Exploring the evidence: Maternity Blood Optimisation (MBOP): a practice improvement strategy

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Background

Although iron-deficiency and anaemia are common in pregnancy, prevention and management is surprisingly challenging and often inconsistent. Anaemia in pregnancy reduces tolerance to blood loss and is associated with increased morbidity, mortality and other adverse maternal and infant outcomes - although the evidence is limited. With advances in patient blood management, the focus is on comprehensive evidence-based clinical guidance to progress the management of iron-deficiency +/- anaemia from early in pregnancy to postpartum; to improve outcomes and reduce interventions.

Methods

The Australian Red Cross Blood Service (ARCBS) practice improvement strategy* has been adapted as a Maternity Blood Optimisation (MBOP) pilot, by a multi-disciplinary team in one New Zealand area. However, specific challenges in applying current evidence to clinical practice remain. The main challenges are: defining treatment thresholds for iron-deficiency and anaemia; the influence of inflammation on hepcidin-mediated iron balance and oral iron dosing regimens. This pilot will be audited post-implementation.'

Results

MBOP pre-pilot data showed that of the 85% of second trimester women (n=4411) who had ferritin tested (n=3766), 82% were iron-deficient and 7% had iron-deficiency anaemia. The ARCBS practice improvement strategy has reduced the rate of anaemia at delivery from 12% to 3%.

Discussion

Although the unresolved complexities of iron metabolism create challenges in applying the evidence to clinical guidelines and practice, **knowledge advancements do suggest improved pathways for managing iron status beyond haemoglobin testing alone - based on a consistent approach of early recognition, prevention and treatment of iron deficiency with or without anaemia.**

The Challenges

Thresholds

Diagnosing anaemia in pregnancy is inherently complicated by physiological changes and demands. Furthermore, there is no agreed normal haemoglobin reference range, or **optimal value** to define anaemia throughout pregnancy. **There appears to be a fine balance between too little and too much iron.** In the absence of clear population-based evidence, MBOP has settled on parameters consistent with current WHO and Centre for Disease Control parameters, and local data.

The evidence to support any recommended serum ferritin (SF) cutoff for diagnosing iron-deficiency is also limited. The common cut-off of 15mcg/L is specific but not sensitive, missing many cases of iron-deficiency (perhaps half). An SF cutoff <30mcg/L has higher sensitivity, but more false positive diagnoses. More primary research is urgently required on iron indices, especially for pregnant women. Diagnosis of iron-deficiency in the absence of inflammation is otherwise (relatively) straight forward!

Oral iron

Nausea and constipation are well known side effects of oral iron, commonly affecting compliance to treatment for low iron status. Side effects to oral iron are dose related. Hepcidin controls iron absorption, bioavailability and release from stores. Well-designed RCTs have demonstrated that hepcidin increases in response to oxidative stress or inflammation induced from high doses of oral iron. This mechanism explains why single doses of oral iron on intermittent days appear to be almost as effective as multiple daily doses in treating non-anaemic iron-deficiency, with less side effects. However, there is no published evidence replicating these findings in anaemic pregnant women.

Ferritin, hepcidin and Inflammation

Hepcidin is a liver hormone and the master-regulator of iron-metabolism that tightly controls iron balance. Hepcidin levels decrease in iron-deficiency and iron-deficiency anaemia, enhancing absorption and bioavailability of iron. Hepcidin increases with inflammation, infection, and increased iron levels. When hepcidin increases, circulating iron is sequestered in macrophages, where the iron is unavailable for release (ferritin levels increase). **Because ferritin is an inflammatory marker, diagnosis of iron-deficiency in the presence of inflammation (CRP>5mg/L) requires a higher ferritin cut off - however this is not clearly defined and may be as high as SF <100mcg/L.** Obesity and diabetes are inflammatory states common to pregnancy, presenting a significant challenge in diagnosing iron-deficiency in these groups of women, as inflammation masks iron-deficiency.

References

*Flores C, Sethna F, Stephens B et al. Improving patient blood management in obstetrics: snapshots of a practice improvement partnership. BMJ Quality Improvement reports, 2017; 6: e000009

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