

Abs) were used as the "gold standard" for monoclonal component quantification (4), there was no consistent trend to the discrepancies. In one, the Kallestad reagent gave a considerably higher result than the Beckman reagent; however, the value obtained with the Beckman reagent agreed better with the densitometric scan of the gammopathy. In three other samples, the value obtained with the Kallestad reagent agreed closely with the densitometric quantification, whereas the Beckman reagent gave a much higher result. In the fifth sample, the result obtained with the Beckman antisera agreed closely with the densitometric scan, but the Kallestad antisera gave a much lower value.

These differences between the results obtained with reagent antisera from two different companies likely reflect the difficulties in standardizing polyclonal reagents for situations in which there are massive expansions of particular immunoglobulin subclasses and idiotypes. Further, it is well known that monoclonal gammopathies may be unusual molecules with deletions or additions of determinants. Thus, an antiserum standardized against polyclonal immunoglobulins will react well with polyclonal samples. However, when tested against a monoclonal sample, the antiserum may give very high results if it contains many antibodies that react with the determinants expressed by that gammopathy, or low results if it contains few such antibodies. Also, commercial antisera clearly may contain cross-reactive antibodies, which would give unwanted reactivity. For instance, if an anti- κ reagent were reactive against transferrin, the results would vary with the transferrin concentration. This type of reaction has been demonstrated by IFX (5).

These findings emphasize why it is important to always perform both HRE and quantification of immunoglobulins when seeking to identify a monoclonal gammopathy. If one were to perform only immunoglobulin quantification, one could easily miss a monoclonal gammopathy that would be obvious by HRE. The use of only κ/λ ratios to detect monoclonal gammopathies will clearly result in false-positive and false-negative results (6). When we have small bands, which cause only a small distortion of the κ/λ ratio, we always perform an IFX. Riches et al. (7) emphasized the importance of overestimation of heavy-chain isotype by nephelometry and related those discrepancies to the specific antisera used. We have extended their observations to light-chain antisera and documented both an over- and underes-

timination of monoclonal proteins determined with specific commercial antisera.

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Methodological Considerations in Arterialization of Venous Blood

To the Editor:

Drs. Bramley and Green and colleagues have discussed in a recent article (1) and letter (2) problems associated with the technique of "arterialization" of venous blood. We also have had considerable experience with this technique and offer the following comments.

First, these authors are certainly justified in asserting that the success of arterialization differs from subject to subject, and should be verified by mea-

surement of (e.g.) oxygen saturation. The success of arterialization is, however, dependent on the mode of warming. In our experience, a box warmed by fast-moving air (e.g., produced by a hair dryer) is less satisfactory and less safe than one with almost static warm air. One problem with the former is uneven heat flow, so that the temperature needed for arterialization may result in local areas of heat injury. This was noted by Green et al. (1) with their box heated by a hair-dryer. Because heat delivery is related to both air temperature and air flow, we think that their assertion that injury occurred "despite using a lower air temperature than previous workers" is not necessarily relevant. Heat delivery is even greater with warm water (as discussed below) and a water temperature of 44 °C may cause injury in some subjects.

For many researchers interested in substances other than oxygen, some degree of imperfect arterialization will not be critical. No significant differences between true arterial blood and arterialized blood have been found for concentrations of glucose, nonesterified fatty acids, glycerol, ketone bodies, insulin, glucagon, and several amino acids and other intermediary metabolites, nor for specific radioactivities of glucose, fatty acids, and ketone bodies (3-7). Even with only 92.5% (mean) oxygen saturation in arterialized blood, concentrations of some metabolites were not significantly different from their concentrations in true arterial blood (6). The low-air-velocity warm box used by Gallen and Macdonald (8) produced arterialized oxygen saturations within 3% of the simultaneously measured arterial values, and mean glucose concentrations in arterial and arterialized blood differed by only 0.1 mmol/L (not significant), both under basal conditions and during hyperinsulinemia (Liu, Moberg, Kollind, Lins, Adamson, and Macdonald, unpublished). [In each of the above studies, when specified, the cannulation was performed in a retrograde direction, whereas Green et al. (1) cannulated in an antegrade direction; this may also be relevant.] In fact, it is only for P_{aO_2} that consistent differences between arterial and arterialized blood had previously been shown (9); Green et al. (1) have now added ammonia to this list. It remains an open question why the tissues traversed by poorly arterialized blood remove a significant amount of oxygen but not of other substances.

Finally, different methods of arterialization may cause artifacts. The use of an electric warming pad will increase

the forearm blood flow and core and skin temperature, and result in underestimation of forearm oxygen consumption, whereas a warm-air box has very little such effect (8, 10). This is presumably related again to heat transfer; a warm pad in contact with the skin will cause considerable heat transfer and thus systemic effects, compared with the minimal conduction from almost static air. In this connection, the technique of warm water immersion used by Bramley et al. (2), despite its long history (11), is likely to have particularly unfavorable systemic effects. The heat transfer coefficient from water is substantially greater than that from a warm pad or warm air. Immersing a hand in water at 44 °C will lead to a heat input to the subject of at least 50 W, almost equivalent to the resting heat production. This imposes a substantial thermoregulatory load.

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Change in Plasma Sodium Concentration Associated with Mortality

To the Editor:

Hyponatremia, as defined by a sodium concentration in serum or plasma of <135 mmol/L, is one of the most common electrolyte abnormalities in hospitalized patients. In a 12-month period involving 11 993 inpatients of our hospital, 4078 (34%) were found to have at least one episode of hyponatremia.

After the development of a prototype computer system involving a relational database (Informix Software Inc., Menlo Park, CA; Version 2.10), its implementation of structured query language (SQL), the chemical pathology database, the discharge ICDN.9.CM diagnosis codes (Commission on Professional and Hospital Activities, MI), and discharge status, a search of the database was performed, based on criteria similar to that described by Neithercut and Spooner (1). Those authors found a mortality rate of 42% in 30 patients who had "nosocomial dysnatremia" (both hyponatremia and hypernatremia within one admission period). Using the criteria of plasma sodium contents of <130 mmol/L and >150 mmol/L in a single admission, we were able to find 13 cases showing these features, of which five patients survived (62% mortality).

Using another database query, we selected for a relationship between mortality and either the lowest or highest plasma sodium during a single admission period. These data, summarized in Figure 1 (top), show the well-known association of mortality with either hypo- or hypernatremia.

A further SQL query was performed to correlate mortality with the maximum change in plasma sodium during an admission period (Figure 1, bottom). When changes of plasma sodium exceeded 5 mmol/L during an admission, there appeared to be an almost linear increase ($r = 0.85$) in mortality with increasing variation in plasma sodium,

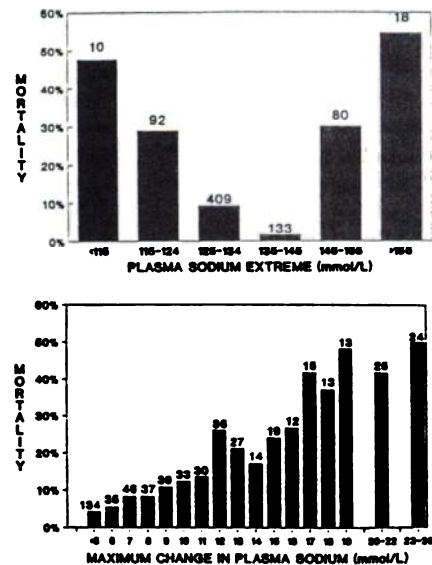


Fig. 1. Relationship between mortality and (top) extremes of plasma or (bottom) maximum variation in plasma sodium for 11 933 admissions

Numbers above each bar represent total deaths in that group

up to a maximum of ~50% mortality for changes in plasma sodium >20 mmol/L.

Currently, we are reviewing the relationship of mortality, the rate of change of plasma sodium, and the initial plasma sodium concentration. Initial studies indicate that the average rate of change of plasma sodium between extreme values was significantly slower in survivors than in those who died (Wilcoxon two-sample test, $P < 0.0005$). We do not believe, in general, that the change in plasma sodium in most of these patients directly causes death but, like mortality, is associated with the primary disease process.

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Immunochemical Evaluation of Monoclonal Gammopathies: Heavy Chain to Light Chain Ratio Is of Little Practical Value for Detecting IgD Myelomas and Free Light Chains

To the Editor:

The immunoglobulin light chain kappa/lambda (K/L) ratio is of consid-