Intravenous Iron Order Set Optimization at an Academic Medical Center

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Purpose

Iron deficiency anemia (IDA) can occur from decreased iron absorption or increased iron loss such as hemorrhage, inflammatory bowel disease (IBD), or chronic kidney disease (CKD). Oral iron products are a cost-effective treatment; however, they can cause gastrointestinal (GI) upset and are absorbed slowly. Intravenous (IV) iron products are ideal for patients who cannot tolerate oral iron; however, carry risk for infusion reactions and iron overload. A drug utilization evaluation of adult patients receiving IV iron products at The University of Kansas Health System discovered differences in prescribing patterns among services and indications. Seventy one percent of orders were not ordered through the IV iron order set, which removes monitoring parameters, vital checks, and infusion reaction medications. Twenty seven percent of patients receiving IV iron products did not have iron studies (serum iron, ferritin, transferrin saturation, and total iron binding capacity) within 14 days prior. Twenty three percent of patients received greater than 1000 mg in a 14-day period, especially when considering iron supplied from blood transfusions, which risks iron overload. Order set optimizations were necessary to encourage order set use and maximize appropriate drug utilization and patient safety outcomes. Additionally, an outpatient anemia clinic served as a potential site for patients to receive treatment in the outpatient setting. The purpose of this study was to assess the impact of order set optimization on IV iron ordering practices based on indication and patient safety outcomes.

Methods

This study was an IRB-approved single site, quasi-experimental chart review comparing pre-intervention and post-intervention data. Optimizations to the IV iron order set included: restricting IV iron to the order set, populating iron studies into the order, including oral iron plus ascorbic acid to promote utilization when appropriate, a statement indicating the maximum recommended iron in a 14-day period including iron from blood products, indication-specific guideline table for appropriate use based on lab values, and a drop down selection of indication when ordering. Education was provided to pharmacists and a multi-disciplinary committee of acute care providers. Post-implementation data was collected after the intervention go-live date on December 3rd, 2020. Descriptive statistics were used to assess post-intervention data independently. Chi-square and t-test analyses were used to compare pre/post-intervention data. The primary endpoint of this study was appropriate use of IV iron based on indication and total iron received in a 14-day period. Indication was assessed using the indication selected through the order set, cross-referenced with associated diagnosis through chart review, and the corresponding lab values to support the selected indication. Total iron received was assessed by identifying if greater than 1000 mg of iron was administered within a 14-day period including IV iron products and blood products (assuming maximum estimated iron per unit of blood to be 250 mg). Safety endpoints included decrease in patients receiving greater than 1000 mg of iron post-intervention and increase in availability of pre-medications or infusion reaction medications. Secondary endpoints included cost savings based on average total dose received post-intervention and number of referrals made to the outpatient anemia clinic.

Results

From two-hundred fifty-six patients screened, two-hundred fifty-two patients were included as four patients were excluded due to age less than 18 years old. Baseline demographics between pre/post-intervention populations were comparable. Approximately ninety-eight percent of patients received iron sucrose at an average dose of 288.8 mg per dose for 2 doses for a total average dose of 587.7 mg (including all IV iron doses within 14 days and iron from blood products). Roughly seventy-three percent of IV iron ordered had "IDA" as a selected indication; when cross-referenced with corresponding diagnoses, only 68.1% of "IDA" orders had formal IDA diagnoses. The remaining 30.3% were found to be diagnoses without guideline-recommended lab values, such as postpartum anemia and acute blood loss, and 1.6% as CKD. Appropriate indication of IV iron was accomplished 56.3% of the time in the 190 patients with iron studies available to assess. Appropriate total dose received (<1000 mg including all IV iron doses and iron from blood products) was accomplished 88% of the time out of all 252 patients. Pre/post-intervention comparison found a significant decrease in patients receiving a cumulative IV iron dose >1000 mg (23.1 vs 11.9, p=0.001), and a significant increase in order set utilization (29 vs 96.8, p=0.001). Pre/post-intervention comparison found no significant difference in total IV iron dose (including only IV iron ordered inpatient). After implementation of the electronic referral process for the outpatient anemia clinic, it was discovered the referral did not appropriately route patients to the clinic and the number of patients referred was unable to be assessed.

Conclusions

Health system providers are appropriately using IV iron 56.3% of the time when iron studies are available and appropriate indication is selected, with 86% of patients appropriately receiving total iron doses <1000 mg (including total IV iron doses and iron from blood products). Elevated ferritin in acute disease states likely confounded results of appropriate IV iron use when matching lab values to selected indications. Selection of "IDA" as an indication without a supporting diagnosis may be due to placement of IDA at the top of the drop-down list of indications within the order set. These outcomes may be further improved with more patients having recent iron studies available, more accurate selection of indication with supporting diagnosis and lab values, and guidance for indications without guidelines recommendations (postpartum anemia) through health system protocols. Pre/post-intervention comparison showed improved patient safety post-intervention through an increase in order set utilization, correlating with increased availability of pre/peri-infusion reaction medications, and decreased number of patients receiving cumulative iron doses >1000 mg. These outcomes were likely influenced by restricting IV iron products to ordering solely through the order set, inclusion of the statement warning of iron present in blood products, and education to providers on these interventions. With no difference in average dose pre/post-intervention and an inability to appropriately track electronic referrals to the outpatient anemia clinic, cost savings was not able to be appropriately measured. However, future impact of the order set optimizations may be measured through a working electronic referral process. Additionally, subgroup analysis of IV iron dosing per indication could provide further insight into appropriate prescribing practices.