



Periarterial and Sub-adventitial Divestment Along with Triangle Operation and RAMPS for Pancreatic Body Cancer

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Background. Locally advanced cancers of the pancreatic body can abut or involve the celiac axis, hepatic artery, or superior mesenteric artery. Recent evidence suggests that these tumors are amenable to surgery after neoadjuvant chemotherapy (Hackert et al., Locally advanced pancreatic cancer: neoadjuvant therapy with FOLFIRINOX results in resectability in 60 % of the patients. *Ann Surg* 264:457–463, 2016; Rangelova et al., Surgery improves survival after neoadjuvant therapy for borderline and locally advanced pancreatic cancer: a single-institution experience. *Ann Surg* 273:579–86, 2021). An arterial divestment technique can be used for these cancers to get an R0 clearance, thereby avoiding morbid arterial resections (Miao et al., Arterial divestment instead of resection for locally advanced pancreatic cancer (LAPC). *Pancreatology* 16:S59, 2016; Habib et al., Periadventitial dissection of the superior mesenteric artery for locally advanced pancreatic cancer: surgical planning with the “halo sign” and “string sign.” *Surgery* 169(5):1026–1031, 2021; Diener et al., Periarterial divestment in pancreatic cancer surgery. *Surgery* 169(5):1026–31, 2020). Two techniques are described for arterial divestment. In the periarterial divestment technique, the plane of the dissection is between the tumor and the adventitia (Habib et al., Periadventitial dissection of the superior mesenteric artery for locally advanced pancreatic cancer: surgical planning with the “halo sign” and “string sign.” *Surgery* 169(5):1026–1031, 2021; Diener et al., Periarterial divestment in pancreatic cancer surgery. *Surgery* 169(5):1026–31, 2020). In sub-adventitial dissection, the plane of dissection

is between the tunica adventitia and the external elastic lamina (Gao et al., Sub-adventitial divestment technique for resecting artery-involved pancreatic cancer: a retrospective cohort study. *Langenbecks Arch Surg* 406:691–701, 2021). The TRIANGLE operation also is one of the surgical techniques to achieve R0 resection in locally advanced pancreatic cancer (Hackert et al., The TRIANGLE operation: radical surgery after neoadjuvant treatment for advanced pancreatic cancer: a single-arm observational study. *HPB Oxford* 19:1001–1007, 2017). This multimedia article aims to demonstrate peri-arterial and sub-adventitial divestment techniques as well as the TRIANGLE operation for a locally advanced cancer of the body of the pancreas. The video also highlights the technique of posterior radical antegrade modular pancreato-splenectomy (RAMPS) together with lymph node clearance.

Patient and Methods. A 57-year-old woman was detected to have pancreatic body adenocarcinoma with tumor contact of the artery and superior mesenteric artery. After neoadjuvant chemotherapy, she was planned to undergo surgical resection.

Results. The surgical technique consisted of peri-arterial and sub-adventitial divestment, the TRIANGLE operation and RAMPS (Fig. 1). The procedure was performed within 240 min, and involved with a blood loss of 250 mL. After the procedure, pancreatic leak (POPF-B), chyle leak and diarrhea developed, which were managed conservatively. The final histopathology showed residual, viable, moderately differentiated adenocarcinoma (ypT2N1M0) with all resection margins free.

Conclusion. The surgical technique consisting of peri-arterial and sub-adventitial divestment, the TRIANGLE operation and RAMPS helps in R0 resection of locally advanced pancreatic body cancer without any compromise in oncologic outcomes and offers an alternative surgical approach to morbid arterial resection.

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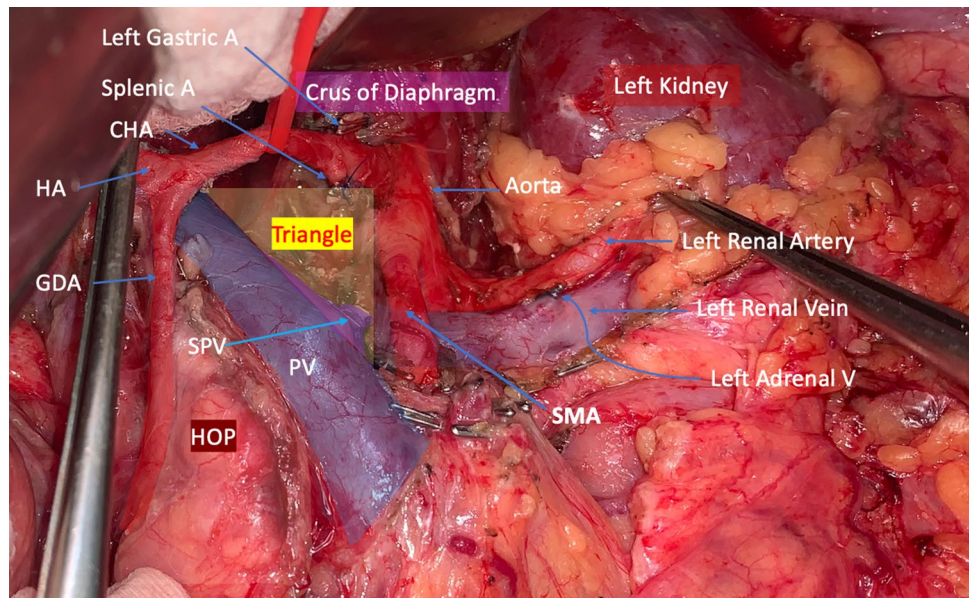
First Received: 6 December 2023

Accepted: 2 April 2024

Published online: 7 May 2024

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FIG. 1 Post resection bed following arterial divestment along with Triangle operation and RAMPS.



Locally advanced cancers of the pancreatic body can abut or involve the celiac axis, hepatic artery, or superior mesenteric artery. Recent evidence suggests that these tumors are amenable to surgery after neoadjuvant chemotherapy.^{1,2} An arterial divestment technique can be used for these cancers to get an R0 clearance, thereby avoiding morbid arterial resections.^{3–5} Two techniques are described for arterial divestment. In the periarterial divestment technique, the plane of the dissection is between the tumor and the adventitia.^{4,5} In sub-adventitial dissection, the plane of dissection is between the tunica adventitia and the external elastic lamina.⁶ The TRIANGLE operation also is one of the surgical techniques to achieve R0 resection in locally advanced pancreatic cancer.⁷

This multimedia article aims to demonstrate peri-arterial and sub-adventitial divestment techniques as well as the TRIANGLE operation for a locally advanced cancer of the body of the pancreas. The video also highlights the technique of posterior radical antegrade modular pancreatosplenectomy (RAMPS) together with lymph node clearance (Fig. 1).

SUPPLEMENTARY INFORMATION The online version contains supplementary material available at <https://doi.org/10.1245/s10434-024-15303-y>.

ACKNOWLEDGMENT The authors acknowledge Dr Menaita Lala for assistance and the videography team of Kasturba Medical College, MAHE, Manipal for help in video recording.

AUTHOR CONTRIBUTIONS Conceptualization, Writing original draft, Video editing, Supervision: NK. Review and editing: AP, NU, SA, NK.

FUNDING Open access funding provided by Manipal Academy of Higher Education, Manipal.

DISCLOSURE There are no conflicts of interest.

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