

Sarcopenia and Pancreatic Fistula after Pancreatic Surgery

Subjects: **Surgery**

Contributor: Teresa Perra , Giovanni Sotgiu , Alberto Porcu

Postoperative pancreatic fistula (POPF) is one of the most critical complications after pancreatic surgery. The relationship between sarcopenia and outcomes following this type of surgery is debated. There is increasing evidence that sarcopenia should be considered in the preoperative risk assessment and treatment decision making in patients undergoing pancreatic surgery.

pancreatic surgery

sarcopenia

postoperative pancreatic fistula

CT measurements

pancreatoduodenectomy

distal pancreatectomy

Whipple

skeletal muscle

1. Introduction

Pancreatic surgery is technically complex and associated with significant postoperative morbidity, mortality, and prolonged hospitalisation. In recent decades, although survival after pancreatic surgery has improved due to recent advancements in perioperative management and operative technique, many patients still develop complications.

Pancreatoduodenectomy is the gold standard in the treatment of pancreatic, periampullary, and distal bile duct malignancies and should only be performed in centres with high expertise in this type of surgery. Postoperative pancreatic fistula (POPF) is one of the most common and relevant complications following this procedure.

Many possible risk factors of POPF have been identified, such as male gender, higher body mass index, prior history of cholangitis, cardiovascular disease, benign rather than malignant indication, extra-pancreatic tumour location, blood loss, soft parenchymal texture, narrow pancreatic duct width (<3 mm), absence of intraoperative blood transfusion, and higher fluid amylase on postoperative day 1 ^[1].

The evaluation of the nutritional status of patients undergoing pancreatic surgery has been receiving increasing attention, especially in recent years, and according to a position paper of the International Study Group on Pancreatic Surgery (ISGPS), the measurement of nutritional status should be part of the routine preoperative assessment, as malnutrition is a known risk factor for surgery-related complications. The group also suggests considering, in addition to the patient's weight loss and body mass index, the measurement of sarcopenia and sarcopenic obesity ^{[2][3]}.

Sarcopenia seems to be associated with poorer survival, higher postoperative morbidity, and mortality in patients undergoing pancreatic surgery. It can be assessed by the routine preoperative staging CT, but its role in surgical outcomes is still unclear. In particular, its role in the occurrence of POPF is debated.

There is increasing evidence that sarcopenia should be considered in the preoperative risk assessment and treatment decision making in patients undergoing pancreatic surgery [\[4\]](#)[\[5\]](#).

Predicting POPF using a combination of objective preoperative CT measurements could be very useful. Body composition parameters could be evaluated routinely, easily, and at no additional cost.

2. Sarcopenia and Pancreatic Fistula after Pancreatic Surgery

Many risk factors for POPF after pancreatic surgery are known. Researchers investigated the impact of sarcopenia on the occurrence of POPF.

The role of sarcopenia in POPF formation after pancreatic surgery, and following pancreatoduodenectomy and distal pancreatectomy specifically, is still controversial in the literature. A better definition of its role could lead to strategies to reduce complications associated with POPF.

The results showed no clear differences in the incidence of POPF between sarcopenic and non-sarcopenic patients undergoing pancreatic surgery. Six of the twenty-one studies observed a statistically significant effect of sarcopenia, but the data showed an unclear picture of its role in POPF formation. According to Nishida et al. [\[6\]](#), and Linder et al. [\[7\]](#), sarcopenia contributed to the occurrence of POPF, while Amrani et al. [\[8\]](#), Sui et al. [\[9\]](#), Box et al. [\[10\]](#), and Tsukagoshi et al. [\[11\]](#) reported that sarcopenia was a protective factor for POPF. Centonze et al. [\[12\]](#) showed a significant difference only for grade C POPF.

An important point to consider is the surgical procedure performed. The occurrence of POPF after pancreatoduodenectomy usually has different causing factors than after distal pancreatectomy.

Seventeen of the twenty-one studies were conducted on patients undergoing pancreatoduodenectomy, but only five studies [\[6\]](#)[\[7\]](#)[\[9\]](#)[\[10\]](#)[\[11\]](#) reported a significant difference in POPF between the two groups. In order to better understand these findings, researchers also conducted a sub-analysis focusing on the grade of POPF among the studies. Three studies showed a significant difference in the occurrence of clinically relevant POPF (CR-POPF).

Only one study included patients undergoing distal pancreatectomy [\[13\]](#). There is little evidence in the medical literature on this topic.

Sarcopenia is a common condition among patients undergoing pancreatic surgery, but different definitions and cut-offs have been used to define it. In order to better understand its role in this and other fields, a standardisation of its definition is mandatory.

According to a consensus document elaborated by a Special Interest Group within ESPEN in 2010, diagnosis of sarcopenia should be based on the combined presence of low muscle mass (criterion 1) and low gait speed (criterion 2). Criterion 1 is defined as a percentage of muscle mass ≥ 2 standard deviations below the mean measured in young adults of the same sex and ethnic background. Criterion 2 can be considered as a walking speed below 0.8 m/s in the 4 m walking test [\[14\]](#).

In 2010, the European Working Group on Sarcopenia in Older People defined sarcopenia (EWGSOP) as documentation of low muscle mass (criterion 1) plus documentation of either low muscle strength (criterion 2) or low physical performance (criterion 3). According to the group, one of the techniques that can be used to assess muscle mass in research and routine clinical practice is computed tomography (CT) [\[15\]](#).

In 2019, a revised European consensus on the definition and diagnosis of sarcopenia was published. Probable sarcopenia is identified by low muscle strength (criterion 1). Diagnosis is confirmed by additional documentation of low muscle quantity or quality (criterion 2). If criteria 1, 2, and 3 (low physical performance) are all met, sarcopenia is considered severe. Lumbar third vertebra imaging by computed tomography is considered among the techniques that can be used to detect low muscle mass [\[16\]](#).

Researchers studied the role of sarcopenia in the risk of POPF, but other factors such as visceral adiposity and sarcopenic visceral obesity should be considered and could play a role in this field [\[7\]\[17\]\[18\]\[19\]\[20\]\[21\]\[22\]](#).

Preoperative nutritional status and malnutrition should be carefully evaluated, as malnutrition could be responsible for the attenuated healing process of pancreatic anastomosis.

In order to adequately assess the role of sarcopenia, researchers should also evaluate data on the state of nutrition of patients, parenteral nutrition, and jejunostomy. The trend of a lower POPF rate in sarcopenic patients than in non-sarcopenic patients found in researchers' study could be explained by the perioperative nutritional supplementation in sarcopenic patients, but more studies are needed to clarify these findings.

The evaluation of sarcopenia, and body composition parameters in general, should be considered in the preoperative risk stratification and the clinical decision making for patients undergoing pancreatic surgery [\[8\]\[19\]\[23\]\[24\]](#). It can be easily examined on routine preoperative CT scans and could be useful, combined with the assessment of perioperative clinical features, to identify high-risk patients and improve perioperative management strategies [\[21\]\[25\]](#).

In researchers' centre, researchers carefully evaluate the nutritional status of all patients undergoing pancreatic surgery. Weight loss and BMI are assessed routinely. Serum albumin and protein levels are always considered preoperatively. If surgery can be delayed safely, researchers avoid operating on patients with albuminemia < 2.8 g/dL and proteinemia < 5.5 g/dL. In these cases, nutritional counselling is performed, and nutritional supplements are provided until the aforementioned values are achieved, if possible, before performing surgery. In case of the

detection of sarcopenia in the preoperative CT scans, muscle strength and physical performance should be assessed. Perioperative nutritional supplementation should be considered, especially in high-risk patients.

If the role of sarcopenia in POPF formation were to be confirmed, nutrition therapy and perioperative rehabilitation could help to prevent the occurrence of POPF [\[9\]](#).

Preoperative exercise and nutritional support should be considered and implemented to improve the physical status of patients with a high risk of anastomotic leak. Medications to reduce the risk of POPF such as somatostatin analogues could be used for prophylaxis in selected patients.

References

1. Kamarajah, S.K.; Bundred, J.R.; Lin, A.; Halle-Smith, J.; Pande, R.; Sutcliffe, R.; Harrison, E.M.; Roberts, K.J.; PARANOIA Study Group. Systematic review and meta-analysis of factors associated with post-operative pancreatic fistula following pancreatoduodenectomy. *ANZ J Surg.* 2021, 91, 810–821.
2. Gianotti, L.; Besselink, M.G.; Sandini, M.; Hackert, T.; Conlon, K.; Gerritsen, A.; Griffin, O.; Fingerhut, A.; Probst, P.; Abu Hilal, M.; et al. Nutritional support and therapy in pancreatic surgery: A position paper of the International Study Group on Pancreatic Surgery (ISGPS). *Surgery* 2018, 164, 1035–1048.
3. Perra, T.; Porcu, A. State of the Art in Pancreatic Surgery: Some Unanswered Questions. *J. Clin. Med.* 2022, 11, 2821.
4. Ratnayake, C.B.; Loveday, B.P.; Shrikhande, S.V.; Windsor, J.A.; Pandanaboyana, S. Impact of preoperative sarcopenia on postoperative outcomes following pancreatic resection: A systematic review and meta-analysis. *Pancreatology* 2018, 18, 996–1004.
5. Yue, Y.; Li, M.; Zhang, X.; Yu, H.; Song, B. Prediction of clinically relevant pancreatic fistula after pancreatic surgery using preoperative CT scan: A systematic review and meta-analysis. *Pancreatology* 2020, 20, 1558–1565.
6. Nishida, Y.; Kato, Y.; Kudo, M.; Aizawa, H.; Okubo, S.; Takahashi, D.; Nakayama, Y.; Kitaguchi, K.; Gotohda, N.; Takahashi, S.; et al. Preoperative Sarcopenia Strongly Influences the Risk of Postoperative Pancreatic Fistula Formation After Pancreaticoduodenectomy. *J. Gastrointest. Surg.* 2016, 20, 1586–1594.
7. Linder, N.; Schaudinn, A.; Langenhan, K.; Krenzien, F.; Hau, H.M.; Benzing, C.; Atanasov, G.; Schmelzle, M.; Kahn, T.; Busse, H.; et al. Power of computed-tomography-defined sarcopenia for prediction of morbidity after pancreaticoduodenectomy. *BMC Med. Imaging* 2019, 19, 32.

8. El Amrani, M.; Vermersch, M.; Fulbert, M.; Prodeau, M.; Lecolle, K.; Hebbar, M.; Ernst, O.; Pruvot, F.R.; Truant, S. Impact of sarcopenia on outcomes of patients undergoing pancreatectomy: A retrospective analysis of 107 patients. *Medicine* 2018, 97, e12076.
9. Sui, K.; Okabayashi, T.; Iwata, J.; Morita, S.; Sumiyoshi, T.; Iiyama, T.; Shimada, Y. Correlation between the skeletal muscle index and surgical outcomes of pancreaticoduodenectomy. *Surg. Today* 2018, 48, 545–551.
10. Box, E.W.; Deng, L.; Morgan, D.E.; Xie, R.; Kirklin, J.K.; Wang, T.N.; Heslin, M.J.; Reddy, S.; Vickers, S.; Dudeia, V.; et al. Preoperative anthropomorphic radiographic measurements can predict postoperative pancreatic fistula formation following pancreatoduodenectomy. *Am. J. Surg.* 2021, 222, 133–138.
11. Tsukagoshi, M.; Harimoto, N.; Araki, K.; Kubo, N.; Watanabe, A.; Igarashi, T.; Ishii, N.; Yamanaka, T.; Hagiwara, K.; Hoshino, K.; et al. Impact of preoperative nutritional support and rehabilitation therapy in patients undergoing pancreaticoduodenectomy. *Int. J. Clin. Oncol.* 2021, 26, 1698–1706.
12. Centonze, L.; Di Sandro, S.; Lauterio, A.; De Carlis, R.; Botta, F.; Mariani, A.; Bagnardi, V.; De Carlis, L. The Impact of Sarcopenia on Postoperative Course following Pancreatoduodenectomy: Single-Center Experience of 110 Consecutive Cases. *Dig. Surg.* 2020, 37, 312–320.
13. Vanbrugghe, C.; Ronot, M.; Cauchy, F.; Hobeika, C.; Dokmak, S.; Aussilhou, B.; Ragot, E.; Gaujoux, S.; Soubrane, O.; Lévy, P.; et al. Visceral Obesity and Open Passive Drainage Increase the Risk of Pancreatic Fistula Following Distal Pancreatectomy. *J. Gastrointest. Surg.* 2019, 23, 1414–1424.
14. Muscaritoli, M.; Anker, S.D.; Argilés, J.; Aversa, Z.; Bauer, J.M.; Biolo, G.; Boirie, Y.; Bosaeus, I.; Cederholm, T.; Costelli, P.; et al. Consensus definition of sarcopenia, cachexia and pre-cachexia: Joint document elaborated by Special Interest Groups (SIG) “cachexia-anorexia in chronic wasting diseases” and “nutrition in geriatrics”. *Clin. Nutr.* 2010, 29, 154–159.
15. Cruz-Jentoft, A.J.; Baeyens, J.P.; Bauer, J.M.; Boirie, Y.; Cederholm, T.; Landi, F.; Martin, F.C.; Michel, J.P.; Rolland, Y.; Schneider, S.M.; et al. European Working Group on Sarcopenia in Older People. Sarcopenia: European consensus on definition and diagnosis: Report of the European Working Group on Sarcopenia in Older People. *Age Ageing* 2010, 39, 412–423.
16. Cruz-Jentoft, A.J.; Bahat, G.; Bauer, J.; Boirie, Y.; Bruyère, O.; Cederholm, T.; Cooper, C.; Landi, F.; Rolland, Y.; Sayer, A.A.; et al. Writing Group for the European Working Group on Sarcopenia in Older People 2 (EWGSOP2), and the Extended Group for EWGSOP2. Sarcopenia: Revised European consensus on definition and diagnosis. *Age Ageing* 2019, 48, 16–31.
17. Pecorelli, N.; Carrara, G.; De Cobelli, F.; Cristel, G.; Damascelli, A.; Balzano, G.; Beretta, L.; Braga, M. Effect of sarcopenia and visceral obesity on mortality and pancreatic fistula following pancreatic cancer surgery. *Br. J. Surg.* 2016, 103, 434–442.

18. Sandini, M.; Bernasconi, D.P.; Fior, D.; Molinelli, M.; Ippolito, D.; Nespoli, L.; Caccialanza, R.; Gianotti, L. A high visceral adipose tissue-to-skeletal muscle ratio as a determinant of major complications after pancreatoduodenectomy for cancer. *Nutrition* 2016, 32, 1231–1237.
19. Okumura, S.; Kaido, T.; Hamaguchi, Y.; Kobayashi, A.; Shirai, H.; Yao, S.; Yagi, S.; Kamo, N.; Hatano, E.; Okajima, H.; et al. Visceral Adiposity and Sarcopenic Visceral Obesity are Associated with Poor Prognosis After Resection of Pancreatic Cancer. *Ann. Surg. Oncol.* 2017, 24, 3732–3740.
20. Yamane, H.; Abe, T.; Amano, H.; Hanada, K.; Minami, T.; Kobayashi, T.; Fukuda, T.; Yonehara, S.; Nakahara, M.; Ohdan, H.; et al. Visceral Adipose Tissue and Skeletal Muscle Index Distribution Predicts Severe Pancreatic Fistula Development After Pancreaticoduodenectomy. *Anticancer Res.* 2018, 38, 1061–1066.
21. Jang, M.; Park, H.W.; Huh, J.; Lee, J.H.; Jeong, Y.K.; Nah, Y.W.; Park, J.; Kim, K.W. Predictive value of sarcopenia and visceral obesity for postoperative pancreatic fistula after pancreaticoduodenectomy analyzed on clinically acquired CT and MRI. *Eur. Radiol.* 2019, 29, 2417–2425.
22. Pecorelli, N.; Capretti, G.; Sandini, M.; Damascelli, A.; Cristel, G.; De Cobelli, F.; Gianotti, L.; Zerbi, A.; Braga, M. Impact of Sarcopenic Obesity on Failure to Rescue from Major Complications Following Pancreaticoduodenectomy for Cancer: Results from a Multicenter Study. *Ann. Surg. Oncol.* 2018, 25, 308–317.
23. van Dijk, D.P.; Bakens, M.J.; Coolsen, M.M.; Rensen, S.S.; van Dam, R.M.; Bours, M.J.; Weijenberg, M.P.; Dejong, C.H.; Olde Damink, S.W. Low skeletal muscle radiation attenuation and visceral adiposity are associated with overall survival and surgical site infections in patients with pancreatic cancer. *J. Cachexia Sarcopenia Muscle* 2017, 8, 317–326.
24. Van Rijssen, L.B.; van Huijgevoort, N.C.; Coelen, R.J.; Tol, J.A.; Haverkort, E.B.; Nio, C.Y.; Busch, O.R.; Besselink, M.G. Skeletal Muscle Quality is Associated with Worse Survival After Pancreatoduodenectomy for Periapillary, Nonpancreatic Cancer. *Ann. Surg. Oncol.* 2017, 24, 272–280.
25. Takagi, K.; Yoshida, R.; Yagi, T.; Umeda, Y.; Nobuoka, D.; Kuise, T.; Fujiwara, T. Radiographic sarcopenia predicts postoperative infectious complications in patients undergoing pancreaticoduodenectomy. *BMC Surg.* 2017, 17, 64.

Retrieved from <https://encyclopedia.pub/entry/history/show/61490>