

## Bariatric surgery patients and their medicines including alternative formulations and nutritional supplements

There has been a steady increase in bariatric surgery over recent years, the National Institute of Health and Care Excellence (NICE) has published an updated clinical guideline (CG189) on obesity, identification, assessment and management, which includes bariatric surgery as a treatment option.<sup>1</sup> The pharmacokinetics of medicines may be changed due to the altered digestive system following bariatric surgery. In addition, bariatric surgery patients often have co-morbidities associated with obesity that may be affected by weight loss. For a short period following bariatric surgery, a patient is restricted to a liquid diet and any medicines that the patient is taking are often changed to liquid formulations (usually unlicensed preparations), which is likely to have implications for the drug budget.<sup>2,3</sup> As part of the medicines optimisation process post-surgery, it is important to consider how bariatric surgery can affect the medicines a patient is taking and the effects of that particular medicine on the patient.

This bulletin provides information for prescribers on optimising medicines for patients that have undergone bariatric surgery. Regularly reviewing bariatric surgery patient's changing medication needs is essential to optimise their medicine use in both the short and long term.

### Recommendations

- Ensure the type of bariatric surgery the patient has undergone is recorded in the patient's notes.
- Patient's may require their tablets to be crushed or switched to dispersible, chewable or soluble tablets or to a liquid form for up to six weeks following bariatric surgery.<sup>2</sup>
- If there is no suitable licensed liquid formulation either prescribe an alternative medicine, consider an alternative route of administration, temporarily stop (if clinically appropriate) or prescribe an unlicensed liquid formulation. Review this regularly with the aim of reverting to a licensed preparation as soon as possible.
- Where commissioning arrangements permit, secondary care specialists may be able to retain prescribing responsibility for short term medicines, which may not readily be available as licensed liquid formulations.
- Formulations to be avoided after bariatric surgery include:
  - » Enteric coated or sustained release products as a delay in drug release may reduce absorption. Film coated formulations may also be problematic.<sup>4</sup>
  - » Effervescent tablets may cause discomfort to the patient. If necessary, they should be allowed to fully dissolve and settle before taking.<sup>4</sup>
  - » Formulations with a high sugar content (sucrose, corn syrup, lactose, maltose, fructose, honey or mannitol) as they increase the risk of dumping syndrome.<sup>5</sup>
  - » Larger tablets (generally with a diameter larger than 10mm, see table 1) as they may get stuck in the pouch. Larger tablets need to be split or crushed, but only if pharmaceutically appropriate. This may render their use off-license.<sup>6</sup>

## Recommendations

- Patients should have a pre-surgical consultation with a pharmacist to help prepare for medication changes after bariatric surgery. A post-operative review with a pharmacist may support improvements in compliance with vitamins and medications.<sup>7</sup>
- Review patient's medication regularly for decreased efficacy of medicines, side effects and signs of toxicity, and the continued need for medicines for long term conditions, such as diabetes, as weight loss occurs.
- Following gastric banding, patients should purchase a suitable OTC multivitamin and mineral supplement for self-care, such as Tesco Complete multivitamins and minerals tablets or LloydsPharmacy A-Z multivitamins and minerals tablets.
- Following Roux-en-Y gastric bypass, sleeve gastrectomy or biliopancreatic diversion and duodenal switch, patients should purchase a suitable OTC multivitamin and mineral supplement for self care or if they are unable to purchase, may receive a NHS prescription for their multivitamin and mineral supplement.

## Background

- NICE clinical guideline CG189 on obesity recommends that bariatric surgery is a treatment option for adults (age 18 and over) with severe and complex obesity if all the following criteria are fulfilled:<sup>1</sup>
  - » The person has a BMI of 40kg/m<sup>2</sup> or more, or between 35kg/m<sup>2</sup> and 40kg/m<sup>2</sup> and other significant disease (for example, type 2 diabetes or high blood pressure) that could be improved if they lost weight.
  - » All appropriate non-surgical measures have been tried but the person has not achieved or maintained adequate, clinically beneficial weight loss.
  - » The person has been receiving or will receive intensive management in a tier 3 service.
  - » The person is generally fit for anesthesia and surgery.
  - » The person commits to the need for long term follow-up.
- NICE CG189 also recommends to:<sup>1</sup>
  - » Offer bariatric surgery as a first-line option (instead of lifestyle interventions or drug treatment) for adults with a BMI of more than 50kg/m<sup>2</sup> when other interventions have not been effective.
  - » Offer an expedited assessment for bariatric surgery for people with recent-onset type 2 diabetes with a BMI of 35kg/m<sup>2</sup> or over if they are also receiving, or will receive assessment in a tier 3 service (or equivalent).
  - » Consider an assessment for bariatric surgery for people with recent-onset type 2 diabetes (within the last ten years) if the BMI is 30-34.9kg/m<sup>2</sup> (or, for people of Asian family origin, consider a lower BMI threshold (2.5kg/m<sup>2</sup> lower BMI levels) than other populations if they are also receiving, or will receive assessment in a tier 3 service (or equivalent).
- The responsibility for commissioning adult severe and complex obesity surgery services fully transferred from NHS England (NHSE) to Clinical Commissioning Groups (CCGs) on 1 April 2016, as they are no longer classified as specialised services.<sup>8</sup>
- Prior to this, NHSE had guidance on Surgery for Severe and Complex Obesity. This required that patients fulfilled additional criteria beyond NICE CG189 criteria for eligibility for bariatric surgery to ensure adequate preparation and improve post-surgical compliance. These criteria were set out in the guidance as well as the risk:benefit evaluation that the individual should consider. For these patient groups bariatric surgery has been shown to be highly cost effective.<sup>9</sup>
- It is now for CCGs to determine their local policy and criteria for surgery. Some CCGs have adopted the NHSE guidance,<sup>9</sup> whilst others have added in additional criteria such as smoking status.

- The Health Survey for England 2017 reported on the proportion of adults (aged 16+) who are morbidly obese with a BMI of 40kg/m<sup>2</sup> or more. According to the report, the proportion of men and women in England who were morbidly obese was 2% and 5%. Based on a mean of 3.5%, the number of adults with morbid obesity in England would be around 1.9 million (population of England 2017 was 53.9 million). In a CCG covering a population of 500,000, one would expect around 17,500 morbidly obesity adults.<sup>10</sup>

## Main types of bariatric surgery

The current standard types of bariatric surgery are gastric banding, gastric bypass, sleeve gastrectomy and biliopancreatic diversion and duodenal switch (BPD/DS). These are predominantly undertaken laparoscopically under general anaesthetic.<sup>3</sup> Figure 1 explains the different types of bariatric surgery performed and the effects on absorption of food and nutrients. Other types of bariatric surgery are undertaken and figure 1 covers the main types undertaken in the UK.

### Figure 1. Main types of bariatric surgery<sup>9</sup>

#### Gastric banding

The gastric band (or sometimes referred to more fully as laparoscopic adjustable gastric band – LAGB) helps reduce the amount of food eaten. It acts like a belt around the top portion of the stomach, creating a small pouch. Patients feel full after eating only a small quantity of food. It is adjustable and reversible.

#### Gastric bypass

There are a number of variations of gastric bypass operation but the most popular one conducted in the UK is called a Roux–en–Y gastric bypass (RNY). At surgery, the top section of the stomach is divided off by a line of staples, creating a small 'pouch' stomach. A new exit from this pouch is made into a 'Y' loop from the small intestine so that food bypasses the original stomach and part (about 100-150cm) of the small intestine. The size of stomach pouch and the length of small intestine that is bypassed are carefully calculated to ensure that patients will be able to eat enough for their body's needs at normal weight.

#### Sleeve gastrectomy

The sleeve gastrectomy reduces the size of the stomach by about 75%. It is divided vertically from top to bottom leaving a banana shaped stomach along the inside curve and the pyloric valve at the bottom of the stomach, which regulates the emptying of the stomach into the small intestine, remains intact. This means that although smaller, the stomach function remains unaltered.

#### Bilio-pancreatic diversion and duodenal switch (BPD/DS)




The bilio-pancreatic diversion and duodenal switch (BPD/DS) works primarily by creating malabsorption. Following a sleeve gastrectomy, a short segment of the duodenum at the base of the stomach is left but the remainder cut, and the second half of the small intestine brought up and joined to the duodenum (this part of the operation is very similar to a RNY gastric bypass but is slightly lower down in the digestive tract). The bypassed section of small intestine is then rejoined to carry bile and pancreatic juices to the latter part of the small intestine near where it joins the large intestine (colon). Digestion and absorption of fat depends on it mixing with bile (from the liver and normally entering the duodenum). As this mixing does not occur until much further on in the intestine after a BPD/DS, the body's ability to digest and absorb calories from fat is severely reduced. As a result, weight drops, even when eating quite normally.

## Types of bariatric surgery and their impact on medicines

After bariatric surgery, the physical changes made to the gastrointestinal tract not only impacts on the absorption of nutrients, but also of medicines.<sup>2</sup> The reduced size of the stomach, reduced acid production in the stomach and reduced surface area will lead to changes in the rate and extent of absorption of medicines. This will vary according to the type of surgery the patient has received. It is important that the type of surgery the patient has received is recorded in their medical notes.

Figure 2 illustrates the main types of bariatric surgery<sup>3</sup> and their impact on medicines.<sup>2,5,7</sup> The BPD/DS is a variation of RYGB where a longer length of the small intestine is bypassed. The impact on medicines will be similar to the RYGB but with further reductions in drug absorption.<sup>2,5,7</sup>

**Figure 2. Main types of weight loss surgery<sup>3</sup> and their impact on medicines<sup>2,5,7,11</sup>**

Laparoscopic Adjustable Gastric Band (LAGB)	Roux-en-Y gastric bypass (RYGB)	Laparoscopic Sleeve Gastrectomy (LSG)
		
<p><b>Impact on medicines:</b></p> <ul style="list-style-type: none"> <li>• Consider tablet size</li> <li>• Band can be loosened if medicine gets stuck in the pouch</li> <li>• Absorption of drugs unaffected</li> </ul>	<p><b>Impact on medicines:</b></p> <ul style="list-style-type: none"> <li>• Larger tablets (generally &gt;10mm diameter) may get stuck – refer to table 1</li> <li>• Drug dissolution/disintegration rate and absorption affected</li> <li>• Oily solutions, suspensions, tablets less rapidly absorbed than aqueous solutions</li> <li>• Reduced stomach size results in less acid produced, thus raising the stomach pH which increases the solubility of basic drugs and reduces the solubility of acidic drugs. This may impact drug absorption</li> <li>• Reduced surface area for drug absorption which may reduce the total amount of drugs absorbed that are mainly absorbed in the upper intestine</li> <li>• High sugar content medicines may cause dumping syndrome, a set of symptoms such as diarrhoea, experienced after consuming a high intake of sugars</li> <li>• Reduced mixing of drugs with bile salts so lipophilic drugs will have decreased absorption</li> </ul>	<p><b>Impact on medicines:</b></p> <ul style="list-style-type: none"> <li>• Oral dosage forms dissolution/disintegration affected by reduced stomach size</li> <li>• Impact on drug absorption less than gastric bypass</li> </ul>

**Table 1. Tablet diameters of a selection of medicines<sup>12-30</sup>**

Drug name	Brand name/manufacturer	Strength	Diameter (mm)	Not>10mm
Alogliptin	Vipidia®	6.25mg 12.5mg 25mg	9.1	Yes
Atorvastatin	Consilient Health Ltd	20mg	8	Yes
Atorvastatin	Consilient Health Ltd	40mg	10	Yes
Candesartan	Aurobindo	2mg 4mg 8mg 16mg	7.3	Yes
Candesartan	Aurobindo	32mg	10	Yes
Dapagliflozin	Forxiga®	5mg	7	Yes
Dapagliflozin	Forxiga®	10mg	11 x 8 (depth)	No
Linagliptin	Trajenta®	5mg	8	Yes
Lisinopril	Zestril®	10mg 20mg	8	Yes
Losartan potassium	Accord-UK Ltd	50mg	10	Yes
Metformin	Glucophage®	500mg	11 x 5.7 (depth)	No
Metformin	Glucophage®	850mg	13.5 x 6.6 (depth)	No
Pioglitazone	Accord-UK Ltd	45mg	8	Yes
Ramipril	Accord-UK Ltd	10mg	11 x 5.5 (depth)	No
Simvastatin	Aurobindo Pharma-Milpharm Ltd	40mg	10.1	Yes
Simvastatin	Aurobindo Pharma-Milpharm Ltd	80mg	18.8 x 8.8 (depth)	No

## Dealing with the impact of bariatric surgery on medicines

There is no strong evidence base to firmly guide decision-making. However, knowledge of the pharmacokinetics of the drugs and type of bariatric surgery the patient has undergone will provide some guidance on the potential impact of bariatric surgery on drug absorption.<sup>2</sup> Pharmacists can advise on suitable formulations to be used in bariatric surgery patients.<sup>5</sup> Medicines with specific advice following bariatric surgery are listed in the table in attachment 1.

Figure 3 illustrates some of the impacts that bariatric surgery may have on medicines and some strategies to deal with them.

**Figure 3. Dealing with the impact of bariatric surgery on medicines**

Formulation	Advice following bariatric surgery
<b>Solid dosage forms</b>	Use tablets with a diameter less than 10mm to avoid them getting stuck (see table 1). If the tablet size is greater than 10mm then consider how to reduce this. For example, halving the tablets if they are scored, using an alternative manufacturer's version which has a smaller diameter, dissolving or dispersing the tablet, an alternative administration route, soluble tablets or liquid formulations. Refer to the section below on liquid formulations for post bariatric surgery. Refer to the Summary of Product Characteristics for information on tablet diameters and dispersal methods or consult the manufacturer if the tablet diameter is not listed.

Formulation	Advice following bariatric surgery
<b>Liquid formulations</b>	<p>Used for up to six weeks post-operatively when patients can usually only tolerate a liquid diet.<sup>2,3</sup> Do not start liquid formulations before surgery. Convert liquids back to solid dose forms when solid nutrients are reintroduced. Avoid using costly, unlicensed, 'special' liquids where possible. Alternative options include:</p> <ul style="list-style-type: none"> <li>• Halving/splitting tablets</li> <li>• Dispersing tablets in water</li> <li>• Soluble/orodispersible tablets</li> <li>• Opening capsules</li> <li>• A different route of administration</li> <li>• Prescribing an alternative medicine</li> <li>• Temporarily stopping the medicine</li> </ul>
<b>Large liquid volumes</b>	<p>The reduction in the capacity of the stomach can mean that doses need to be staggered, particularly liquid formulations. Consider using licensed, higher strength liquid formulations to reduce the volume of each dose. Take care with dose conversion and ensure the patient is fully briefed on any new dose.</p>
<b>Sugar-containing medicines</b>	<p>To minimise dumping syndrome in gastric bypass patients, avoid products (including over-the-counter medicines) that contain a large amount of sucrose, corn syrup, lactose, maltose, fructose, honey and mannitol.<sup>5,31</sup> For example, use sugar-free versions of liquid formulations where available.</p>
<b>Effervescent tablets</b>	<p>Effervescent formulations should be avoided in bariatric patients as the build-up of gas trapped in the pouch can be uncomfortable for the patient. The excess sodium in these formulations is also not appropriate for bariatric patients with hypertension. If no suitable alternative is available, the effervescent tablet should be allowed to dissolve and settle fully before taking.<sup>5</sup></p>
<b>Acidic formulations</b>	<p>Disintegration and dissolution usually occur in the stomach and are rate-limiting steps of drug absorption and bioavailability. Gastric mixing is reduced in the smaller pouch. Tablets are usually formulated to dissolve in an acidic environment, but the increased pH of the pouch alters this process, so the drug behaves differently than predicted. The solubility of more basic drugs is increased, while that of acidic drugs is decreased. The disintegration of solid dosage forms is also decreased. Examples of drugs affected are rifampicin, digoxin, simvastatin, ketoconazole and iron supplements.<sup>32</sup></p> <p>Co-administering iron supplements with ascorbic acid converts the iron into an absorbable ferrous form.</p> <p>Using an alternative salt may improve absorption, e.g. calcium citrate, which will be better absorbed than calcium carbonate.<sup>11,32</sup></p>
<b>Sustained/delayed release or enteric-coated preparations</b>	<p>Formulations with prolonged dissolution times (e.g. sustained release, long-acting, modified release, extended release, enteric coated) should be avoided as they can pass through the altered gastrointestinal (GI) tract of gastric bypass patients before absorption is complete. They will have a reduced bioavailability so should be replaced with immediate release formulations.<sup>2,32</sup> Sustained release, long-acting, modified release, extended release, enteric coated preparations should not be crushed or cut in half.</p>

Formulation	Advice following bariatric surgery
<b>Lipophilic drugs</b>	There will be changes in distribution volumes of highly lipid-soluble drugs due to the reduced amount of mixing with bile salts. Lipophilic drugs, for example ciclosporin, phenytoin, rifampicin and levothyroxine, will have decreased absorption. <sup>32</sup> These drugs will require close monitoring and possibly dose adjustments.
<b>Drugs damaging to gut mucosa</b>	<p>Avoid NSAIDs or aspirin as the risk for GI bleeds, ulcers or perforations is increased.<sup>4,11</sup></p> <p>Avoid diuretics as they can precipitate potential complications in patients who are dehydrated or have prolonged nausea or vomiting.</p> <p>Increased potential of GI perforation by bisphosphonates (drugs that are usually taken with a full glass of water) due to reduced stomach size. However, bariatric surgery patients are at risk of osteoporosis due to reduced calcium absorption. Possible alternatives to oral bisphosphonates are intravenous bisphosphonates, raloxifene, denosumab, or teriparatide if clinically appropriate.<sup>11</sup></p>
<b>Malabsorption</b>	<p><b>Calcium</b></p> <p>Absorbed in the duodenum. Reduced absorption following sleeve gastrectomy, RYGB and BPD/DS. Calcium supplements should be given in divided doses to enhance absorption. Calcium citrate can increase absorption compared to calcium carbonate. Calcium carbonate should be given with meals whereas calcium citrate may be given with or without meals.<sup>11,33,34</sup></p> <p><b>Fat soluble vitamins (A, D, E, K)</b></p> <p>Occur due to fat malabsorption in BPD/DS. These patients will need life-long supplementation of fat soluble vitamins.<sup>11,33</sup></p> <p><b>Vitamin B12</b></p> <p>The level of parietal cells in Roux-en-Y gastric bypass, sleeve gastrectomy and BPD/DS patients is reduced due to the loss of stomach. This means that less intrinsic factor is secreted so absorption of vitamin B12 is reduced. British Obesity and Metabolic Surgery Society (BOMSS) recommend three-monthly injections of vitamin B12.<sup>35</sup> To avoid additional GP surgery visits and potentially painful injections, an oral vitamin B12 oral formulation at a 1mg daily dose may be used.<sup>11</sup></p>

## Nutritional supplements

Patients who have undergone bariatric surgery are at increased risk of nutritional deficiencies.<sup>35</sup> NICE CG189 recommends at least annual monitoring of nutritional status and appropriate supplementation according to need following bariatric surgery, as part of a shared care model of chronic disease management. Nutritional supplements should be considered if there is concern about micronutrient intake of all vitamins and minerals.<sup>1</sup> The BOMSS guidelines on perioperative and postoperative biochemical monitoring and micronutrient replacement for patients undergoing bariatric surgery make recommendations on vitamin and mineral supplementation requirements for each type of bariatric surgery.<sup>35</sup> The BOMSS guidelines recommend that all patients should have an assessment of their nutritional status before and after bariatric surgery with any deficiencies treated before surgery. The likely extent of any nutritional deficiencies is dependent upon the type of bariatric surgery the patient has undergone and their pre-operative status.<sup>35</sup> Nutritional supplementation should be individualised.<sup>1</sup> Table 2 provides a summary of the type of bariatric surgery, impact on absorption and the recommended vitamin and mineral supplements.<sup>11,35</sup> These will be in addition to any nutritional deficiencies identified pre or post-surgery, e.g. iron, vitamin D. The BOMSS nutritional guidelines are currently being updated.<sup>36</sup>

Table 2. Nutritional supplement requirements and impact on absorption for bariatric surgery type<sup>11,35</sup>

Type of bariatric surgery	Impact on absorption	Nutritional supplements
Gastric band	No impact on absorption of nutrients, but patients may experience vomiting or regurgitation and develop food intolerances.	OTC for self care multivitamin and mineral supplement, e.g. Tesco Complete multivitamins and minerals tablets (take two tablets daily), LloydsPharmacy A-Z multivitamins and minerals tablets or equivalent (take two tablets daily).
Sleeve gastrectomy and Roux-en-Y gastric bypass	Iron, calcium, vitamin D, vitamin B12, zinc, copper, selenium, vitamin A absorption may be affected.	<ul style="list-style-type: none"> <li>• Either: <ul style="list-style-type: none"> <li>» OTC for self care multivitamin and mineral supplement, e.g. Tesco Complete multivitamins and minerals tablets (take two tablets daily), LloydsPharmacy A-Z multivitamins and minerals tablets (take two tablets daily) or equivalent</li> <li><b>OR</b></li> <li>» A NHS prescription for a suitable multivitamin and minerals preparation</li> </ul> </li> <li>• Additional iron supplement such as ferrous sulphate 200mg daily, ferrous fumarate 210mg daily or ferrous gluconate 300mg daily.</li> <li>• Calcium and vitamin D supplements.</li> <li>• 1mg of vitamin B12 three monthly intramuscular injections or oral cyanocobalamin 1mg tablets once daily.<sup>11,35</sup></li> </ul>
Biliopancreatic diversion and duodenal switch (BPD/DS)	Iron, calcium, vitamin D, vitamin B12, protein, fat, fat soluble vitamins A, E and K, zinc, copper and selenium absorption are affected.	<ul style="list-style-type: none"> <li>• Either: <ul style="list-style-type: none"> <li>» OTC for self care multivitamin and mineral supplement, e.g. Tesco Complete multivitamins and minerals tablets (take two tablets daily), LloydsPharmacy A-Z multivitamins and minerals tablets (take two tablets daily) or equivalent</li> <li><b>OR</b></li> <li>» a NHS prescription for a suitable multivitamin and minerals preparation</li> </ul> </li> <li>• Additional iron supplement such as ferrous sulphate 200mg daily, ferrous fumarate 210mg daily or ferrous gluconate 300mg daily.</li> <li>• Calcium and vitamin D supplement.</li> <li>• Vitamin B12 1mg intramuscular injection three monthly or oral cyanocobalamin 1mg tablets once daily.<sup>11,35</sup></li> <li>• Supplement containing additional fat soluble vitamins A, E, K.<sup>36</sup></li> </ul>



A complete multivitamin and mineral supplement (containing iron, selenium, zinc and copper) is recommended for all bariatric procedures. A minimum of 2mg of copper per day is recommended. The ratio of 8-15mg of zinc for each 1mg copper should be maintained.<sup>35</sup> The BOMSS nutritional guidelines recommend the use of Forceval® capsules, one capsule taken daily as this contains 2mg copper. However, each Forceval® capsule contains 15mg zinc resulting in a zinc to copper ratio of 7.5 mg to 1mg, which is below the recommended ratio for zinc to copper.<sup>37</sup>

Table 3 compares the constituent amounts of multivitamins and minerals in Forceval® capsules, Forceval® soluble tablets, Tesco Complete multivitamins and minerals tablets per two tablets and LloydsPharmacy A-Z multivitamins and minerals tablets per two tablets and their retail costs. Tesco Complete multivitamins and minerals tablets and LloydsPharmacy A-Z multivitamins and minerals tablets per two tablets provide 2mg of copper and 20mg zinc giving a zinc to copper ratio of 10mg to 1mg and so meet the recommended requirements.<sup>34</sup>

**Table 3. Constituents per dose of some multivitamin and mineral tablet examples<sup>37-41</sup>**

Constituent	Forceval®* capsule	Forceval® soluble tablet	Tesco Complete multivitamins and minerals tablets x 2	LloydsPharmacy A-Z multivitamins and minerals tablets x 2
Vitamin A (Retinol Equivalent)	750 micrograms	750 micrograms	1600 micrograms	1600 micrograms
Vitamin D2 /D3 (Ergocalciferol)	400 iu (10 micrograms)	10 micrograms	20 micrograms	10 micrograms
Vitamin B1 (Thiamine)	1.2mg	1.2mg	2.2mg	2.2mg
Vitamin B2 (Riboflavin)	1.6mg	1.6mg	2.8mg	2.8mg
Vitamin B6 (Pyridoxine)	2mg	2 mg	2.8 mg	2.8 mg
Vitamin B12 (Cyanocobalamin)	3 micrograms	3 micrograms	5 micrograms	5 micrograms
Vitamin C (Ascorbic Acid)	60mg	60mg	160mg	160mg
Vitamin E (dl- $\alpha$ -Tocopheryl Acetate)	10 mg	10 mg	24 mg	24 mg
d-Biotin (Vitamin H)	100 micrograms	100 micrograms	100 micrograms	100 micrograms
Niacin (Vitamin B3)	18mg	18mg	32mg	32mg
Pantothenic Acid (Vitamin B5)	4mg	4mg	12mg	12mg
Folic Acid (Vitamin B Complex)	400 micrograms	400 micrograms	400 micrograms	400 micrograms
Calcium	108mg	120mg	400mg	400mg
Iron	12mg	12mg	28mg	28mg
Zinc	15mg	15mg	20mg	20mg
Copper	2mg	2mg	2mg	2mg

Constituent	Forceval®* capsule	Forceval® soluble tablet	Tesco Complete multivitamins and minerals tablets x 2	LloydsPharmacy A-Z multivitamins and minerals tablets x 2
Zinc to copper ratio (8-15:1 recommended)	7.5:1	7.5:1	10:1	10:1
Phosphorus	83mg	105mg	Unspecified quantity	Unspecified quantity
Magnesium	30mg	56.25mg	200mg	200mg
Potassium	4mg	300mg	Unspecified quantity	Unspecified quantity
Iodine	140 micrograms	140 micrograms	300 micrograms	300 micrograms
Manganese	3mg	3mg	4mg	4mg
Selenium	50 micrograms	50 micrograms	110 micrograms	110 micrograms
Chromium	200 micrograms	200 micrograms	80 micrograms	80 micrograms
Molybdenum	250 micrograms	250 micrograms	100 micrograms	100 micrograms
Vitamin K	no	no	150 micrograms	150 micrograms
Retail price per 30 tablets <sup>41</sup>	£17.86	£17.19	£1.17	£1.93

\*Classified as a pharmacy medicine and so only available from pharmacies.

Vitamins and minerals are included in the NHS England (NHS E) Guidance for Clinical Commissioning Groups (CCGs) on conditions for which over the counter (OTC) items should not routinely be prescribed in primary care.<sup>42</sup> There are exceptions made for vitamins and minerals for medically diagnosed deficiency, including for those patients who have undergone surgery that results in malabsorption. The continuing need should be reviewed on a regular basis. Patients who have undergone Roux-en-Y gastric bypass, sleeve gastrectomy or BPD/DS surgery which result in malabsorption would be included in these exceptions. These patients may receive an NHS prescription for their vitamin and mineral supplements or if they are able and willing may purchase a suitable OTC preparation for self care. As gastric banding does not result in malabsorption, this would not fulfil the NHS E exception criteria. Patients with a gastric band should purchase a suitable OTC multivitamin and mineral preparation for self-care. Table 3 provides some examples.

## Medicine optimisation priorities

There will be both immediate medication issues to be considered due to the physical changes in the gastrointestinal tract, as well as the longer-term impacts of weight loss through, for example, a reduction in blood pressure or HbA1c. A pre-operative consultation with a pharmacist can help prepare for medication changes after bariatric surgery.<sup>7</sup>

Regular medicine reviews should be undertaken post bariatric surgery. Practice pharmacists are well placed to regularly review bariatric surgery patient's medicines as they have access to patient records, including blood results. Any medication changes should be discussed with the patient and other healthcare professionals involved in the patient's care, such as the community pharmacist. Attachment 2 includes points to consider in these medication reviews. Figure 4, on page 11, provides a summary of the short and long term medicine optimisation priorities in bariatric surgery patients.

**Figure 4. Medicine optimisation priorities in bariatric surgery patients**

<b>Short term medicine optimisation priorities</b>
<ul style="list-style-type: none"> <li>• Medication review up to six weeks post-surgery, considering the following:           <ul style="list-style-type: none"> <li>» Recommence any medicines stopped before surgery which are still needed.</li> <li>» Review the continued need for all items on repeat prescription.</li> <li>» All oral medication should be in a liquid, crushed or chewable form - crushing tablets or opening capsules may be possible, but becomes an off-license use.<sup>6</sup> Add these items as acute prescriptions as frequent changes may be needed.</li> <li>» Use small liquid volumes or spread the doses out to prevent overloading the small gastric pouch.</li> <li>» Enteric-coated or modified-release oral preparations should be switched to immediate-release preparations or suitable alternatives where possible.</li> <li>» Consider a licensed alternative formulation to the oral route if available or suitable, such as topical preparations, patches, suppositories, or injectables.</li> <li>» Review patient's blood tests, depending on the type of procedure they have had (see BOMSS guidance).</li> <li>» Give advice on dietary supplements which can be purchased over the counter and monitoring for nutritional deficiencies.</li> </ul> </li> </ul>
<b>Longer-term medicine optimisation priorities</b>
<ul style="list-style-type: none"> <li>• Medication review, beyond six weeks after bariatric surgery, consider the following:           <ul style="list-style-type: none"> <li>» Review whether liquid medicines started post-surgery can be converted back to tablets/capsules.</li> <li>» Review whether tablets being crushed, split, dissolved or chewed or capsules being opened can be taken whole again.</li> <li>» Review whether alternative formulations or medicines switched to can be converted back to tablets/capsules again.</li> <li>» Avoid oral formulations with a diameter larger than 10mm (refer to table 1 for some examples, check Summary of Product Characteristics or contact manufacturer for information).</li> <li>» Medicines prescribed based on patient weight will need to be adjusted as the patient loses or regains weight.</li> <li>» Monitor for adverse drug effects, and signs of toxicity, a possible result of increased bioavailability or due to weight loss.</li> <li>» Monitor for decreased efficacy of medicines, this may be due to reduced bioavailability.</li> <li>» Adjust doses or stop treatments where the underlying condition improves with weight loss, or worsens after weight regain, and ensure close monitoring to make sure no adverse effects are occurring.</li> <li>» Consider moving appropriate medicines back from acute to repeat prescription.</li> </ul> </li> </ul> <p><b>Medicine groups that should be prioritised include:</b></p> <ul style="list-style-type: none"> <li>• Hypoglycaemics</li> <li>• Antihypertensives</li> <li>• Lipid modification</li> <li>• Analgesics</li> <li>• Diuretics</li> <li>• Medicines that have weight-based dosing</li> </ul>

Some medicines might need to be substituted with alternatives or the doses increased due to the impact on their absorption site depending on the bariatric surgery type. Where possible, monitoring of blood levels to ensure therapeutic levels are maintained is recommended.<sup>43</sup>

Patients should be assessed after surgery for the long term continuation of medication for diabetes and hypertension.<sup>43</sup> These medications may require complete cessation or dose modifications in the immediate postoperative period (with regular monitoring of blood pressure (BP) and capillary glucose) to prevent postural hypotension and hypoglycaemia, respectively. Other medications need to be assessed for efficacy and/or adverse effects. However, it should be made clear to patients and all caring teams that type 2 diabetes relapses in a proportion of patients with time and the effect of weight loss on hypertension is variable, incomplete and often temporary. Generally, patients who have had a gastric bypass are discharged on prophylactic proton pump inhibitors to help reduce marginal ulcers.<sup>43</sup>

Patients should be reviewed at regular intervals to check metabolic status and to titrate correct doses of certain medications, e.g. levothyroxine dose might need to be reduced following weight loss, the absence of which can lead to cardiac complications in a patient with low cardiac reserve due to hypermetabolism. Patients prescribed anticoagulants, e.g. warfarin, low molecular heparin, should be managed by the bariatric multi-disciplinary team (MDT) in conjunction with the anti-coagulation team, especially patients with a duodenal switch who are more likely to develop fat soluble vitamin deficiencies, e.g. vitamin K.<sup>43</sup> Detailed dietary advice about vitamin K content of foods and warfarin interaction should be provided to patients by the bariatric dietician and anti-coagulation team.<sup>43</sup>

### Summary

- Bariatric surgery can cause changes in the pharmacokinetics of medicines as they go through the altered digestive system. Bariatric patients often have co-morbidities associated with obesity that may be improved by weight loss and the associated polypharmacy will need review.
- It is important to review the medication prescribed regularly in view of the patient's changing medication requirements.

## Implementation resources

Attachment 3, medicines use review before and after bariatric surgery, is a useful tool to complete during medication reviews and to give to patients to share with other healthcare professionals. It also reinforces the key messages discussed and acts as an aide memoire. This can be adapted for local use.



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## Additional PrescQIPP resources

 Briefing	<a href="https://www.prescqipp.info/our-resources/bulletins/bulletin-224-bariatric-surgery/">https://www.prescqipp.info/our-resources/bulletins/bulletin-224-bariatric-surgery/</a>
 Implementation resources	

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