

**33° CONGRESSO
NAZIONALE SICOB
SORRENTO**

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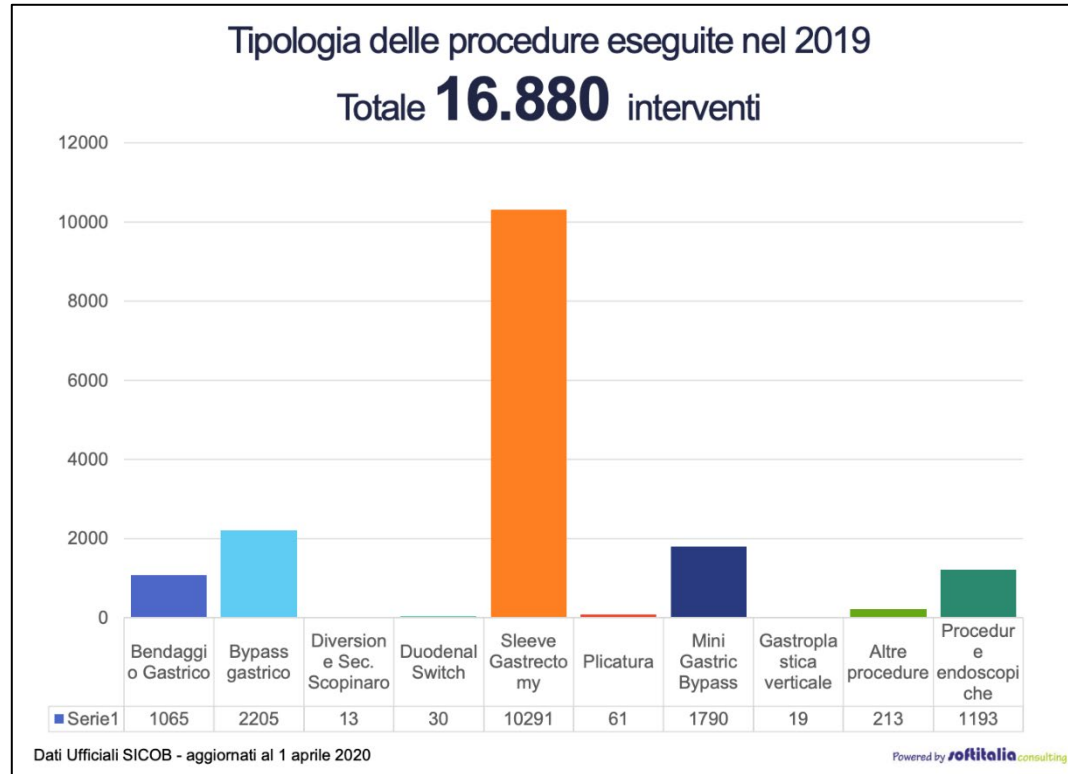
**HILTON
SORRENTO
PALACE**

INTEGRAZIONE NUTRIZIONALE PERIOPERATORIA NEI PAZIENTI POST-BARIATRICI CANDIDATI A CHIRURGIA PLASTICA RICOSTRUTTIVA: STATO DELL'ARTE

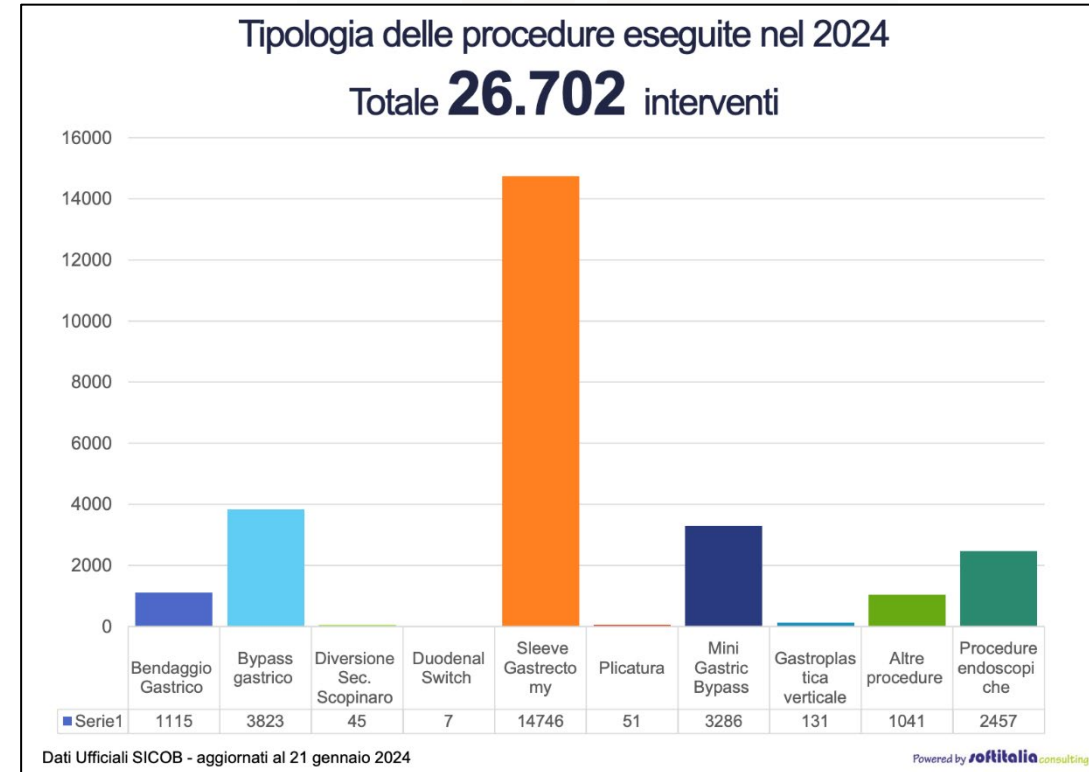
DOTT.SSA NOEMI ZELASCHI

**ISTITUTO CLINICO BEATO MATTEO,
VIGEVANO (PV)**

BACKGROUND



+58,19%



✓ + 96% pz post bariatrici sviluppano **lassità cutanea o eccesso di tessuti molli**

Sadeghi P, Duarte-Bateman D, Ma W, Khalaf R, Fodor R, Pieretti G, Ciccarelli F, Harandi H, Cuomo R. Post-Bariatric Plastic Surgery: Abdominoplasty, the State of the Art in Body Contouring. J Clin Med. 2022 Jul 25;11(15):4315. doi: 10.3390/jcm11154315. PMID: 35893406; PMCID: PMC9330885

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BACKGROUND

Complicanze chirurgiche 60-87%

-  **Sieromi**
-  **Deiscenze**
-  **Infezioni**
-  **Necrosi cutanee**



Complicanze nutrizionali

-  **Modifiche anatomiche**
-  **Apporto alimentare ridotto**
-  **Carenze pre esistenti**
-  **Scarsa compliance**
-  **Fe, B12, folati, Ca, vitamine liposolubili, oligoelementi**

Hasanbegovic E., Sørensen J.A., *Journal of Plastic, Reconstructive & Aesthetic Surgery*, 2014; 67(3):295–301

BACKGROUND

Peggiori outcome

La **malnutrizione** preoperatoria, sia essa conclamata o subclinica, costituisce un **fattore di rischio indipendente per complicanze post-operatorie**

La **valutazione nutrizionale** sistematica e la **correzione di eventuali deficit** riducono le **complicanze post-operatorie e i costi sanitari correlati**

Migliori outcome

Fonte: Weimann, Arved et al. "ESPEN guideline on clinical nutrition in surgery - Update 2025." *Clinical nutrition* (Edinburgh, Scotland), vol. 53 222-261. 3 Sep. 2025, doi:10.1016/j.clnu.2025.08.029

STATO DELL'ARTE

Cosa dice la letteratura circa il ruolo della nutrizione nella chirurgia plastica ricostruttiva?

Pochi studi con evidenze preliminari e di bassa qualità ☹

2 trials clinici

3 studi osservazionali

2 reviews narrative



METANALISI



RISULTATI

Supplementazione preop ↓ rischio SSI (~50%)

Formula immunonutrizionale con proteine, carboidrati, grassi e nucleotidi, spesso arricchita con arginina, omega-3 e nucleotidi. È il supplemento più studiato (12 studi).

Altri supplementi a base di carboidrati, proteine, acidi grassi, glutammina

TRIAL CLINICI

TITOLO	TIPOLOGIA	RISULTATI/CONCLUSIONI
Enhanced Recovery after Abdominoplasty Using Perisurgical Nutritional Supplementation	Studio clinico controllato non randomizzato	Supplementazione (arginina, glutammina, vit C, ecc.) → ↓40% oppiacei, ↓ 48 % drenaggi, recupero più rapido. Dati non traslabili su popolazione generale perché campione solo femminile
Improving Abdominal Plastic Scars with a Dietary Supplement—A Comparative Study	RCT randomizzato controllato	Supplemento (Celergen, selenio, collagene, Q10...) -> ↓tempo di guarigione (24 vs 34 gg); migliore qualità delle cicatrici (POSAS) -> basso potere statistico x campione ridotto (studio pilota)



NARRATIVE REVIEW

Baranwal, N., Gong, J. H., Arnoff, T. E., & Mehrzad, R. (2024). The role and management of vitamin supplementation in plastic surgery patients: A comprehensive review. *European Journal of Plastic Surgery*, 47(1), 22.

Table 3 The surgical relevance of the common essential vitamins and management recommendations

Vitamin	Surgical relevance	Advice for the plastic surgeon and patient
A <i>Retinoids</i>	Drives epithelial cell turnover, increases re-epithelialization rate, and restores epithelial structure. Promotes type 1 collagen production, keratinocyte and fibroblast proliferation, skin elasticity, and angiogenesis. Enhances immune function.	• Do not screen in general population because Vitamin A deficiency is rare. • Post-bariatric surgery patients should take 5000–10,000 IU daily ○ Screening is recommended within the first year after WLS, particularly for those who underwent BPD/DS, regardless of symptoms.
B1 <i>Thiamine</i>	Aids with collagen production and granulation tissue maturation. Thiamine requirements increase during surgery because the body does not store it in appreciable amounts.	• Post-bariatric surgery patients should be taking dietary supplements containing 100–200% of the recommended dietary intake of thiamine daily. • Prior to plastic surgery for post-bariatric surgery patients, consider measuring levels or documenting whether patients are taking thiamine supplementation as surgery can decrease the body's thiamine levels.
B2 <i>Riboflavin</i>	Helps with red blood cell production, iron absorption, and collagen maintenance. Deficiency slows wound contraction rate, decreases wound tensile strength, decreases total collagen content, and can cause anemia.	• Do not screen in typical patient as most foods are fortified with riboflavin and deficiency is rare. • Only screen if patient has a history of other nutritional deficiencies
B3 <i>Niacin</i>	Helps with wound healing through collagen synthesis, fibroblast proliferation, and revascularization Can increase the risk of bleeding	• Consider taking supplemental niacin to assure adequate levels before surgery • If patient has been taking niacin long-term, assess for thrombocytopenia and anemia prior to surgery.
B5 <i>Pantothenic acid</i>	Enhances wound healing process through keratinocyte proliferation and differentiation, fibroblast proliferation, and through mobilization of trace elements	• Do not screen in typical patient because pantothenic acid is found in many foods, including eggs, milk, vegetables, beef, chicken, and whole grains; thus deficiency is rare. • Consider supplementation to accelerate wound healing and strengthen surgical scars
B6 <i>Pyridoxine</i>	Deficiency can be associated with weakened immune function and anemia, and decreased wound contraction, tensile strength, and time for epithelialization	• Conduct thorough medication reconciliation as certain medications (such as isoniazid, valproic acid, phenytoin, and carbamazepine) can contribute to vitamin B6 deficiency. • Consider checking vitamin B6 levels in patients who take vitamin B6 supplements as supplements tend to contain increased dosages, and can contribute to vitamin B6 toxicity. Post-bariatric surgery patients are likely taking supplements and should have their vitamin B6 level checked preoperatively. • Do not need to screen or supplement in typical patient as vitamin B6 is adequately obtained in diet.
B7 <i>Biotin</i>	Intake can interfere with lab results (affects troponin, thyroid, parathyroid, and electrolyte assays). Deficiency can have dermatologic manifestations (dermatitis, enteritis, alopecia)	• Be aware of biotin supplementation interference with lab results during preoperative evaluation. • Do not need to screen or supplement in healthy individuals.
B9 <i>Folate</i>	Fundamental in DNA synthesis for new cells during wound healing. Supplementation intensifies gluconeogenesis and accelerates wound healing. Deficiency can lead to anemia and may result in hyperhomocysteinemia, increasing perioperative risk of myocardial infarction, stroke, peripheral arterial thrombosis, and venous thromboembolism, which can worsen patient outcomes in the perioperative period Nitrous oxide anesthesia during surgery can inhibit folate metabolism.	• Screening for folate deficiency in post-bariatric surgery patients is recommended. ○ If deficient, supplement with 1mg of oral folic acid daily • Supplementation not recommended in patients other than those with malabsorptive conditions or pregnant patients.

Table 3 (continued)

Vitamin	Surgical relevance	Advice for the plastic surgeon and patient
B12 <i>Cobalamin</i>	Promotes wound healing and increases wound tensile strengths. Deficiency can lead to anemia. Nitrous oxide anesthesia can inactivate vitamin B12 and induce hyperhomocysteinemia (see above). Essential for tissue regeneration, cross-linking, producing, and providing tensile strength to collagen. Deficiency impairs wound healing. Plasma levels of vitamin C drop after surgery.	• Can consider screening for post-bariatric surgery patients presenting for plastic surgery ○ More common screening (every 3 months) one year after bariatric surgery and afterwards, screening can be conducted annually or as clinically indicated. ○ If deficient, can receive 1000 mcg IM once weekly for one month, followed by once monthly dosing OR 1000 mcg/day of oral supplementation • Patients without B12 deficiency do not need supplementation • No requirement to screen. • No requirement to supplement if the patient is sufficient. • Can consider adding vitamin C supplementation (topical or oral) perioperatively due to beneficial wound healing effects. Extent of benefits depends on patient's baseline status.
D	May accelerate wound healing through anti-inflammatory and antioxidant effects. Tissue injury results in increased vitamin D requirement in skin cells. Low perioperative vitamin D status is associated with adverse outcomes after surgery and increased risk of surgical site infections.	• Consider screening patients in the preoperative period for vitamin D levels ○ Recommend supplementation prior to surgery in those found to have a deficiency
E	Benefits in wound healing and scar formation not consistently demonstrated. Combination with pentoxifylline shown to reduce postoperative capsular contracture and implant loss following breast augmentation. Some studies show that topical application before and after surgery can improve wound healing and improve cosmetic results. Toxicity can increase bleeding risk.	• Do not screen as Vitamin E deficiency is rare as Vitamin E is found in variety of foods (leafy vegetables, whole grains, nuts, seeds, and fortified cereals). Post-bariatric surgery patients are at higher risk of vitamin E deficiency though clinical manifestations are rare. • Complete full medical reconciliation of patients who take supplemental vitamin E due to increased bleeding risk in perioperative period. Check for concomitant antiplatelet or anticoagulant use to assess bleeding risk profile. • Stop vitamin E intake at least two weeks prior to surgery.
K	Aids with early wound healing as initial stage of hemostasis depends on blood clotting. Enhances rate of wound contraction and coordination of angiogenesis. Vitamin K levels should be considered for patients who take warfarin.	• Consider topical application of vitamin K to promote accelerated wound healing, particularly with patients with acute or chronic skin wounds. • Post-bariatric surgery patients should take recommended daily intake of 90–120 ug/day of supplemental vitamin K • Only screen post-bariatric surgery patients who are symptomatic (such as mucosal bleeding, purpura, petechiae, and increased menstrual bleeding). ○ Screen with PT, INR, and PTT For patients who take warfarin: Pre-op* • 5 days prior to surgery, discontinue warfarin • 2 days prior to surgery, assess INR. If INR > 1.5, give oral vitamin K (1–2 mg) ○ Re-check INR next day or morning of surgery. If INR is still > 1.5, administer IV vitamin K (1 mg)

WLS, weight loss surgery; BPD/DS, biliopancreatic diversion without or with duodenal switch; PT, prothrombin time; INR, internationalized normalized ratio; PTT, partial thromboplastin time
*Consider heparin bridging therapy for patients with higher thromboembolism risk. Refer to guidelines by American Society of Regional Anesthesia and American College of Surgeons for more information [14, 15].



NARRATIVE REVIEW

Toninello, Paolo et al. "Nutritional Support for Bariatric Surgery Patients: The Skin beyond the Fat." Nutrients vol. 13,5 1565. 6 May. 2021, doi:10.3390/nu13051565

Table 1. Most common nutrient deficiencies in post-bariatric patients and their effects on health and wound healing.

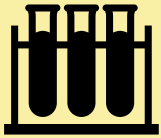
Deficiency	Effects on Wound Healing	Deficiency Effect on Wound Healing	Supplementation	Comments	Reference
Vitamin B ₁₂	DNA synthesis and myelin production.	Megaloblastic anemia can impair blood supply to the wound bed.	500 mg/day for 1 month	Deficiency increases homocysteine and MMA, increasing thrombotic risk.	[57,60,61]
Iron	Matrix synthesis and ROS protection.	Anemia impedes normal wound healing. Inefficient ROS protection increases oxidative stress of the wound.	Oral ferrous sulfate 300 mg 2–3 times/day	50% of the patients resist oral supplementation, IV supplementation may become necessary.	[126,129–131]
Zinc	Fibroblast proliferation and collagen production. Acute phase response protein and metalloprotease production.	Impaired collagen production and fibroblast differentiation. Lower metalloproteases and antioxidant proteins.	220 mg daily for 1 month up to 2–3 times/day	Zinc competes for absorption with copper and iron, must be given separately.	[22,137,138]
Copper	Necessary for optimal immune system function and erythropoiesis.	Skin is less resistant to damage, and immune system is impaired.	2 to 4 mg/day for 1 month	Mainly bound to Cp in the bloodstream.	[62,65,119,120]
Selenium	Immune regulation, muscle metabolism, thyroid function, antioxidant processes, protein synthesis.	Necessary for glutathione peroxidase function. Its deficiency causes an increased oxidative stress with impaired immune system and increased infection rate.	100 mg/day	An important cofactor in many ubiquitous physiologic reactions.	[22,133,134]
Arginine	Collagen synthesis, nitric oxide production.	Faster healing in ulcers.	200–500 mg/kg/day	NOS activity is impaired by inhibitory by-products rather than Arg deficiency.	[41,42,173]
Glutamine	Involved in energy production and nucleotide synthesis.	Better fibroblast and macrophages development.	20 g/day in micronutrient complex supplement	It makes intestinal cells more efficient in nutrient absorption.	[43–45,174]

Folate	DNA synthesis and amino acid conversion	Megaloblastic anemia, reduced cell duplication rate, and hyperhomocysteinemia.	400 mg/day up to 1000 mg/day	Folate represents many forms of water-soluble vitamins of the B-complex.	[22,62–64]
Vitamin C	Collagen synthesis, nitric oxide production, and increase in iron absorption.	Reduced strength of skin, tendons, and blood vessels. Impaired wound healing, phagocytosis, and complement activity.	300 mg 2–3 times/day	Low-molecular-weight antioxidant.	[22,66,67,69]
Vitamin D	Phagocytosis and bacterial killing.	Low-grade persistent inflammation and impaired cellular immunity lead to increased infections.	2000–5000 IU/day	Mega doses of 600,000 UI/year can be given i.m. with no side effects.	[38,102,107,108]
Vitamin A	Influences neutrophil maturation and phagocytic activity. Promotes neoangiogenesis and fibroblast activity.	Impairment in wound healing; low collagen and glycoprotein deposition.	10,000–50,000 UI/day	No human trial on supplementation. Check liver and kidney function to avoid overdosage.	[65,78,80–82]
Vitamin E	Antioxidant effect and increased infection resistance.	Dryness and skin fragility.	400–800 UI/day for 1 month	Protect cells from lipid peroxidation.	[109–111,113]
Vitamin K	Involved in the coagulation cascade.	Increased bleeding risk.	5–10 mg/day or 10 mg i.m. single dose	Coagulation time is the main index of vitamin K deficiency.	[62,65,117]
Proteins	Growth of granulation tissue; collagen and extracellular matrix synthesis.	Wound healing impairment; inefficient immune response with easier bacterial translocation.	0.8–2.4 g/kg/body weight	Measurable with albumin and pre-albumin levels.	[21,24,25,39,40]

STUDI OSSERVAZIONALI

TITOLO	TIPOLOGIA	RISULTATI/CONCLUSIONI
✓ <i>The Impact of Protein Nutritional Supplementation for Massive Weight Loss Patients Undergoing Abdominoplasty</i>	Studio osservazionale retrospettivo	Supplementazione proteica (80 gr/die) ↓ complicanze di ferita (0% vs 21.8%). Risultati buoni e statisticamente significativi, tuttavia campione ridotto
✓ <i>Nutritional Assessment of Bariatric Surgery Patients Presenting for Plastic Surgery: A Prospective Analysis</i>	Studio prospettico osservazionale	Carenze nutrizionali frequenti ; valutazione combinata consigliata; rischio maggiore con età, dumping e forte calo di BMI.
⊘ <i>Complications in post-bariatric body contouring surgery using a practical treatment regime to optimise the nutritional state</i>	Studio prospettico osservazionale multicentrico	Protocollo nutrizionale periop -> Nessuna associazione (no significatività statistica e missing data); necessario specificare tipi di complicanze, tempi di follow-up ben definiti e popolazioni omogenee
⊘ <i>Analysis of laboratory markers in body contouring procedures after bariatric surgery does not indicate particular risks for perioperative complications</i>	Studio retrospettivo monocentrico	59 pazienti post-bariatrici: marker lab nella norma , complicanze 13,7%. Chirurgia plastica post-bariatrica sicura con supplementazione e follow up ravvicinati

STATO DELL'ARTE



Nutrienti presi in esame nel pre-operatorio: A, C, D, B12, B9, zinco, selenio; Proteine in particolare arginina, glutammina e collagene



Evidenza buona di impatto positivo di **supplementazione nutrizionale peri operatoria** a base di **macronutrienti** (proteine) sugli out-come chirurgici (infezioni, deiscenze, necrosi cutanee);



Studi di intervento sull'utilizzo perioperatorio di **supplementi a base di micronutrienti**, amminoacidi, collagene marino e coenzima Q10 hanno mostrato risultati promettenti nella più rapida guarigione delle ferite e qualità delle cicatrice -> studi pilota, campioni limitati e campioni solo femminili



Risultati contrastanti: ottimizzazione nutrizionale pre operatoria non ha portato a riduzione delle complicanze di guarigione delle ferite; Parametri laboratoristici nella norma e non correlazione tra complicanze e deficit nutrizionali -> ma buon follow up nutrizionale



CONCLUSIONI E PROSPETTIVE FUTURE



Il paziente post-bariatrico fa parte di una **popolazione fragile** con alta prevalenza di carenze nutrizionali.



Le carenze influenzano negativamente gli **esiti della chirurgia plastica** (deiscenze, infezioni, ritardi di cicatrizzazione).



Le **evidenze** disponibili sono **eterogenee**, spesso basate su **piccoli campioni** e **studi osservazionali**.



L'ottimizzazione dello stato nutrizionale (proteine e vitamine) mostra risultati promettenti ma ancora preliminari.



Prospettive future: studi multicentrici randomizzati, protocolli condivisi di screening e supplementazione, maggiore aderenza al follow-up.



Approccio integrato e multidisciplinare per migliorare la gestione e ridurre la variabilità clinica.



GRAZIE PER L'ATTENZIONE!



**Equipe della dott.ssa Lilia Bertolani
Istituto Clinico Beato Matteo di Vigevano**



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