The Bedside Laboratory
A Critical Step Forward in ICU Care

Stat laboratory determinations have become requisite in the management of many critically ill patients. Indwelling vascular catheters permit easy access to the circulation for blood collection. However, excessive blood sampling may be an unfortunate consequence of indwelling arterial catheters which may lead to anemia and an iatrogenic blood transfusion requirement. A "noninvasive" approach to monitoring of biochemical variables may be extremely effective in some patients; however, at this time we lack such approaches in the assessment of circulating electrolyte and glucose concentrations. One approach to limit blood loss and the time it takes to receive laboratory determinations is bedside microchemistry. With this new technology, blood gases, electrolytes, glucose and hematocrit can be determined on whole blood samples of less than 0.5 ml in less than 90 seconds! I am grateful to Dr. Soffer and to the American College of Chest Physicians for the opportunity to be the guest editor for this supplement to Chest. I believe that the important contributions contained in this issue provide evidence in support of the concept that the ACCP is committed to advancing the science and art of critical care.

The four articles in this supplement review present knowledge about the accuracy, cost, ease and regulation of bedside microchemical determinations. Drs. Baer and Belsey provide information about regulation of laboratories. If bedside microchemistry becomes a routine component of critical care practice, ICU directors will find the data about regulatory approaches to be invaluable. Dr. Zaloga details the benefits of bedside microchemical determinations, some disadvantages of the techniques, and a description of a number of the commercially available laboratory instruments. Mr. Misiano and co-workers describe the methodology and technology which permit microchemical measurements. They explore the spectrum of technology from continuous noninvasive monitoring to continuous invasive biochemical analysis. Dr. Statland and Ms. Brzys evaluate the cost factors in bringing this advanced machinery to the bedside.

Is the bedside laboratory a critical step forward?

The objective evidence necessary to answer this question will become clear in the next five years. Critical care medicine is in an era of self-assessment. The focus of the last five years has been to evaluate whether critical care practice is cost-effective, efficient, and whether or not it alters outcome. Bedside microchemistry, like any new critical care technology, must undergo tests of cost-effectiveness, reliability, efficiency, precision, accuracy, usefulness, as well as evaluations of its impact on outcome variables. However, unlike other technologies, bedside microchemistry must meet additional standards. Will the performance of assays by non-medical technologists diminish the accuracy of laboratory determinations? There is a relationship between employing certified medical technologists and accuracy of test results.

Stringent quality assurance standards, measurement of sensitivity and specificity of determinations, and compliance with standards established (for "satellite" laboratories) by accrediting agencies must be met. Unlike many other monitoring devices in the ICU, bedside microchemistry will likely require a financial charge to be issued for each sample analyzed. Proper documentation of results (and serial review of results) is mandatory.

My recommendation is that critical care practitioners work in collaboration with pathologists and clinical chemists in order to ensure the provision of: 1) quality assurance; 2) proper documentation of results; 3) payment for laboratory testing—avoiding conflict of interest problems; 4) documented continuing education programs concerning the bedside laboratory; and 5) expertise for "trouble-shooting" equipment. It is likely that the American Association for Clinical Chemistry, the Joint Commission on Accreditation of Health Care Organizations, and the College of American Pathologists will expand their positions and suggested standards regarding bedside laboratories as the microchemistry laboratory becomes more entrenched in critical care units. For this reason, and because I predict that reimbursement issues will arise in which third party payers will wish to avoid duplication of charges, I strongly urge the critical care community...
to reach out to our colleagues in clinical chemistry and pathology. A collaborative approach to this new critical care technology is more likely to succeed than a fractionated one.

Bedside microchemistry has the potential to be an important step forward in critical care. Iatrogenic blood loss can be decreased, “turn-around” time can be dramatically reduced, potentially we may realize manpower savings (both in elimination of personnel needed for transport of samples from the unit to the “lab,” and in technician time) and perhaps the rapidity of test performance may decrease pre-analytical errors. I am enthusiastic about the possibilities; however, I recognize the potential roadblocks which may impede the success of this approach and the many tests described above which will ultimately define the place of bedside microchemistry. Finally, it is imperative to mention the role of the critical care nurse in the bedside laboratory. As with most other bedside technology, the responsibility for bedside microchemical determinations may ultimately rest with the critical care nurse. These highly trained professional men and women are in short supply. Will the addition of the bedside laboratory be a blessing or a burden? It will likely be perceived by them as a burden unless critical care nurses are included in the development, design and evaluation of these new machines.

The consumers of critical care medicine (patients and admitting physicians) will likely appreciate the decrease in iatrogenic blood loss and increased efficiency of bedside microchemistry. However, these attributes will quickly be weighed against objective studies of cost effectiveness and impact on outcome. I hope that the readers of Chest will enjoy and benefit from this unique supplement. Perhaps this issue of Chest will prompt the initiation of clinical studies to test the hypothesis that the bedside microchemistry laboratory is a critical step forward.

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