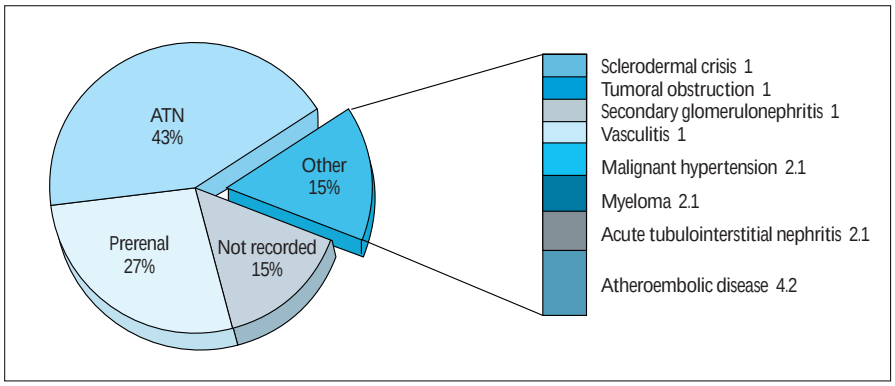

FIGURE 8-8
The most frequent causes of acute renal failure (ARF) in patients with preexisting chronic renal failure are acute tubular necrosis (ATN) and prerenal failure. The distribution of causes of ARF in these patients is similar to that observed in patients without previous kidney diseases. (*Data from* Liaño *et al.* [1])

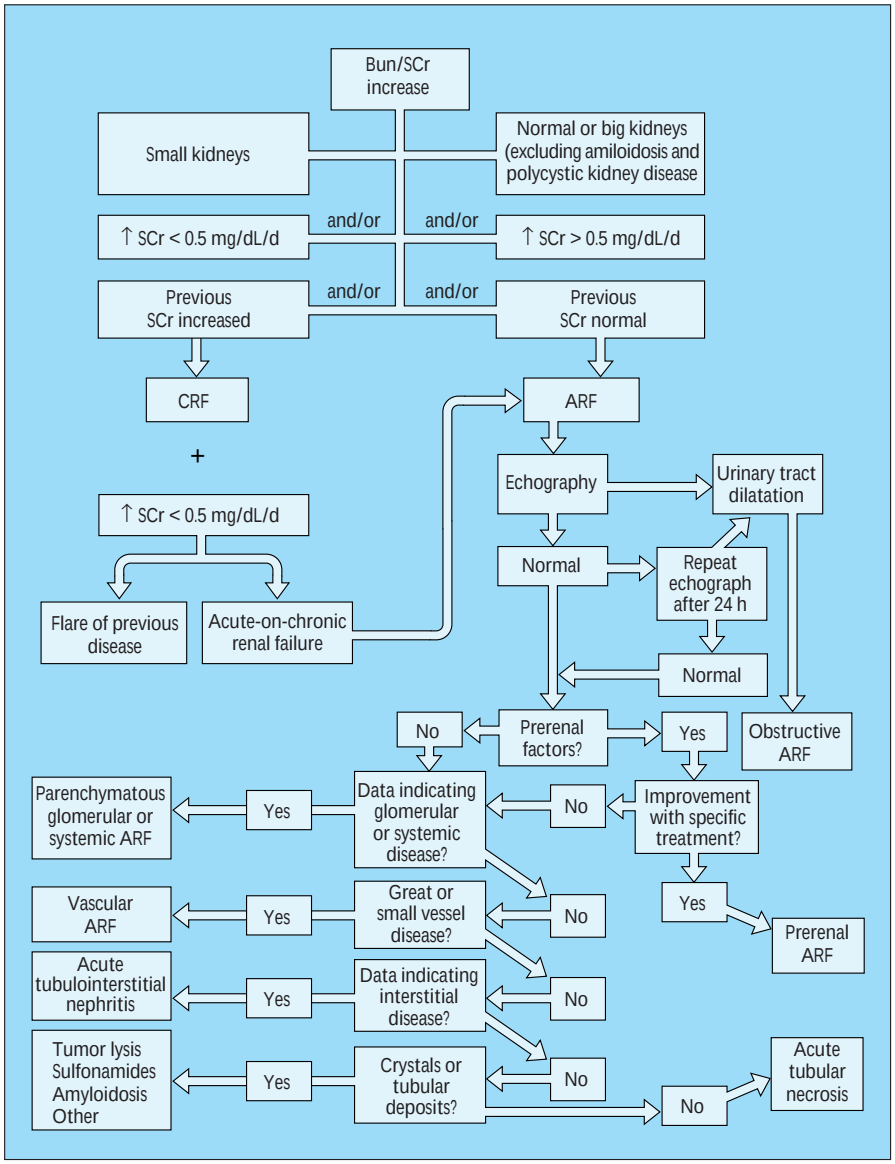

FIGURE 8-9
Discovering the cause of acute renal failure (ARF). This is a great challenge for clinicians. This algorithm could help to determine the cause of the increase in blood urea nitrogen (BUN) or serum creatinine (SCr) in a given patient.

BIOPSY RESULTS IN THE MADRID STUDY

Disease	Patients, n
Primary GN	12
Extracapillary	6
Acute proliferative	3
Endocapillary and extracapillary	2
Focal sclerosing	1
Secondary GN	6
Antiglomerular basement membrane	3
Acute postinfectious	2
Diffuse proliferative (systemic lupus erythematosus)	1*
Vasculitis	10
Necrotizing	5*
Wegener's granulomatosis	3
Not specified	2
Acute tubular necrosis	4*
Acute tubulointerstitial nephritis	4
Atheroembolic disease	2
Kidney myeloma	2*
Cortical necrosis	1
Malignant hypertension	1
ImmunoglobulinA GN + ATN	1
Hemolytic-uremic syndrome	1
Not recorded	2

* One patient with acute-on-chronic renal failure.

FIGURE 8-10

Biopsy results in the Madrid acute renal failure (ARF) study. Kidney biopsy has had fluctuating roles in the diagnostic work-up of ARF. After extrarenal causes of ARF are excluded, the most common cause is acute tubular necrosis (ATN). Patients with well-established clinical and laboratory features of ATN receive no benefit from renal biopsy. This histologic tool should be reserved for parenchymatous ARF cases when there is no improvement of renal function after 3 weeks' evolution of ARF. By that time, most cases of ATN have resolved, so other causes could be influencing the poor evolution. Biopsy is mandatory when a potentially treatable cause is suspected, such as vasculitis, systemic disease, or glomerulonephritis (GN) in adults. Some types of parenchymatous non-ATN ARF might have histologic confirmation; however kidney biopsy is not strictly necessary in cases with an adequate clinical diagnosis such as myeloma, uric acid nephropathy, or some types of acute tubulointerstitial nephritis . Other parenchymatous forms of ARF can be accurately diagnosed without a kidney biopsy. This is true of acute post-streptococcal GN and of hemolytic-uremic syndrome in children. Kidney biopsy was performed in only one of every 16 ARF cases in the Madrid ARF Study [1]. All patients with primary GN, 90% with vasculitis and 50% with secondary GN were diagnosed by biopsy at the time of ARF. As many as 15 patients were diagnosed as having acute tubulointerstitial nephritis, but only four (27%) were biopsied. Only four of 337 patients with ATN (1.2%) underwent biopsy. (*Data from* Liaño *et al.* [1].)

Predisposing Factors for Acute Renal Failure

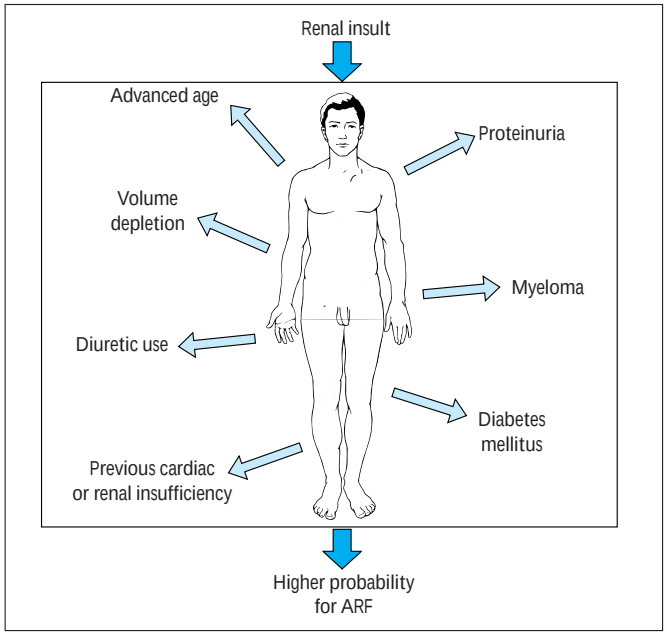

FIGURE 8-11

Factors that predispose to acute renal failure (ARF). Some of them act synergistically when they occur in the same patient. Advanced age and volume depletion are particularly important.

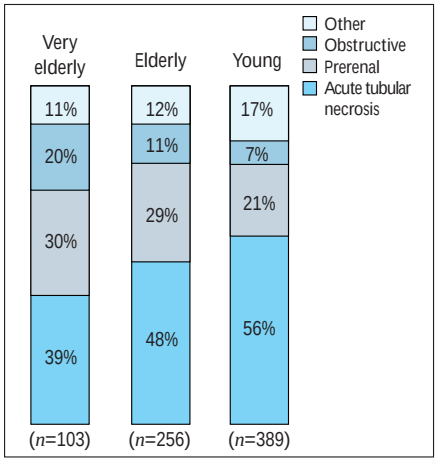

FIGURE 8-12

Causes of acute renal failure (ARF) relative to age. Although the cause of ARF is usually multifactorial, one can define the cause of each case as the most likely contributor to impairment of renal function. One interesting approach is to distribute the causes of ARF according to age. This figure shows the main causes of ARF, dividing a population diagnosed with ARF into the very elderly (at least 80 years), elderly (65 to 79), and young (younger than 65). Essentially, acute tubular necrosis (ATN) is less frequent (P=0.004) and obstructive ARF more frequent (P<0.001) in the very old than in the youngest patients. Prerenal diseases appear with similar frequency in the three age groups. (*Data from* Pascual *et al.* [3].)

Epidemiology of Acute Renal Failure

EPIDEMIOLOGY OF ACUTE RENAL FAILURE

Investigator, Year	Country (City)	Study Period (Study Length)	Study Population (millions)	Incidence (pmp/y)
Eliahou *et al.*, 1973 [4]	Israel	1965–1966 (2 yrs)	2.2	52
Abraham *et al.*, 1989 [5]	Kuwait	1984–1986 (2 yrs)	0.4	95
McGregor *et al.*, 1992 [6]	United Kingdom (Glasgow)	1986–1988 (2 yrs)	0.94	185
Sanchez *et al.*, 1992 [7]	Spain (Cuenca)	1988–1989 (2 yrs)	0.21	254
Feest *et al.*, 1993 [8]	United Kingdom (Bristol and Devon)	1986–1987 (2 yrs)	0.44	175
Madrid ARF Study Group, 1996 [1]	Spain (Madrid)	1991–1992 (9 mo)	4.23	209

FIGURE 8-13

Prospective studies. Prospective epidemiologic studies of acute renal failure (ARF) in large populations have not often been published . The first study reported by Eliahou and colleagues [4] was developed in Israel in the 1960s and included only Jewish patients. This summary of available data suggests a progressive increase in ARF incidence that at present seems to have stabilized around 200 cases per million population per year (pmp/y). No data about ARF incidence are available from undeveloped countries.

EPIDEMIOLOGY OF ACUTE RENAL FAILURE: NEED OF DIALYSIS

Investigator, Year	Country	Cases (pmp/y)
Lunding *et al.*, 1964 [9]	Scandinavia	28
Eliahou *et al.*, 1973 [4]	Israel	17*
Lachhein *et al.*, 1978 [10]	West Germany	30
Wing *et al.*, 1983 [11]	European Dialysis and Transplant Association	29
Wing *et al.*, 1983 [11]	Spain	59
Abraham *et al.*, 1989 [5]	Kuwait	31
Sanchez *et al.*, 1992 [7]	Spain	21†
McGregor *et al.*, 1992 [6]	United Kingdom	31
Gerrard *et al.*, 1992 [12]	United Kingdom	71
Feest *et al.*, 1993 [8]	United Kingdom	22†
Madrid ARF Study Group [1]	Spain	57

* Very restrictive criteria.
† Only secondary care facilities.

FIGURE 8-14

Number of patients needing dialysis for acute renal failure (ARF), expressed as cases per million population per year (pmp/y). This has been another way of assessing the incidence of the most severe cases of ARF. Local situations, mainly economics, have an effect on dialysis facilities for ARF management. In 1973 Israeli figures showed a lower rate of dialysis than other countries at the same time. The very limited access to dialysis in developing countries supports this hypothesis. At present, the need for dialysis in a given area depends on the level of health care offered there. In two different countries (*eg*, the United Kingdom and Spain) the need for dialysis for ARF was very much lower when only secondary care facilities were available. At this level of health care, both countries had the same rate of dialysis. The Spanish data of the EDTA-ERA Registry in 1982 gave a rate of dialysis for ARF of 59 pmp/y. This rate was similar to that found in the Madrid ARF Study 10 years later. These data suggest that, when a certain economical level is achieved, the need of ARF patients for dialysis tends to stabilize.

HISTORICAL PATTERNS OF ACUTE RENAL FAILURE

	Proportion of Cases, %				
	France 1973	India 1965–1974	France 1981–1986	India 1981–1986	South Africa 1986–1988
Surgical	46	11	30	30	8
Medical	30	67	70	61	77
Obstetric	24	22	2	9	15

FIGURE 8-15

Historical perspective of acute renal failure (ARF) patterns in France, India, and South Africa. In the 1960s and 1970s, obstetrical causes were a great problem in both France and India and overall incidences of ARF were similar. Surgical cases were almost negligible in India at that time, probably because of the relative unavailability of hospital facilities. During the 1980s surgical and medical causes were similar in both countries. In India, the increase in surgical cases may be explained by advances in health care, so that more surgical procedures could be done. The decrease in surgical cases in France, despite the fact that surgery had become very sophisticated, could be explained by better management of surgical patients.

(Legend continued on next page)