Iron deficiency and prevalence of anemia: 3 years study after one anastomosis gastric bypass (OAGB) for severe obesity

Deeba Siddiqui, Indraprastha Apollo Hospital, New Delhi

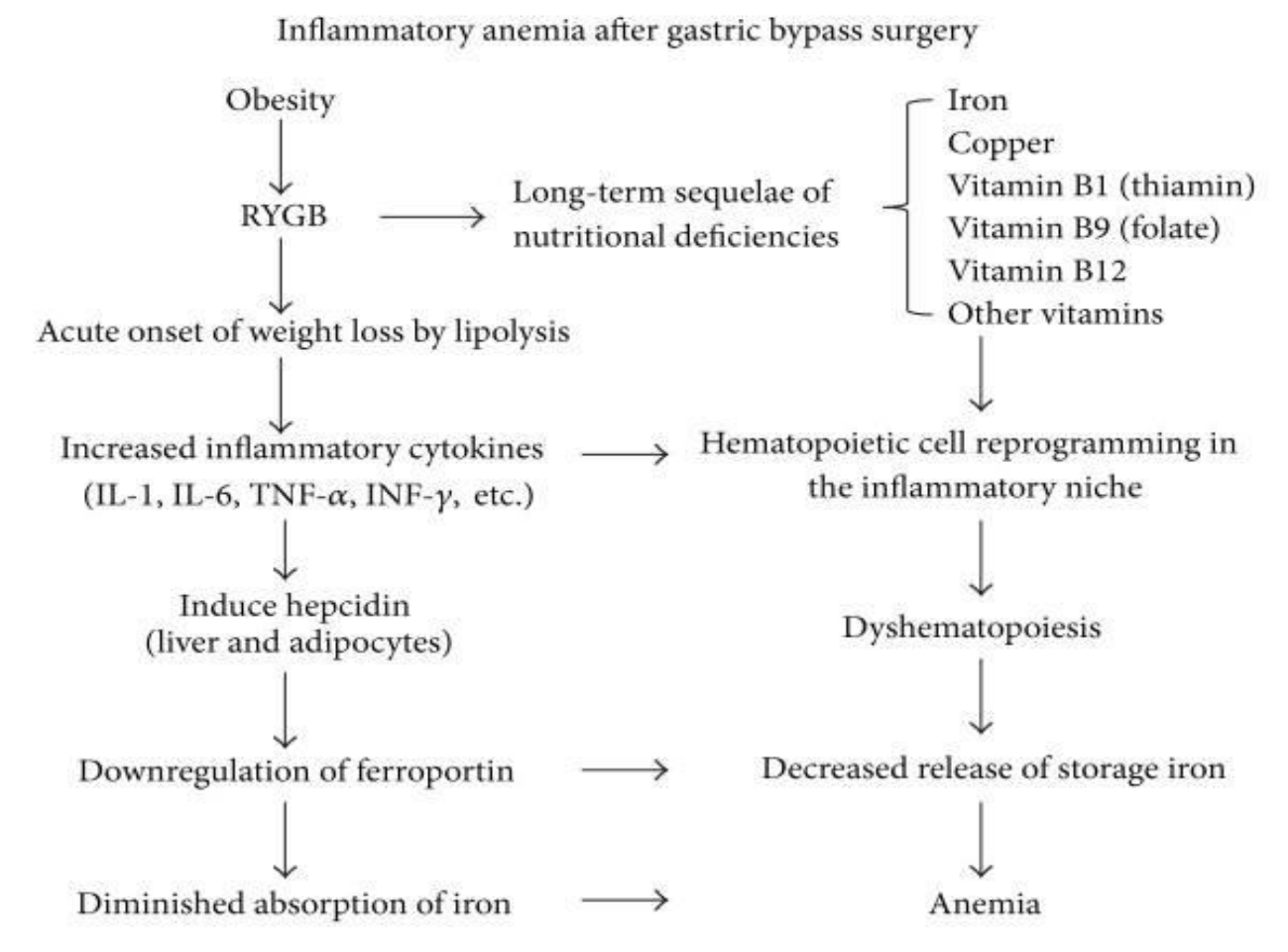
- Postoperative anemia has been reported in approximately one-fourth to one-half of the patients within 6 months to 3 years following malabsorptive procedures.

- Iron deficiency is one of the most common micro nutrient deficiencies after OAGB and is often overlooked by bariatric surgery team when patients present with vague symptoms or laboratory results do not demonstrate straightforward iron-deficiency anemia.

- The clinical relevance of iron deficiency and iron insufficiency might be misjudged as long as the hemoglobin levels are normal.

I hereby declare that we have no potential conflict of interest to report

Mechanism



- **Biological processes, such as inflammation, that stimulate hepcidin expression, will reduce iron absorption even in a state of iron deficiency**

- **The cross talk between metabolic disorders, chronic inflammation, and immune dysregulation on the one hand and long-term sequelae of nutritional deficiency on the other may lead to a complex suppression of normal hematopoiesis that often does not respond to the simple replacement of oral supplementation**

AIM

- To explore the frequency of iron deficiency and iron deficiency anemia after OAGB

- Secondary aims were to explore the present use of per oral iron supplements, the frequency of intravenous iron treatment after OAGB surgery

Materials and Methods

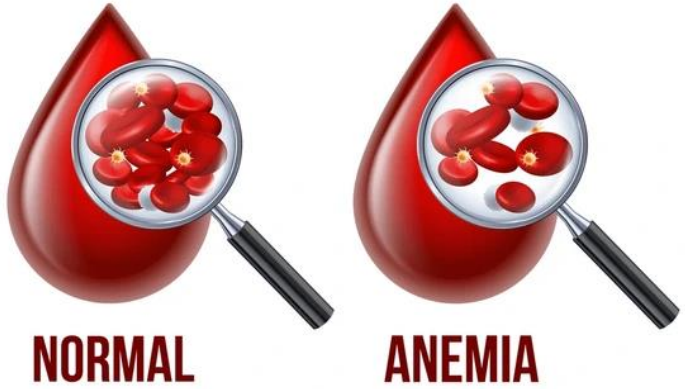
- A retrospective analysis of prospectively collected data from patients who underwent One Anastomosis Gastric Bypass surgery (OAGB)
- Duration: January 2016 and February 2022.
- Primary Bariatric Surgery
- written informed consent

Before the OAGB procedure , each patient underwent a routine upper GI endoscopy. No pathological findings that could impact the occurrence of anemia and disturbances in iron metabolism post-surgery were identified in any case.

Exclusion Criteria

1. Previous bariatric surgery
2. Not willing to give consent
3. Lack of Follow up
4. Pregnant Females

- Iron deficiency was defined as a ferritin level less than 30 ng/mL.
- Ferritin plays a major role in iron sequestration and transport, and low ferritin levels are diagnostic for iron deficiency. However, ferritin levels are increased by inflammation, and iron deficiency can therefore coexist with high ferritin levels
- Perioperative guidelines such as those by the British Committee for Standards in Hematology also consider patients to be iron deficient if the transferrin saturation is less than 20% and ferritin level is less than 100 ng/mL



Hemoglobin:

Men: <130g/L

Female (Non Pregnant): <120g/L

Ferritin:

<30 ng/mL.

Transferrin Saturation :

<20%

Variables : BMI, EWL percentage, S. Ferritin, S. Iron, TIBC, Transferrin Saturation, CBC

Frequency: Baseline,3 months, 6 months, 18 months, 24 months & 36 months

Follow-Up Program

- **The over-the-counter multivitamin and mineral-supplements, which were recommended to the patients on a daily basis, contains 30 mg iron in the form of Ferrous bisglycinate.**

(Adapted from Parrott J, et al. Surg Obes Rel Dis. 2017;13:727-741 (448))

- **Additional iron supplement was recommended on an individual basis as continuous or intermittent treatment to keep the ferritin levels above 50 µg/L**

- **When intravenous iron treatment was needed, it was mainly given as a single dose of 1 g of ferric carboxymaltose, or less often as iron sucrose 200 mg over five visits.**

Prevention

RYGB/BPD/DS & F with menses: 45-60 mg (all sources)
Oral supplementation should be taken in divided does

Repletion

Oral: 150-200 mg/day to 300 mg/2-3 times/day of elemental iron
*IV Infusion administration if not responded to oral therapy
*Divided doses separate from Calcium supplements, acid-reducing medicines & phytates/ polyphenols

Adapted from Parrott J et al. ASMBS Integrated Health Nutritional Guidelines For The Surgical Weight Loss Patient-2016 Update: Micronutrients

#Prevention: supplementation to prevent post operative micronutrient deficiency
##Repletion: therapeutic correction for postoperative deficiency of micronutrients

Statistical Methods

- Continuous normal distributed variables are reported as mean ± standard deviation (SD), and for these variables, independent t-tests have been performed.
- The non-normal distributed variables are reported as median with interquartile range (IQR), and for these variables, non-parametric Mann–Whitney U tests have been performed.
- Categorical variables are reported with numbers and percentages, and for these variables, Chi-squared tests have been performed.
- Bivariate correlation analyses were performed to explore the relationships between continuous variables.
- Differences were considered significant at $p < 0.05$.

Table 1

Patients' characteristics

	Women (270)	Men (60)	*p*
Age at baseline, years Mean (SD)	39.9 (8.9)	41.1 (9.4)	0.228
Preoperative BMI, kg/m^2 Mean (SD)	44.2 (5.2)	45.1 (6.3)	0.168
%TWL at nadir Mean (SD)	33.2 (8.6)	32.9 (10.7)	0.787

Table 2

Baseline laboratory data

Variable	Statistic (N = 330)
Hemoglobin, mean (SD), g/L	133 (12)
Ferritin, median, µg/L	70
Iron, mean (SD), µmol/L	13 (5)
Transferrin saturation, mean (SD), %	21.9 (8.5)
Vitamin B12, mean (SD), pmol/L	315 (199)
Iron deficiency status, n (%)	
Anemia	12 % (47)
Iron deficiency	18.6 % (72)
Iron deficiency anemia	5.7 %(22)

6 Months follow up

- At 6-month follow-up, 41% of patients were receiving oral iron, whereas 49% of patients were receiving an iron-containing multivitamin only.
- Mean hemoglobin remained relatively stable throughout follow-up, but the median ferritin level decreased throughout follow-up from a peak of 78 µg/L.
- Anemia, iron deficiency, and IDA were identified in 8%, 17%, and 3% of patients at 6-month follow-up, respectively.

- **Median (IQR) ferritin level was 33 (16–60) µg/L for all participants, 41 (20–81) µg/L in men, and 30 (15–57) µg/L in women.**

- **Iron deficiency (ferritin ≤ 15 µg/L) was seen in 78 (23.6%) of all participants, women 68/270 (25.1%) and men 11/60 (17.8%) ,**

- **Iron insufficiency (ferritin 16–50 µg/L) occurred in 145 (44%) of all patients, 24/60 (41.1%) men, and 121/270 (44.7%) women.**

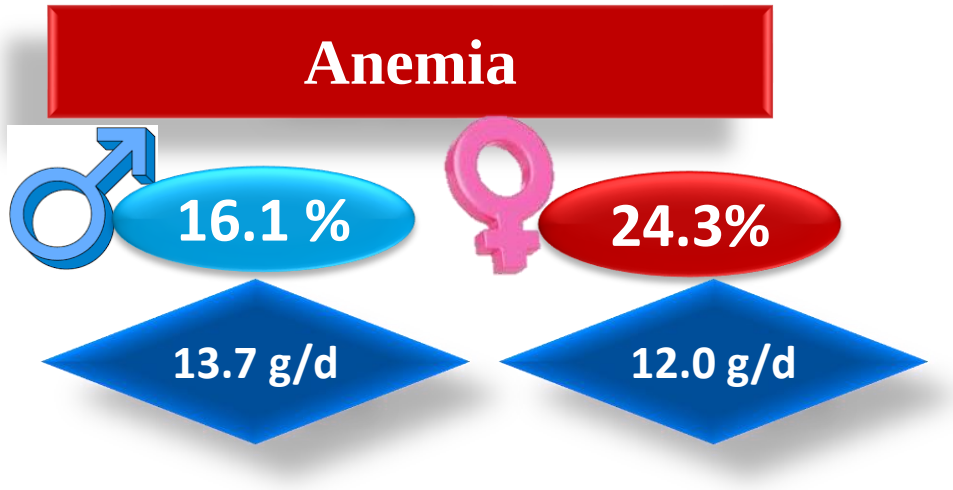
Iron deficiency=43% (as defined by WHO, a ferritin level <30 µg/mL

Our data were also reanalyzed using a ferritin cutoff of 40 µg/mL based on the results from a systematic review that demonstrated that the positive likelihood ratio for iron deficiency does not start to decrease until 40 ng/mL in an unselected population of patients

Guyatt GH, Oxman AD, Ali M, Willan A, McIlroy W, Patterson C. Laboratory diagnosis of iron-deficiency anemia: an overview. J Gen Intern Med. 1992;7(2):145-153.

- **The mean (SD) hemoglobin level was 13.4 (1.3) g/dl in the entire population, 13.1 (1.2) g/dl in women, and 14.5 (1.3) g/dl in men.**

- **Regarding the frequency of anemia, according to the WHO gender-specific definitions, 43 (16.1%) women had hemoglobin below 12.0 g/dl and 14 (24.3%) men had hemoglobin below 13.7 g/dl (p = 0.047), which is not a significant difference when correcting for multiple hypothesis testing.**



Per oral iron suppleentation

58 % women on iron supplements had hemoglobin levels of 13.0 (1.0) g/dl, compared to hemoglobin levels of 13.2 (1.1) g/dl in women without iron supplements .

Hemoglobin was at 14.4 (1.3) g/dl in 46% men on iron supplements, and at 14.7(1.3) g/dl in men without.

IV iron suppleentation

Information on intravenous iron treatment in three years following the OAGB procedure was available for 301 participants and 83 participants 27.5% had received this treatment.

- 31% females required IV iron supplementation
- 14% males required IV iron supplementation

p < 0.001

- Median (IQR) ferritin was 38 (16–60) µg/L in patients who had received intravenous iron treatment once or several times, and 30 (16–60) µg/L in patients who had not .

Table 4

	Baseline	1 year	2 years	3 years
Hb g/dL (mean ± SD); all patients	14.1 ± 1.2	13.6 ± 1.1	13.5 ± 1.2	13.5 ± 1.2
Hb g/dL (mean ± SD); women	13.7 ± 1.0	13.3 ± 1.0	13.2 ± 1.0	13.2 ± 1.0
Hb g/dL (mean ± SD); men	15.2 ± 0.9	14.5 ± 1.0	14.7 ± 1.0	14.6 ± 0.9
Ferritin µg/L; median (IQR); all patients	80 (42–141)	76 (33–133)	59 (31–105)	45 (22–84)
Ferritin µg/L; median (IQR); women	61 (36–100)	59 (27–104)	50 (26–89)	40 (21–74)
Ferritin µg/L; median (IQR); men	173 (123–265)	135 (91–205)	101 (68–174)	78 (48–122)

Table 4

	Men	Women	*p*
Total number of patients *N* = 330	*N* = 60	*N* = 270	
Ferritin < 15 µg/L, *N* (%)	11 (17.8)	68 (25.1)	0.112
Ferritin < 50 µg/L, *N* (%)	24 (41.4)	121 (44.7)	0.032**
Anemia *N* (%)	14 (24.3)	43 (16.1)	0.046**
Per oral iron *N* (%)	27(46)	157 (58.2)	0.029**
Intravenous iron 83 *N* (%)	11(14)	25(31.2)	<0.001
Fatigue *N* (%)	21 (36.3)	163 (60.6)	<0.001
Restless legs *N* (%)	21 (35.6)	128 (47.7)	0.027
Muscular pain *N* (%)	30 (50.5)	191 (71.0)	<0.001
Dizziness *N* (%)	7 (11.8)	103(38.2)	<0.001
Headache *N* (%)	21 (35.9)	152 (56.3)	<0.001

3 Years Follow Up

- **27.5% (83) had received IV treatment. This was more common among women 31% than men 14% ($p < 0.001$).**

- **The number of patients with low iron stores (ferritin 16–50 µg/L) was**
  35.3% at baseline and 44.6% after 3 years in women
  3.5% before and 37.3% after 3 years among men

Conclusion

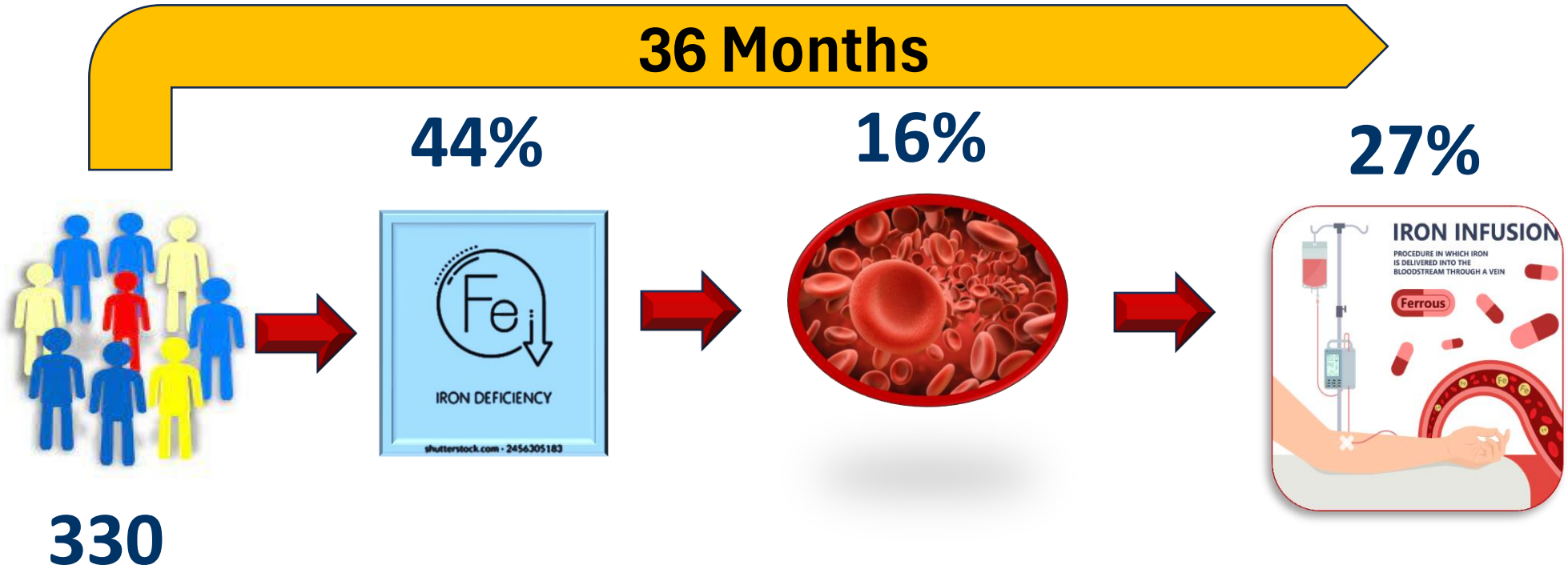
- **The frequencies of iron deficiency and iron insufficiency were common in 3 years after OAGB even when the patients were advised to use iron supplements either continuously or intermittently to keep the ferritin level above 50 µg/L.**

- **Intravenous iron treatment was available for patients with iron deficiency who did not respond to per oral treatment.**

- **Annual blood tests are recommended lifelong after OAGB, but the clinical relevance of iron deficiency (ferritin levels < 15 µg/L) and iron insufficiency (ferritin levels 15–50 µg/L) might be misjudged as long as hemoglobin levels are normal.**

- **A low serum ferritin concentration (<30 ng/mL) is diagnostic for absolute iron deficiency, independently of any other parameter.**

36 Months


44%
16%
27%
330
Fe
IRON DEFICIENCY
shutterstock.com · 2456305183
IRON INFUSION
PROCEDURE IN WHICH IRON IS DELIVERED INTO THE BLOODSTREAM THROUGH A VEIN
Ferrous

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