Giving intravenous iron to patients with symptomatic heart failure is safe and cost effective

Abstract

Aims/Background Heart failure affects approximately 1 million people in the UK, adversely affecting quality of life, functional capacity and cognitive health. Iron deficiency complicates heart failure in approximately 50% of patients. Giving intravenous ferric carboxymaltose has been shown to improve quality of life in patients with heart failure (New York Heart Association class and Kansas City Cardiomyopathy Questionnaire).

Methods A quality improvement project was designed to assess the feasibility, safety and cost implications of establishing an intravenous iron service in the authors' centre.

Results Between July and December 2019 61 patients who were screened met the inclusion criteria and were administered intravenous ferric carboxymaltose. There were statistically significant improvements in ferritin levels (83.3 ug/litre to 433 ug/litre; $P<0.0001$), transferrin saturation (18% to 30%; $P<0.0001$) and haemoglobin levels (126 g/litre to 135 g/litre; $P<0.01$). No demonstrable changes in New York Heart Association class or quality of life scores were noted. The overall financial impact for the trust was income generation of £14 665, a net income of £240 per patient.

Conclusions Intravenous iron replacement with ferric carboxymaltose is safe and cost effective, and should be considered in eligible iron-deficient patients with symptomatic heart failure. Integration with another day case intravenous service represented the most logistically simple and economically viable method of service delivery.

Key words: Heart Failure, Intravenous, Iron

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Introduction

Heart failure affects approximately 1 million people in the UK, adversely affecting their quality of life, functional capacity and cognitive health. This results in frequent hospitalisation and significant healthcare costs (Ambrosy et al, 2014; Bhatnagar et al, 2016). Iron deficiency complicates heart failure in approximately 50% of patients (von Haehling et al, 2019) and is increasingly recognised as a significant contributor to morbidity in this group. Giving intravenous ferric carboxymaltose has been shown to improve quality of life (New York Heart Association class and Kansas City Cardiomyopathy Questionnaire), performance in 6-minute walk test and reduce hospitalisation. It is now recommended for use in selected patients with heart failure as per international guidelines (McMurray and Pfeffer, 2005; Ponikowski et al, 2015, 2016; Cannon et al, 2017).

Background

Liverpool Heart and Chest Hospital is a large, tertiary cardiology centre that provides cardiothoracic care in the north west of England. At the authors' centre, optimisation of heart failure medication is undertaken by specialist nurses under the auspices of the consultant cardiologist. An audit of referrals to the nurse-led heart failure clinic over a 3-month period from January to March 2019 demonstrated that just 6% (13/216) of patients were screened for iron deficiency. There was no current service available to deliver iron replacement therapy to eligible patients.

A quality improvement project was subsequently designed to assess the feasibility, safety and cost implications of establishing an intravenous iron service to provide guideline-mandated care for eligible patients with heart failure in a large tertiary cardiology centre.

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Method

Based on recommendations from the European Society of Cardiology guidelines and in conjunction with the trust's existing transfusion service, information technology team, clinical governance team, pharmacy, clinical coding and finance department, the heart failure team developed an intravenous iron policy. The driver diagram in Figure 1 set out the goals and main elements of the project.

Between July and December 2019, outpatients who attended consultant or nurse-led heart failure clinics with symptomatic heart failure (New York Heart Association class ≥2) and severe left ventricular systolic dysfunction (left ventricular ejection fraction ≤40%) were screened, and serum iron studies performed. In accordance with the policy, patients with iron deficiency (ferritin <100 ug/ml or 100–300 ug/ml and transferrin saturation <20%) were included in the pilot and referred for intravenous iron infusion. Patients were excluded if polycythaemic (haemoglobin ≥150 g/litre) or if there was evidence of active infection. Those found to have iron-deficiency anaemia were informed and referred back to their GP for further investigation where required.

The planned intervention was conveyed to GPs with an 'intravenous iron' letter and patients were invited to attend as day case admissions for treatment. Intravenous ferric carboxymaltose was prescribed electronically the day before admission and then administered by the trust transfusion nurse within the existing infrastructure of the transfusion service. This aimed to avoid the need for additional staff, reduce the requirement for training and improve productivity in the service.

On completing the intravenous ferric carboxymaltose therapy an email was sent to the heart failure nurse team and a 12-week follow-up appointment was made where quality of life scores (New York Heart Association and Kansas City Cardiomyopathy Questionnaire)

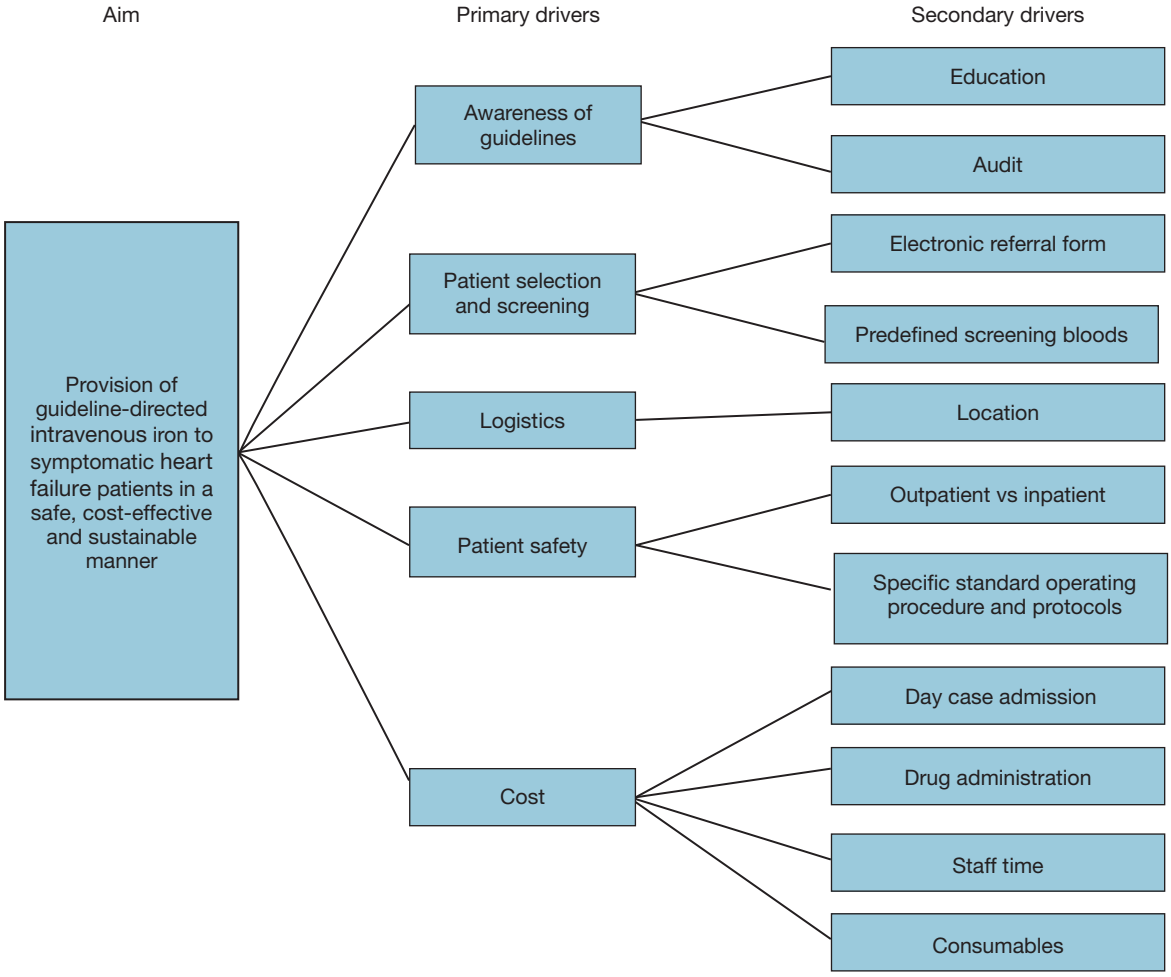

Figure 1. Primary aim and drivers of the intravenous iron service.

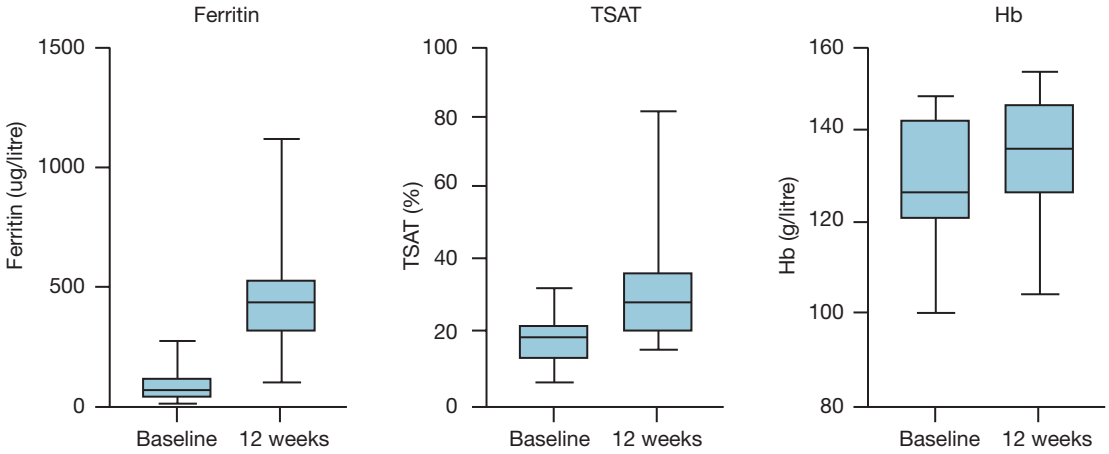

Figure 2. Changes in ferritin, transferrin saturation (TSAT) and haemoglobin (Hb) at 12-week follow-up appointment.

and serum measures of iron deficiency (ferritin, transferrin saturation, haemoglobin) were compared with baseline measures. Patients who did not require ongoing specialist follow up were discharged back to the GP with advice to monitor iron levels in 12 months' time and re-refer to the service where appropriate.

The financial impact was calculated by subtracting the total cost of administration (day case admission, drug administration, staff time, consumables) from the received tariff. Coding varied slightly depending on the presence of anaemia associated with underlying iron deficiency.

Statistical analysis was performed using the chi-squared test for categorical variables.

Results

During the pilot period, July 2019 to February 2020, 61 patients underwent intravenous iron replacement (69% male, mean age 66 years) with no significant adverse events or hospital admissions. There were statistically significant improvements in ferritin (83.3 ug/litre to 433 ug/litre; $P<0.0001$), transferrin saturation (18% to 30%; $P<0.0001$), and haemoglobin (126 g/litre to 135 g/litre; $P<0.01$) (Figure 2). No demonstrable changes in New York Heart Association class or quality of life scores were noted. Mean New York Heart Association class and Kansas City Cardiomyopathy Questionnaire scores were unchanged, at 2.5–2.3 ($P=0.09$) and 35–36 ($P=0.68$) respectively.

Having initially audited referrals to the nurse-led heart failure clinics between January and March 2019, new clinic referrals were subsequently re-audited between November 2019 and January 2020 and a significant improvement in the appropriate evaluation of heart failure patients for iron deficiency was identified. Rates of screening for iron deficiency rose from 6% (13/216) before the start of the quality improvement project to 41% (92/227) after its implementation ($P<0.001$).

Costing

Tariffs varied depending on the complexity and comorbidity score of the patient and whether or not there was concomitant anaemia. The average tariff was £410 for the first infusion and £477 for the second. Among this cohort, 57% ($n=35$) of patients required two ferric carboxymaltose infusions. Average expenditure was £258 and £323 for the first and second infusions respectively. The overall financial impact for the trust was income generation of £14 665, a net income of £240 per patient.

Discussion

A clear mandate exists for the use of intravenous iron in the management of patients with chronic, symptomatic heart failure who have iron deficiency. Data from randomised

Key points

- The use of intravenous iron in patients heart failure and iron deficiency is safe and cost effective.
- Integrating an intravenous iron service with existing transfusion or infusion services reduces the need for additional training and helps to improve cost effectiveness.
- The development of an iron policy with clear indications and exclusions criteria combined with an electronic referral pathway helped to reduce the time required to screen referrals.

controlled trials have established the quality of life benefits associated with intravenous ferric carboxymaltose and results are awaited from larger trials with regard to outcome data.

This project demonstrates the feasibility of providing guideline-directed intravenous iron for patients with heart failure in this region, in a manner that is safe and sustainable. The service has been well received by the patients themselves, many of whom have taken to the time to leave positive feedback, with one making a generous contribution to the trust charity fund.

The authors feel that there are a number of factors that have contributed to the success of this project, which should be considered if the results are to be replicated elsewhere. First, the availability of a clear iron policy describes inclusion and exclusion criteria to identify eligible patients for treatment. Second, a prespecified order set to enable appropriate screening of eligible patients without wasteful duplication of resources. Finally, by developing a pathway that integrates the iron service into the existing transfusion service, the authors were able to minimise the need for additional training and make more efficient use of available space in the trust.

The coding of the procedure is key to financial viability. In order to obtain appropriate remuneration, intravenous iron was given as part of a day case admission, rather than through the outpatient service and coded for accurately.

It is important to note that, in contrast to previous intravenous iron preparations, intravenous ferric carboxymaltose does not need to be preprepared and as such, does not need to be prerequested from pharmacy. This has been a significant obstacle to the delivery of intravenous iron in the past.

Moving forward, the authors plan to improve access to the intravenous iron service by allowing referrals from all the cardiology clinics. This quality improvement project has allowed the authors to refine the electronic referral pathway so that this is streamlined for physicians who are less accustomed to the specific indications and exclusions for iron replacement. The heart failure specialist nurses are being upskilled to include intravenous iron prescribing.

Conclusions

Intravenous iron replacement with ferric carboxymaltose is safe and cost effective and should be considered in eligible iron-deficient patients with symptomatic heart failure. In the authors' centre, where identification of iron deficiency has not necessitated a dedicated service, integration with another day case intravenous service was the most logistically simple and economically viable method of delivery.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

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