

ESAs in Dialysis Patients: Are You a Hedgehog or a Fox?

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The philosopher Isaiah Berlin¹ divides authors and perhaps people in general into two categories: Hedgehogs, who view the world through the lens of one defining idea, and foxes, for whom the world cannot be boiled down to a single idea. Looking at erythropoiesis-stimulating agents (ESAs) for the treatment of anemia in chronic kidney disease (CKD), should there be a single conclusion about the safety of ESAs?

In a previous editorial, I discussed the use of ESAs in nondialysis patients.² Here, I consider their continued use for the anemia of dialysis patients. ESAs have proved effective in correcting anemia in patients with ESRD. No one relishes blithely turning the clock back to the pre-ESA era, when dialysis patients were treated with repeated blood transfusions, iron therapy, anabolic steroids, and other maneuvers; however, mortality and the rate of cardiovascular complications in the dialysis population remain high, and reducing risk would be important in improving outcomes.

Randomized, controlled trials (RCTs) demonstrate there is increased risk in correcting anemia with ESAs in all patients with CKD—both dialysis and nondialysis. In the recently published Trial to Reduce Cardiovascular Endpoints with Aranesp Therapy (TREAT),³ a placebo-controlled, double-blind, randomized study comprising 4038 nondialysis patients, there was a significantly higher rate of strokes in patients who were treated with darbepoetin (hazard ratio 1.92; $P < 0.001$) as well as higher rates of thromboembolism and cancer-related deaths. In the Correction of Hemoglobin and Outcomes in Renal Insufficiency (CHOIR) study,⁴ the risk was a higher rate of mortality and cardiovascular complications in nondialysis patients targeted to a hemoglobin (Hb) level of 13.0 g/dl with epoetin-alfa (hazard ratio 1.34; $P = 0.03$). A higher rate of death or myocardial infarction (MI) or vascular access thrombosis was also observed in the Normal Hematocrit study.⁵

Meta-analyses have reached similar conclusions.^{6,7} In the meta-analysis by Phrommintikul *et al.*,⁶ nine RCTs were selected

on the basis of quality, sample size, and follow-up and viewed together for a total sample of 5143 patients, including both dialysis and nondialysis CKD trials. There was a higher risk for all-cause mortality (risk ratio [RR] 1.17; 95% confidence interval [CI] 1.01 to 1.35; $P = 0.031$) and arteriovenous access thrombosis (RR 1.34; 95% CI 1.16 to 1.54; $P = 0.0001$) in the higher Hb target group compared with the lower Hb target group. In a National Kidney Foundation (NKF) meta-analysis, published as a part of the revised 2007 NKF anemia guidelines,⁷ dialysis and nondialysis patients with CKD were evaluated separately. Four studies and 2391 patients were included in the NKF analysis of dialysis patients. The NKF reported increased risk with anemia correction, despite the use of a random-effect rather than a fixed-effect model. The point estimate for risk with the study by Phrommintikul *et al.*⁶ was 1.17 (95% CI 1.01 to 1.35; $P = 0.031$), whereas with the NKF study, the hazard ratio was 1.12 (95% CI 0.91 to 1.37).

Some in the academy will argue that because both the CHOIR study and TREAT enrolled nondialysis patients with CKD, these studies are not generalizable to the dialysis population; however, results of two RCTs of dialysis patients counter this assertion. The Normal Hematocrit study⁵ is the largest anemia correction RCT of dialysis patients. It tested the hypothesis that the correction of anemia with Epogen in hemodialysis patients with clinical evidence of congestive heart failure or ischemic heart disease would improve outcomes. The primary end points were length of time to death or a first nonfatal MI. The study was halted at the third interim analysis on the recommendation of the Data Safety Monitoring Committee. At 29 months, there were 183 deaths and 19 first nonfatal MIs in the group with a normal hematocrit level and 150 deaths and 14 nonfatal MIs in the low hematocrit group (RR 1.3; 95% CI 0.9 to 1.9). Even though these differences did not reach the prespecified statistical stopping boundary, the study was halted for safety reasons. In addition, the incidence of thrombosis of vascular access sites was higher in the normal hematocrit group compared with the low-hematocrit group (243 [39%] versus 176 [29%] patients; $P = 0.001$). Unpublished data from the Normal Hematocrit study, archived by the Food and Drug Administration (FDA),⁸ showed that the incidence of nonfatal MI was 3.1 and 2.3% in the normal and low hematocrit groups, respectively. The incidences of vascular thrombosis (39 versus 29%) and all other thrombotic events (22 versus 18%) were also higher in the normal hematocrit group (of note, there was no significant difference in the rate of stroke: 7% in normal and 6% in normal hematocrit group, respectively; personal communication from David Goodkin). The risk for thrombotic events is consistent with the TREAT data. With respect to patient-reported quality-of-life determinations, only one category of eight showed improvement in quality of life with higher Hb concentrations, but between-group comparisons (high versus low Hb) for quality of life were not reported.

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Because the Normal Hematocrit study recruited high-risk patients, it may not be generalizable to the dialysis population at large; however, consider the Canadian-European Normalization of Hemoglobin with Erythropoietin Trial,⁹ which enrolled relatively healthy incident hemodialysis patients by excluding patients with symptomatic heart disease as well as those with left ventricular dilation at baseline. Patients were randomly assigned to higher *versus* lower Hb (13.0 *versus* 11.0 g/dl, respectively). The primary end point was a change in left ventricular volume index. Changes in parameters of heart failure, stroke, and quality of life were also measured. No significant benefit in either of the cardiac structural or functional parameters was observed in the high- *versus* low-Hb groups; however, there was a statistically significantly higher rate of stroke in the higher Hb group. Quality of life showed improvement in the vitality score in the high- *versus* low-Hb group, although the 6-minute walk test and two other measures of quality of life did not improve significantly.

The FDA has lumped together the major RCTs on anemia correction in patients with CKD.¹⁰ The current FDA recommendation states a Hb goal of 10 to 12 g/dl for all patients with CKD, regardless of dialysis status.¹⁰ From a safety perspective, there is some rationale for lumping the trials together: The risk of ESA exposure seems insensitive to the patient population. Data from RCTs of patients with CKD,^{3,4,5,11,12} patients with cancer,^{11,13} healthy individuals who underwent spine surgery,¹⁴ and critically ill patients¹⁵ all point to increased risk with ESA exposure.

In patients with CKD, data from both observational studies and secondary analyses of RCTs suggest that exposure to high dosages of ESA explains the higher risk for mortality and cardiovascular complications^{16–19}; however, no study has proved causality so far, and the issue continues to be debated.²⁰ Confounding by indication and dosage-targeting bias have been raised as limitations in these analyses.^{21,22} Furthermore, not all studies implicate ESA exposure in explaining risk; a recent study using marginal structural modeling failed to report an association between high ESA dosage and adverse outcome.²³ Conversely, a secondary analysis of the CHOIR study, using landmark analysis as a way to avoid some of the biases inherent in observational studies, demonstrated that high ESA dosage was an independent predictor of the combined end point of mortality, nonfatal MI, heart failure, and stroke.¹⁷ In this analysis, targeting a higher Hb or lower Hb with higher dosages of ESA associates with poor outcomes, whereas achieving a higher Hb improves outcomes. A fair appraisal of the evidence is that, although additional studies will be needed to address causality, we should be concerned about the possibility of adverse effects from high ESA dosage.

Reducing ESA dosage in dialysis patients will probably result in a higher red cell transfusion rate. In the Normal Hematocrit study,⁵ 129 (21%) patients in the normal hematocrit group received red cell transfusions compared with 192 (31%) patients in the low hematocrit group ($P < 0.001$). In the Canada-Europe study, transfusion rates were 9.1% with the high

target *versus* 19.3% with the low target. In TREAT, nearly twice as many patients required blood transfusions when assigned to placebo *versus* darbepoetin (496 [24.5%] *versus* 297 [14.8%] patients, respectively; $P < 0.001$).

Although the FDA review cited a low rate of transfusion-related complications in the current era, it is unlikely that repeated blood transfusions will be without risk.¹¹ Iron use will also rise with aggressive attempts to reduce ESA dosage. Exposure to large amounts of intravenously administered iron, over the long-term, raises safety concerns,²⁴ although observational studies have been reassuring.²⁵

In the absence of additional RCTs, clinicians are faced with making decisions on what to do with managing anemia in dialysis patients. Maintaining dialysis patients on the lowest possible dosage of ESA, above a Hb threshold of >9 g/dl, is commensurate with the placebo arm of TREAT. This Hb threshold is also consistent with the lower Hb arm of the Normal Hematocrit study. For some patients, this strategy will be well tolerated and should be the goal. These patients probably will be healthier and have less laboratory evidence of inflammation, normal iron stores, well-controlled metabolic bone disease parameters, and good dialysis adequacy; however, a Procrustean one-size-fits-all approach to treating anemia in dialysis patients has its own problems, because dramatically decreasing the ESA dosage in some patients, perhaps the majority, will result in a precipitous fall in Hb concentration, long-term complications of repeated blood transfusion, and intolerable fatigue. In these patients, engaging in a discussion about the risks and benefits of ESA therapy, as well as individualizing goals of therapy, will be important. A computerized “generic” anemia protocol will not do for these patients. Maneuvers that lower ESA dosage but prevent a concomitant drop in the Hb concentration should be aggressively pursued. These include using intravenous iron therapy to keep the patient iron-replete, even when the patient has a high ferritin level.^{26,27} Switching to subcutaneous ESA will also result in one-third lower ESA dosage use,²⁸ and patients may be willing to trade the discomfort of subcutaneous ESA for greater safety.²⁹ Optimizing adequacy of dialysis or switching patients to alternative modalities, such as peritoneal dialysis³⁰ or nocturnal³¹ hemodialysis, may also result in lower ESA dosage. Treating inflammation either with drugs, such as pentoxifylline³² or a statin,³³ or treating an underlying infection or treating hyperparathyroidism also seem effective in reducing ESA dosage without causing the Hb to fall. For some patients who are waiting for a kidney allograft, long-term ESA therapy will be necessary because blood transfusion must be avoided to minimize the risk for sensitization. Conversely, avoiding ESAs should be considered for patients who are within 2 years of a diagnosis of a malignancy or are actively undergoing chemotherapy.

In conclusion, there is increased risk in targeting a higher Hb level in dialysis patients. Aiming for an Hb level of >9 g/dl is commensurate with the placebo arm of TREAT but also the lower Hb arm of the Normal Hematocrit study; however, a higher rate of red cell transfusion will probably be necessary

with such a strategy. The key to ESA therapy in dialysis patients will be individualization of risk and benefit. In seventh century BC, the Greek soldier-poet Archilochus³⁴ wrote, “The fox knows many things but the hedgehog knows one big thing.” In CKD anemia, the one big thing is using the lowest possible dosage of ESA because of safety concerns; however, reducing exposure to ESA and individualizing therapy will require “many things” and undeniably the smarts of a fox.

DISCLOSURES

A.K.S. was principal investigator of the CHOIR study and a member of the Executive Committee for TREAT. He presented to the FDA Cardiovascular Disease and Renal Advisory Committee in September 2007 and to the US Congress House of Representatives Ways and Means Committee in December 2006 and June 2007. He has received consulting fees from Amgen, Johnson and Johnson, Fibrogen, and Watson and has received grant support from Amgen, Johnson and Johnson, and Watson.

REFERENCES

1. *The Hedgehog and the Fox: An Essay on Tolstoy's View of History*, London, Weidenfeld & Nicolson, 1953; New York, Simon and Schuster, 1953
2. Singh AK: Does TREAT give the boot to ESAs in the treatment of CKD anemia? *J Am Soc Nephrol* 21: 2–6, 2010
3. Pfeffer MA, Burdmann EA, Chen CY, Cooper ME, de Zeeuw D, Eckardt KU, Fezy JM, Ivanovich P, Kewalramani R, Levey AS, Lewis EF, McGill JB, McMurray JJ, Parfrey P, Parving HH, Remuzzi G, Singh AK, Solomon SD, Toto R, TREAT Investigators: A trial of darbepoetin alfa in type 2 diabetes and chronic kidney disease. *N Engl J Med* 361: 2019–2032, 2009
4. Singh AK, Szczec L, Tang KL, Barnhart H, Sapp S, Wolfson M, Reddan D, CHOIR Investigators: Correction of anemia with epoetin alfa in chronic kidney disease. *N Engl J Med* 355: 2085–2098, 2006
5. Besarab A, Bolton WK, Browne JK, Egrie JC, Nissenson AR, Okamoto DM, Schwab SJ, Goodkin DA: The effects of normal as compared with low hematocrit values in patients with cardiac disease who are receiving hemodialysis and epoetin. *N Engl J Med* 339: 584–590, 1998
6. Phrommintikul A, Haas SJ, Elsik M, Klum H: Mortality and target haemoglobin concentrations in anemia patients with chronic kidney disease treated with erythropoietin: A meta-analysis. *Lancet* 369: 381–388, 2007
7. KDOQI; National Kidney Foundation. II. Clinical practice guidelines and clinical practice recommendations for anemia in chronic kidney disease in adults. *Am J Kidney Dis* 47[Suppl 3]: S16–S85, 2006
8. FDA Briefing Document May 4, 2004 Oncologic Drugs Advisory Committee. Available at: <http://www.fda.gov/ohrms/dockets/ac/04/briefing/4037b2.htm>. Accessed January 17, 2010
9. Parfrey PS, Foley RN, Wittreich BH, Sullivan DJ, Zagari MJ, Frei D: Double-blind comparison of full and partial anemia correction in incident hemodialysis patients without symptomatic heart disease. *J Am Soc Nephrol* 16: 2180–2189, 2005
10. Epogen Label. Available at: http://www.accessdata.fda.gov/drugsatfda_docs/label/2007/103234s51581b1.pdf. Accessed March 2, 2010
11. Oncologic Drugs Advisory Committee: FDA Briefing Document: March 13, 2008. Available at: <http://www.fda.gov/ohrms/dockets/ac/08/briefing/2008-4345b2-01-FDA.pdf>. Accessed January 19, 2010
12. Druke TB, Locatelli F, Clyne N, Eckardt KU, Macdougall IC, Tsakiris D, Burger HU, Scherhag A, CREATE Investigators: Normalization of hemoglobin level in patients with chronic kidney disease and anemia. *N Engl J Med* 355: 2071–2084, 2006
13. Bennett CL, Silver SM, Djulbegovic B, Samaras AT, Blau CA, Gleason KJ, Barnato SE, Elverman KM, Courtney DM, McKoy JM, Edwards BJ, Tigue CC, Raisch DW, Yarnold PR, Dorr DA, Kuzel TM, Tallman MS, Trifilio SM, West DP, Lai SY, Henke M: Venous thromboembolism and mortality associated with recombinant erythropoietin and darbepoetin administration for the treatment of cancer-associated anemia. *JAMA* 299: 914–924, 2008
14. Stowell CP, Jones SC, Enny C, Langhoff W, Leitz G: An open-label, randomized, parallel-group study of perioperative epoetin alfa versus standard of care for blood conservation in major elective spinal surgery: Safety analysis. *Spine* 34: 2479–2485, 2009
15. Corwin HL, Gettinger A, Fabian TC, May A, Pearl RG, Heard S, An R, Bowers PJ, Burton P, Klausner MA, Corwin MJ, EPO Critical Care Trials Group: Efficacy and safety of epoetin alfa in critically ill patients. *N Engl J Med* 357: 965–976, 2007
16. Zhang Y, Thamer M, Stefanik K, Kaufman J, Cotter DJ: Epoetin requirements predict mortality in hemodialysis patients. *Am J Kidney Dis* 44: 866–876, 2004
17. Szczec LA, Barnhart HX, Inrig JK, Reddan DN, Sapp S, Califf RM, Patel UD, Singh AK: Secondary analysis of the CHOIR trial epoetin-alpha dose and achieved hemoglobin outcomes. *Kidney Int* 74: 791–798, 2008
18. Servilla KS, Singh AK, Hunt WC, Harford AM, Miskulin D, Meyer KB, Bedrick EJ, Rohrscheib MR, Tzamaloukas AH, Johnson HK, Zager PG: Anemia management and association of race with mortality and hospitalization in a large not-for-profit dialysis organization. *Am J Kidney Dis* 54: 498–510, 2009
19. Kilpatrick RD, Critchlow CW, Fishbane S, Besarab A, Stehman-Breen C, Krishnan M, Bradbury BD: Greater epoetin alfa responsiveness is associated with improved survival in hemodialysis patients. *Clin J Am Soc Nephrol* 3: 1077–1083, 2008
20. Singh AK: Resolved: Targeting a higher hemoglobin is associated with greater risk in patients with CKD anemia—Pro. *J Am Soc Nephrol* 20: 1436–1441, 2009
21. Bradbury BD, Brookhart MA, Winkelmayer WC, Critchlow CW, Kilpatrick RD, Joffe MM, Feldman HI, Acquavella JF, Wang O, Rothman KJ: Evolving statistical methods to facilitate evaluation of the causal association between erythropoiesis-stimulating agent dose and mortality in nonexperimental research: Strengths and limitations. *Am J Kidney Dis* 54: 554–560, 2009
22. Greene T, Daugirdas J, Depner T, Allon M, Beck G, Chumlea C, Delmez J, Gotch F, Kusek JW, Levin N, Owen W, Schulman G, Star R, Toto R, Eknoyan G, Hemodialysis Study Group: Association of achieved dialysis dose with mortality in the hemodialysis study: An example of “dose-targeting bias.” *J Am Soc Nephrol* 16: 3371–3380, 2005
23. Wang O, Kilpatrick RD, Critchlow CW, Ling X, Bradbury BD, Gilbertson DT, Collins AJ, Rothman KJ, Acquavella JF: Relationship between epoetin alfa dose and mortality: Findings from a marginal structural model. *Clin J Am Soc Nephrol* December 17, 2009 [epub ahead of print]
24. Bishu K, Agarwal R: Acute injury with intravenous iron and concerns regarding long-term safety. *Clin J Am Soc Nephrol* 1[Suppl 1]: S19–S23, 2006
25. Feldman HI, Joffe M, Robinson B, Knauss J, Cizman B, Guo W, Franklin-Becker E, Faich G: Administration of parenteral iron and mortality among hemodialysis patients. *J Am Soc Nephrol* 15: 1623–1632, 2004
26. Kapoian T, O'Mara NB, Singh AK, Moran J, Rizkala AR, Geronemus R, Kopelman RC, Dahl NV, Coyne DW: Ferric gluconate reduces epoetin requirements in hemodialysis patients with elevated ferritin. *J Am Soc Nephrol* 19: 372–379, 2008
27. Pizzi LT, Bunz TJ, Coyne DW, Goldfarb DS, Singh AK: Ferric gluconate treatment provides cost savings in patients with high ferritin and low transferrin saturation. *Kidney Int* 74: 1588–1595, 2008

28. Kaufman JS, Reda DJ, Fye CL, Goldfarb DS, Henderson WG, Kleinman JG, Vaamonde CA: Subcutaneous compared with intravenous epoetin in patients receiving hemodialysis. Department of Veterans Affairs Cooperative Study Group on Erythropoietin in Hemodialysis Patients. *N Engl J Med* 339: 578–583, 1998
29. Patel TV, Robinson K, Singh AK: Is it time to reconsider subcutaneous administration of epoetin? *Nephrol News Issues* 21: 57, 59, 63–64, 2007
30. Coronel F, Herrero JA, Montenegro J, Fernandez C, Gandara A, Conesa J, Rivera MT, Torrente J, Portolés J, Gomez-Martino JR: Erythropoietin requirements: A comparative multicenter study between peritoneal dialysis and hemodialysis. *J Nephrol* 16: 697–702, 2003
31. Schwartz DI, Pierratos A, Richardson RM, Fenton SS, Chan CT: Impact of nocturnal home hemodialysis on anemia management in patients with end-stage renal disease. *Clin Nephrol* 63: 202–208, 2005
32. Cooper A, Mikhail A, Lethbridge MW, Kemeny DM, Macdougall IC: Pentoxifylline improves hemoglobin levels in patients with erythropoietin-resistant anemia in renal failure. *J Am Soc Nephrol* 15: 1877–1882, 2004
33. Chiang CK, Yang SY, Peng YS, Hsu SP, Pai MF, Huang JW, Hung KY, Wu KD: Atorvastatin increases erythropoietin-stimulating agent hyporesponsiveness in maintenance hemodialysis patients: Role of anti-inflammation effects. *Am J Nephrol* 29: 392–397, 2009
34. Attributed to Archilochus Greek lyric poet and soldier, 675–635 BC. Available at: <http://en.wikiquote.org/wiki/Archilochus>, Accessed February 14, 2010

Round 2 at JASN

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To become the second editor of *JASN* was not an easy road traveled. My competition consisted of two highly visible and extremely well-published nephrologists from prestigious institutions with extensive editorial experience, each of whom had served the American Society of Nephrology (ASN) in many capacities, including president. Before and immediately after my interview with the search committee at the time of the 1995 ASN Annual Meeting in San Diego, I had serious doubts that I would be selected; however, on the final day of the annual meeting, I learned that I would be the next editor of *JASN*.

After a very brief period of euphoria, I began to feel like the old hound that loved to chase cars but after finally catching one was uncertain what to do next. I quickly recovered and immediately asked Kirsten M. Madsen and R. Tyler Miller to serve as my deputy editors, and together we set about the task of orga-

nizing a new staff in preparation for taking on the editorial responsibilities of *JASN* in July 1996.

Critical to our effort was convincing Ms. Bonnie O'Brien, then current managing editor of *JASN* (founding editor Jared Grantham's right-hand person) and a native of Kansas City, to relocate with *JASN* to Gainesville and the University of Florida. I believe the fact that she was an avid and very skilled tennis player and that tennis is enjoyed outdoors the year around in Gainesville was a major factor in her successful recruitment. The transition from the old to the new editorial team was virtually seamless, in large part because of the professionalism displayed by the very successful founding editor, Jared Grantham, and the presence of Bonnie. Interestingly, although the journal editorship has moved twice since leaving Gainesville, first to Seattle under William Couser and now in Nashville with Eric Neilson, Bonnie and the managing editor's office have remained in Gainesville, a true testimonial to the power of the internet and tennis!

I was extremely fortunate to enjoy the support of an outstanding group of associate editors that included Corinne Antignac, Alfred K. Cheung, Mark Knepper, Alan M. Krensky, Richard P. Lifton, William E. Mitch, Giuseppi Remuzzi, and Eberhard Ritz. These individuals manifested an incredible wealth of knowledge and experience in their respective areas of expertise, which was especially important to this newly minted editor. Indeed, their contributions along with those of Kirsten Madsen, who was later appointed senior deputy editor, to the quality of the editorial process were immeasurable. Also, I would be remiss in not acknowledging the extremely important role of the members of the editorial board and the dozens of additional referees who day in and day out provided thoughtful, well-written, and detailed reviews of manuscripts submitted to *JASN*. Their outstanding efforts maintained the integrity and quality of the peer-review process.

An initial mini-crisis involving *JASN* arose somewhat unexpectedly at the ASN Spring Council meeting in 1996. The editor's report included an artist's rendering of a proposed new style and color for the cover. Furthermore, the editor proposed that greater emphasis be placed on "nephrology" in the title so that gradually, over the course of approximately 3 years, the journal might become known simply as "NEPHROLOGY" rather than *JASN*. Eventually, the cover would have read, "NEPHROLOGY, the official publication of the American Society of Nephrology." The council did not accept the proposal, and, as they say, "the rest is history." We will never know whether NEPHROLOGY could have replaced *JASN* in name recognition. The deep red or burgundy color was found acceptable and, incidentally, matched the color of the editor's pick-up truck.

A new feature introduced with the January 1997 issue was the "Milestones in Nephrology" series. We are indebted to Mark Knepper, who served as the feature editor. Our intent was to reprint scientific articles from any journal source that had provided

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CORRECTION

Erratum for Singh: ESAs in Dialysis Patients: Are You a Hedgehog or a Fox? *J Am Soc Nephrol* 21: 543–546, 2010. In the original published version of this article, the references were incorrectly numbered. In the reference list, reference 32 should have been listed as reference 31, reference 33 should have been listed as reference 32, and reference 34 should have been listed as reference 33. Reference 31 should have been omitted.

Also, the following text was incorrect: “The incidences of stroke (39 versus 29%) and all other thrombotic events (22 versus 18%) were also higher in the normal hematocrit group. The risk for stroke and thrombotic events is consistent with the TREAT data.” The text should have read: “The incidences of vascular thrombosis (39 versus 29%) and all other thrombotic events (22 versus 18%) were also higher in the normal hematocrit group (of note, there was no significant difference in the rate of stroke: 7% in normal and 6% in normal hematocrit group, respectively; personal communication from David

Goodkin). The risk for thrombotic events is consistent with the TREAT data.”

We apologize for these errors.

A corrected version of this manuscript has been posted online.

CORRECTION

Erratum for Berl *et al.*: Oral Tolvaptan Is Safe and Effective in Chronic Hyponatremia. *J Am Soc Nephrol* 21: 705–712, 2010. There is an error in the affiliation line. Although Dr. Quittnat-Pelletier is presently at the Renal Division, University of Toronto, Toronto, Ontario, Canada, her contribution to this manuscript was made when she was at the Division of Nephrology, Department of Medicine III, Universitätsklinikum C.G.Carus, Dresden, Germany.

We apologize for this error.