HUMORAL FACTORS IN IMMUNE SUPPRESSION AFTER INJURY

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INTRODUCTION

The immune suppression which follows major accidental or operative injury leaves an otherwise normal host at risk for life threatening infections. The immunologic changes which accompany injury reverse completely with patient recovery; thus, the goal of clinical research is to intervene during the early acute period to the benefit of the patient. As noted by Ninnemann (1988), most of the lessons to date have been learned from thermal injury, which provides an easily quantified injury model. The immune suppression which accompanies burns mirrors closely the immune changes seen with other types of tissue injury (Ninnemann, 1988).

Immune depression invariably accompanies burns of greater than 40% of body surface area, with lesser burns predisposing to infection at the extremes of age. The variety of immunologic changes which may occur in these patients are presented in Table 1. These will only be briefly and selectively reviewed here, because many are covered in detail in the previous chapter.

The early burn period is characterized by profound suppression of these immune surveillance mechanisms, and cellular immune functions are most impaired. Similar changes are noted in patients with multiple trauma. For example, in a study of 31 patients with blunt trauma, 6 patients had normal delayed hypersensitivity skin test
Table 1. Immunologic Changes Which Accompany Thermal Injury (Adapted from Ninneman [1988])

1. Release of endotoxin, tissue-degradation products, hormones, cytokines and lymphokines with immunosuppressive properties into the general circulation.
2. Activation of the complement system with the production of complement-split products with immunoregulatory capabilities.
3. Reduced monocyte/macrophage function with increased suppressor macrophage function, increased immunosuppressive PGE production, and depressed phagocytosis.
4. Total loss of skin-test reactivity and recall-antigen responses.
5. Transient depression in B cell numbers and immunoglobulin production affecting both primary and secondary humoral immune responses.
6. Depression of neutrophil functions including chemotaxis, phagocytosis, chemiluminescence, and intracellular killing.
7. Depletion of fibronectin and serum opsonic activity.
8. Decreased natural killer (NK) cell and lymphokine-activated killer (LAK) cell function.
9. Long-term and profound depression of T lymphocyte responses with increased T-suppressor cell activity.
10. Reversal of T lymphocyte helper cell/suppressor cell ratios.

reactions and no infections or death, while 25 were anergic on skin testing with 20% experiencing sepsis and a 60% mortality rate (Christou and Meakins, 1982). Keane et al. (1983) found that the in vitro lymphocyte response to antigens, mitogens, and mixed leukocyte culture were significantly depressed up to 15 to 20 days in 31 patients with extensive multiple trauma. A lower lymphocyte response and a longer duration of suppression was shown for patients who developed infection, and the 3 patients who died had extremely low in vitro lymphocyte responses.

Surgery may also result in clinically significant immune suppression. In a prospective series of 503 skin-test positive surgical patients, 32 patients (6.4%) developed anergy in the postoperative period (Christou et al., 1982). This group had a 41% rate of sepsis and a 22%