Introduction

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Acute renal failure is one of the most frequent major complications of critical illness and adds an extraordinary burden of complexity, morbidity and cost to the management of intensive care patients.

Although some patients develop acute renal failure in intensive care because of primary renal disease or because of renal outflow obstruction, in the vast majority of cases, acute renal dysfunction is secondary to prerenal factors. Such prerenal factors affect the kidney in several ways, including the infiltration of the kidney by immunologically active cells. However, the primary and most important mechanism of renal injury in the setting of critical illness is, initially, functional and relates to inadequate oxygen supply.

The understanding that the maintenance of adequate renal perfusion and oxygen delivery are paramount to renal protection in critically ill patients, inevitably leads physicians to focus on the role of the renal circulation in both the pathogenesis of renal failure and the attenuation of any cardiovascular insult to the kidney.

The first part of this issue, which presents the proceedings of an international meeting held in Barcelona under the auspices of the European Intensive Care Society and the American Physiological Society, is dedicated to the analysis of the physiologic and pathophysiologic characteristics of the renal circulation with particular attention on how they may affect the kidney's response to stress. Various experts present state-of-the-art information on how a number of physiologic mechanisms participate in the control of renal blood flow. Such physiologic mechanisms include the nitric oxide system, the eicosanoid pathways, the myogenic control of glomerular blood flow by the mesangium, the significance of outer medullary blood flow, and the role of adenosine in its regulation.

The role of systemic inflammation and cardiovascular physiologic adjustments is then explored, because these systemic factors have a powerful influence on renal perfusion and function. The role of endogenous humoral mediators of sepsis, endotoxin, and cytokines is explored as is their manipulation in critical illness. In addition, the importance of atrial natriuretic factor as a physiologic mechanism of cardiovascular and renovascular control is reviewed with emphasis on its therapeutic potential for the future.

The next part of the issue is dedicated to an analysis of therapeutic interventions directed toward the manipulation of the renal vasculature and renal function in the clinical arena. The role of beta- and alpha-adrenergic manipulation (including the use of dopamine) is reviewed as is the effect of administering loop diuretics. The role of a new promising renal hormone (urodilatin) as a potential therapeutic tool in patients with early renal dysfunction is also described.

Despite all therapeutic interventions directed to the protection of renal perfusion and function, established renal failure requiring artificial and renal support eventually occurs in some patients. Artificial renal support in the intensive care unit is

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217

now increasingly being offered in the ICU and is in the form of continuous hemofiltration (continuous renal replacement therapy). This novel approach to artificial renal support introduces another circulation (that associated with the extracorporeal circuit) with all of its unique features and associated issues (blood-membrane interaction, maintenance of blood flow and ultrafiltration, adequacy of vascular access, consequences of recirculation, immune effects, adequacy of blood purification, effects on outcome and so on). The practicalities, characteristics, indications, and consequences of continuous renal replacement are therefore discussed in great detail as are their implications for patient care.

In summary, this issue brings together the unique expertise of experimental physiologists, pharmacologists, intensive care physicians, and nephrologists, and provides a unique combined picture of the pathophysiology of the native and artificial renal circulations with great emphasis on their clinical implications.

Any nephrologist or intensivist who deals with issues related to acute renal failure will find this issue an excellent source of information and insight into the mechanisms of renal dysfunction and an invaluable guide to the most effective approaches to the prevention and treatment of acute renal failure in critically ill patients.

218

Blood Purif 1997;15:217-218

Ronco/Artigas/Bellomo