

# Anemia Institute Review

Anemia Institute for Research and Education

Second Edition March 10, 2003

## A LETTER FROM THE EDITOR:

On behalf of the Anemia Institute for Research and Education, I am pleased to present you with the second edition of the Anemia Institute Review. The articles selected are intended to provide an overview of leading-edge research on anemia. The abstracts and commentaries in this issue focus specifically on the consequences of anemia in relation to various patient groups, including patients with cancer, HIV/AIDS, hepatitis C, kidney disease, rheumatoid arthritis and to those undergoing major surgery. The risks and benefits of anemia treatments are also highlighted.

**Dr. Jerry Teitel, MD, FRCPC, Associate Professor of Medicine, University of Toronto, Canada**  
Head of Hematology & Oncology, St. Michael's Hospital, Toronto, Canada



## ANEMIA IN CANCER

### Prevalence of anemia in cancer patients undergoing radiotherapy: prognostic significance and treatment

HARRISON LB, SHASHA D, HOMEL P. *ONCOLOGY* 2002 63 [SUPPL 2]: 11 – 18.

As the antitumor activity of radiation is mediated via its interaction with oxygen to form labile free radicals, the intratumoral oxygen level has an important influence on the ability of radiation therapy to kill malignant cells. By decreasing the oxygen-carrying capacity of the blood, anemia may result in tumor hypoxia and may have a negative influence on the outcome of radiotherapy for various malignancies, even for small tumors not normally assumed to be hypoxic. In addition, anemia also has a negative effect on the quality of life of cancer patients, as evidenced by worsening fatigue. As a high proportion (about 50%) of cancer patients undergoing radiotherapy are anemic prior to or during treatment, strategies to correct anemia and/or the resultant tumor hypoxia are increasingly being considered an important component of treatment. In particular, epoetin alfa (recombinant human erythropoietin), which has proved an effective and well-tolerated means of raising hemoglobin levels in anemic patients receiving radiotherapy, potentially could reverse the negative prognostic influence of a low hemoglobin in patients with certain malignancies. Radiation oncologists need to be aware of the possibility of anemia in cancer patients undergoing radiotherapy so that timely intervention can be instituted whenever anemia is diagnosed.

*Comment: This is an excellent review article looking at the prognostic significance of anemia in cancer patients and the strategies to correct it. The authors report on the prevalence of anemia in their institution. A surprisingly high number of patients (41%) presenting for radiotherapy were anemic at baseline. As well, 54% of patients were found to be anemic within three to five weeks of starting radiotherapy. Evidence is presented supporting a relationship between anemia, radiation resistance and poor outcome.*

*Dr. Barbara Melosky, Medical Oncologist, B.C. Cancer Agency, Vancouver, British Columbia*

## ANEMIA IN CARDIAC FUNCTIONS

### Folate and vitamin B-12 and risk of fatal cardiovascular disease: cohort study from Busselton, Western Australia

HUNG J, BEILBY JP, KNUIMAN MW, DIVITINI M. *BMJ* 2003 326: 131 – 134.

**Objective:** To test the hypothesis that the incidence of fatal coronary heart disease and cardiovascular disease in a general population is related to serum and red cell folate and vitamin B-12 concentrations.

**Design:** Cohort study with follow up of 29 years.

**Setting:** Busselton, Western Australia.

**Participants:** 1419 men and 1531 women aged 20 to 90 years, who were alive more than three years after their participation in the 1969 Busselton health survey. 2314 (78.4%) had no cardiovascular disease at the initial survey.

**Main outcome measures:** Hazard ratios for fatal coronary heart disease and cardiovascular disease in men and women according to baseline concentrations of serum and red cell folate and serum vitamin B-12.

**Results:** 213 men and 159 women died from coronary heart disease, and

342 men and 302 women died from cardiovascular disease. Serum and red cell folate concentrations showed a moderate positive correlation ( $r=0.26$ ,  $P<0.001$ ) but otherwise serum and red cell folate and serum B-12 concentrations were not strongly correlated with each other or with other standard risk factors. After age and standard risk factors were adjusted for, there was no independent association between folate and B-12 concentrations and death from coronary heart disease or cardiovascular disease in the full cohort or the subcohort with no cardiovascular disease at baseline. The multivariate adjusted hazard ratio for death from cardiovascular disease in the lowest versus the highest category of red cell folate concentration was 1.05 (95% confidence interval 0.77 to 1.43) in men and 1.10 (0.81 to 1.51) in women.

**Conclusions:** These findings do not support the hypothesis that lower folate and B-12 concentrations increase the risk of fatal cardiovascular disease in a general population. The routine use of these vitamins for preventing cardiovascular disease should await evidence from clinical trials.

### Anemia is associated with worse symptoms, greater impairment in functional capacity and a significant increase in mortality in patients with advanced heart failure

HORWICH TB, FONAROW GC, HAMILTON MA, MACLELLAN WR, BORENSTEIN J. *J AM COLL CARDIOL* 2002 39(11): 1780 – 1786.

**Objectives:** This study aimed to evaluate the relationship between anemia and heart failure (HF) prognosis.

**Background:** Although it is known that chronic diseases, including HF, may be associated with anemia, the impact of hemoglobin (Hb) level on symptoms and survival in HF has not been fully defined.

**Methods:** We analyzed a cohort of 1,061 patients with advanced HF (New York Heart Association [NYHA] functional class III or IV and left ventricular ejection fraction [LVEF] <40%) referred to a single center for evaluation and management. The Hb level was drawn at time of initial evaluation. Patients were divided into quartiles of Hb: Hb <12.3; Hb 12.3 to 13.6; Hb 13.7 to 14.8; Hb >14.8 g/dl.

**Results:** Mean Hb was 13.6, and values ranged from 7.1 to 19.0 g/dl. The Hb groups were similar in age, medication profile, LVEF, hypertension, diabetes, smoking status and serum sodium. Lower Hb was associated with an impaired hemodynamic profile, higher blood urea nitrogen and creatinine, and lower albumin, total cholesterol and body mass index. Patients in the lower Hb quartiles were more likely to be NYHA functional class IV ( $p > 0.0001$ ) and have lower peak oxygen consumption (PKV02) ( $p < 0.0001$ ). Survival at one year was higher with increased Hb quartile (55.6%, 63.9%, 71.4% and 74.4% for quartiles 1, 2, 3 and 4, respectively). On multivariate analysis adjusting for known HF prognostic factors, low Hb proved to be an independent predictor of mortality (relative risk 1.131, confidence interval 1.045 to 1.224 for each decrease of 1 g/dl).

**Conclusions:** In chronic HF, relatively mild degrees of anemia are associated with worsened symptoms, functional status and survival.

*Comment: This retrospective study adds further epidemiological evidence to the growing literature supporting the deleterious effect of even mild anemia on*

symptoms and survival in patients with severe heart failure. Within the limitations of the post-hoc methodology, anemia appeared to predict worse outcomes independently of the "traditional" risk factors for mortality. This study, in conjunction with randomized trials in which anemia is treated with erythropoietin or transfusion, may spur more aggressive treatment of anemia in the ever-growing number of patients with congestive heart failure.

Dr. Terrence Yau, Cardiac Surgeon, Toronto General Hospital, Toronto, Ontario

## ANEMIA IN CRITICAL CARE

### Impact of allogenic packed red blood cell transfusion on nosocomial infection rates in the critically ill patient

TAYLOR RW, MANGANARO L, O'BRIEN J, TROTTIER SJ, PARKAR N, VEREMAKIS C. *CRIT CARE MED* 2002 30(10): 2249 – 2254.

**Objective:** To determine whether critically ill patients who receive allogenic packed red blood cell transfusions are at increased risk of developing nosocomial infections during hospitalization.

**Design:** Retrospective database study utilizing Project IMPACT.

**Setting:** A 40-bed medical-surgical-trauma intensive care unit in an 825-bed tertiary referral teaching hospital.

**Patients:** One thousand seven hundred and seventeen patients admitted to the medical-surgical-trauma intensive care unit.

**Measurements and main results:** Data were collected by using the Project IMPACT database. Nosocomial infection rates were compared among three groups: the entire cohort, the transfusion group, and the nontransfusion group. We determined the nosocomial infection rates in these groups while adjusting for probability of survival by using Mortality Prediction Model (MPM-o) scores, age, gender, and number of units of packed red blood cells transfused. The average number of units transfused per patient was 4.0. The nosocomial infection rate for the entire cohort was 5.94%. The nosocomial infection rates for the transfusion group (n = 416) and the nontransfusion group (n = 1301) were 15.38% and 2.92%, respectively (p < .005 chi-square). Transfusion of packed red blood cells was related to the occurrence of nosocomial infection, and there was a dose-response pattern (the more units of packed red blood cells transfused, the greater the chance of nosocomial infection; p < 0.0001 chi-square). The transfusion group was six times more likely to develop nosocomial infection compared with the nontransfusion group. In addition, for each unit of packed red blood cells transfused, the odds of developing nosocomial infection were increased by a factor of 1.5. A subgroup analysis of nosocomial infection rates adjusted for probability of survival by using MPM-o scores showed nosocomial infection to occur at consistently higher rates in transfused patients vs. nontransfused patients. A second subgroup analysis adjusted for patient age showed a statistically significant increase in rates of nosocomial infection for transfused patients regardless of age.

**Conclusions:** Transfusion of packed red blood cells is associated with nosocomial infection. This association continues to exist when adjusted for probability of survival and age. In addition, mortality rates and length of intensive care unit and hospital stay are significantly increased in transfused patients.

## ANEMIA IN CHRONIC HEPATITIS C INFECTION

### Treatment of hepatitis C and anemia in human immunodeficiency virus-infected patients

DIETERICH DT. *J INFECT DIS* 2002;185 [SUPPL 1]: S128 – 137.

Because of shared modes of transmission, co-infection with human immunodeficiency virus (HIV) and hepatitis C virus (HCV) is common. Co-infection with HIV increases HCV virus load, liver-related mortality, and the risk of sexual and perinatal transmission of HCV, and it may accelerate HCV disease progression. With combination interferon (IFN)- $\alpha$ 2b/ribavirin or pegylated IFN- $\alpha$ 2b/ribavirin therapy, long-term remission is possible for HCV-infected patients. Preliminary evidence suggests that the combination of IFN- $\alpha$ 2b/ribavirin can achieve similar response rates in HCV/HIV – co-infected individuals with no adverse effect on HIV RNA concentrations. Although adverse effects are more frequent with combination therapy than with IFN- $\alpha$  monotherapy, most are manage-

able. In addition, few instances of drug-drug antagonism have been reported among drugs used to treat each disease, although further study is necessary. Ribavirin-associated hemolytic anemia is a potential problem in a patient population that is already susceptible to anemia but is manageable with recombinant human erythropoietin (epoetin alfa).

## ANEMIA IN HIV

### Associations of anemia, treatments for anemia, and survival in patients with human immunodeficiency virus infection

SULLIVAN P. *J INFECT DIS* 2002 185 [SUPPL 2]: S138 – 142.

Three large observational cohort studies suggest that, after controlling for virus load and CD4 cell count, anemia is related to disease progression and survival in patients with human immunodeficiency virus (HIV) infection. Recovery from anemia has been linked to improved survival outcomes. Blood transfusion has been associated with accelerated disease progression and mortality in patients with HIV infection, and review of related literature suggests that the mechanism for negative transfusion-associated outcomes may be transfusion-related immunosuppression. Therefore, the use of transfusion should be restricted to patients with acute or severe anemia. Prescription of epoetin alfa has been associated with increased survival in an observational cohort among patients with HIV infection and anemia. In the absence of data from a clinical trial documenting the effect of treating anemia on survival, clinicians should consider non-transfusion options for management of anemia on the basis of clinical status and patient functional ability.

## ANEMIA IN RENAL DISEASE

### Anemia treatment in the pre-ESRD period and associated mortality in elderly patients

XUE JL, ST. PETER WL, EBBEN JP, EVERSON SE, COLLINS AJ.

*AM J KIDNEY DIS* 2002 40: 1153 – 1161.

**Background:** Anemia is a common complication of advancing chronic kidney disease, yet little is known about the consistency of anemia treatment before end-stage renal disease (ESRD) and mortality on dialysis therapy.

**Methods:** We studied 89,193 incident Medicare patients with ESRD in 1995 to 1997 aged 67 plus years with claims 2 years before their dialysis therapy initiation. Patients were classified as follows: no epoetin, 25% or less (least consistent), greater than 25% to 50%, greater than 50% to 75%, and greater than 75% (most consistent) epoetin treatment in the available months from the first pre-ESRD epoetin dose to the first ESRD service date. Cox regression modeled the risk for 1-year death in the post-ESRD period, adjusting for age, sex, race, diabetic status, albumin level and incidence year.

**Results:** Sixty percent of patients had hematocrits less than 30% at ESRD initiation, yet only 15.6% (N = 13,877) had epoetin claims before ESRD. The most consistent epoetin treatment group had hematocrits increase from 27.5% to 30.8% (P < 0.0001) by month 4 of treatment. Patients with the most consistent epoetin treatment had a greater mean hematocrit (29.2%  $\pm$  0.11%; P < 0.0001) and albumin level (3.31  $\pm$  0.01 g/dL [33.1 g/L]) at initiation than those with the least consistent treatment (28.1%  $\pm$  0.10% and 3.21  $\pm$  0.01 g/dL [32.1 g/L], respectively). The relative risk for death in patients with the least consistent versus the most consistent (the reference) epoetin treatment was 1.460 (95% CI, 1.245 to 1.713; P < 0.0001) 1 year after the first ESRD service date.

**Conclusion:** Elderly patients with consistent pre-ESRD epoetin treatment had lower risks for death in the first year of dialysis therapy after ESRD initiation.

**Comment:** Anemia is an inevitable complication of renal failure and there has been considerable controversy regarding when to begin correction of anemia with erythropoietin (EPO) and the target hemoglobin. This large epidemiological study in an elderly population lends further support to starting EPO early in pre-ESRD and aiming for significant correction of the anemia.

Dr. Paul Barré, Nephrologist, McGill University Health Centre, Montreal, Quebec

## ANEMIA IN SURGERY

### Perioperative blood management practices in elective orthopaedic surgery

KEATING EM, MEDING JB. *J AM ACAD ORTHOP SURG* 2002 10(6): 393 – 400.

Concern about the cost and safety of allogenic blood transfusion, including the risk of viral infection and immunosuppression, has led to refinements in and new approaches to blood conservation, including the development of transfusion practice standards and improvements in surgical practice. Preoperative autologous blood collection, the use of hemostatic agents, perioperative blood salvage, and the use of recombinant human erythropoietin (epoetin alfa) to stimulate erythropoiesis have contributed to decreased use of allogenic blood services. Development of appropriate blood management strategies to help reduce or eliminate exposure to allogenic blood requires a preoperative assessment of the likelihood of transfusion and of the risks as well as costs associated with conservation and replacement options. The informed selection of alternatives based on preoperative assessment of hematologic status, estimated blood loss, and sources for blood replacement may enhance blood management practices in major elective orthopaedic surgery.

**Comment:** This article by Keating and Meding concisely reviews the perioperative blood management practices in elective orthopedic surgery. It covers the predictive risks of allogenic blood transfusion, and the effect of anemia on surgical recovery. A perioperative blood conservation approach is outlined and it emphasizes the important of the preoperative assessment of Hb levels and estimated blood loss. A practical algorithm for optimizing blood management strategies in orthopedic surgery is presented.

Dr. Davy Cheng, Anesthesiologist, London Health Sciences Centre and St. Joseph's Health Centre, London, Ontario

### The uses of epoetin alfa in complex spine deformity surgery

SHAPIRO GS, BOACHIE-ADJEI O, DHAWLIKAR SH, MAIER LS.

*SPINE* 2002 27(18): 2067 – 2071.

**Study design:** A prospective randomized trial comparing Epoetin alfa (Procrit) with placebo saline injection to determine effectiveness in increasing erythropoietic recovery in complex spine deformity surgery.

**Objectives:** To determine if Epoetin alfa can allow preoperative autologous donation completion more effectively and reduce perioperative homologous blood transfusion.

**Summary of background data:** The use of Epoetin alfa has been studied, primarily in the arthroplasty literature, for its effectiveness in decreasing transfusion requirements and increasing hemoglobin levels. It has not been studied in patients undergoing complex spine deformity surgery.

**Methods:** A total of 48 patients were prospectively randomized into an Epoetin alfa group and a control group. All patients attempted to donate 4 units of preoperative autologous donation at weekly intervals; 40,000 units of Epoetin alfa were injected subcutaneously at the time of preoperative autologous donation in the Epoetin alfa group. Hematocrit levels were recorded weekly during the donation process and daily in the preoperative period.

**Results:** Preoperative autologous donation was completed more effectively in the patients receiving Epoetin alfa. Epoetin alfa resulted in statistically higher hematocrit levels during preoperative autologous donation and perioperatively ( $P < 0.005$ ). Homologous transfusion was decreased by 2.4 units and hospital stay was 1.8 days shorter in patients receiving Epoetin alfa.

**Conclusion:** Patients who received Epoetin alfa were able to complete preoperative autologous donation more effectively, increase erythropoietic recovery, decrease homologous transfusion requirements, and had shorter hospital stays.

**Comment:** Despite a more extensive surgical procedure, patients receiving EPO had reduced allogeneic transfusion requirements and a higher hematocrit in the perioperative period. The authors surmise that EPO increased postoperative vigour and accelerated recovery but this was not demonstrated convincingly. Nonetheless, based on these results, the use of weekly EPO (approximately 600 U/kg) in conjunction with preoperative autologous blood donation should be considered seriously in patients undergoing complex spine deformity surgery in order to decrease allo-

genic transfusions and, possibly, to improve recovery.

Dr. Jean-François Hardy, Anesthesiologist, Université de Montréal, Montreal, Quebec

## ANEMIA IN THE ELDERLY

### Looking at the relationship between hemoglobin concentration and prevalent mobility difficulty in older women. Should the criteria currently used to define anemia in older people be reevaluated?

CHAVES PH, ASHAR B, GURALNIK JM, FRIED LP.

*J AM GERIATR SOC* 2002 50(7): 1257 – 1264.

**Objectives:** The World Health Organization (WHO) and other currently used criteria for defining anemia in older women are mainly based on statistical distribution considerations. To explore their clinical appropriateness, we evaluated the relationship between hemoglobin (Hb) concentration, prevalent mobility difficulty, and the Summary Performance Score (SPS).

**Design:** Cross-sectional study.

**Setting:** Two population-based studies, the Women's Health and Aging Studies I and II, Baltimore, Maryland.

**Participants:** Six hundred thirty-three community-dwelling women aged 70 to 80 with Hb levels obtained within 90 days from baseline assessment.

**Measurements:** Mobility difficulty (self-reported difficulty walking one-quarter of a mile or climbing 10 steps (primary outcome)). SPS, a performance-based summary measure of lower extremity function that combines the results of walking, chair stands, and balance tests (secondary outcome).

**Results:** Mobility prevalence was not constant within the WHO "normal" Hb range (12.0 – 16.0 g/dL). For example, a Hb of 13.5 g/dL was associated with a significantly lower mobility difficulty prevalence than a Hb of 12.0 g/dL (OR=0.68, 95% CI=0.47 – 0.93) even after adjustment for chronic diseases and other relevant health indicators. A consistent trend of improvement in performance-based scores with increasing Hb categories less than 12.0 g/dL, 12.0 to 13.0 g/dL, and 13.0 – 14.0 g/dL was observed.

**Conclusion:** Our findings raise two hypotheses: (1) Hb currently perceived as "mildly-low" and even "low-normal" might have an independent, adverse effect on mobility function, and (2) Hb of 12.0 g/dL might be a suboptimal criterion for defining anemia in older women. Formal testing of these hypotheses might prove relevant for anemia- and mobility disability-related clinical decision-making.

**Comment:** This study highlights the question of an appropriate hemoglobin level for diagnosing anemia in elderly women, and its association with clinically significant differences in an overall measure of mobility. Mobility was assessed by participant's ability to walk. Being able to rise from a chair and to balance while standing are important considerations in quality of life and the maintenance of an independent lifestyle. The ability to maintain balance is important in avoiding falls — a major cause of hospitalization of the elderly. The fall in hemoglobin concentration as people age is well known, and may be greater for men than for women. Since our population is aging, it seems important to define age-appropriate hemoglobin concentrations in order to diagnose anemia in the elderly and to promote adequate treatment for the condition.

Dr. Robin Moore-Orr, Faculty of Medicine, Health Sciences Centre, St. John's, Newfoundland

## ANEMIA IN PEDIATRICS

### Pharmacokinetics of darbepoetin alfa in pediatric patients with chronic kidney disease

LERNER G, KALE AS, WARADY BA, JABS K, BUNCHMAN TE, HEATHERINGTON

A, OLSON K, MESSER- MANN L, MARONI BJ. *PEDIATR NEPHROL* 2002 17: 933 – 937.

Darbepoetin alfa is a novel erythropoiesis-stimulating protein with a two- threefold longer half-life than recombinant human erythropoietin (epoetin) in adult patients with chronic kidney disease (CKD). This randomized, open-label, crossover study was conducted to determine the pharmacokinetic profile of darbepoetin alfa in pediatric patients with CKD. Twelve patients 3–16 years of age with CKD were randomized and received

single 0.5 µg/kg dose of darbepoetin alfa administered intravenously (IV) or subcutaneously (SC). After a 14- to 16-day washout period, patients received an identical dose of darbepoetin alfa by the alternate route. After IV administration, the mean clearance of darbepoetin alfa was 2.3 ml/h per kg, with a mean terminal half-life of 22.1 h. After SC administration, absorption was rate limiting, with a mean terminal half-life of 42.8 h and a mean bioavailability of 54%. Comparison of these results with those from a previous study of darbepoetin alfa in adult patients indicated that the disposition of darbepoetin alfa administered IV or SC is similar in adult and pediatric patients, although absorption may be slightly more rapid in pediatric patients after SC dosing. The mean terminal half-life of darbepoetin alfa in this study was approximately two- to fourfold longer than that previously reported for epoetin in pediatric patients.

#### **Almost all children experience anemia after renal transplantation**

AM J KIDNEY DIS 2002 40: 1306-1318.

Nearly all children and adolescents who undergo renal transplantation experience anemia at some point after the procedure, according to a recent report.

Posttransplant anemia is known to be a common problem in adult transplant recipients, but few studies have characterized the problem in pediatric populations.

In the current study, Dr. Peter D. Yorgin, from Stanford University in California, and colleagues analyzed data from 162 pediatric renal transplant recipients to assess the prevalence, severity, and predictors of posttransplant anemia. The findings are published in the December issue of the American Journal of Kidney Diseases [REUTERS HEALTH INFORMATION 2003].

The researchers found that 67% of patients were anemic at the time of transplantation. Within one month of transplantation, this percentage had increased to 84.3%. Furthermore, between 6 months and 5 years after transplantation, the percentage of recipients with anemia never dropped below 64.2%. Only 2.5% of patients were never anemic at some point during follow-up.

Compared with older recipients, those younger than 2 years of age at the time of transplantation were less likely to experience anemia during the first year ( $p < 0.0001$ ), the authors note. Iron depletion was common among anemic patients evaluated at 1 and 5 years.

Discharge hematocrit level, calcium level, and the cyclosporine dose were found to correlate with anemia at 3 months posttransplant. In contrast, creatinine clearance and the white blood cell count correlated with anemia at 1 year. Only creatinine clearance was related to anemia at 5 years after transplantation.

"Given the data in our study, a strategy to reduce posttransplant anemia might include steps to detect and minimize iron depletion, and preservation of functional renal mass by avoiding renal excretory function and tubular/interstitial loss by posttransplant acute tubular necrosis, calcineurin inhibitor toxicity, and rejection," Dr. Yorgin and colleagues, the authors.

Prospective studies are needed to "better delineate the causes and significance of posttransplant anemia," they conclude.

*Comment: Anemia is common in renal failure and transplantation, and may ultimately be due to a lack of erythropoietin (EPO), a hormone that is produced by the healthy kidney but that decreases in renal failure and less often in transplantation. The authors correctly note, however, that before the administration of EPO it is important to correct other causes of anemia such as iron and vitamin deficiency. Exogenous EPO will correct the anemia in the case of renal failure or certain drugs such as cyclosporin.*

Dr. Paul Barré, Nephrologist, McGill University Health Centre, Montreal, Quebec

#### **Pediatric use of recombinant human erythropoietin**

KILLIAN A. PEDIATR PHARM 2002 8(11).

The use of rHuEPO in adults has been well described in a variety of clinical situations. Although it is currently approved only for children with CRF, its use in other pediatric patient populations continues to increase. Publication of additional data on its use in children is needed to determine efficacy, define appropriate dosing regimens, and evaluate cost-effectiveness.

*Comment: This article reviews a variety of clinical uses of erythropoietin in children. There are a variety of erythropoietin doses used to treat childhood anemia, depending on the clinical process and age of the child.*

*Erythropoietin pharmacokinetics in childhood is not completely understood, although believed to be similar to adults. In children with cancer, for every 3 children treated with erythropoietin one child would be spared a blood transfusion. While in anemia of prematurity the Number Needed to Treat (NNT) would be 9 neonates treated with erythropoietin to prevent one blood transfusion. Further studies of erythropoietin use in children must be undertaken to enhance our knowledge of the use of this medication in the treatment of childhood anemia.*

Dr. Kent Stobart, Pediatric Hematologist, University of Alberta, Edmonton, Alberta

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