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Body protein loss in preoperative patients: 
the assessment of its impact on 
physiologic function and surgical risk.

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Thesis submitted for the 
Degree of Doctor of Medicine.

University of Auckland School of Medicine, 
Auckland, NEW ZEALAND. 
"My flesh has grown lean, without fatness; and my knees are weak from fasting."

Psalms 109: 24

"It is a major challenge to every surgeon to understand the significance of surgical weight loss and the extent to which it can occur before important bodily functions begin to be compromised."

J. M. Kinney (1), 1984

"Functional tests hold considerable promise for the objective assessment of malnutrition, at least in research, if not also in a routine clinical setting."

D.S. McLaren (2), 1988
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SYNOPSIS OF THESIS

The nutritional assessment of patients awaiting major abdominal surgery is important. It has been shown that malnutrition is common in such patients, but is often unrecognized. Because of the widespread availability of safe forms of nutritional therapy the task of identifying patients who warrant this therapy has become more urgent. However, current techniques used for the identification of significantly malnourished surgical patients have several important limitations. It has become increasingly evident that a fresh approach to nutritional assessment is now required. Drawing on some preliminary evidence that the loss of body protein is associated with an impairment of a range of physiologic functions, this thesis asserts that in order to improve on our ability to identify preoperative patients who are at a significantly increased risk of postoperative morbidity and mortality because of the loss of body protein, it would be necessary to assess physiologic functions that can be easily measured, are protein dependent, and clinically relevant.

Therefore, the following concept was investigated: That patients lose weight in response to disease and/or nutrient deprivation and the important component of this loss is body protein. The loss of body protein results in an impairment of important physiologic functions, which is the basis of the increased surgical risk noted in malnourished patients, and which results in the increased morbidity and mortality after major surgery. In order to investigate the inter-relationships of weight loss, protein loss, impaired function and surgical risk several objective measurement techniques had to be developed in order to measure physiologic functions (respiratory function, liver function, skeletal muscle function, wound healing response and psychological function). An \textit{in vivo} neutron activation analysis facility was available for the direct measurement of body protein status. In addition, techniques for the clinical assessment of nutritional status, diet, and postoperative course were developed. The fundamental conclusions of these clinical studies were: [1] that the measurement of preoperative weight loss is no longer useful in identifying patients who are at an increased risk of dying following major surgery, [2] that the preoperative loss of body protein is associated with an increased postoperative morbidity and mortality, [3] that the loss of body protein is associated with an
impairment of clinically relevant physiologic functions including liver, skeletal muscle and respiratory function, [4] that a proportion (20 to 25%) of body protein can be determined and must be lost before there is an impairment of some important physiologic functions, [5] that plasma transferrin and prealbumin concentrations are sensitive to the adequacy of recent food intake, and are a measure of body protein status in the elective patients studied, [6] that plasma albumin concentration, in the elective patients studied, is sensitive to the adequacy of recent food intake, but does not reflect body protein status, [7] that voluntary grip strength is a practical and sensitive measure of the extent of body protein loss, [8] that body protein loss is an important, and hitherto unrecognized risk factor for postoperative pneumonia because of its impact on respiratory function, [9] that the wound healing response is sensitive to the adequacy of recent food intake, but not to body protein status, and [10] that a clinical assessment of weight loss, wasting and physiologic function can be objectively validated and can identify preoperative patients at an increased risk of postoperative morbidity and mortality.

There are several important implications of these studies. The future direction of nutritional assessment will be the refinement of a clinical method that incorporates an assessment of physiologic function. Further study is required to demonstrate that nutritional therapy is able to reverse the impairment of clinically relevant physiologic functions and to demonstrate that such an improvement translates into a decrease in postoperative morbidity and mortality. It may be that specific defects due to protein loss and responsible for the impairment of function can be identified and treated with short-term nutritional therapy. The method of clinical assessment developed in this thesis can be used to select preoperative patients for nutritional therapy and predict the likely efficacy of such therapy.
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