

Improving IV Iron and Anemia Management in the Hemodialysis Setting: A Collaborative CQI Approach

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Iron-deficiency anemia is common in patients on hemodialysis due to numerous factors, including impaired erythropoiesis resulting from chronic kidney disease (CKD) and blood (and iron) loss during the dialysis procedure. Therefore, effective anemia management is a critical component in the dialysis setting to reduce complications and improve patient outcomes. National guidelines have been published on anemia and intravenous (IV) iron treatment in this patient population, but adherence to standard guidelines should be complemented by individualized patient care. Nurses involved in the routine management of iron-deficiency anemia should take a proactive approach to patient management, such as understanding the significant role that IV iron has in the erythropoietic process and looking beyond laboratory monitoring of iron status to focus on the whole patient. In addition, it is important to apply standardized IV

Patients on hemodialysis may suffer from iron-deficiency anemia ensuing from impaired erythropoiesis due to kidney disease and the ongoing loss of blood during the hemodialysis procedure, among other clinical factors. Effective treatment of iron-deficiency anemia is critical for patients but can be challenging for nurses and fellow staff members because proper management requires a balance between erythropoietin-stimulating agents and intravenous iron therapy. Implementing a continuous quality improvement program that focuses on a collaborative approach to managing iron-deficiency anemia can successfully educate all dialysis staff members on treatment-related issues, streamline patient care, and improve anemia-related outcomes, as demonstrated by a regional network of dialysis centers. This article focuses on their experiences and the important role of the nurse in this initiative.

iron protocols that provide continuous therapy while still considering patient-specific needs that may influence iron requirements. Nurses also should intermittently review recent patient outcomes and report findings so that physicians can revise established protocols if patients are not consistently achieving IV iron and anemia management goals.

The Clinical Performance Measures report from the Centers for Medicare and Medicaid Services concluded that, from October to December of 2005, an average of 83% of patients on hemodialysis achieved target hemoglobin (Hb) levels of greater than 11 g/dL at any given time and 82% received IV iron in a monthly period. Based on these statistics, it can be assumed that IV iron and anemia management protocols are approximately 80% effective and approximately 20% of patients on hemodialysis can benefit from more effective anemia management (2005 ESRD CPM annual report). To better enable dialysis centers to consistently achieve and maintain target hematologic and iron parameters in a greater percentage of their patients, nurses can initiate a continuous quality improvement (CQI) program (see

Table 1) that provides targeted educational programs for the staff and improved protocols for patients. In addition, these tools can improve relationships and facilitate collaboration among nurses, physicians, dietitians, and other staff members. This review discusses successful strategies to improve education and protocols and facilitate collaboration of dialysis personnel with respect to IV iron and anemia management, as evidenced by a recent CQI program conducted by Fresenius Medical Care. The contributions of the nurse as part of this collaborative approach allowed the clinics to consistently meet target anemia parameters in a greater number of patients.

Role of the Nurse to Ensure Appropriate Anemia Management

Processes Contributing to Anemia

Nurses are responsible for assessing patients for conditions that often impede anemia correction, such as gastrointestinal blood loss or iron deficiency. Therefore, it is necessary for nurses to be familiar with the pri-

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Table 1
What Is a CQI Initiative?

A CQI initiative is a management philosophy that requires an organized team to routinely monitor patient data in order to evaluate and update practices to improve outcomes (Bowe & Ammel, 2005).

Key steps are to:

1. Establish an anemia management team
2. Analyze current treatment processes
3. Identify opportunities for improvement
4. Develop and initiate an intervention plan
5. Assess the results
6. Revise the plan as needed

many factors that can drive anemia in patients on hemodialysis: (1) impaired production of red blood cells (RBCs) by the bone marrow, (2) excessive blood loss, and (3) abnormal rates of RBC destruction (hemolysis). CKD blunts the synthesis of erythropoietin, which is needed for adequate production of RBCs by the bone marrow (Shander, 2004; Sakiewicz & Paganini, 1998; National Kidney Foundation, 2006). Cells in the kidney are specifically designed to rapidly respond to tissue hypoxia (low oxygen) with an increase in the production of the hormone erythropoietin, which in turn stimulates the production of RBCs. This process is impaired in patients with CKD, and patients are treated with erythropoiesis-stimulating agents (ESAs) to address inadequate erythropoietin secretion (National Kidney Foundation, 2006). However, ESA therapy increases erythropoiesis to supraphysiologic rates, thereby increasing the demand for iron to support Hb synthesis faster than iron can be released from the storage supply. This condition is known as functional iron deficiency or iron-restricted erythropoiesis and results in ESA resistance. Further complicating this situation, hemodialysis patients already have increased iron loss.

Blood and iron loss is common in patients on hemodialysis and results from multiple sources, including necessary blood sampling needed for diagnostic analysis, gastrointestinal ulcers, bleeding from the dialysis

access site, and the hemodialysis procedure (Sakiewicz & Paganini, 1998). As a result of blood loss, a patient on hemodialysis can experience an annual iron loss of up to 3000 mg (Sakiewicz & Paganini, 1998). Anemia guidelines and recommendations from the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative (KDOQI) suggest that the average IV iron dose needed to maintain a neutral iron balance appears to be in the range of 22 to 65 mg each week (National Kidney Foundation, 2006).

Blood loss in CKD is further exacerbated by abnormal platelet function that occurs with uremia, which impairs clotting ability. CKD also affects nutrition and the ability to absorb vitamins and minerals that are necessary for the production of Hb, such as iron and folic acid (Bistrian & Khaodhiar, 1999). These nutrients also can be removed from the blood by the dialysis process.

Finally, the clinical impact of blood loss in CKD-related anemia is compounded by increased hemolysis (i.e., the breaking open of RBCs and the release of Hb into the surrounding fluid), which is likely due to the toxic effects of uremia. Although hemolysis is usually minor in CKD, the effects of this process are more pronounced in an environment of continued blood and iron loss as observed in patients on hemodialysis and in those experiencing inadequate erythropoiesis due to CKD.

Importance of Anemia as a Target for Clinical Intervention

Because nurses are accountable for the routine management of patients on hemodialysis, they should appreciate the significance of anemia as a target for clinical intervention. Anemia in CKD can result in fatigue and has a major impact on daily quality of life (QOL). The treatment of anemia has been shown to significantly improve QOL, and improved QOL has been directly linked to improved measures of morbidity and mortality in end stage renal disease (Kimmel & Patel, 2006). Unchecked anemia can increase the risk of cardiovascular events, whereas the correction of anemia can reduce cardiovascular risk in patients with CKD (Lahera et al., 2006). Additionally, anemia has been recognized as an independent predictor of poor outcomes in CKD. Although higher Hb levels have been associated with hypertension and mortality risk, the Dialysis Outcomes and Practice Patterns Study (DOPPS) demonstrated that the judicious correction of anemia in dialysis patients reduces morbidity and mortality risk (Locatelli et al., 2004).

KDOQI: Anemia Evaluation and Diagnosis

Nurses are often responsible for tracking and compiling new information and assessing its impact on current anemia management practices. For example, nurses should be well-versed in the updated 2006 KDOQI guidelines and recommendations. KDOQI states that levels of Hb, serum ferritin, and transferrin saturation (TSAT) or reticulocyte Hb content (CHR) should be evaluated jointly to provide important information about iron stores and iron available for erythropoiesis (National Kidney Foundation, 2006). Evaluation of iron status should be performed at least once every 3 months during established ESA therapy. Some clinical settings may require increased frequency of iron status testing; for example, correcting a lower-than-target Hb level during ongoing ESA use, recent

bleeding, a surgical procedure, monitoring response following a course of IV iron therapy, or detecting ESA resistance. Additionally, it is important to evaluate iron sufficiency before starting ESA treatment to ascertain the contribution of iron deficiency, which may be significant, to anemia.

According to the KDOQI guidelines and recommendations, treating patients with an ESA to a target Hb level of 11 g/dL or more will result in measurable QOL benefits, whereas intentionally treating to an Hb level of 13 g/dL or more may increase a patient's risk for serious adverse events (National Kidney Foundation, 2006). Recent studies have demonstrated an increased cardiovascular risk in patients treated with ESA therapy to obtain an Hb level of greater than 13 g/dL; in fact, one trial was ended early due to reported deaths linked to higher Hb levels (Drueke et al., 2006; Singh et al., 2006). Although an association between reported deaths with higher Hb levels and administration of ESA therapy was not confirmed by trial researchers, it is encouraging that integrating IV iron therapy in an anemia treatment plan can help clinicians avoid the use of unnecessarily high doses of ESA therapy. Studies have repeatedly shown that IV iron administration can decrease ESA requirements (Kapoian et al., 2006; Besarab et al., 2000; Fishbane et al., 1995).

Additionally, the KDOQI guidelines and recommendations states that adult hemodialysis patients should be maintained at a serum ferritin level of greater than 200 ng/mL and a TSAT level of greater than 20% or a CHr level of greater than 29 pg/cell (National Kidney Foundation, 2006). These iron targets reflect a decision by the KDOQI Anemia Work Group not to set upper cut-off restrictions but to only establish a lower target threshold for these indices. An upper limit of serum ferritin was not instituted due to a lack of published safety and efficacy data regarding IV iron use at moderately elevated serum ferritin levels, thereby preventing the Work Group from

concluding that IV iron therapy should be routinely administered in patients with a serum ferritin level of greater than 500 ng/mL. However, the KDOQI guidelines and recommendations emphasizes that a lack of adequate evidence to recommend maintaining a serum ferritin level of greater than 500 ng/mL does not prohibit IV iron administration if a physician determines that a patient needs a course of IV iron therapy. Patients with a serum ferritin level of greater than 500 ng/mL and a TSAT level of less than 20% may be iron deficient and IV iron administration may be necessary.

A recent trial, Dialysis Patients' Response to IV Iron With Elevated Ferritin (DRIVE), was designed to examine the effectiveness of IV iron therapy in treating anemia in hemodialysis patients with higher serum ferritin levels (500 to 1200 ng/mL) and a TSAT level of 25% or less and on adequate ESA doses (Coyne et al., 2007). Patients were randomized to receive IV iron (1 g of sodium ferric gluconate administered over 8 hemodialysis sessions) or no IV iron. At the beginning of week 1, both groups received a 25% increase in ESA dose, which was then held constant for the next 6 weeks. DRIVE results demonstrated that, compared to the no iron group, the IV iron group had a greater increase in Hb, a greater percentage of patients had an Hb response (defined as a 2 g/dL or more increase in Hb at any study point), and time to Hb response was faster. Additionally, the IV iron group experienced a significant increase in serum ferritin and TSAT levels, indicating better availability of iron for erythropoiesis, whereas serum ferritin levels decreased in the no iron group. DRIVE participants were likewise enrolled in DRIVE-II, a follow-up observational study that allowed patients to resume routine management of ESA and IV iron therapy (Kapoian et al., 2006). DRIVE-II results showed that the IV iron group experienced a mean ESA dose reduction of about 21%, whereas the ESA

dose remained unchanged in the control group, with the final ESA dose being significantly higher in the control group. DRIVE and DRIVE-II provided compelling evidence for the efficacy of IV iron therapy in anemic hemodialysis patients with serum ferritin levels between 500 and 1200 ng/mL and TSAT levels of 25% or less and receiving adequate ESA therapy.

Balancing IV Iron and ESA Therapy

Nurses are responsible for assessing ESA and IV iron doses in accordance with the patient's needs, so it is essential that they understand the importance of a balanced approach to ESA and IV iron therapy and that both erythropoietin and iron are needed for effective erythropoiesis. Erythropoietin can be considered the "driving force" behind erythropoiesis, in which the kidney responds to hypoxia by triggering the synthesis and release of erythropoietin, which then proceeds to the bone marrow to activate RBC production. In turn, iron can be considered the "fuel" needed for the production of new RBCs. On approximately day 20 of RBC production (a 25-day process), iron is taken up by the cells and incorporated into Hb. If iron is unavailable on this day (e.g., during a state of iron deficiency), the patient will develop anemia. It is essential that iron is accessible at the precise time because after the mature RBCs are formed, iron can no longer be integrated into the cells, and insufficient iron supplies can lead to microcytic, hypochromic RBCs. By following a continuous IV iron regimen, clinicians can be assured that iron will be readily available for effective erythropoiesis in their patients (Petroff, 2005; Adamson, 1994; Information Center for Sickle Cell and Thalassemic Disorders, 2006).

The consistent administration schedule of IV iron therapy provides many clinical benefits to patients on hemodialysis. Continuous IV iron therapy provides an ongoing supply of iron, thereby preventing the recur-

rence of absolute iron deficiency and avoiding iron-restricted erythropoiesis. In addition, IV iron administration on a regular basis helps to stabilize Hb, TSAT, and serum ferritin levels, thereby avoiding considerable swings in hematologic and iron values that occur with giving iron and then holding iron. Finally, evidence has shown that continuous IV iron therapy helps to overcome ESA resistance, resulting in enhanced erythropoiesis and decreased ESA requirements (Fishbane et al., 1995; Chang et al., 2002; Besarab et al., 2000).

Because management of iron-deficiency anemia can be challenging in patients on hemodialysis, dialysis centers need to make a concerted effort to provide nurses and fellow staff members with the tools they need to effectively balance IV iron and ESA therapy and provide effective anemia care. Initiating staff education and standardized anemia management protocols, which allow an opportunity for individualized patient care, are important components of a successful anemia management program.

The complexity of balancing ESA and IV iron therapy under an established anemia management protocol requires a joint effort for all staff members to work in a cohesive manner on a daily basis. Therefore, a successful anemia management program should emphasize a collaborative approach to therapy that allows nurses, physicians, dietitians, and other staff members to contribute equally to the process of achieving treatment goals for all patients.

Case Study - Improving Anemia: A Collaborative Approach

A regional network of Fresenius Medical Care dialysis centers, spearheaded by a regional vice president of the organization, recognized the need for improvements in patient care, effective use of staff time, and IV iron management. This recognition resulted in the implementation of a CQI initiative to enhance anemia outcomes. During the initial stages of the CQI initiative, an anemia manage-

ment team began a review of the centers' IV iron and anemia practices in the spring of 2004. As part of the anemia management team, nurses were able to assess patient trends and identify poor responders to current therapeutic approaches. Once these outcome data were compiled, the clinical manager determined that some facilities were experiencing high serum ferritin levels and low TSAT levels in a majority of patients on hemodialysis. These findings, which were complemented by a literature review and consultation with dialysis personnel, led the team to conclude that changes in IV iron and anemia management practices were needed. Nurses were especially supportive during this phase because they were able to recommend different interventions to improve patient outcomes.

The Process: A Team Effort

The team developed a CQI proposal that was reviewed by the regional vice president of the dialysis network, the director of operations, the quality assurance manager, various medical directors and physicians, anemia managers, nurses, and other staff members. Area educators were responsible for any literature updates or changes to clinical guidelines and coordinated the educational activities under the initiative. The network's clinical manager and medical director were ultimately responsible for ensuring the implementation of the protocol. During this process, nurses were an essential resource to help obtain information on various IV iron products and appropriate iron dosing practices. In addition, nurses were able to research existing IV iron protocols to compare with the facility's current practices.

Based on the data compiled, the team established the following educational and therapeutic goals for the CQI project:

- Educate and assist in anemia manager training and further develop the level of clinical anemia management.
- Decrease the percentage of patients with serum ferritin

greater than 800 ng/mL through a better understanding of anemia management and factors that cause ESA hyporesponse and increased serum ferritin levels. Note: at the time, the dialysis centers followed the 2001 KDOQI-recommended serum ferritin upper limit of greater than 800 ng/mL; the 2006 KDOQI guidelines and recommendations, which removed the upper limit for serum ferritin, had not yet been published.

- Maintain the number of patients achieving target Hb levels.
- Improve the balance between the use of ESA and IV iron regimens.
- Simplify or not further complicate the iron management process.

After the goals were determined, the nurses and fellow team members conducted a series of meetings to develop the content of the educational initiatives that would provide the foundation for a standardized anemia management protocol. Aspects of anemia management associated with poor patient outcomes and educational needs of the staff were identified. After a preliminary review of these findings, an initial educational plan was developed with support from the network's regional vice president.

Medical directors of individual facilities subsequently met to review the preliminary plan and develop additional educational supplements. A quality assurance individual was then included in the discussion; this individual acted as the primary contact person for the initiative and helped with recommending protocol changes, as well as a list of participants and key personnel at each dialysis facility in the network.

Anemia managers at each facility completed a 1-week home study course, after which they reported back to the quality assurance individual. The anemia managers at each facility also were responsible for completing a series of 6 educational pro-

grams during mandatory monthly meetings over a period of 6 months. The new anemia management protocol was presented to the anemia managers at the subsequent monthly meeting. Finally, a question-and-answer session was held to address any concerns with the new protocol during the next monthly meeting prior to the implementation of the protocol.

Accomplishing Goals Through Education and Protocols

A series of educational presentations were offered to help nurses and other staff members re-evaluate and improve outcomes of current treatment processes. One of the educational presentations reviewed how to properly assess serum ferritin values in patients on hemodialysis. The presentation was beneficial because nurses are responsible for monitoring the patient's iron status, and some were unaware of the limitations of the serum ferritin marker as an accurate reflection of iron stores. Although the KDOQI guidelines and recommendations suggest measuring serum ferritin to help determine IV iron treatment decisions, this marker is an indirect measure of iron stores and, therefore, its clinical utility is restricted. In addition, serum ferritin is a positive acute-phase reactant, meaning its plasma concentration will be increased in a state of underlying inflammation and malnutrition, resulting in a higher serum ferritin level regardless of the patient's true iron status (Kalantar-Zadeh et al., 2003; Kalantar-Zadeh et al., 2004). Based on these data, nurses and fellow staff members were taught to investigate the cause of high serum ferritin levels, such as inflammatory sources, rather than assume the patient has excess iron stores, especially in the presence of TSAT levels that suggest insufficient iron status. This information is particularly relevant for nurses because they are responsible for detecting infection and inflammation as a causative factor for an insufficient response to an ESA.

It is important to note that recent evidence from the DRIVE trial has demonstrated that most anemic hemodialysis patients who have elevated serum ferritin and low TSAT levels suffer from inflammation, as measured by elevated C-reactive protein levels (Coyne et al., 2007). In this trial, a 1-g course of IV iron therapy was effective in overcoming inflammation-mediated reticuloendothelial blockade in patients who received adequate ESA doses and had Hb 11 g/dL or less, serum ferritin 500 to 1200 ng/mL, and TSAT 25% or less. In addition, IV iron administration did not worsen existing inflammation.

Because baseline serum ferritin values are a poor predictor of response to IV iron therapy, the principal outcome of the educational program was to encourage a philosophy of treating the whole patient, without relying only on iron parameters to guide anemia management. By assessing all available patient information, such as patient history, clinical status, hematologic and iron indices, and ESA dose/response, nurses can better determine if the patient needs iron supplementation. The program also emphasized the importance of nurses and other staff members familiarizing themselves with the 2006 update to the KDOQI guidelines and recommendations for anemia management. The educational presentations offered through the CQI initiative were complemented by the development and implementation of IV iron protocols that simplified the anemia process and reflected the KDOQI guidelines and recommendations.

Nurses were informed to initially address anemia by following a simple IV iron repletion protocol, consisting of sodium ferric gluconate 125 mg delivered at 8 consecutive dialysis sessions, when TSAT levels were less than 20% and serum ferritin levels were less than 100 ng/mL (parameters established in the 2001 KDOQI guidelines, which have been updated in the 2006 version). This protocol called for blood work to be repeated within 5 to 7 days of completing the

IV iron regimen. If the values of serum ferritin and TSAT increased and target Hb levels were achieved with the current ESA dose, nurses followed a continuous IV iron therapy regimen.

On the other hand, if patients were on a continuous IV iron and ESA regimen but did not achieve Hb levels of greater than 11 g/dL, nurses directed patients to the anemia manager for follow-up, thereby providing an opportunity for individualized patient care. The anemia manager consulted a separate intervention protocol to address anemia correction in these patients. Anemia managers were alerted to rule out iron-restricted erythropoiesis and possible underlying bleeding, as well as markers of infection or inflammation, elevated parathyroid hormone, or other causes of ESA hyporesponse. The anemia management team noted during the educational presentations that this new process was only a starting point and that the anemia manager should evaluate all aspects of patient care and laboratory trends over time to appropriately assess an apparent lack of ESA efficacy. Furthermore, if patients did not fit the specified categories or interventions were ineffective, anemia managers were directed to consult the attending nephrologist.

A triage supplement checklist also was available to anemia managers if the patient presented with multiple complications, if the patient had been treated for iron-restricted erythropoiesis without success, or if the anemia manager was uncomfortable proceeding directly to interventional treatments without assessing the patient for possible underlying causes of abnormal laboratory findings. The checklist directed anemia managers to rule out inflammation and infection as causes of ESA hyporesponse, leading to improvements in care and a more efficient utilization of staffing resources. In addition, the triage checklist included additional patient-specific questions to consider when assessing anemic patients, for example: Was the patient recently hospitalized or did the patient undergo

Table 2
Initial Changes (%) in Anemia Management Parameters, 3 Months
After Launch of the CQI Initiative

Iron Management Parameter	Change, %
Hct 30% or less	11.77%
Hct 33% or less	9.48%
Hb 11 g/dL or less	11.30%
TSAT 20% or less	29.45%
Serum ferritin 100-700 ng/mL	-1.56%
Serum ferritin greater than 700 ng/mL	9.70%
Patients receiving IV iron	32.4%
ESA use*	-21.50%
IV iron use†	29.78%

*Average units/patient/week administered.

†Average mg/patient/week administered.

Hct = hematocrit; Hb = hemoglobin; TSAT = transferrin saturation; ESA = erythropoiesis-stimulating agent

surgery? Was there any change in access? Is the patient experiencing gastrointestinal bleeding or access bleeding? All of these tools helped to facilitate the management of anemia in patients on hemodialysis and maximize patient outcomes. To review the IV iron protocol, anemia manager intervention recommendation, and triage checklist, please see the article by Bowe & Ammel, in the *Nephrology Nursing Journal* (2005, volume 32, pp. 535-543).

CQI Initiative Results: Improvements in Anemia Management

Three months after the debut of the new management protocol under the CQI initiative, nurses and other members of the anemia management team conducted an analysis of the dialysis centers' annual data and concluded that the educational presentations and standardized protocols had a positive effect on outcomes as measured by the monthly use of ESA and IV iron therapy. However, some participating clinics performed better than others, and this initial analysis will be used to identify areas for further educational needs and clinical

goal reinforcement. In addition, this analysis was not designed with the rigor of a scientific study, and therefore the reasons for improvements are difficult to identify and are speculative.

The primary conclusion from the analysis is that the seesawing effect of administering IV iron and then withholding iron was stabilized as a result of the new IV iron protocol. In addition, there was a decrease in the percentage of patients with serum ferritin levels greater than 800 ng/mL, which may be due to several factors: (1) a protocol design that specified a 50% decrease in iron dose when serum ferritin levels were greater than 500 ng/mL but less than 800 ng/mL, (2) improved overall patient care thus reducing serum ferritin levels associated with inflammation, (3) improved efficacy of continuous IV iron delivered weekly or every other week, and (4) a better understanding of the clinical significance of serum ferritin levels. Because nurses were well educated on the proper assessment of patients with higher serum ferritin levels, more patients with serum ferritin greater than 800 ng/mL are now treated with an IV iron challenge, followed by an assessment of the clinical

response to guide further treatment.

A greater number of patients also achieved target Hb levels after the launch of the CQI initiative, which may be due to more aggressive treatment of the inflammatory processes that lead to ESA hyporesponse and blocking of iron stores. Additionally, treatment of iron-restricted erythropoiesis on a more frequent basis, normalization of ESA dosing, and an increase in the number of patients receiving IV iron may have improved Hb targets. A summary of the changes in anemia management parameters at 9 participating Fresenius Medical Care dialysis centers, 3 months after the launch of the CQI initiative, is presented in Table 2.

Finally, nurses have an essential role in facilitating a CQI initiative and helping to improve anemia management, including:

- Assessing current IV iron and anemia management trends
- Identifying poor responders to present practices
- Recommending new interventions to improve patient outcomes
- Tracking, compiling, and presenting new data to the team
- Researching existing IV iron protocols to compare with current practices
- Monitoring patient's response to IV iron and ESA therapy
- Assessing infection and inflammation in patients
- Evaluating the whole patient to guide treatment-related decisions

CQI Initiative: Next Steps

It will be important to maintain the positive trend of improved outcomes achieved through the first phase of the CQI initiative, and nurses and other team members should regularly evaluate anemia management processes and troubleshoot any potential problems as needed. This can be accomplished through a series of regular activities. For instance, nurses should continue to monitor patient outcomes and triage patients

more effectively when they present with elevated serum ferritin levels, exorbitantly high ESA doses, and suboptimal Hb levels. This triage process will be important to effectively manage staff time and increase the percentage of patients achieving target Hb values.

Tools should also be developed to monitor anemia manager compliance to the protocol between clinic locations, determine better processes to evaluate previously identified data conditions that may warrant further analysis, and establish a communication plan to relay the critical aspects of the program to other anemia managers for implementation.

Supplementary follow-up education should be provided to nurses and fellow staff members on a quarterly or semiannual basis to cover any gaps in knowledge and address any changes to anemia management protocol. Importantly, appropriate staff members should be identified and trained to serve as anemia educators, who will be needed to continue the learning process for new and existing staff.

Practical Strategies for Implementing A CQI Initiative for IV Iron and Anemia Management

A successful CQI initiative requires effective collaboration among nurses, physicians, dietitians, and other staff members in developing and implementing a streamlined IV iron and anemia management protocol. Nurses who want to initiate a center-specific plan for quality improvement can consider the following strategies.

- Dialysis personnel can compare a center's anemia management outcomes with national trends through a standard literature review. Nurses, physicians, dietitians, and other staff members should be consulted to encourage a collaborative approach to more effective IV iron and anemia management, an improved use of staff time, and enhanced

patient outcomes. Updated anemia management protocols should reflect the KDOQI guidelines and recommendations and successful processes described in the literature.

- Educational and therapeutic goals should be determined prior to the launch of a CQI initiative to track the success of the program. Possible goals can include educating staff on factors that cause ESA hyporesponse and increased serum ferritin levels, improving the number of patients achieving target Hb levels, providing a balanced regimen of IV iron and ESA therapy, and simplifying the anemia management process.
- Educational programs that address specific iron management issues, such as iron physiology, the utility of serum ferritin as a marker, and the important role of IV iron therapy, should be required for dialysis anemia managers before the implementation of a new management protocol. Educational programs also should encourage anemia managers to assess every patient on an individual basis and avoid excessive reliance on laboratory values to guide treatment. A meeting should be held to address staff members' questions or concerns before the launch of a new management protocol.
- A clinic can implement a simple IV iron repletion protocol to guide treatment in anemic patients presenting with TSAT levels of less than 20% and serum ferritin levels of less than 200 ng/mL. If, after completing a course of IV iron therapy, the patients' serum ferritin and TSAT levels increase and target Hb levels of greater than 11 g/dL are achieved without changing the ESA dose, a continuous IV iron therapy regimen can be

implemented. Conversely, if Hb levels of greater than 11 g/dL are not achieved, staff members should be instructed to consult with the anemia manager and attending nephrologist to provide more individualized care.

- Develop a separate intervention protocol to address anemia correction in patients who do not achieve Hb levels of greater than 11 g/dL under an iron repletion protocol to rule out iron-restricted erythropoiesis, possible underlying bleeding, markers of infection or inflammation, elevated parathyroid hormone, or other causes of ESA hyporesponse. A triage checklist also can be developed under a new protocol for use by anemia managers to assess abnormal laboratory findings in patients with multiple complications.

Conclusion

Standardized anemia management protocols and educational collaboration among nurses, physicians, dietitians, and other staff members can improve the ability of centers to achieve IV iron management targets and lead to a better use of staff time. Furthermore, an improved understanding of the underlying causes of high serum ferritin, including inflammatory processes, allows nurses to properly address the underlying inflammation and improve the erythropoietic response. Finally, implementing a balanced approach to IV iron and ESA therapy can maximize patient outcomes.

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