelial atypia (dysplasia) and CIS	57
Well-differentiated keratinizing squamous cell carcinoma of the bladder	59
Urachal adenocarcinoma	59
Metastatic adenocarcinoma of the prostate	59
Metastatic adenocarcinoma of the colon	60
Metastatic melanotic melanoma	60
Metastatic osteogenic sarcoma	61
Renal cell carcinoma	61
Wilms' tumor	62
Urinary lymphoma	62
Urinary globules	63
Corpora amylacea	63
Renal (urinary) casts	63
Performing the microscopic examination	69
6. QUALITY CONTROL AND ASSURANCE	73
General guidelines for laboratory safety	73
Chemical safety	75
Alcohol	75
Xylene	75
7. ACUTE RENAL FAILURE	76
Clinical presentation	76
Classification of acute renal failure	76
Routine urinalysis findings	76
Cytodiagnostic urinalysis findings	79
Correlative histopathologic findings	81
Special tests and confirmatory studies	84
Prognostic significance	85
8. GLOMERULAR DISEASES	86
Clinical presentation	86
Classification of glomerular diseases	86
Primary forms of glomerulonephritis	87
Secondary forms of glomerular injury	89
Routine urinalysis findings	90
Cytodiagnostic urinalysis findings	92
Correlative histopathologic findings	95
Special studies and confirmatory tests	99
Prognostic significance	99

9. RENAL TRANSPLANTATION	101
Clinical presentation	101
Classification of renal allograft rejection	101
Classification of diseases of the graft	101
Mechanisms of allograft rejection	101
International standardization for the histologic diagnosis of renal allograft rejection	101
Immunohistologic analysis of acute rejection	102
Routine urinalysis findings	102
Fine needle aspiration biopsy	102
Cytodiagnostic urinalysis findings	103
Correlative histopathologic findings	105
Predictive value of urine cytology in acute rejection	107
Prognostic significance	109
10. RENAL NEOPLASIA	112
Clinical presentations	112
Pathogenesis of renal cell carcinoma	112
Classification of renal neoplasia	112
Routine urinalysis findings	113
Cytodiagnostic urinalysis findings	113
Correlative histopathologic findings	114
Special studies and confirmatory tests	115
Prognostic significance	116
11. INFECTIONS AND INFLAMMATORY CONDITIONS OF THE LOWER URINARY TRACT	117
Urinary tract infections	117
Bacteria	117
Parasitic infections	121
Inflammatory conditions of the lower urinary tract	123
Eosinophilic cystitis	123
Radiation cystitis	124
Malakoplakia of the kidney and bladder	125
Lithiasis	126
12. LOWER URINARY TRACT	129
Clinical presentations	129
Classification of urothelial neoplasia	129
Routine urinalysis findings	130
Cytodiagnostic urinalysis findings	130
Correlative histopathologic findings	132
Prognostic significance	136

13. FORMULATION AND SELECTION OF A DIAGNOSTIC STATEMENT FOR CYTODIAGNOSTIC URINALYSIS	138
Selection of a diagnostic statement	138
Diagnostic statements for cytodiagnostic urinalysis	138
Unsatisfactory, general, renal, and urologic cytodiagnoses	139
14. DIAGNOSTIC CASE STUDIES/COLOR ATLAS	141
Monosymptomatic hematuria	143
Glomerulopathy	145
Nephrotic syndrome	147
Hepatorenal failure	149
Lead nephropathy	151
Renal candidiasis	153
Acute renal transplant rejection	155
Acute tubular necrosis (ATN)	157
Multiple myeloma	159
Schistosomiasis	161
Eosinophilic cystitis	163
Malackoplakia	165
Severe urothelial atypia (dysplasia)/CIS	167
Grade I urothelial carcinoma	169
Grade II urothelial carcinoma	171
Grade III urothelial carcinoma	173
Squamous cell carcinoma	175
Metastatic colon adenocarcinoma	177
Metastatic uterine sarcoma	179
Renal cell carcinoma	181
Tubulointerstitial inflammation	183
Lymphoma/lithiasis	185
IL-2 nephrotoxicity	187
Melanoma	189
CMV nephropathy	191
GLOSSARY	192
INDEX	195