FIGURE 8-15 *(Continued)*

Changes in classification criteria—inclusion of a larger percentage of medical cases than a decade before—could be an alternative explanation. In addition, obstetric cases had almost disappeared in France in the 1980s, but they were still an important cause of ARF in India. In a South African study that excluded the white population the distribution of ARF causes was almost identical to that observed in India 20 years earlier. In conclusion, 1) the economic level of a country determines the spectrum of ARF causes observed; 2) when a developing country improves its economic situation, the spectrum moves toward that observed in developed countries; and 3) great differences can be detected in ARF causes among developing countries, depending on their individual economic power. (*Data from* Kleinknecht [13]; Chugh *et al.* [14]; Seedat *et al.* [15].)

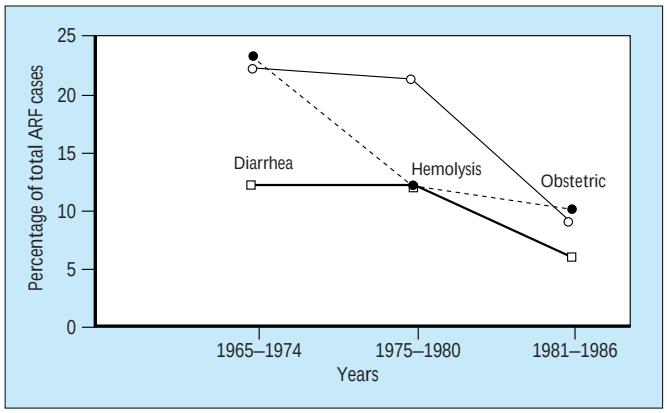

FIGURE 8-16

Changing trends in the causes of acute renal failure (ARF) in the Third-World countries. Trends can be identified from the analysis of medical and obstetric causes by the Chandigarh Study [14]. Chugh and colleagues showed how obstetric (septic abortion) and hemolytic (mainly herbicide toxicity) causes tended to decrease as economic power and availability of hospitalization improved with time. These causes of ARF, however, did not completely disappear. By contrast, diarrheal causes of ARF, such as cholera and other gastrointestinal diseases, remained constant. In conclusion, gastrointestinal causes of ARF will remain important in ARF until structural and sanitary measures (*eg*, water treatment) are implemented. Educational programs and changes in gynecological attention, focused on controlled medical abortion and contraceptive measures, should be promoted to eradicate other forms of ARF that constitute a plague in Third World countries.

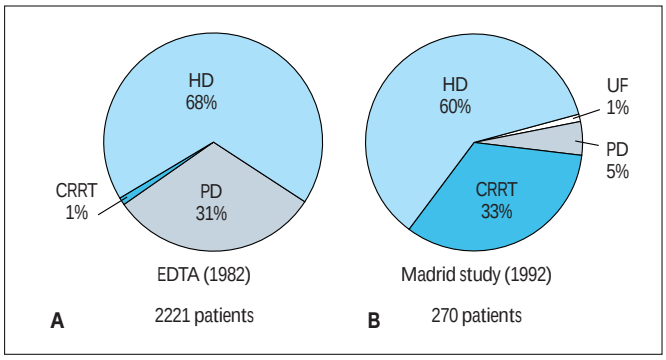

FIGURE 8-17

Evolution of dialysis techniques for acute renal failure (ARF) in Spain. **A**, The percentages of different modalities of dialysis performed in Spain in the early 1980s. **B**, The same information obtained a decade. At this latter time, 90% of conventional hemodialysis (HD) was performed using bicarbonate as a buffer. These rates are those of a developed country. In developing countries, dialysis should be performed according to the available facilities and each individual doctor's experience in the different techniques. PD—peritoneal dialysis; CRRT—continuous renal replacement technique; UF—isolated ultrafiltration. (**A**, *Data from* the EDTA-ERA Registry [11]; **B** *data from* the Madrid ARF Study [1].)

Hospital-Related Epidemiologic Data

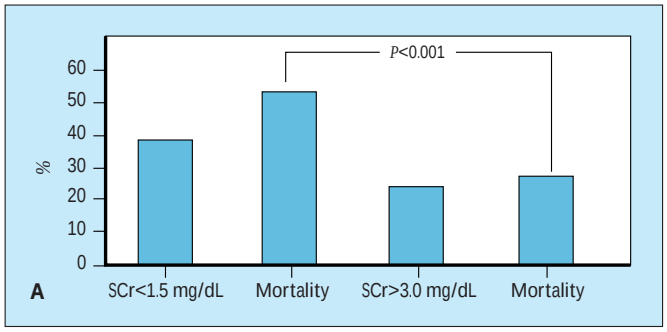

FIGURE 8-18

Serum creatinine (SCr) at hospital admission has diagnostic and prognostic implications for acute renal failure (ARF). **A**, Of the patients included in an ARF epidemiologic study 39% had a normal SCr concentration (less than 1.5 mg/dL) at hospital admission. It is worth noting that only 22% of the patients had clearly established ARF (SCr greater than 3 mg/dL) when admitted (no acute-on-chronic case was included). Mortality was significantly higher in patients with normal SCr at admission.

(Continued on next page)

ARF	Community-acquired (SCr at admission>3 mg/dL)	Hospital-acquired (SCr at admission<1.5 mg/dL)
ATN	41.8	58.2
Prerenal	47.5	52.5
Obstructive	77.3	22.7
Total	49.7	50.3

B

FIGURE 8-18 *(Continued)*

B, With the same two groups, acute tubular necrosis (ATN) predominated among the hospital-induced ARF group, whereas the obstructive form was the main cause of community-acquired ARF. In conclusion, the hospital could be considered an ARF generator, particularly of the most severe forms. Nonetheless, these iatrogenic ARF cases are usually "innocent," and are an unavoidable consequence of diagnostic and therapeutic maneuvers. (*Data from* Liaño *et al.* [1].)

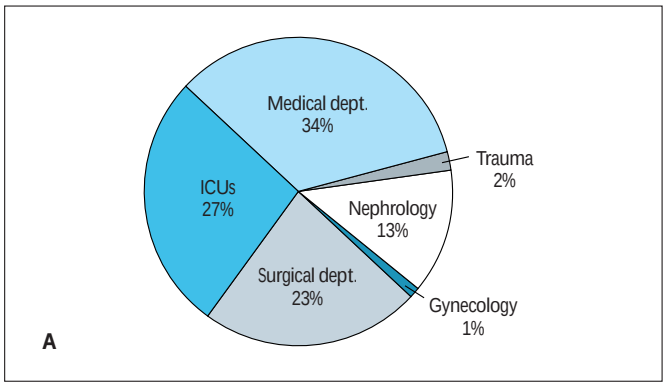

FIGURE 8-19

Acute renal failure: initial hospital location and mortality. **A**, Initial departmental location of ARF patients in a hospital in a Western country. The majority of the cases initially were seen in medical, surgical, and intensive care units (ICUs). The cases initially treated in nephrology departments were community acquired, whereas the ARF patients in the other settings generally acquired ARF in those settings. Obstetric-gynecologic ARF cases have almost disappeared. ARF of traumatic origin is also rare, for two reasons: 1) polytrauma patients are now treated in the ICU and 2) early and effective treatments applied today to trauma patients at the accident scene, and quick transfer to hospital, have decreased this cause of ARF. **B**, Mortality was greater for patients initially treated in the ICU and lower in the nephrology setting than rates observed in other departments. These figures were obtained from 748 ARF patients admitted to 13 different adult hospitals. (*Data from* Liaño *et al.* [1].)

EPIDEMIOLOGIC VARIABLES

Investigator, Year	Acute Renal Failure in Hospitalized Patients (per 1000 admissions)
Hou *et al.*, 1983*	49.0
Shusterman *et al.*, 1987*	19.0
Lauzurica *et al.*, 1989*	
First period	16.0
Second period	6.5
Abraham *et al.*, 1989	1.3
Madrid Study, 1992	1.5

* Case-control studies.

FIGURE 8-20

Epidemiologic variable. The incidence of hospital-acquired acute renal failure (ARF) depends on what epidemiologic method is used. In case-control studies the incidence varied between 49 and 19 per thousand. When the real occurrence was measured in large populations over longer intervals, the incidence of hospital-acquired ARF decreased to 1.5 per thousand admissions. (*Data from* [1,5,16,17,18].)

Prognosis

HISTORICAL PERSPECTIVE OF MEDICAL PROGNOSIS APPLIED IN ACUTE RENAL FAILURE

Criteria	Derivation	Applications	Advantages	Drawbacks
Classical	Doctor's experience	Individual prognosis	Easy	Doctor's inexperience Unmeasurable
Traditional	Univariate statistical analysis	Risk stratification	Easy	Only one determinant of prognosis is considered
Present	Multivariate statistical analysis Computing facilities	Risk stratification Individual prognosis?	Measurable Theoretically, "all" factors influencing outcome are considered	Complexity (variable, depending on model)
Future	Multivariate analysis Computing facilities	Risk stratification Individual prognosis Patient's quality of life evaluation Functional prediction	Measurable "All" factors considered	Ideally, none

FIGURE 8-21

Estimating prognosis. The criteria for estimating prognosis in acute renal failure can be classified into four periods. The *Classical* or heuristic way is similar to that used since the Hippocratic aphorisms. The *Traditional* one based on simple statistical procedures, is not useful for individual prognosis. The *Present* form is more or less complex, depending on what method is used, and it is possible, thanks to computing facilities and the development of multivariable analysis. Theoretically, few of these methods can give an individual prognosis [19]. They have not been used for triage. The next step will need a great deal of work to design and implement adequate tools to stratify risks and individual prognosis. In addition, the estimate of residual renal function and survivors' quality of life, mainly for older people, are future challenges.

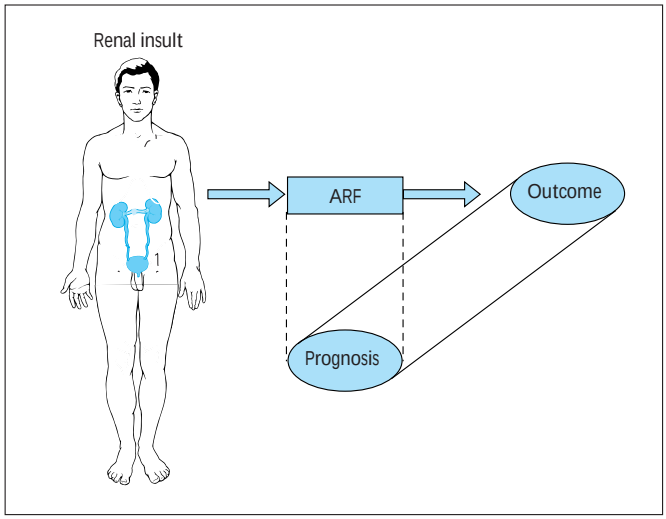

FIGURE 8-22

Ideally, prognosis should be established as the problem, the episode of acute renal failure (ARF), starts. Correct prognostic estimation gives the real outcome for a patient or group of patients as precisely as possible. In this ideal scenario, this fact is illustrated by giving the same surface area for the concepts of outcome and prognosis.

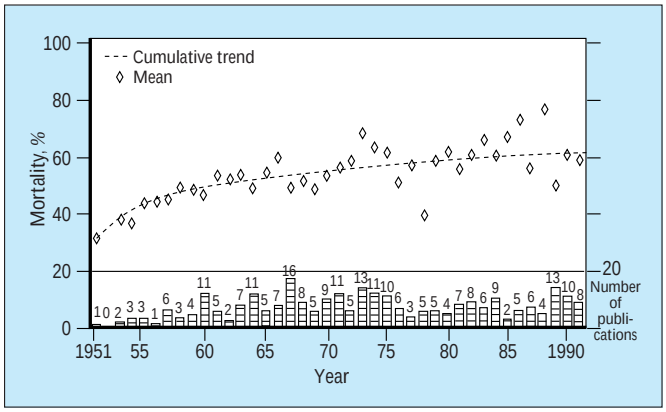

FIGURE 8-23

Mortality trends in acute renal failure (ARF). This figure shows the evolution of mortality during a 40-year period, starting in 1951. The graphic was elaborated after reviewing the outcome of 32,996 ARF patients reported in 258 published papers. As can be appreciated, mortality rate increases slowly but constantly during this follow-up, despite theoretically better availability of therapeutic armamentarium (mainly antibiotics and vasoactive drugs), deeper knowledge of dialysis techniques, and wider access to intensive care facilities. This improvement in supporting measures allows the physician to keep alive, for longer periods of time patients who otherwise would have died. A complementary explanation could be that the patients treated now are usually older, sicker, and more likely to be treated more aggressively. (*From* Kierdorf *et al.* [20]; with permission.)