

## Malnutrition and Nosocomial Infection

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The synergistic interaction of poor nutrition and superimposed infection increases the morbidity and mortality of hospitalized patients as well as adds hundreds of millions of dollars to the health care costs. Yet the importance of nutrition is not emphasized in the teaching of medical students and is still largely unrecognized in hospital practice. The article, "Association of Malnutrition with Nosocomial Infection," by Gorse et al (pp 194-203) illustrates once again that it is the malnourished patient who is most likely to experience nosocomial pneumonia, urinary tract infection, wound infection, and bacteremia. Although the association of infection and nosocomial infection in this study does not prove causation, the epidemiologic and experimental evidence for causation has been firmly established.

As Bistran et al<sup>1,2</sup> showed over a decade ago, malnutrition in hospital patients can be determined readily with the indicators, such as serum albumin, anthropometric indices, and delayed cutaneous hypersensitivity, used for studies in underprivileged populations. They found that even in major Boston teaching hospitals, the nutritional status of some surgical patients deteriorated during their hospital stay even before surgery because of a lack of attention<sup>1</sup> to their nutrition and that the situation was little better on the medical services.<sup>2</sup> Their observations have been repeated since then in many different North American hospitals with similar findings.

Since publication of the World Health Organization's monograph, *Interactions of Nutrition and Infection*,<sup>3</sup> over two decades ago, the synergistic interaction of malnutrition and infection has come to be seen as the major determinant of excess morbidity and mortality in low-income populations of developing coun-

tries, particularly in young children. Extensive epidemiologic and experimental evidence support this conclusion, and the mechanisms are reasonably well understood. Moreover, interventions that improve the nutritional status of poorly nourished groups at high risk reduce morbidity and mortality from infections.

In the current study by Gorse et al, malnutrition, using the criteria of serum albumin, total lymphocyte count, and unintentional body weight loss, was found retrospectively to be far more common in patients who developed a nosocomial infection than in uninfected control patients. It is noteworthy that the data to identify the patients with malnutrition were available from the beginning but that this diagnosis is not yet a part of usual hospital practice, even in most teaching hospitals. In view of the conclusive evidence of its importance, this neglect of the nutritional status of hospital patients can no longer be tolerated.

As a consequence of protein-calorie malnutrition, a variety of specific and nonspecific biological mechanisms of resistance to infection are impaired and much progress has been made in elucidating them.<sup>4</sup> Cell-mediated and other nonspecific immune factors are readily affected by even mild to moderate malnutrition. These include T cell formation, lymphocyte response to mitogens, delayed cutaneous hypersensitivity, C<sub>3</sub> complement, immunoglobulins, phagocytosis, and phagocytic killing power. Several of these mechanisms also are affected by iron deficiency.<sup>5</sup> Atrophy of the intestinal mucosa along with the appearance of bacteria and endotoxin in the small intestine have been identified as additional consequences of the lack of enteral feeding.<sup>6</sup> A sufficiently severe deficiency of protein, iron, and most vitamins also will interfere with the antibody response to infectious agents. Regardless of the exact mechanisms, the net result of malnutrition is an increase in morbidity and mortality from a variety of common infections.

It should also be recognized that any infection,

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even if asymptomatic and afebrile, with the exception of the common cold, has an adverse effect on nutritional status. Whether or not this is of health significance depends upon the prior nutritional status of the individual, the diet during and after the infection, and factors relating to the pathogen. Well-nourished individuals recover quickly from most infections, but for poorly nourished patients in a hospital, nutritional status is worsened and resistance to the infection further reduced. This is because nutritional status is adversely affected by infections through both biological and social mechanisms.

Anorexia, reduced food intake, and increased metabolic losses occur with infection, even one as mild as that from yellow fever vaccine, which is a live virus infection not usually associated with symptoms. There is also some internal diversion of amino acids and other nutrients for the synthesis of immunoglobulins, C-reactive proteins, and components of the immune response. When the gastrointestinal tract is involved in any way, absorption of amino acids and other nutrients is also affected. Since each worsens the other, the relationship between malnutrition and infection can be described as synergistic.<sup>3</sup>

Nosocomial infections cannot be prevented entirely in the hospital setting, but their frequency and consequences can be minimized by attention to the nutritional status of all hospital patients, by ensuring appropriate food intake, and by protecting poorly nourished patients from superimposed infections. Early experience with attempts to treat the severe protein deficiency syndrome kwashiorkor on an open pediatric ward is instructive.<sup>7</sup> Despite efforts to ensure an optimum therapeutic intake of dietary protein and energy, and the prompt disappearance of most clinical signs, many weeks passed before any weight gain was observed. With the same therapeutic regimen, this long lag period was no longer seen when children were hospitalized in individual cubicles that permitted semi-isolation and resulted in less intercurrent infection.<sup>8</sup> The continuing lack of recognition and concern for the increased susceptibility of malnourished patients in most developing countries' hospitals is responsible for many thousands of needless deaths and the financial and human cost of tens of thousands of unnecessary hospital days. It is even more inexcusable that the same appears to be true in the United States. To correct this situation,

medical and other health personnel need to receive training in nutrition and to apply it in the hospital setting to reduce the frequency and severity of nosocomial infection. Currently, recognition and management of malnutrition in the hospital setting are seriously inadequate.

Regardless of the cause of hospital admission, the evaluation of the nutritional status of the patient and the treatment of those who are malnourished should be routine in all hospitals. For this purpose the enteral route is always to be preferred because it is more physiological, far cheaper, freer of complications, and often more effective. Total parenteral hyperalimentation is less often necessary and, if improperly done, can be life-threatening.<sup>9</sup> Infections may even be promoted if blood sugar control is not maintained<sup>10</sup> or if intravenous fat is provided too rapidly.<sup>11</sup> Given the complexities and hazards, parenteral alimentation is best managed by a nutrition support team.<sup>12</sup> However, every primary physician, including internists, family practitioners, surgeons, and pediatricians, should be capable of diagnosing the nutritional needs of their patients and of managing enteral feeding, including the use of a nasogastric tube.

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