

FIRST STEP IN EVALUATION OF ACUTE RENAL FAILURE**History**

Disorders that suggest or predispose to renal failure: hypertension, diabetes mellitus, human immunodeficiency virus, vascular disease, abnormal urinalyses, family history of renal disease, medication use, toxin or environmental exposure, infection, heart failure, vasculitis, cancer

Disorders that suggest or predispose to volume depletion: vomiting, diarrhea, pancreatitis, gastrointestinal bleeding, burns, heat stroke, fever, uncontrolled diabetes mellitus, diuretic use, orthostatic hypotension, nothing-by-mouth status, nasogastric suctioning

Disorders that suggest or predispose to obstruction: stream abnormalities, nocturia, anticholinergic medications, stones, urinary tract infections, bladder or prostate disease, intra-abdominal malignancy, suprapubic or flank pain, anuria, fluctuating urine volumes

Symptoms of renal failure: anorexia, vomiting, reversed sleep pattern, pruritus

Record review

Recent events (procedures, surgery)

Medications (see Fig. 12-22)

Vital signs

Intake and output

Body weights

Blood chemistries and hemogram

Physical examination

Skin: rash suggestive of allergy, palpable purpura of vasculitis, livedo reticularis and digital infarctions suggesting atheroemboli

Eyes: hypertension, diabetes mellitus, Hollenhorst plaques, vasculitis, candidemia

Lungs: rales, rubs

Heart: evidence of heart failure, pericardial disease, jugular venous pressure

Vascular system: bruits, pulses, abdominal aortic aneurysm

Abdomen: flank or suprapubic masses, ascites, costovertebral angle pain

Extremities: edema, pulses, compartment syndromes

Nervous system: focal findings, asterixis, mini-mental status examination

Consider bladder catheterization

Urinalysis (see Fig. 12-13)

FIGURE 12-13

First step in evaluation of acute renal failure.

SECOND STEP IN EVALUATION OF ACUTE RENAL FAILURE

Urine diagnostic indices (see Fig. 12-16)

Consider need for further evaluation for obstruction

Ultrasonography, computed tomography, or magnetic resonance imaging

Consider need for additional blood tests

Vasculitis/glomerulopathy: human immunodeficiency virus infections, antineutrophilic cytoplasmic antibodies, antinuclear antibodies, serologic tests for hepatitis, systemic bacterial endocarditis and streptococcal infections, rheumatoid factor, complement, cryoglobins

Plasma cell disorders: urine for light chains, serum analysis for abnormal proteins

Drug screen/level, additional chemical tests

Consider need for evaluation of renal vascular supply

Isotope scans, Doppler sonography, angiography

Consider need for more data to assess volume and cardiac status

Swan-Ganz catheterization

FIGURE 12-14

Second step in evaluation of acute renal failure.

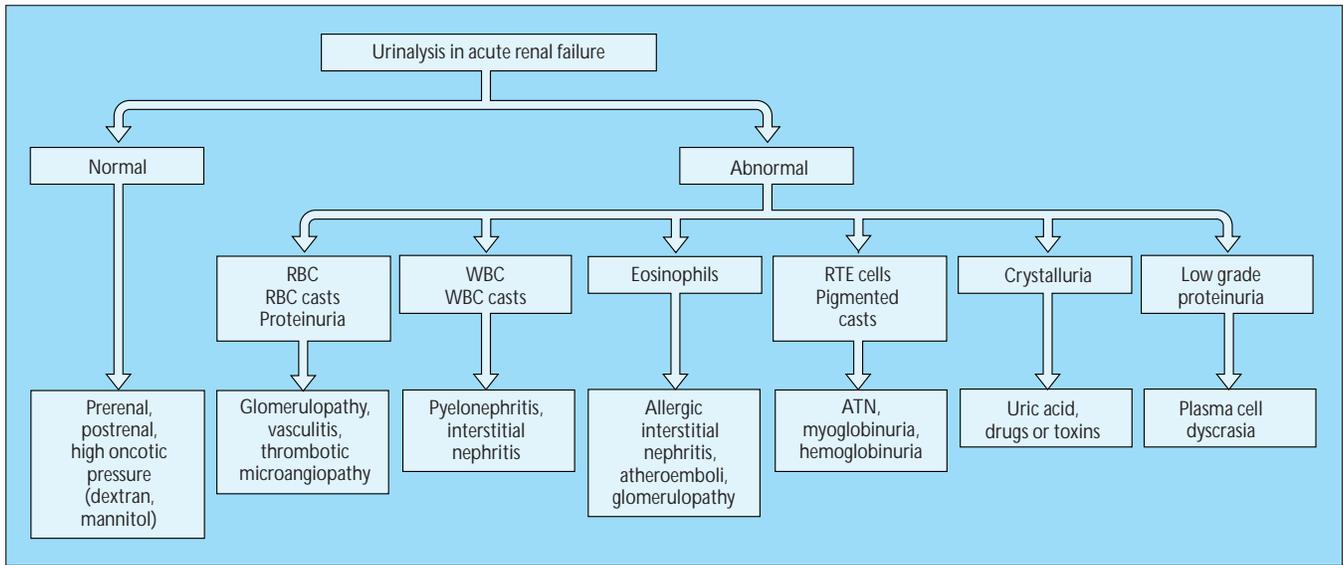


FIGURE 12-15

Urinalysis in acute renal failure (ARF). A normal urinalysis suggests a prerenal or postrenal form of ARF; however, many patients with ARF of postrenal causes have some cellular elements on urinalysis. Relatively uncommon causes of ARF that usually present with oligoanuria and a normal urinalysis are mannitol toxicity and large doses of dextran infusion. In these disorders, a “hyperoncotic state” occurs in which glomerular capillary oncotic pressure, combined with the intratubular hydrostatic pressure, exceeds the glomerular capillary hydrostatic pressure and stop glomerular filtration. Red blood cells (RBCs) can be seen with all renal forms of ARF. When RBC casts are present, glomerulonephritis or vasculitis is most likely.

White blood cells (WBCs) can also be present in small numbers in the urine of patients with ARF. Large numbers of WBCs and WBC casts strongly suggest the presence of either pyelonephritis or acute interstitial nephritis. Eosinophiluria (Hansel’s stain) is often present in either allergic interstitial nephritis or atheroembolic disease [13, 14]. Renal tubular epithelial (RTE) cells and casts and pigmented granular casts typically are present in pigmenturia-associated ARF (see Fig. 12-21) and in established acute tubular necrosis (ATN). The presence of large numbers of crystals on urinalysis, in conjunction with the clinical history, may suggest uric acid, sulfonamides, or protease inhibitors as a cause of the renal failure.

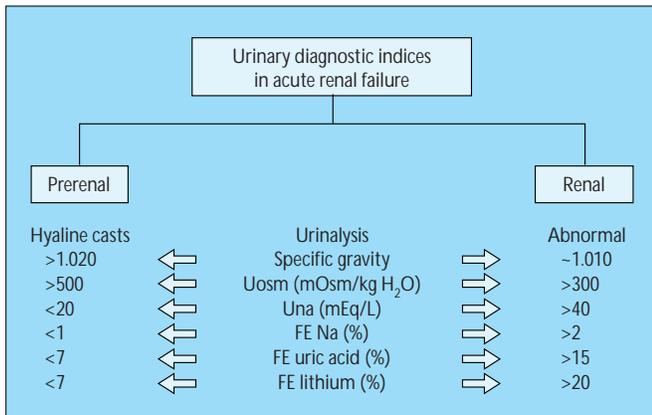


FIGURE 12-16

Urinary diagnostic indices in acute renal failure (ARF). These indices have traditionally been used in the setting of oliguria, to help differentiate between prerenal (intact tubular function) and acute tubular necrosis (ATN, impaired tubular function). Several caveats to interpretation of these indices are in order [1]. First, none of these is completely sensitive or specific in differentiating the prerenal from the ATN form of ARF. Second, often a continuum exists between early prerenal conditions and late prerenal conditions that lead to ischemic ATN. Most of the data depicted here are derived from patients relatively late in the progress of ARF when the serum creatinine concentrations were 3 to 5 mg/dL. Third, there is often a relatively large “gray area,” in which the various indices do not give definitive results. Finally, some of the indices (eg, fractional excretion of endogenous lithium [FE lithium]) are not readily available in the clinical setting. The fractional excretion (FE) of a substance is determined by the formula: $U/P \text{ substance} \div U/P \text{ creatinine} \times 100$. U/P—urine-plasma ratio.

Vascular Mechanisms Involved in Acute Renal Failure

VASCULAR CAUSES OF ACUTE RENAL FAILURE

Arterial	Venous
Large vessels	Occlusion
Renal artery stenosis	Clot
Thrombosis	Tumor
Cross-clamping	
Emboli	
Atheroemboli	
Endocarditis	
Atrial fibrillation	
Mural thrombus	
Tumor	
Small vessels	
Cortical necrosis malignant hypertension	
Scleroderma	
Vasculitis	
Antiphospholipid syndrome	
Thrombotic microangiopathies	
Hemolytic-uremic syndrome	
Thrombotic thrombocytopenic purpura	
Postpartum	
Medications (mitomycin C, cyclosporine, tacrolimus)	

FIGURE 12-17

Vascular causes of acute renal failure (ARF). Once prerenal and postrenal causes of ARF have been excluded, attention should be focused on the kidney. One useful means of classifying renal causes of ARF is to consider the anatomic compartments of the kidney. Thus, disorders of the renal vasculature (*see* Fig. 12-18), glomerulus (*see* Fig. 12-19), interstitium (*see* Fig. 12-20) and tubules can all result in identical clinical pictures of ARF [1]. This figure depicts the disorders of the renal arterial and venous systems that can result in ARF [15].

DIAGNOSIS OF POSSIBLE VASCULAR CAUSE OF ACUTE RENAL FAILURE

History	Examination	Laboratory/Other
Factors that predispose to vascular disease (smoking, hypertension, diabetes mellitus, hyperlipidemia)	Marked hypertension	Thrombocytopenia
Claudication, stroke, myocardial infarction	Atrial fibrillation	Microangiopathic hemolysis
Surgical procedure on aorta	Scleroderma	Coagulopathy
Catheterization procedure involving aorta	Palpable purpura	Urinalysis with hematuria and low-grade proteinuria
Selected clinical states (scleroderma, pregnancy)	Abdominal aortic aneurysm	Abnormal renal isotope scan and/or Doppler ultrasonography
Selected medications, toxins (cyclosporine, mitomycin C, cocaine, tacrolimus)	Diminished pulses	Renal angiography
Constitutional symptoms	Infarcted toes	Renal or extrarenal tissue analysis
	Hollendorst plaques	
	Vascular bruits	
	Stigmata of bacterial endocarditis	
	Illius	

FIGURE 12-18

Diagnosis of a possible vascular cause of acute renal failure (ARF). This figure depicts the historical, physical examination, and testing procedures that often lead to diagnosis of a "vascular cause" of ARF [1, 15, 16].