CASE STUDY

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PRESENTING COMPLAIN

Mrs E is 34 year old lady, admitted in tertiary Care Hospital with c/o dizziness, fatigue, painful abdominal bloating, restless legs and drowsiness.

Vitals:

• Blood Pressure: 70/40 mm/Hg
• Respiratory Rate: 13 BPM
• Pulse: 126 BPM
• O2 Sat: 75 %
• Temp: 39 C
PAST MEDICAL HISTORY

• 10 days prior to presentation, she was hospitalized with an acute chest syndrome and found to have a methicillin-resistant Staphylococcus aureus (MRSA) pneumonia.
• She was transfused 2 packed red blood cells (RBCs) at the previous admission because of low HB (6.5 g/dl).
• She has a significant history of GI disturbance (bloating, diarrhea frequently)
• Had no history of jaundice
• Family Hx: Positive for DM but negative for anemia or any other hematologic disorder.
LABORATORY EVALUATION

- Hemoglobin (Hb): 5.8 \( \downarrow \)
- Hematocrit (Hct): 4 \( \downarrow \)
- MCV: 75 fL \( \downarrow \)
- MCHC: 22 g/dL \( \downarrow \)
- White blood cell count: 14,200 \( \uparrow \)
- Platelet: 75,000 \( \downarrow \)

- Total Bilirubin: 2.5 mg/dL \( \uparrow \)
- Serum Iron: 12 \( \uparrow \)
- Total iron-binding capacity: 500 \( \uparrow \)
- Saturation of transferrin: 10% \( \downarrow \)
- Serum Ferritin: 6 \( \downarrow \)
- Reticulocyte count: 7% \( \downarrow \)
ANTHROPOMETRIC MEASUREMENTS

• She has a history of 5 kg weight loss in 1 month.
• Her current weight was 44 kg with a height of 164 cm.
• BMI: 16.4 kg/m²
CLINICAL PRESENTATION

- Pallor
- Lethargic
- SOB
- Low BP
- Yellow eyes
DIET HISTORY:

- Tobacco addicted
- Takes energy drinks frequently (one per day)
- Dislikes vegetables and has no milk intake
- Has very low fruit intake (1-2 per week)
- Consumed chicken mostly (4 days per week)
- Usually munching on processed foods.
- Improper meal timing
CURRENT MEDICATIONS

She undergone transfusion of 1 packed cell and prescribed following drugs by her doctors:

• Omeprazole
• Tetracycline
• Ibuprofen

After transfusion, her latest Hb was 7.5g/dL.
FINDINGS
DIAGNOSIS

Iron deficiency anemia
WHAT SUBJECTIVE / OBJECTIVE SIGNS, SYMPTOMS AND LABORATORY TESTS ARE HELPFUL FOR THE DIAGNOSIS OF THIS PATIENT?

• SUBJECTIVE:
  Fatigue, Dizziness, Restless legs,

• OBJECTIVE:
  Pallor, Increased Heart Rate, Decreased saturation, Low Blood Pressure

• LABORATORY TESTS:
  Low Serum Iron, Low Serum Ferritin, High TIBC
WHAT ARE THE SECONDARY ISSUES WITH THIS PATIENT?

• High Bilirubin: Jaundice
• Low Platelets: High risk of bleeding
• Increased WBCs count: Infection/ immune compromised
WHAT IS THE RDA OF IRON FOR WOMEN?

• Women: 18 mg
• Pregnancy: 27 mg
• Lactation: 10 mg
• Upper tolerable Limit: 45 mg
WHAT ARE THE CALORIC AND PROTEIN REQUIREMENT?

**MIFFLIN-ST JEOR EQUATION:**

\[
BMR = 10 \times \text{weight (kg)} + 6.25 \times \text{height (cm)} - 5 \times \text{age (y)} - 161
\]

\[
BMR = 1134 \times \text{AF} \times \text{SF}
\]

\[
BMR = 1134 \times 1.2 \times 1.2
\]

\[
BMR = 1632 \text{ calories}
\]

**PROTEIN:** 1.5gm/kg/day = 66gms
WHAT ARE THE FACTORS PREDISPOSING THIS PATIENT TO IDA

• Inadequate utilization secondary to GI disturbance.
• Inadequate dietary intake.
• Inadequate absorption because of drug interference such as proton-pump inhibitors or tetracycline.
WHAT WILL BE YOUR TREATMENT RELATED GOALS?

- Control of the underlying causes of anemia
- GI issues should be corrected
- Dietary intake should be analyzed and modified
- Supplemental iron should be prescribed to replenish her stores and correct the anemia.
WHAT WILL BE YOUR DIETARY REGIME?

• Iron rich foods should be advised including red meat, peas, beans, nuts, etc.
• Increase consumption of Vitamin C rich foods with dietary intake of iron.
• Avoid foods that inhibit iron absorption including carbonated beverages, oxalates, phytates and excessive calcium intake.
• Encourage to increase intake of antioxidants.
<table>
<thead>
<tr>
<th>Time</th>
<th>Meal</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td>• Orange (1 medium)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Scrambled Egg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Bread slice (2)</td>
</tr>
<tr>
<td>Midmorning</td>
<td></td>
<td>• Plums (3 medium)</td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td>• Green Pea Pulao (1 cup)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lentil (½ cup)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Spinach (½ cup)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Onion and tomato salad</td>
</tr>
<tr>
<td>Tea Time</td>
<td></td>
<td>• Chickpea Chaat (1 cup)</td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
<td>• Beef (3 oz)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Chapatti (1 medium)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Yogurt (1/2 cup)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Strawberries (3 medium)</td>
</tr>
<tr>
<td>Bed time</td>
<td></td>
<td>• Milk (1 cup)</td>
</tr>
</tbody>
</table>

**Total Calories**: 1685  
**Proteins**: 65.5 gms  
**Iron**: 18.25 mgs
### WHICH MODE OF IRON THERAPY IS RECOMMENDED FOR THIS PATIENT?

#### Enteral or Parenteral?

<table>
<thead>
<tr>
<th>GRADE (WHO)</th>
<th>DEGREE OF ANEMIA</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>11-14 gm/dL</td>
<td>Normal</td>
<td>-</td>
</tr>
<tr>
<td>9-11 gm/dL</td>
<td>Mild</td>
<td>Oral iron therapy</td>
</tr>
<tr>
<td>7-9 gm/dL</td>
<td>Moderate</td>
<td>Parenteral iron therapy</td>
</tr>
<tr>
<td>&lt;7 gm/dL</td>
<td>Severe</td>
<td>Blood transfusion</td>
</tr>
</tbody>
</table>
WHAT WILL BE THE DOSE OF IRON SUPPLEMENTATION?

The cumulative dose for repletion of iron is based on the patient’s Hb and body weight, calculated by “Ganzoni formula”:

\[
\text{Total body iron deficit/cumulative iron dose (mg)} = \text{Body weight} \times (\text{Target – Actual hemoglobin}) \times 0.24 + \text{Iron for iron stores (mg iron)}
\]

*Use ideal body weight in overweight patients. If underweight, use actual body weight

*** Hemoglobin must be in g/L (1x10)

***The factor 0.24 = 0.0034 x 0.07 x 1,000: For this calculation the iron content of hemoglobin = 0.34%, blood volume = 7% of the bodyweight, and 1,000 is the conversion from g to mg

****Iron stores

<35 kg body weight = 15 mg/kg body weight

>35 kg body weight = 500 mg

Now Calculate:

44 kg female with a hemoglobin of 75 g/L needs a dose of 44 x (110–75) x 0.24 + 500 = 870 mg iron
FOR HOW LONG THE DOSE WILL BE GIVEN?

• Dose of Venofer® (Iron sucrose) expressed as number of 5mL ampoules (each ampoule contains 100mg)

• Venofer® may be administered up to maximum of 200mg three times weekly.

• **Required Fe: 870mg = 9 ampule**

• Oral iron is not required after IV iron is given if the total iron deficit has been (or will be) repleted with IV iron therapy.
**PARENTERAL IRON FORMULATIONS AVAILABLE IN PAKISTAN:**

<table>
<thead>
<tr>
<th>IV iron formulations</th>
<th>Brand names</th>
<th>Elemental iron</th>
<th>Rs/-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron Sucrose</td>
<td>Venofer</td>
<td>20mg/ml</td>
<td>1465/-</td>
</tr>
<tr>
<td></td>
<td>Sangobion</td>
<td>10mg/ml</td>
<td>601/-</td>
</tr>
<tr>
<td>Ferric Carboxymaltose</td>
<td>Ferinject</td>
<td>50mg/ml (1vial=10ml=500ml)</td>
<td>6550/-</td>
</tr>
<tr>
<td>Iron Dextran</td>
<td>Cosmofer</td>
<td>20mg/ml</td>
<td>1250/-</td>
</tr>
</tbody>
</table>
**SIMPLIFIED METHOD:**

- The following table can be used for adult patients of body weight $\geq 35$ kg.

<table>
<thead>
<tr>
<th>Hb gm/dl</th>
<th>Body Wt 35 to &lt;70kg</th>
<th>Body Wt $\geq$ 70kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>$&lt;$10g/dl</td>
<td>1500mg</td>
<td>2000mg</td>
</tr>
<tr>
<td>$\geq$10g/dl</td>
<td>1000mg</td>
<td>1000mg</td>
</tr>
</tbody>
</table>
DIFFERENCE BETWEEN FORMS OF IRON SUPPLEMENTS AVAILABLE?

• The ferrous form of iron is absorbed three times more readily than the ferric form (iron pyrophosphate, iron protein succinyllate, ammonium citrate-Vitaglobin, hydroxide Polymaltose- Maltofer)

• Although ferrous sulfate, ferrous gluconate, and ferrous fumarate are absorbed almost equally, each contains a different amount of elemental iron.

<table>
<thead>
<tr>
<th>Common Compound</th>
<th>Elemental iron</th>
<th>Available Brands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ferrous Sulfate (300mg)</td>
<td>20%</td>
<td>Ferrous sulphate, Fefol vit, iberet, unifer, fesovit-z, fenim, femorate etc</td>
</tr>
<tr>
<td>Ferrous Gluconate (500mg)</td>
<td>12%</td>
<td>Theron-F, neuro-vit, , irolic, amvit etc</td>
</tr>
<tr>
<td>Ferrous Fumarate (180mg)</td>
<td>33%</td>
<td>Iron plus, olifol, ,givitol, allifer, fefan etc</td>
</tr>
</tbody>
</table>
HOW WILL YOU MONITOR HER?

- Normalize the Hb and Hct concentrations and replete iron stores.
  - If the doses of iron are adequate, the reticulocyte count will begin to increase by the 3 to 4 day and peak by the 7 to 10 day of therapy.
  - By the end of the 2nd week of iron therapy, the reticulocyte count will fall back to normal.
  - The Hb response is a convenient index to monitor in out patients. Hematologic response is usually seen in 2 to 3 weeks with a 1 g/dL increase in hemoglobin and a 6% increase in the hematocrit.
• Anemia can be expected to resolve in 1 to 2 months; however, iron therapy should be continued for 3 to 6 months after the hemoglobin is normalized to replete iron stores.

• Therapy duration is related to the absorption pattern of iron.
  ○ During the first month of therapy, as much as 35 mg of elemental iron is absorbed from the daily dose.
  ○ With time, the percentage of iron absorbed from the dose decreases, and by the third month of therapy, only 5 to 10 mg of elemental iron is absorbed.
POINTS TO CONSIDER WHILE COUNSELLING THE PATIENT?

• Oral iron therapy produces dark stools.
• Take iron on an empty stomach.
• Counselling should also be given for GI discomfort which can be caused by oral iron supplement.
**WHAT ARE THE OTHER INDICATIONS FOR PARENTERAL IRON THERAPY?**

Initiate PN iron therapy when the oral does not work which can be caused by:

<table>
<thead>
<tr>
<th>Reason</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inadequate iron intake</td>
<td>Non-adherence, insufficient iron content in supplement</td>
</tr>
<tr>
<td>Inadequate iron absorption</td>
<td>Concomitant consumption of inhibitors of iron absorption (e.g. tea, calcium)</td>
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<tr>
<td></td>
<td>Coexisting inflammation with iron sequestration</td>
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<tr>
<td></td>
<td>Intestinal mucosal disorders (e.g. coeliac disease)</td>
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<tr>
<td></td>
<td><em>Helicobacter pylori</em> infection</td>
</tr>
<tr>
<td></td>
<td>Impaired gastric acid secretion (use of proton pump inhibitors)</td>
</tr>
<tr>
<td>Ongoing blood losses</td>
<td>Occult blood loss</td>
</tr>
<tr>
<td>Coexisting condition interfering with bone marrow response</td>
<td>Concomitant vitamin B&lt;sub&gt;12&lt;/sub&gt; or folate deficiency, primary bone marrow disease</td>
</tr>
<tr>
<td>Incorrect diagnosis</td>
<td>Haemoglobinopathy, anaemia of chronic disease or renal failure</td>
</tr>
</tbody>
</table>
IS THERE ANY DRUG-NUTRIENT INTERACTION?

- Proton pump inhibitor, inhibits serum iron and vitamin B12 absorption by increasing the pH of the stomach and decreasing the solubility of ferrous salts.

**What to do:** Take iron at least 1 hour before or 3 hours after the proton pump inhibitor dose. Absorptions of both iron and tetracycline are decreased when administered concomitantly, the iron should be taken 3 hours before or 2 hours after the tetracycline dose as well.
ANY OTHER SUPPLEMENTATION?

• The recommended dose of vitamin B12 is 500 mcg (PO) per day depend upon the lab value.

• Maintaining depleted stores requires an absolute minimum oral intake of 50 to 100 mcg of folic acid daily.
• Krause food and the nutrition care process 14th edition.
• World health organization guideline summaries
• Journal Australian prescriber v.36 (6), 2016 dec