

Transfusion practices among the neurosurgical community of Puerto Rico

David Lozada, Gloria Rodriguez-Vega

Abstract

Objective: The use of PRBC includes health risk and has other significant implications. Our objective was to characterize and define the clinical factors that influence PRBC transfusion practice.

Design: Prospective study using a validated 11 item questionnaire administered to 43 physicians.

Setting: University of Puerto Rico, Neurosurgery Department.

Patient and participants: Population included attending physicians (AP) and residents (R).

Interventions: Questions included decision making logistics and therapeutic elements: general demographics, reasons for transfusion, quantity given, transfusion threshold, and the expected appropriate hemoglobin (Hb) level for patients with subarachnoid hemorrhage (SAH), traumatic brain injury (TBI), with coronary artery diseases (CAD) or without CAD.

Measurements and results: Fifty three percent neurosurgeons responded the questionnaire. 65% were

AP and 33% were R. 43% of AP vs 25% of R transfused to increase oxygen delivery, 50% of R vs 38% of AP transfused to avoid ischemic injury, 50% of both AP and R considered that age and disease severity may interfere with adaptation of anemia, therefore needing transfusion, and 50% of AP vs 38% of R to improved safety margin anticipating further blood loss. Threshold for transfusion was a Hb level of 8-10 g/dL (36%) or <7 g/dL (41%). 77% of AP and 63% of R thought the appropriate level of Hb in SAH was 10-12 g/dL. 65% of AP thought that in TBI Hb level should be between 10-12 g/dL and 38% of R answered 8-12 g/dL. 63% of R thought that the appropriate Hb for a post-op patient with CAD was between 10-12 g/dL and 46% of AP answered 10-12 g/dL or >12 g/dL. The appropriate Hb for post-op patient without CAD was 10-12 g/dL, and there was no significant difference between AP and R.

Conclusions: Recognizing when to transfuse blood in a neurological critical care patient remains a clinical challenge. Frequent and unwarranted transfusions may worsen outcome of patients. More studies regarding transfusion recommendations in neurological critical care are needed.

Key words: Transfusions, anemia, neurocritical care.

From University of Puerto Rico/Medical Sciences Campus, San Juan, Puerto Rico (David Lozada and Gloria Rodriguez-Vega)

Address for correspondence:

Gloria Rodriguez-Vega, MD, FACP, FCCM, FCCP
Director of the Neurointensive Care Unit, Section of Neurological Surgery
University of Puerto Rico/Medical Sciences Campus
PO Box 365067
San Juan, Puerto Rico 00936
Tel: (787) 765-8276
Email: glorie68@gmail.com

Introduction

Anemia is a common problem in the intensive care unit (ICU); almost 95% of patients admitted to an ICU have a hemoglobin (Hb) level below normal by day 3. (1) Serious effects of anemia include increased risk of cardiac related morbidity and mortality, as well as generalized decrease in oxygen carrying capacity. More than 50% of the patients admitted to the ICUs will receive blood transfusions. (1) Although anemia can easily be corrected with packed red blood cells (PRBC), multicenter, randomized, controlled trials and large, prospective, observational studies have shown that liberal use of blood transfusions to be ineffective and potentially harmful. (1-3) A more selective and objective data is needed to establish a more strict criteria for PRBC transfusion, without increasing morbidity and mortality in patients in a critical care setting.

Many patients in a neurocritical care intensive care unit are at risk of developing anemia. Almost all central nervous system (CNS) pathology is at an increased risk to ischemia, mostly due to vulnerability. To date an optimal hemoglobin level for specific CNS pathologies is not clearly defined. The management and outcomes of patients with anemia in a critical care unit have been studied, but not in a neurosurgical critical care unit. In the ABC trial, the overall mean pre-transfusion hemoglobin levels were 8.4 g/dL for the entire population and 8.5 g/dL for those without acute bleeding. In the TRICC trial subgroup of trauma victims who had sustained a closed head injury, they did not observe any significant differences among all primary and secondary outcomes including mortality, length of stay, and organ failure. Moreover, a restrictive strategy was comparable to a liberal transfusion strategy. To our knowledge, a survey of how we as neurosurgeons choose when, why and how to transfuse blood in a critically ill patient has never been done. The current study was undertaken to characterize and define the clinical factors that influence PRBC transfusion practice in the neurosurgical intensive care unit of Puerto Rico.

Methods

The study design was a prospective observational study of the neurosurgical community in Puerto Rico (PR). A list of all practicing neurosurgeons and those who graduated from the training program in PR was obtained from the

Department of Neurosurgery of the University of Puerto Rico. Fifty one neurosurgeons were identified as eligible for the study. Contact information was obtained for 43 and a validated 11 item questionnaire was administered by mail, email or direct contact. Population included private practice physicians, academic attending physicians (AP) and residents (R). Questions included decision making logistics and therapeutic elements. Questions 1-4 were general demographics, including graduating year, years of practice, place and type of practice. Question number five stated as follows: I transfuse to: a. increase oxygen delivery; b. avoid ischemic injury; c. age and disease severity may interfere with adaptation of anemia; and d. improve safety margin. Question number six assessed how much quantity of blood, does a practicing neurosurgeon give when ordering a transfusion at a given time. Question number seven was the threshold of hemoglobin level needed in order to transfuse blood. The last four questions were intended to assess the appropriate hemoglobin level for patients with subarachnoid hemorrhage (SAH), traumatic brain injury (TBI), pre operative patients with coronary artery disease (CAD) or without CAD respectively.

Results

Fifty one neurosurgeons were identified in the list of the neurosurgery department of the University of Puerto Rico. Out of the forty three neurosurgeons who were surveyed 23 (53%) responded the questionnaire. Fifteen (65%) were AP and eight (35%) were R (**Figure 1**).

When describing reasons to transfuse packed red blood cells (PRBC), 43% of AP vs 25% of R transfused blood to increase oxygen delivery. 50% of R vs 38% of AP transfused blood to avoid ischemic injury. 50% of both AP and R considered that age and disease severity may interfere with adaptation of anemia, therefore needing transfusion. 50% of AP vs 38% of R used blood to improve safety margin anticipating further blood loss (**Figure 2**).

93% of AP preferred transfusing 2 units of PRBC at a given time, 7% transfused more than 2 units and none gave one unit. 75% of R gave 2 units of blood, 25% gave one unit and none gave more than 2 units of blood at a given time (**Figure 3**). 35% of AP had a transfusion threshold <7 g/dL, 28% of 8-10 g/dL, 7% of 10-12 g/dL, and another 28%

had no transfusion threshold (**Figure 4**). The R transfusion threshold was divided equally: 50% chose Hb<8 g/dL and the other 50% chose Hb 8-10 g/dL.

In patients with SAH 14% of AP thought that 8-10 g/dL was an appropriate Hb level, 77% chose 8-10 g/dL, 8% more than 12 g/dL and none thought that having less than 8 g/dL was appropriate. 37% of R thought that 8-10 g/dL was appropriate, 62% 10-12 g/dL and none chose <8 g/dL or >12 g/dL (**Figure 5**).

In patients with TBI 7% of AP thought that <8 g/dL was an appropriate Hb level, 14% chose 8-10 g/dL, 65% 10-12 g/dL, and 14% more than 12 g/dL. 37% of R in TBI thought that 8-10 g/dL of Hb was appropriate, 37% 10-12 g/dL, 25% more than 12 g/dL and none chose <8 g/dL (**Figure 6**).

In elective patients with CAD, 46% of AP thought that the appropriate post operative Hb level needed to be >10-12 g/dL, another 46% chose a Hb level >12 g/dL, and 8% chose between 8-10 g/dL. 63% of R chose a level of 10-12 g/dL, 25% thought >12 g/dL would be a better Hb level and 13% chose 8-10 g/dL as an appropriate Hb level (**Figure 7**).

In elective patients without CAD, 54% of AP thought that the appropriate post operative Hb level needed to be 10-12 g/dL, 31% chose a Hb level 8-10 g/dL, and 15% chose between more than 10-12 g/dL. 37% of R chose a Hb level of 10-12 g/dL, 25% thought 8-10 g/dL, another 25% chose more than 12 g/dL, and 13% thought that a patient without CAD could tolerate a Hb level less than 8 g/dL (**Figure 8**).

Discussion

Neuronal tissue is very sensitive to change in oxygen and perfusion. This is why the CNS has many auto regulatory mechanisms. When these auto regulatory mechanisms are pushed to the limit, a competent systemic response is crucial. Patients in a neurocritical intensive care unit who already have a primary insult to the CNS depend on this competent systemic response and on the oxygen being transported by the red blood cells. If oxygen delivery is compromised or diminished, patients are at risk of developing cerebrovascular complications. In a critical care unit, anemia is a very common problem as was

mentioned before, therefore is important to understand, recognize, treat and also not over treat, to prevent many complications.

Decisions about transfusing PRBC are often made without a complete understanding of the risks and benefits of transfusion. (4,5) Although today we have a much clearer understanding of the risks of transfusion, the benefits are less well characterized. According to our results most of our physicians preferred transfusing PRBC to prevent complications of anemia regarding age, disease, to avoid ischemic injury or to have a safety margin. The rationale of transfusing PRBC is to increase O₂ delivery, therefore preventing many secondary injuries. Although we might think this is a very well understood concept, most of our physicians did not choose this option as a sole reason for transfusing. Instead, they preferred to choose avoiding ischemic injury, having a safety margin and preventing complications. It is very important to mention that we would have gotten more information if the question was answered with one choice instead of multiple. This could have given us more information regarding the importance given by the physician. A consideration that we will take for a larger multicenter questionnaire, involving more than one neurocritical care unit.

The decision and quantity of PRBC to be transfused is determined by the physician, and most of the time by an attending physician. We know that one unit of PRBC increases the hemoglobin concentration by 1 g/dL, but if we follow this numerical value, we can end transfusing a number and not a patient. There are many clinical reasons of why to transfuse different quantities of PRBC. We have observed in our survey that most physicians (AP & R) transfused 2 units of PRBC rather than 1 unit of PRBC. More interesting was the fact that only residents thought of giving one unit of PRBC if needed. This is a very critical point in our study. AP was more liberal than R regarding this topic. This could reflect a trend towards evidence base medicine in the younger generation. This could mean that we might be overexposing our patients to more complications, therefore changing the clinical course of our patient. It would be interesting to see how patients in our ICU responded to restrictive vs liberal transfusion practice. To have more information regarding this topic we need to have a larger multicenter survey to have a proper auto evaluation.

The exact level of hemoglobin known to prevent an ischemic attack in the CNS is still unknown. We have accepted the “10/30” rule for many years, but recent data suggest that a usual transfusion trigger (Hb ~10 g/dL) is no better than a more restricted trigger (Hb ~7 g/dL). (3,6) It was also speculated that supra normal levels of hemoglobin, would increase oxygen delivery and improve outcomes, but many studies have shown that it does not change mortality and can be harmful. (7) A transfusion threshold in critically ill patients has been debated in the past decade and continues to be unclear in special subgroup of patients. Less than ten percent of the physicians in our survey chose a level of 10 g/dL as a threshold for transfusion. In general terms there seems to be a more restrictive pattern. When the questions were guided towards a specific diagnosis the threshold values started trending up. Hence we are arbitrarily changing our parameters for a specific diagnosis, without evidence base information.

The neurocritical population which is at risk of secondary CNS ischemia falls in this subgroup of patients, of which we do not know an acceptable level of hemoglobin. (8) Even though anemia can be corrected with PRBC transfusions, there are risks that need to be considered in the critically ill population. The transfusion of blood products promotes cytokine release, and altered cellular immunity, therefore decreasing the immune response of the body. (9) When giving a blood product to a critically ill patient, who has an immune system that is challenged, we are augmenting the morbidity and mortality of these patients. Recently we have learned about these complications, but in clinical practice it is easily forget, and we see ourselves transfusing blood without a good clinical and physiological indication. It is therefore necessary to established thresholds or to make a consensus about the use of blood products in the critical care population.

The transfusion behavior in our survey was consistent with previous studies, which noted that transfusion decisions tend to be driven by individual transfusion triggers rather than specific physiologic indications. (10) We think that there is a significant number of physicians who are less up to date about the serious risks and the benefits of transfusion of blood products. It was reported by Salem-Schatz et al (4) the widespread deficiencies in physicians’ knowledge of transfusion risks and indications. Our variability in

transfusion practices among neurosurgeons reflects the lack of evidenced-based data regarding transfusion thresholds in the neurocritically ill population.

Conclusion

Recognizing when to transfuse PRBC in a neurological critical care patient remains a clinical challenge. Many of the decisions taken today are based on our clinical experience or learned criteria. Frequent and unwarranted transfusions may worsen patient outcome, therefore this subject is not to be taken lightly. Criteria for optimal management are still not clearly defined. More studies regarding transfusion recommendations in neurological critical care are needed.

Figure 1. Transfusion practices of neurosurgeons in Puerto Rico

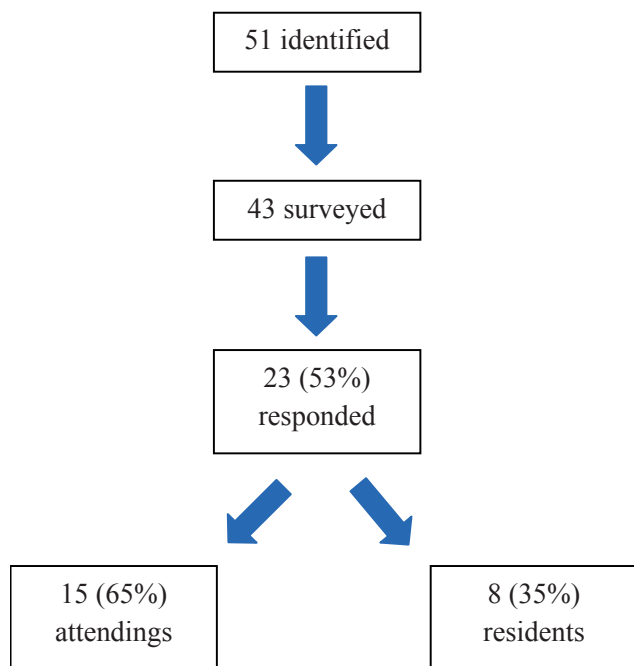


Figure 2. Reasons to transfuse PRBC

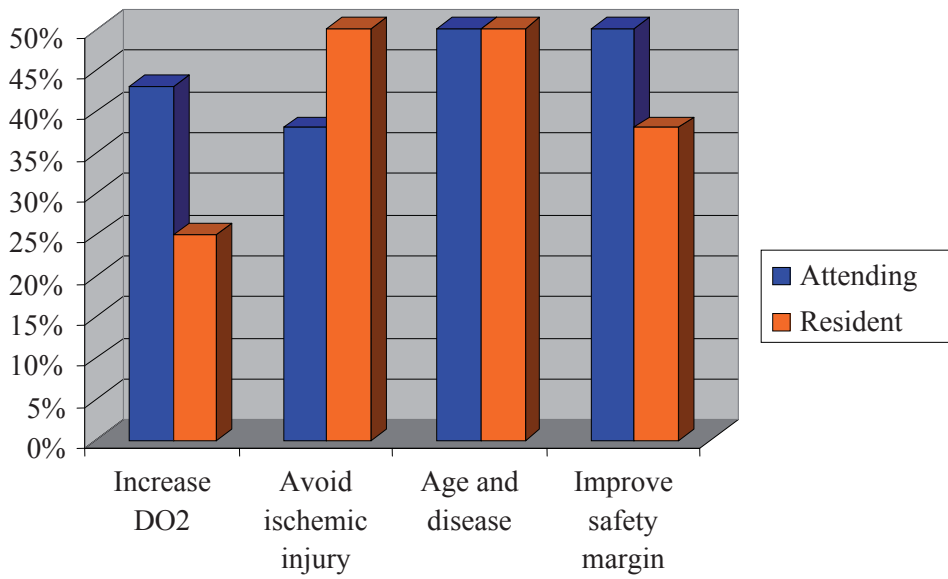


Figure 3. Number of units transfuse per order

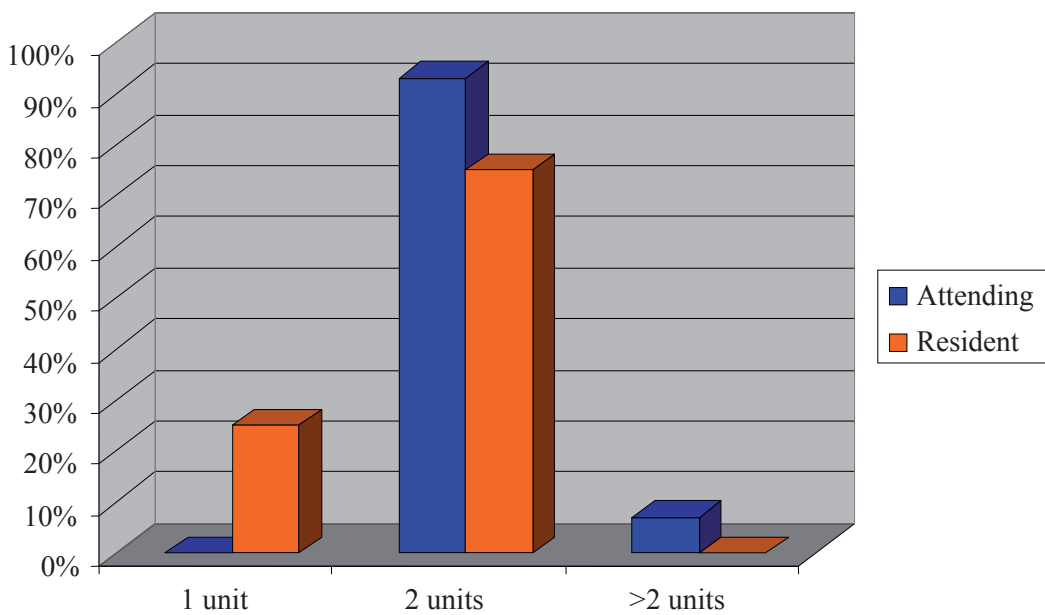


Figure 4. Trasfusión threshold

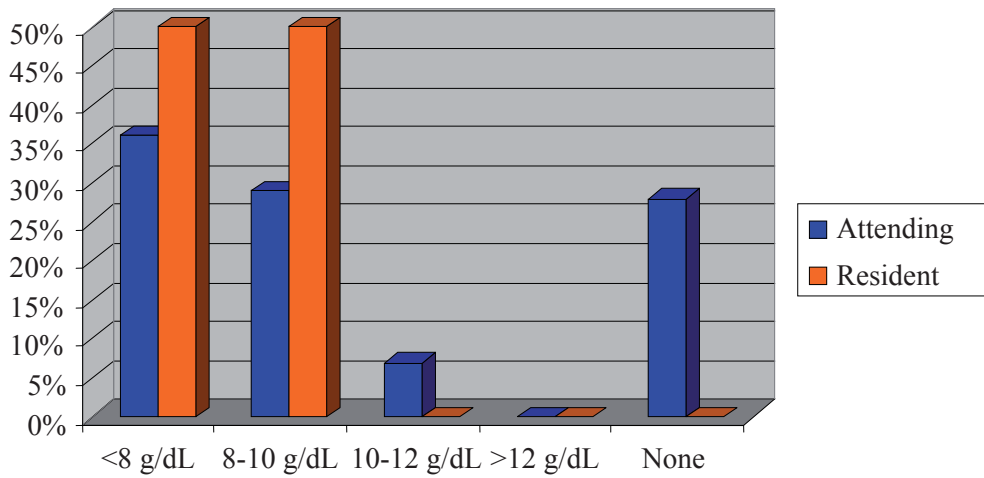


Figure 5. Appropriate Hb for SAH

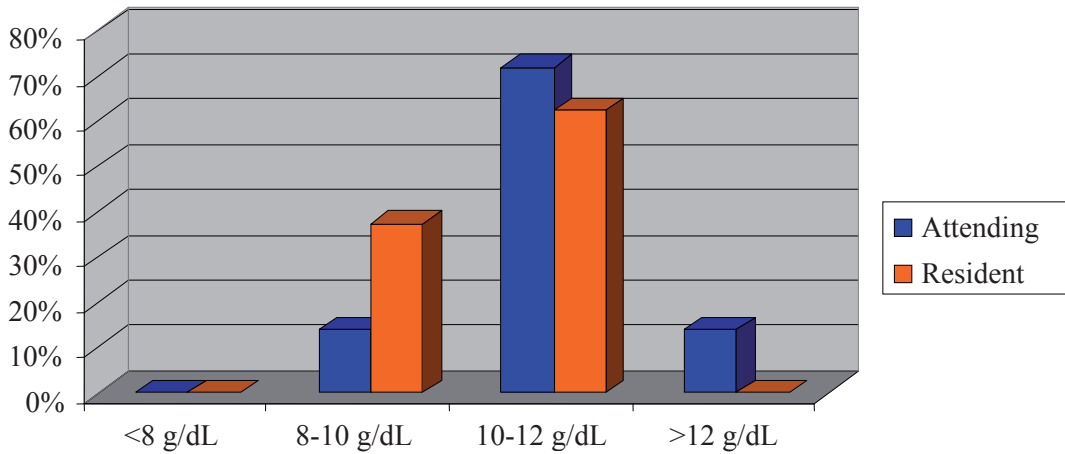


Figure 6. Appropriate Hb for TBI

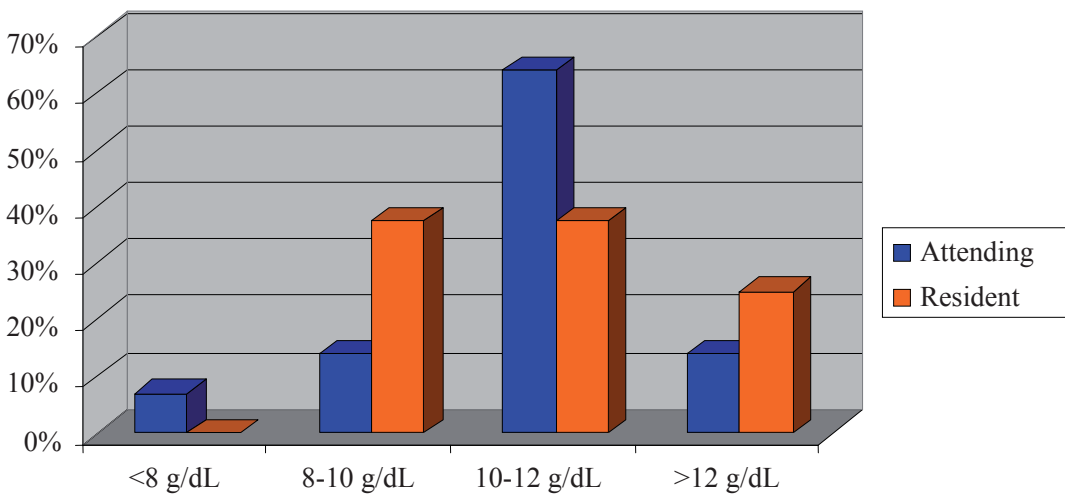


Figure 7. Appropriate Hb for post-op with CAD

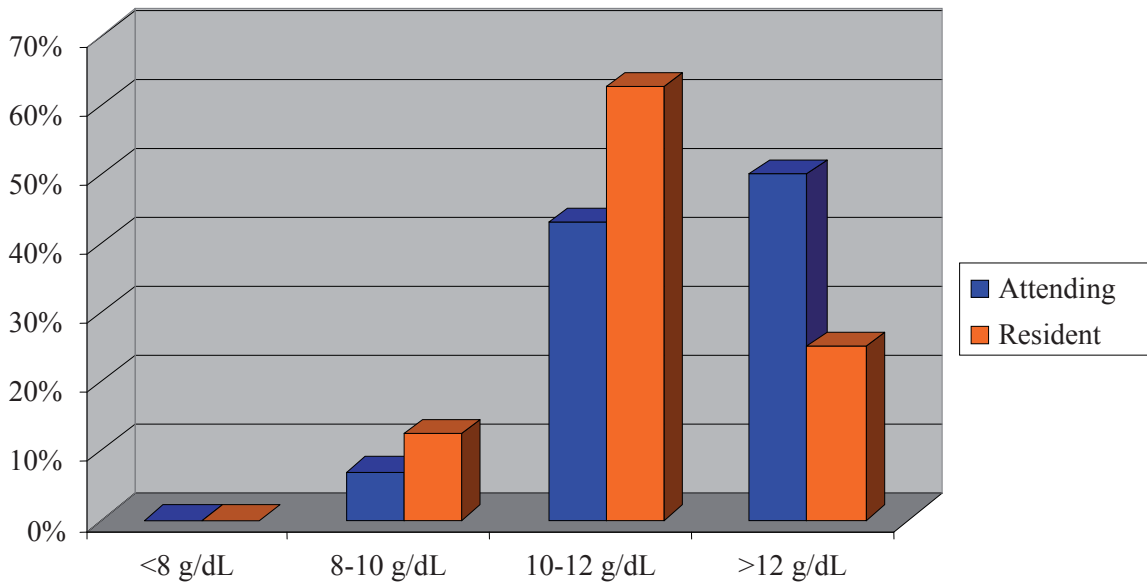
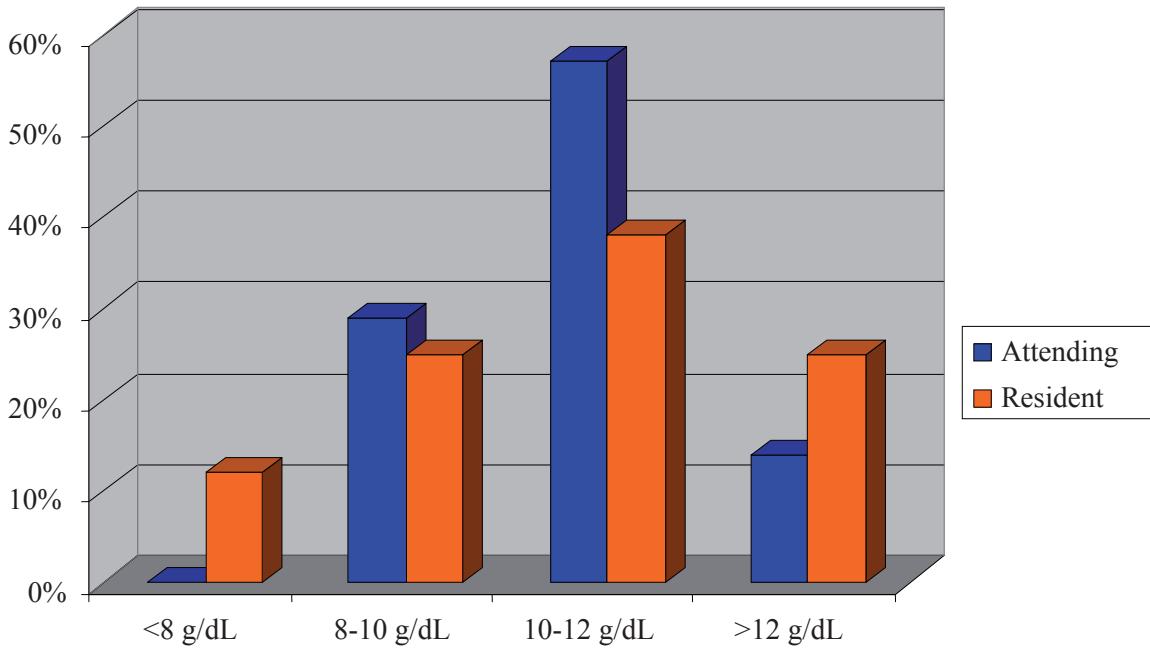


Figure 8. Appropriate Hb for post-op without CAD



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