South African Journal of Clinical Nutrition 2023; 36(4):175–178
https://doi.org/10.1080/16070658.2023.2281198

SAJCN
ISSN 1607-0658 EISSN 2221-1268

CASE REPORT

Perioperative nutritional management of a Whipple's patient

Safiyah Hasson*

Department of Dietetics, Groote Schuur Hospital, Cape Town, South Africa
**Correspondence: Safiyah.hasson@westerncape.gov.za*

Pancreatic cancers comprise one of the most difficult cancers to diagnose and one of the leading causes of cancer-related deaths in the world.[1,2] A 70-year-old male presenting with a head of pancreas malignant mass was referred for nutritional optimisation as part of the Enhanced Recovery After Surgery (ERAS) programme. He was planned for a pancreatoduodenectomy procedure, also known as a Whipple's procedure. The patient's nutritional status was assessed using the Nutritional Risk Screening 2002 (NRS-2002) tool and bioelectrical impedance analysis (BIA). He was classified as nutritionally at risk. This case study highlights the importance of perioperative nutrition care, the use of appropriate monitoring of body composition changes, where available, and employment of appropriate pharmacologic strategies. A significant improvement in weight, muscle mass and percentage body fat were observed once nutrition was initiated perioperatively. Despite complications during the patient's postoperative phase, he still maintained a good nutritional status through adequate nutrition support.

Keywords: pancreatic cancer; nutritional balance; nutritional support; pancreatic enzyme replacement therapy; PERT

Case study

A 70-year-old male presented with a malignant head of pancreas mass. He was referred as an outpatient as part of the Enhanced Recovery After Surgery (ERAS) programme for nutritional work-up and it was planned that he undergo a Whipple's procedure. His past medical history included a Nissen fundoplication 30 years ago and hypertension, controlled on treatment. He presented with a history of obstructive jaundice and loss of weight. He had percutaneous transhepatic cholangiography (PTC) for a stent placement for symptomatic relief prior to surgery.

Pre-operative management

Anthropometry

The patient's initial nutritional assessment was three weeks prior to surgery. His malnutrition risk was assessed using the NRS-2002 screening tool, anthropometry and bioelectrical impedance analysis (BIA). On his initial assessment he weighed 75.6 kg with a reported weight loss of 6.4 kg (7.8% loss of bodyweight). He was unable to quantify the period of his weight loss. He had a height of 1.77 m and a BMI of 24 kg/m^2. He was found to be nutritionally at risk with an NRS-2002 score of 3. According to his BIA, as indicated in Figure 1, he had a skeletal muscle mass of 37.6 kg, skeletal muscle index (SMI) of 8.8 kg/m^2, percentage body fat of 11% and a phase angle (PhA) of 6.3°. The SMI was indicative of moderate sarcopenia, while the PhA was above the cut-off for increased morbidity and mortality risk. On this basis supplementation was introduced.

Biochemistry

His biochemistry was unremarkable. His albumin three weeks prior to his initial referral was 35 g/l and on admission it had increased to 44 g/l. He had normal electrolytes with a slightly raised ALP of 161 U/l.

Pre-operative dietary management

The patients' caloric requirements were calculated using the European Society for Clinical Nutrition and Metabolism (ESPEN) surgical guidelines of 25–30 kcal/kg total energy (TE) and protein of 1.2–1.5 g/kg.[3] This provided a range of 1 890–2 268 kCal TE and 91–113 g protein.

On his initial consultation he reported having a good appetite and was managing three meals a day at home, which was approximately 1 600 kCal TE and 80 g of protein in accordance with his diet history. Due to his nutritional risk, he was provided with nutritional supplementation in the form of a drink and a porridge. He was required to use the supplements daily leading up to the surgery. This provided him with an additional 426 kCal TE and 16 g of protein a day.

On his admission for surgery, he reported taking 100% of his daily nutritional supplementation, in addition to his regular diet. He also reported going for regular walks as a form of exercise in preparation for his surgery. He had gained 2.8 kg in weight in a period of three weeks, his skeletal muscle had increased by 4.3 kg and his SMI had improved from 8.8 kg/m^2 to 10.8 kg/m^2. This improvement in muscle mass and SMI resulted in him not being classified as sarcopenic. He also had an increased PhA from 6.3^0 to 6.4^0 on admission. Figure 1 depicts how BIA can be useful in indicating the body composition changes with nutritional support and exercise within a period of three weeks. It was also helpful to assess the post-operative outcomes of body composition.

On admission for his surgery, he received 400 ml of a carbohydrate-containing drink the night before and another 400 ml two hours before his surgery, as per ERAS guidelines.[3]

Surgical management

The patient underwent a pylorus-preserving Whipple's procedure. Intraoperatively he had no metastases or ascites. On dissection of the portal structures an inadvertent injury to the

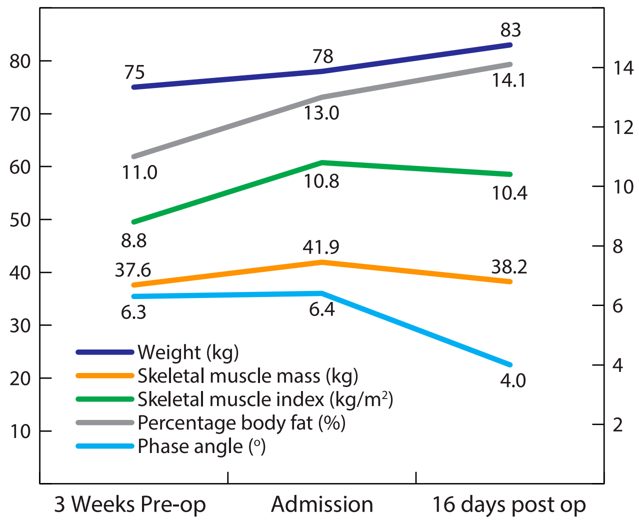

Figure 1: Body composition measurement over time.

artery occurred, which was repaired. A nasojejunal tube (NJT) was placed for post-pyloric feeding and no gastric drainage tubes were used, in accordance with ERAS guidelines. The patient was managed in a postoperative high-care unit where he was mobilised to a chair four hours postoperatively by the physiotherapist. He moved back to the general surgery ward on postoperative day 2.

Postoperative management

Postoperative dietary management

On day 0 post-surgery, feeds were initiated via the NJT. A semi-elemental tube feed was commenced at a low rate of 21 ml/hour as per the unit's protocol. The patient also managed sips of water orally. The feeds were increased daily, and full requirements were met by the third postoperative day using a high-energy, high-protein semi-elemental tube feed. This provided 36 kcal/kg TE and 1.3 g/kg protein. He had no vomiting, diarrhoea or abdominal distention.

On day 2 post-surgery his serum phosphate and sodium decreased. Although refeeding syndrome risk was not initially considered in this patient due to his nutritional optimisation prior to surgery he still displayed electrolyte disturbances following initiation of enteral nutrition. His electrolytes were monitored, replaced and normalised by day 4 post-surgery. His blood glucose remained stable throughout, and he did not require any insulin.

Although oral intake is encouraged postoperatively, patients often are unable to meet their full nutritional requirements orally during the first few days. The patient's appetite improved, and he was challenged on two polymeric oral nutrition supplements (ONS), providing 600 kCal TE and 30 g protein, which was tolerated well. By day 6 post-surgery the patient managed 80% of his oral diet and 25 000 IU of pancreatic enzyme replacement therapy (PERT) was initiated three times a day with meals and 10 000 IU with ONS. This provided 1 880 kCal TE and 78 g protein. NJT feeding was reduced to 21 ml/hour of a semi-elemental tube feed providing 500 kCal TE and 22 g protein, in total providing 30 kCal/kg TE and 1.3 g/kg protein, which was in line with the ESPEN recommendations post-surgery.[3]

On day 8 post-surgery the patient became septic and underwent a computerised tomography (CT) scan. The CT revealed a liver abscess, which was thought to be a complication of mild liver ischaemia as a result of the inadvertent hepatic artery injury intraoperatively. He had a percutaneous drain placed for the liver abscess and a drug resistant *Escherichia coli* was grown on the aspirate. After the procedure he required high care with nasal cannula oxygen support, and was treated with antibiotics. As his oral intake had declined, the decision was made to keep the NJT for feeding, which was increased again to provide full nutritional requirements. A semi-elemental feed was continued during this time. His liver function tests started increasing with a total bilirubin of 31 µmol/l and conjugated bilirubin of 26 µmol/l, which was thought to be related to his liver abscess. The patient continued to improve clinically following percutaneous drain insertion and was transferred back to the surgical ward by day 13 post-surgery. His NJT was removed on day 14 when he was tolerating 100% of the full ward diet as well as the two ONS supplements along with PERT. This provided his full nutritional requirements. Towards his discharge his total bilirubin had decreased to 10 µmol/l.

On day 16 post-surgery his BIA was repeated, and he had gained 5 kg during his hospitalisation. On his BIA report he had increased extra-cellular fluid in his abdominal compartment and lower extremities, which was confirmed by the presence of pedal oedema on clinical examination. His PhA had also significantly decreased to 4° (Figure 1), which was below the cut-off point for increased morbidity and mortality. Despite a small decrease in skeletal muscle mass, he still managed to maintain a higher skeletal muscle mass in comparison with his first presentation. His SMI decreased slightly to 10.4 kg/m^2, which was within the range of moderate sarcopenia for the patient's gender.

The patient was discharged by day 25 post-surgery, at which point he was mobilising and eating well. He continued using PERT with meals and snacks for 6 months post-Whipple. He also continued the oral nutritional supplementation after discharge and was referred to his local community health centre for follow-up.

Discussion

Pancreatic cancer is the fourth leading cause of cancer-related deaths in the world and it is estimated to increase to the second leading cause of cancer deaths by the year 2030.[2,4] Pancreatic cancers are difficult to diagnose early, with only 20% of patients being operable at the time of diagnosis.[4] The pancreaticoduodenectomy procedure, also known as a Whipple's procedure, is one of the surgical interventions to treat a head of pancreas mass.[5] It is also considered for malignancies and benign lesions in the periampullary region.[6] A classic Whipple's procedure involves resection of the head of the pancreas, pylorus, duodenum, common bile duct and gallbladder. A classic Whipple's procedure, however, may carry a higher risk of complications in comparison with a pylorus-preserving Whipple, where the pylorus is not resected.[5] The postoperative complications of a Whipple's procedure can include pancreatic fistulae, ileus, delayed gastric emptying, deep surgical site infection and psuedoaneurysms.[6] Although the postoperative complications carry a high risk, there has been an improvement in the survival rate of patients who maintain good nutritional status and immune response.[4]

Cancer cachexia is particularly high in pancreatic cancer, it is multifactorial and includes inflammation and catabolic effects and pancreatic exocrine insufficiency, as well as cancer treatments such as chemotherapy.[2] The ESPEN 2021 surgical guidelines promote early screening of patients and a minimum of 7–14 days of preoperative nutritional optimisation in patients at risk of malnutrition.[7] Patients who are nutritionally optimised have been shown to have a shorter length of hospital stay (LOS) and better wound healing.[7] Unfortunately, many patients are not referred for preoperative nutrition optimisation. A survey done amongst 420 hepatobiliary surgeons found that 44% did not refer patients for preoperative optimisation and 70% did not have a specific nutrition threshold before surgery.[8] The ERAS programme promotes reduction in surgical stress, maintenance of physiological function, and expedites the return to normal baseline.[9] In the immediate perioperative phase the ERAS guidelines avoid prolonged fasting by recommending solid foods up to six hours prior to surgery and clear liquids up to two hours prior to surgery.[10,7] An 800 ml carbohydrate-rich drink containing maltodextrin is provided the night before surgery and 400 ml two hours prior to surgery.[3] This assists in reducing thirst, hunger and anxiety, as well as postoperative insulin resistance.[3]

Many cancer patients who are eligible for surgery lose significant amounts of lean body mass.[11] There has been a growing interest in the use of BIA in the perioperative phase. Impedance is a measure of the resistance and reactance of the body by applying assumed values to single or multiple current frequencies using different lead configurations to predict body water, fat free mass and fat mass.[11] Measuring weight alone in patients who are being nutritionally optimised does not give insight into the composition of the weight gained. PhA is a direct measurement of BIA, it is the ratio of resistance to reactants, and it has been shown to be a predictor of mortality in different cancers including pancreatic cancer.[11] Measuring PhA could give an indication of mortality risk and could assist in perioperative planning.[11] Patients with a PhA below 4.6° have been shown to be at higher risk of complications.[11] Skeletal muscle index (SMI) is another measurement obtained through BIA that can be used for monitoring of sarcopenia.[12] Moderate sarcopenia is observed when the SMI is between 8.51 and 10.75 kg/m^2 in men or 5.75 and 6.75 kg/m^2 in women. Severe sarcopenia is present with an SMI of $\leq$ 8.50 kg/m^2 in men and $\leq$ 5.75 kg/m^2 in women.[12]

The ERAS guidelines promote early initiation of oral nutrition postoperatively.[10] However, this may not always be achieved and/or maintained depending on the nature of the surgery. A systematic review comparing oral nutrition, NJT feeding, total parenteral nutrition (TPN) and gastrojejunostomy tube feeding (GJT) in patients post-Whipple concluded that oral feeding should be the preferred route of feeding.[13] The ESPEN surgical guidelines advises early enteral nutrition, within 24 hours postoperatively in patients who are unable to meet 50% of their nutritional requirements for seven days or

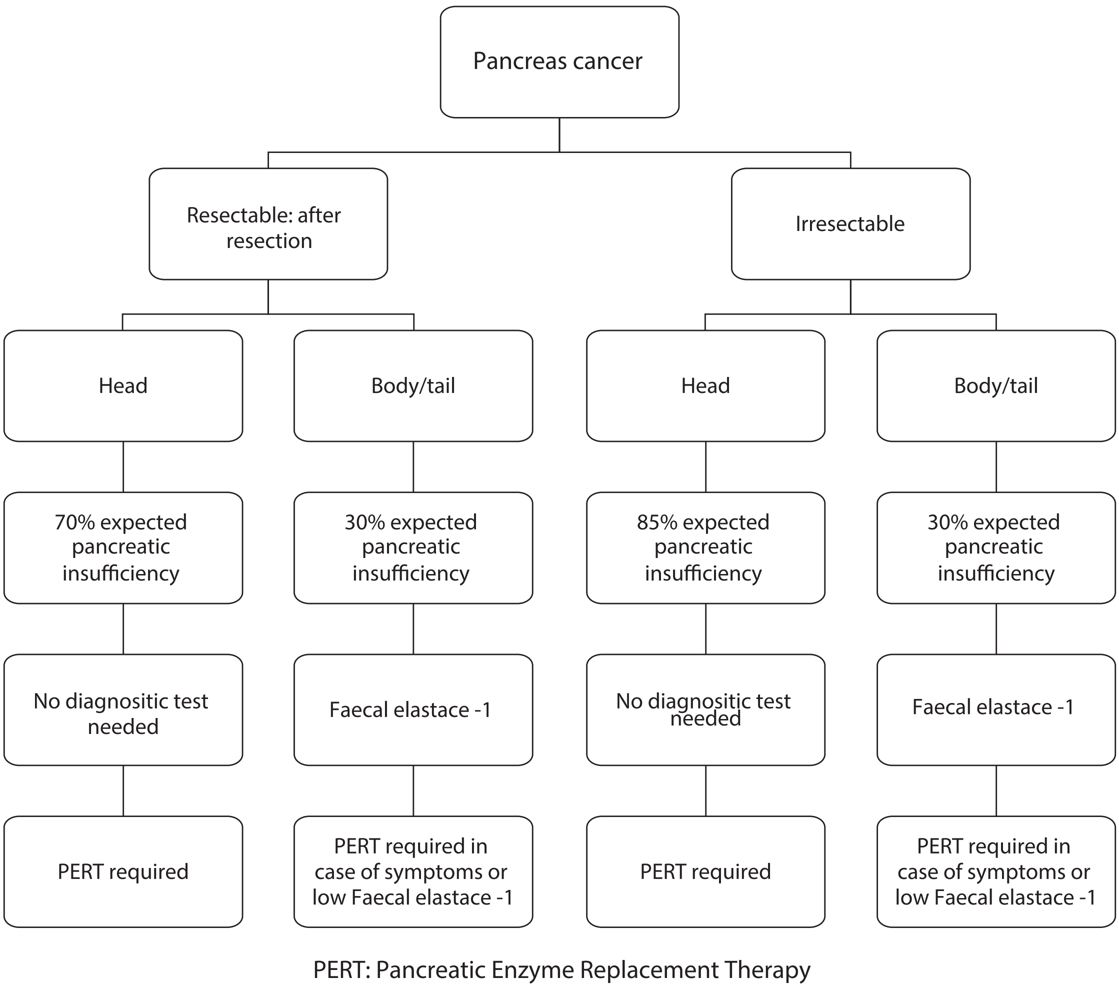

Figure 2: Pragmatic approach to testing and treating pancreatic exocrine insufficiency (PEI) in patients with pancreatic cancer[1].

more in the postoperative period.[7,14] It is often very difficult to predict whether a patient will tolerate a full oral diet after surgery, especially in patients post-Whipple procedure, due to the high risk of postoperative complications, which may hinder oral intake. Furthermore, pancreatic insufficiency due to partial loss of the pancreas predisposes the patient to a higher nutritional risk postoperatively.[1] Enteral feeding may allow the opportunity to reach full nutritional requirement sooner compared with oral intake. In a systematic review comparing different routes of feeding post-Whipple procedure, oral intake took a mean duration of six days to reach full nutritional requirements.[13] The study also found that 29.5% of patients in the oral group required TPN at some point due to complications and delayed gastric emptying.[13] This further supports the concept that post-pyloric enteral feeding post-Whipple is beneficial and that oral intake can be initiated simultaneously. It is important to note that one of the most common reported complications with NJT feeding in this review article was dislodgement of feeding tubes within the first week.[13] A method of reducing dislodgement of feeding tubes and disruption of tube feeding is by placing a bridle.[15] The materials used to place a bridle are inexpensive and easily accessible in a clinical setting.[15] This method of securing NJTs is followed routinely in our institution.

The ERAS guidelines also promote the use of immunonutrition (IN) in patients receiving a Whipple's procedure.[10] The research suggests the use of IN for five to seven days in the perioperative phase.[10] The use of IN has been found to be beneficial in the reduction of infectious complications but the available data remain inconsistent.[10] The use of post-pyloric semi-elemental feeds has not been widely studied. Nevertheless, the presence of pancreatic insufficiency and the inability to provide continuous PERT in continuous enteral feeding provides grounds for the usage of a semi-elemental or elemental feed.[16]

Interestingly, patients who have an irresectable head of pancreas mass have an up to 85% chance of pancreatic insufficiency.[1] This is of particular importance in view of the large population of patients who are diagnosed late and could benefit from being treated with PERT, especially if they undergo palliative cancer treatment.[1] Patients who present with a head of pancreas cancer should be started on PERT before their surgical intervention, especially if they undergo neoadjuvant chemotherapy (NACT).[1] If patients are being worked up for surgery, PERT is thought to assist in maintaining their nutritional status throughout their treatment. PERT therapy should then continue post-surgery as there is a 70% prevalence of pancreatic insufficiency folowing head of pancreas resection.[1] Figure 2 indicates the extent of pancreatic insufficiency expected after removal of different parts of the pancreas.

Conclusion

Despite the growing interest in the use of body composition analysis such as BIA, this assessment has not been widely studied in the context of perioperative nutrition optimisation in patients with pancreatic cancers. Using weight and BMI alone does not give sufficient insight into the changes in body composition. BIA is a good measurement tool to guide perioperative planning and first assessment should be included as close to diagnosis as possible. Although the patient had a longer hospital stay due to surgical complications, the BIA provided a more in-depth understanding of the composition of weight as well as phase angle. The continuation of nutrition support postoperatively also plays an important role in maintaining good nutritional status, and this is shown by an improvement in skeletal muscle mass and SMI. Providing PERT in these patients along with nutritional support should be the standard of care to prevent postoperative loss of weight and improve quality of life.

Disclosure statement – No potential conflict of interest was reported by the authors.

References

1. Pezzilli R, Caccialanza R, Capurso G, et al. Pancreatic enzyme replacement therapy in pancreatic cancer. Cancer. 2020;12(275):1–16. https://doi.org/10.3390/cancers12020275
2. Rovesti G, Valoriani F, Rimini M, et al. Clinical implications of malnutrition in the management of patients with pancreatic cancer: introducing the concept of the nutritional oncology board. Nutrients. 2021;13(10):3522. https://doi.org/10.3390/nu13103522
3. Weimann A, Braga M, Carli F, et al. ESPEN guideline: clinical nutrition in surgery. Clin Nutr. 2017;36(3):623–50. https://doi.org/10.1016/j.clnu.2017.02.013
4. Tazeoglu D, Benli S, Colak T, et al. Comparative analysis of the sarcopenia and HALP score on postoperative outcomes in pancreatic cancer patients after pancreatoduodenectomy. Pancreatology. 2023;23(5):530–6. https://doi.org/10.1016/j.pan.2023.05.006
5. Leichtle SW, Kaoutzanis C, Mouawad NJ, et al. Classic Whipple versus pylorus-preserving pancreaticoduodenectomy in the ACS NSQIP. J Surg Res. 2013;183(1):170–6. https://doi.org/10.1016/j.jss.2013.01.016
6. Cawich SO, Cabral R, Douglas J, et al. Surgery in practice and science Whipple's procedure for pancreatic cancer : training and the hospital environment are more important than volume alone. Surg Pract Sci. 2023;14(July):100211. https://doi.org/10.1016/j.sipas.2023.100211
7. Weimann A, Braga M, Carli F, et al. ESPEN practical guideline: clinical nutrition in surgery. Clin Nutr. 2021;(April):1–18. https://doi.org/10.1016/j.clnu.2021.03.031
8. Martin D, Joliat GR, Halkic N, et al. Perioperative nutritional management of patients undergoing pancreatoduodenectomy: an international survey among surgeons. Hpb. 2020;22(1):75–82. https://doi.org/10.1016/j.hpb.2019.05.009
9. Scott MJ, Baldini G, Fearon KCH, et al. Enhanced recovery after surgery (ERAS) for gastrointestinal surgery, part 1: pathophysiological considerations. Acta Anaesthesiol Scand. 2015;59(10):1212–31. https://doi.org/10.1111/aas.12601
10. Lassen K, Coolsen MME, Slim K, et al. Guidelines for perioperative care for pancreaticoduodenectomy: enhanced recovery after surgery (ERAS®) society recommendations. Clin Nutr. 2012;31(6):817–30. https://doi.org/10.1016/j.clnu.2012.08.011
11. Matthews L, Bates A, Wootton SA, et al. The use of bioelectrical impedance analysis to predict post-operative complications in adult patients having surgery for cancer: a systematic review. Clin Nutr. 2021;40(5):2914–22. https://doi.org/10.1016/j.clnu.2021.03.008
12. Gonzalez MC, Heymsfield SB. Bioelectrical impedance analysis for diagnosing sarcopenia and cachexia: what are we really estimating? J Cachexia Sarcopenia Muscle. 2017;8(2):187–9. https://doi.org/10.1002/jcsm.12159
13. Gerritsen A, Besselink MGH, Gouma DJ, et al. Systematic review of five feeding routes after pancreatoduodenectomy. Br J Surg. 2013;100(5):589–98. https://doi.org/10.1002/bjs.9049
14. Lobo DN, Gianotti L, Adiamah A, et al. Perioperative nutrition: recommendations from the ESPEN expert group. Clin Nutr. 2020;(xxxx). https://doi.org/10.1016/j.clnu.2020.03.038
15. McGinnis C. The feeding tube bridle: one inexpensive, safe, and effective method to prevent inadvertent feeding tube dislodgement. Nutr Clin Pract. 2011;26(1):70–7. https://doi.org/10.1177/0884533610392585
16. Phillips ME, Hopper AD, Leeds JS, et al. Consensus for the management of pancreatic exocrine insufficiency : UK practical guidelines. BMJ Open Gastroenterol. 2021;(May 2020):1–17. https://doi.org/10.1136/bmjgast-2021-000643

Received: 26-10-2023 Accepted: 26-10-2023