

# Investigating iron deficiency in the severely obese: challenges and solutions

Obesity, arguably the single most important public health challenge of our times, is directly linked to diseases including type 2 diabetes mellitus, hypertension, ischaemic heart disease, obstructive sleep apnoea, osteoarthritis and various cancers. People who are overweight or obese also have a higher risk of micronutrient deficiencies including iron deficiency. The prevalence of iron deficiency may be as high as 44% in obese individuals before bariatric surgery (Flancbaum et al, 2006). Although an obesity-related pro-inflammatory state may contribute to a functional iron deficiency, the aetiology appears to be multifactorial and includes over-expression of hepcidin, a key regulatory peptide hormone produced by hepatocytes that modulates iron absorption across the gut mucosa and iron release from stores, as well as nutritional and gastrointestinal factors (Zafon et al, 2010).

Increased prevalence of iron deficiency is seen in obese people irrespective of gender or age. Continuous data from the large population-based National Health and Nutrition Examination Survey provide evidence of a strong inverse relationship between iron levels and the level of individual body mass index in women with no evidence of a differential impact on iron levels by either race or age (Neymotin and Sen, 2011). Menstrual blood loss alone cannot explain the iron deficiency in obese females, as low serum iron indices have been reported in overweight and obese pre-pubertal children and adolescents (Pinhas-Hamiel et al, 2003). Similarly iron deficiency anaemia has been reported among both male and female elderly obese patients (aged 65–91 years) in association with elevated prohepcidin levels, suggesting obesity-related pro-inflammatory state as a contributory factor (Przybyszewska et al, 2011).

## Guidelines for management of iron deficiency anaemia

The British Society of Gastroenterology has produced clear guidelines for the man-

agement of iron deficiency anaemia in the general population (Goddard et al, 2011). In brief, the recommendations include:

- Upper and lower gastrointestinal investigations should be considered in all postmenopausal female and all male patients where iron deficiency anaemia has been confirmed unless there is a history of significant overt non-gastrointestinal blood loss
- If gastroscopy is performed as the initial gastrointestinal investigation, only the presence of advanced gastric cancer or coeliac disease should deter lower gastrointestinal investigation
- In patients over 50 years of age or with marked anaemia or a significant family history of colorectal carcinoma, lower gastrointestinal investigation should still be considered even if coeliac disease is found
- Colonoscopy has advantages over computed tomographic virtual colonography for investigation of the lower gastrointestinal tract in iron deficiency anaemia, and either is preferable to barium enema
- Upper and lower gastrointestinal investigation of iron deficiency anaemia in post-gastrectomy patients is recommended in those over 50 years of age.

## Challenges to investigating iron deficiency in the severely obese

Gastroscopy in people with morbid obesity including those awaiting bariatric surgery is safe and can delineate anatomical abnormalities that might influence the choice of surgical procedure. One large prospective series of 626 gastric bypass patients reported detection of upper gastrointestinal abnormalities on routine preoperative gastroscopy in 288 (46%) patients whose mean  $\pm$  standard deviation age was  $40 \pm 11$  years (Munoz et al, 2009); common findings included gastritis, oesophagitis and hiatus hernia, rarely gastric and duodenal ulcers, and one case of gastric cancer. However, routine preopera-

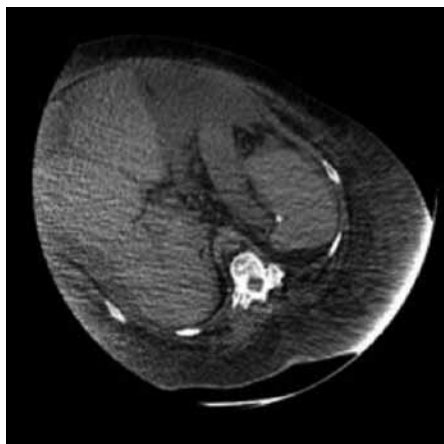
tive gastroscopy remains controversial as the detection rate of significant upper gastrointestinal pathology in asymptomatic subjects varies widely in the literature.

Furthermore, severe obesity presents particular logistical and technical challenges to performing gastrointestinal investigations. Logistical limitations include availability of adequate facilities and equipment. For instance, the maximum load capacity of an endoscopy bed is usually 150 kg. Technical challenges include ensuring the safety of sedation in severely obese patients who not infrequently have comorbid conditions such as obstructive sleep apnoea, obesity hypoventilation syndrome and ischaemic heart disease. The patient might find endoscopy difficult to tolerate because of obesity-related chronic back pain and arthritis of the hips and spine. Colonoscopy is particularly challenging as the standard textbook techniques for loop reduction may not be feasible and changing the patient's position during the procedure could be difficult and impractical. One may also anticipate a higher rate of complications post-procedure and longer time spent in recovery.

Alternative radiological imaging such as computed tomographic virtual colonography and barium studies have similar logistical and technical challenges including load capacity of the scanner and degraded image quality which limit the diagnostic value of the studies (*Figure 1*).

## Possible solutions

To overcome these challenges the authors propose a pragmatic adaptation of the British Society of Gastroenterology guidelines in the severely obese patient with iron deficiency anaemia who is awaiting bariatric surgery. They recommend that gastroscopy should be undertaken preoperatively whenever feasible, particularly in patients undergoing gastric bypass as the bypassed stomach and duodenum will no longer be accessible to the endoscope after surgery. Preoperative gastroscopy may be less



**Figure 1. Computed tomography of the abdomen in a patient who weighed 180 kg. The diagnostic value of the study was severely limited as the entire abdominal cavity could not be accommodated within the field of view of the scanner and there was a large amount of streak artefact degrading the quality of the images.**

imperative in obese patients undergoing gastric banding and sleeve gastrectomy as these operations do not prevent endoscopic access to the native or remnant stomach.

Obese patients are at significantly increased risk of colon cancer. The National Audit Office has estimated that the relative risk of colon cancer in obese men and women is 3.0 and 2.7 respectively (Bourn, 2001). The European Prospective Investigation into Cancer and Nutrition study, a large, prospective cohort of 0.5 million participants without prevalent cancer at baseline from 10 European countries including the UK, has confirmed that central obesity is strongly linked to colorectal cancer incidence in both men and women (Pischon et al, 2006). A large retrospective analysis of 3798 gastrointestinal investigations in 2600 patients presenting to a district general hospital with unexplained iron deficiency anaemia reported that 4% of

patients were diagnosed with a colorectal malignancy, with 40% 5-year survival in those detected by colonoscopy (Stephens et al, 2006).

The authors recommend that colonoscopy should be undertaken in obese people with iron deficiency as soon as technically and logistically feasible following bariatric surgery when they have lost adequate weight. This could be as early as 6 weeks after bariatric surgery. For instance, patients lose 25%, 25% and 13% of their excess weight (the difference of actual weight and ideal weight based on a body mass index of 25 kg/m<sup>2</sup>) at 6 weeks and 45%, 40% and 22% at 3 months after gastric bypass, sleeve gastrectomy and gastric banding respectively (BJ Ammori, unpublished data, 2012).

Iron deficiency anaemia following gastric bypass surgery is commonly a result of inadequate intake of dietary iron and limited absorption of iron supplements. However, post-gastric bypass patients with red flag signs, such as gastrointestinal bleeding and excessive weight loss (especially after having achieved weight stabilization), should undergo a standard gastroscopy to examine the gastric pouch and gastrojejunal anastomosis, and a colonoscopy. If these prove unrevealing, endoscopic assessment of the excluded stomach may be necessary. Whereas the excluded stomach may be accessed by retrograde duodenogastrosopy in patients with a short proximal gastric bypass, laparoscopic gastroduodenoscopy may be required in others.

## Conclusions

Iron deficiency is common in people with severe obesity. Gastrointestinal investigations may prove logistically and technically challenging. In bariatric surgery candidates with iron deficiency anaemia gastroscopy should be undertaken before

gastric bypass surgery where feasible. Colonoscopy may be undertaken as soon as adequate weight loss has been achieved post-bariatric surgery. Further work in this area is urgently required. **BJHM**

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## KEY POINTS

- Iron deficiency in obese individuals could be multifactorial but important gastrointestinal causes should be excluded.
- In line with the British Society of Gastroenterology guidelines bidirectional endoscopies should be considered.
- Endoscopic or radiological investigations could be logistically and technically challenging in individuals with severe obesity awaiting bariatric surgery.
- In bariatric surgical candidates with unexplained iron deficiency the authors recommend that gastroscopy should be undertaken preoperatively, and colonoscopy as soon as technically and logistically feasible after adequate weight loss postoperatively.