Quality Assurance in the Intensive Care Unit—Monitoring Hematocrit Orders*

EDWARD E. MORSE, M.D.,
STEPHEN GORDON, M.D., ANTHONY ISIDRO, M.D.,
and PATRICIA PISCIOTTO, M.D.

The University of Connecticut Health Center,
Farmington, CT 06032

ABSTRACT

To provide a quality assurance (QA) study in the intensive care unit (ICU), hematocrit orders were monitored for five months (September 1989–January 1990) in an attempt to determine appropriate practice. Computer prints of all hematocrits (hct) ordered in the ICU were reviewed. Of all patients admitted to the unit in this time (528), 61 percent (319) had hematocrits ordered. The maximum number ordered per day varied from one to six with a mean of 1.4. All patients having three or more hcts per day (46) were reviewed by one or more of the authors to determine the circumstances. The patients consisted of 27 men and 19 women between the ages of 16 to 92 years with a median of 70 years. Thirty-three (72 percent) were 60 years of age or older. Twenty-seven were patients with active bleeding. Most had need for hct clearly delineated. In 11 others, justification was not clearly delineated, but resulted from blanket orders when vital signs were stable. In eight patients, multiple hcts were not necessary, but were obtained because of confusing orders or clerical error. These observations suggest that QA review of laboratory orders from the ICU will detect a few abuses and will find some patients whose laboratory tests could be optimized in an educational setting.

Introduction

Quality assurance—the concern for appropriate utilization of laboratory facilities for the high quality care of patients by practicing physicians has superseded quality control, a long-standing concern about precision and accuracy in clinical laboratories. The oldest form of quality assessment is medical chart audit, but random chart review is inefficient and insensitive.1 Clinical departments frequently turn to the laboratories for data concerning the quality of practice of their clinicians in the hospital setting. In addition, concerns over the high costs of laboratory work (in excess of 100 billion dollars in 1987)2 have led to the observation that repeated use of simple low-cost tests adds even more to the hospital bill.3,4 It has been proposed that when

* Send reprint requests to: Edward E. Morse, M.D., The University of Connecticut Health Center, Department of Laboratory Medicine, Room C2067A, 263 Farmington Avenue, Farmington, CT 06032.

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physicians in training receive information about charges for and appropriate use of diagnostic testing, the number of tests ordered can be substantially reduced. Overholt, Director of Medical Education at the Gunderson Medical Foundation in Wisconsin, has been quoted as suggesting "Overuse of laboratory testing is generated by the physician's zeal, compulsiveness, or insecurity in a desire to identify deviations from good health." In an effort to determine whether or not similar situations could exist in the acute care setting, the patterns of ordering of hematocrits in the intensive care unit of a university hospital have been examined.

**Methods**

Over a six month period, two laboratory medicine residents and faculty members reviewed computer printouts focusing on the most common hematologic test (hct) ordered in the ICU. The computer was programmed to provide identifying and demographic information about each patient, including diagnosis. In addition, the dates and hct values of each patient were printed out from September 1989 to January 1990. The number of hcts and days in the ICU were determined for each patient. Mean and maximum number of hcts were calculated and the distribution of mean and maximum hct orders per day was determined. The charts of patients who had a maximum of three or more hcts in any single day (24 hour period) were reviewed by one or more of the authors.

**Results**

Data from the hospital admitting office indicated that 528 patients were admitted to the ICU during this five month period. Computer printouts of hcts ordered indicated 319 (61 percent) had at least one hct. The maximum number of hcts ordered each day varied from one to six with a distribution shown in figure 1. The mean hct per day was 1.4.

Charts were reviewed by one or more of the authors on all patients (46) that had a maximum of three or more hcts in any single day (24 hour period). Record review revealed 27 patients were male, 19 were female. They ranged in age from 16 to 92 years. Median age was 70, and 72 percent were 60 or more years old. Twenty-seven patients were admitted to the ICU primarily for bleeding (usually gastrointestinal). These patients typically had blanket orders written for hct q4h to q8h and were frequently transfused. Eight patients without bleeding were found to have had hcts frequently drawn because of clerical confusion over written orders. Five patients with cardiac disease had orders for "cardiac enzymes X 3 q8h" with complete blood count (CBC) ordered separately. However, the CBC was drawn each time the cardiac enzymes

![Figure 1](image-url)
were collected. One patient with disseminated intravascular coagulation (DIC) had orders for "PT/PTT q4h". Hemoglobin/hematocrit (H/H) were also drawn each time, even though not specifically ordered. One patient with inflammatory disease and renal failure undergoing hemodialysis had an order written at 3:40 A.M. for H/H @ 4 A which, while a single order, was misread as q4° (hrs). One patient without specific orders had hcts drawn q8h. Note in progress stated "follow hct closely."

The remaining 11 patients who had blanket orders for hct q 4 to 8 hr had poorly delineated requirements for multiple hct determination. For example, one patient with inflammatory bowel disease, septicemia, hemolytic anemia, and bowel surgery for blood loss had 81 hcts in 26 days in the ICU, often five times a day, whether or not vital signs were stable. Four patients with chronic anemia had hcts tid when their vital signs were stable and there was no reason to suspect blood loss.

One 88-year-old man with metabolic acidosis and new onset atrial fibrillation, bilateral pneumonia, and ascending cholangitis underwent a cholecystectomy and had orders for CBC q6h to q8h with stable values for five days. Orders were crossed out and rewritten several times.

The patient had a total of 27 hcts in 13 days.

The most closely followed patient was another 88-year-old man with a past history of carcinoma of the colon and a recent history of passing blood per rectum. He presented to the Emergency Department the evening of November 26, 1989 at approximately 9:00 P.M. When he was observed at approximately 1:00 A.M. to have a decrease of hct from 42 to 28 following IV fluids and blood in the nasogastric tube, a previous order for H/H q4h was changed to q2h, and an order to transfuse four units of packed cells added. He was admitted to the ICU by 6 A.M. By 8 A.M. he had four hcts, four units of blood transfused, and had a hemoglobin of 15 g per dl and a hct of 46 percent. His vital signs remained stable throughout the first 24 hours and for the rest of his hospitalization. His H/H values are shown in table I.

**Discussion**

Quality assurance efforts in the hospital setting often lead to comparisons of practice between physicians with an attempt to define a norm and then examination of outliers for extenuating circumstances or abuses. Such attempts can be useful in defining systematic prob-

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**Table I**

**Effect of Blanket Orders**
lems, as illustrated by the present study, e.g., blanket orders, poorly written orders, clerical errors, aberrant behavior, etc.; however, much of the time consuming review of charts leads to retrospective criticism of the physician who cared for the patient during the acute episode. While this may be a useful teaching technique in a university hospital setting, it hardly seems an efficient way to judge quality of care in medical practice.

The knowledge gained by this study from the computerized data included the interesting distribution of ordering which implies that the largest proportion of patients got one hct per day as a "routine" or screening procedure and are not closely followed. A decreasing proportion of patients got more than one hct per day, mostly stimulated by evidences of bleeding.

Review of patient records did reveal a common problem of misinterpretation of poorly written orders in 8/46 (14 percent) records, especially those written after midnight. There seems to be little doubt that these problems could be eliminated. On the other hand, in 11/46 (25 percent) where one or another reviewer raised doubts about the indications for multiple hcts, there was little agreement among reviewers about what was excessive ordering and whether or not there was abuse. This phase of the assessment led to a frustrating sense of second-guessing the physician who was responsible for the acute care of the patient.

This study appears to have the following weaknesses: (1) It is unclear how the information will be conveyed to the physicians practicing in the ICU to modify behavior in regards to hematocrit testing; (2) Although screening computerized data and selecting cases for review were relatively easy, it is uncertain that the proper categories of patients were actually assessed. Why did such a large proportion of patients have only one hct per day?; (3) External reviewers had difficulty in agreeing upon the assessment of some patients, indicating some subjectivity in assessment is inevitable; (4) The study lacked internal (ICU) reviewers; (5) The aspect of the duration of the ICU stay was not examined; and (6) Relationship of hcts to outcome was not assessed.

It is estimated that the present study took over 50 man-hours of physician review, as well as programming time from the computer department and record recovery time from medical records. An estimate of cost is $3,000. Over 450 hematocrits would have to be measured just to pay for this study. It is difficult to predict improvements in the quality of patient care from this type of study. Orders might be more clearly written to eliminate clerical errors and blanket orders could be forbidden; however, the effects on quality of care and other hidden costs would have to be tested.

To make real progress in quality assurance, it appears that new approaches are needed. Four major categories of needs exist: administrative procedures, data management, internal and external quality assessments, and research and education. Bennett et al point out that each organization interested in quality assurance needs a body of people with the authority given by top management to achieve specific goals. In addition, management of data that are useful in quality assessment requires accurate logbook and laboratory records in computerized format so that major populations of patients can be screened for potentially productive areas for review. Tracer methods can miss important areas of poor quality care if the wrong tracers are chosen. Micro sampling of selected charts can be useful in determining where potential problems exist and reduce the screening effort to manage-
It appears that considerable progress has been made in the field of quality assurance, even to ways of enticing physicians to adhere to "good practice," but the process of defining standards is tedious and expensive. Most recent authors point out the value of outcome analysis as the productive way to approach quality assurance research and teaching. Screening laboratory tests and reviewing charts for aberrant behavior is less rewarding.

References