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## Polyneuropathy as a neurological complication after sleeve gastrectomy

### Polineuropatía como complicación neurológica tras gastrectomía tubular

Bariatric surgery (BS) is the most effective treatment for weight loss and maintenance thereof in patients with severe obesity, as well as management and/or remission of associated comorbidities. However, after BS, nutrient and vitamin deficiencies are common and can lead to neurological complications, which are usually secondary to deficiencies in B vitamins, vitamin E and/or copper.[1] Following restrictive procedures, such as sleeve gastrectomy (SG), neurological abnormalities are rare, but they can happen. The following are two illustrative case reports.

The first involved a 44-year-old woman with a BMI of 37.5 kg/m$^2$ who underwent SG at another hospital. After surgery, she presented daily vomiting, and after four months, she started to experience progressive weakness in her legs along with paraesthesia which rendered her unable to walk. She had not taken vitamin supplements, denied alcoholism and had lost 20 kg (17% of her baseline body weight). Physical examination revealed areflexia, weakness in her legs and pallhypaesthesia in her feet. Electromyography showed mild axonal sensorimotor polyneuropathy in her legs. Her cerebrospinal fluid (CSF) exhibited no abnormalities. Laboratory testing revealed deficiencies in calcidiol (24.1 nmol/L; normal >50), folate (<4.54 nmol/L; normal >8.8) and copper (65.2 μg/dl; normal >80); all other parameters and vitamins were normal. Intensive vitamin therapy was started based on the recommendations published by Yasawy et al.[2]: intramuscular vitamin B12 (1,000 μg daily for one week followed by 1,000 μg weekly), intravenous (IV) vitamin B1 (500 mg/day for three days followed by 100 mg/day), oral folic acid (5 mg/day) and copper sulphate (250 mg/day). She was referred to a centre specialising in rehabilitation and showed a partial recovery after 12 months (requiring crutches), and a full recovery after 24 months with no need for mobility aids.

The second case involved a 50-year-old woman with a BMI of 39 kg/m$^2$ who underwent SG at our hospital. After four months, she managed to lose 36.5 kg (37% of her baseline body weight), and two weeks prior to visiting the accident and emergency department, she had experienced repeated episodes of vomiting along with gradually worsening hypoaesthesia in her arms and legs as well as difficulty walking. She reported adherence to vitamin supplementation prescribed according to guidelines[3] (a daily multivitamin, calcifediol 16,000 IU every 15 days, calcium/cholecalciferol 1,000 mg/880 IU/day and folic acid 5 mg/day) and denied alcoholism. Physical examination revealed areflexia, hypoaesthesia in her arms and legs, slow gait with a wider base of support and dragging of the feet. Electromyography exhibited axonal sensorimotor polyneuropathy; cerebrospinal fluid testing showed no abnormalities. Laboratory testing revealed mild normocytic anaemia (Hb 116 g/L) and deficiencies in folate (<4.54 nmol/L), vitamin B1 (24 nmol/L; normal >78), vitamin B6 (25 nmol/L; normal >51), biotin (<100 ng/L; normal>100), vitamin C (<0.10 mg/dl; normal >0.4) and calcidiol (34 nmol/L); all other vitamins were normal (including vitamin B12: 265 pmol/L; normal >145). The patient was started on the same vitamin therapy regimen as in the previous case,[2] along with IV immunoglobulins. After 12 months, she showed a partial recovery, and after 24 months, she showed a full recovery, with no need for mobility aids.

The incidence of neurological complications following BS ranges from 0.7% to 5%, depending on the series.[4] Most of them develop after malabsorptive procedures, but they have also been reported after restrictive procedures. Their onset is usually 3–20 months after surgery, and the main risk factors are prolonged vomiting, alcoholism, lack of adherence to vitamin supplementation and large amount of weight loss. The most common are those associated with deficiencies in some B vitamins (B1, B9 and B12); however, they have also been reported in relation to deficiencies in vitamin E, copper, pyridoxine and niacin.[1] Peripheral neuropathy is uncommon, and Guillain–Barré syndrome-like peripheral neuropathy is even less common, with hardly any cases reported in the literature[2,5–7] (Table 1).

When neurological signs and symptoms are present following SG, it is essential to rule out deficiencies in vitamin B12, vitamin B1, vitamin E, copper and folic acid primarily. Up to 18% of patients who undergo SG may present vitamin B12 deficiency.[8] This deficiency has been linked to posterior

**Table 1** Cases of polyneuropathy after sleeve gastrectomy reported in the literature.

| | Isaque et al. 2014 | Landais et al. 2014 | Yasawy et al. 2017 | | Sunbol et al. 2018 | | | |
|---|---|---|---|---|---|---|---|---|
| | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 | Case 6 | Case 7 | Case 8 |
| Age (years) | 30 | 52 | Not specified | 21 | 25 | 20 | 36 | 22 |
| Gender | Female | Female | Female | Female | Female | Female | Female | Female |
| Baseline BMI ($kg/m^2$) | 44 | Not specified | Not specified | 58 | 41 | 42 | Not specified | 43 |
| Surgical procedure | Sleeve gastrectomy | Sleeve gastrectomy | Sleeve gastrectomy | Sleeve gastrectomy | Sleeve gastrectomy | Sleeve gastrectomy | Sleeve gastrectomy | Sleeve gastrectomy |
| Timing of symptom onset after surgery | 1.5 months | 1 month | 2 months | 2 weeks | 3 months | 4 months | 1 year | 1 month |
| Weight loss | 25% | 25 kg | 38 kg (25.3%) | 28 kg | Not specified | 30 kg | 40 kg | Not specified |
| Other risk factors | Not specified | Vomiting | Vomiting No supplementation | Vomiting | Vomiting | Flu-like symptoms | Fever and diarrhoea Vomiting No supplementation | |
| Laboratory findings | Normal vit. B12 | Vit. B1 and B6 deficiency | Vit. B1 and folate deficiency | Normal vit. B12 Folate deficiency | Normal vit. B12 Calcium deficiency | Normal vit. B12 | Normal vit. B12 and D | Vit. B12, D and B1 deficiency |
| Treatment received | Ig (IV) | Thiamine (IV) | Thiamine (IV) | Thiamine, B12 (IV) Folate and E (oral) | Thiamine, B12 (IV) Folate, D, E and calcium (oral) | Ig (IV) Thiamine, B6, B12 (IV) | Ig (IV) Thiamine (IV) | Ig (IV) Vit. B and vit. D complex |
| Recovery | Full | Nearly full | Partial | Nearly full | Nearly full | Nearly full | No | Partial |

Ig: immunoglobulins; IV: intravenous; Mg: magnesium; vit: vitamin.

cord spinal cord and peripheral nerve impairment, including, more rarely, Guillain–Barré syndrome-like polyneuropathy. Given that vitamin B12 is stored in the liver in large quantities, signs and symptoms usually appear after two to three years, although deficiency thereof may present early. One limitation of assessing patients for vitamin B12 deficiency is that vitamin B12 levels may not reflect a state of deficiency; it is advisable to use more sensitive parameters such as methylmalonic acid, homocysteine or transcobalamin, which are not always routinely ordered.[3]

Thiamine (vitamin B1) deficiency has been linked to encephalopathy and peripheral neuropathy, including rapidly progressive acute axonal polyneuropathy.[6] This deficiency can have develop rapidly — within two to three weeks in patients who undergo BS — especially after repeated episodes of vomiting, following rapid weight loss and in patients with alcoholism.

Neurological signs similar to those associated with deficiencies in B vitamins have been reported in individuals with copper deficiency.[9] However, copper deficiency after restrictive procedures is very rare.

Even though folate deficiency is common in patients before and after BS, it rarely leads to neurological signs. It has been associated with Guillain–Barré syndrome-like peripheral neuropathy.[10] It should be noted that deficiency thereof can mask underlying cobalamin deficiency. In the two clinical cases reported, folic acid deficiency was the shared abnormality detected.

When polyneuropathy due to vitamin deficiencies is suspected following BS, the most important thing to do is to start high-dose intensive therapy early, without waiting for full vitamin test results as it could take days to get these. It should be borne in mind that, although up to 85% of cases are reversible following early suitable vitamin replacement therapy, after three to six months residual persistence of symptoms is not uncommon.

These cases illustrate the need for ongoing vitamin supplementation after BS and follow-up by a multidisciplinary team, with regular clinical and laboratory monitoring as recommended by the clinical guidelines.

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