S Afr J Surg. 2024;62:210-215. Online first
https://doi.org/10.36303/SAJS.00166

S Afr J Surg
ISSN 038-2361

PAEDIATRIC SURGERY

Paediatric abdominal oncovascular surgery – a single-centre experience and review of the literature

A Zanini, D Harrison, S Connor, J Loveland

Department of Paediatric Surgery, Faculty of Health Sciences, University of the Witwatersrand, South Africa

Corresponding author, email: *andrea.zanini.87@gmail.com*

Background: Oncovascular surgery is a term identifying vascular resection in the context of tumour resection, which is still controversial in children. We present our experience and review of the literature.
Methods: A retrospective review of children who underwent abdominal oncovascular procedures in our institution from 2018 to 2022 was conducted. Type of operation and postoperative outcome was described. Literature review on oncovascular surgery in children is presented.
Results: Seven cases were identified, mean age 8.25 years (9 months–14 years) – two bilateral paragangliomas, two Wilms tumours, one pancreatoblastoma, one solid pseudopapillary tumour of the pancreas (SPN), and one hepatoblastoma. Five procedures were performed on the inferior vena cava – three patients underwent cavectomy with no reconstruction, one had a partial cavectomy with primary repair, and one had resection and reconstruction with a polytetrafluoroethylene (PTFE) graft which complicated with leaking and infection. Two patients underwent a pancreaticoduodenectomy with portal vein resection and primary anastomosis. Five patients were completely resected (R0), two patients had microscopically positive margins (R1). One patient was lost to follow-up post-resection; all others were alive at last follow-up.
Conclusion: Vascular resection can allow complete tumour resection in locally advanced paediatric tumours. Oncovascular surgery in children is feasible and may be beneficial in selected cases.
Keywords: paediatric surgery, oncology, paediatric oncology, vascular surgery

Introduction

Although commonly complicating certain adult solid tumours, vascular involvement in paediatric oncology is rare.[1] While vascular invasion by tumour has traditionally been considered a contraindication for resectability, over the past decades, resection of the vascular component concomitant with resection of the primary tumour have been reported, extending the boundaries of tumour resectability in selected cases. While in adult surgical oncology some of these vascular resections have become more standardised, their indication in paediatric surgical oncology remains sporadic and controversial.[2] In addition to defining the indications for these extended resections, there is also a lack of consensus regarding the technical aspects of these resections and reconstructions. Different strategies of vascular reconstruction are described in adult oncology, but few reports have been published in this regard in the paediatric population.[1,2] This paper describes our institutional experience with the surgical management of malignancies complicated by vascular invasion, including our techniques of resection and reconstruction, and discusses the current available literature.

Methods

After receiving approval from our Ethics Committee (HREC M220202), we performed a retrospective study from 1 January 2018 to 31 May 2022, including all patients younger than 18 years of age who were operated on for solid tumours with major abdominal vascular involvement, which were selected for a concomitant vascular surgical procedure. We included those cases requiring resection of more than 50% of the circumference of a major abdominal vessel. Standardised procedures such as cavotomy for tumour thrombus removal or partial resection of less than 50% of a vessel wall were not considered for this study.

Demographic data, clinical and surgical information were retrospectively collected and reviewed. More specifically, age at surgery, type of tumour, preoperative radiological findings and staging, location and side of the mass, and vessels involved were collected.

Preoperative assessment and management were directed according to tumour type and the respective institutional protocol. Surgical reports were retrospectively reviewed to collect intraoperative information, specifically the approach to resection of the primary disease, the vascular resection performed, including whether a reconstruction was performed and the type of reconstruction. Intraoperative complications were also noted. Histology reports of the resected specimen were reviewed to confirm the histological diagnosis of the primary tumour and to assess the extent of vascular involvement. Postoperative management was evaluated with a specific focus on complications. All morbidity and mortality were reported, and long-term survival was recorded. Finally, we reviewed the available English

literature specifically focusing on surgical management of vascular involvement in paediatric oncology.

Results

Seven patients met the criteria for this study, four male and three female. Average age was 8.25 years (range: 9 months–14 years). Two patients presented with bilateral paraganglioma, two with pancreatic tumours, two with nephroblastoma, and one with hepatoblastoma (HBL). Patient characteristics are summarised in Table I. Eight vascular procedures were performed – the two patients with pancreatic tumours (one pancreatoblastoma and one solid pseudopapillary tumour of the pancreas [SPN]) had portal vein (PV) resection and reconstruction with primary end-to-end anastomosis as part of a Whipple procedure. The remaining five patients had their procedures performed on the inferior vena cava (IVC). All the patients were operated on by paediatric surgeons with large oncologic, vascular and transplant experience. Surgical information is summarised in Table I.

Three patients had cavectomy with no reconstruction, two for nephroblastoma (Wilms tumour) and one for HBL. The first Wilms tumour (WT) was a 3-year-old male diagnosed with non-metastatic right-sided WT with a tumour thrombus extending into the infrahepatic IVC. Neoadjuvant chemotherapy (NACT) was initiated according to the International Society of Paediatric Oncology (SIOP) Umbrella protocol. However, the family refused surgery and absconded. The patient represented six months later with hypovolemic shock due to an intracapsular bleeding of a massive tumour requiring an emergency laparotomy. The IVC was not visible on the preoperative CT scan, whilst the azygos vein was dilated. Intraoperatively, the infrahepatic suprarenal IVC was not separable from the tumour which had infiltrated the IVC wall. Right nephrectomy with en-bloc cavectomy without reconstruction was performed (Figure 1). Although vascular margins of resection were free, the patient was staged as stage III for the preoperative rupture. No postoperative complication was noted. However, the patient did not undergo radiation therapy and represented with extensive lung metastases, and he was referred for palliative care.

The second patient with WT was a 7-year-old female previously treated for a stage III left-sided tumour. At initial presentation, she had a tumour thrombus extending up the IVC into the heart, which regressed completely after NACT. The patient subsequently underwent a standard left nephrectomy. Due to non-compliance, adjuvant chemo- and radiotherapy were not completed, and the patient represented two years later with a large relapse in the infrahepatic IVC. With extensive disease, and no demonstrable flow, she underwent an elective infrahepatic suprarenal cavectomy without reconstruction. Histology confirmed positive resection margins, although of little relevance in this case, since second line chemotherapy and radiotherapy in recurrent disease are mandatory. The patient completed postoperative adjuvant treatment and is now disease free at 1-year follow-up.

The last cavectomy was performed on a 9-month-old female who presented with a pre-treatment extent of tumour (PRETEXT) 3VP (vein encasement, PV invasion) HBL. After NACT, she was reassessed as post-treatment extent of tumour (POSTTEXT) 3V due to IVC infiltration. She

Table I: Summarised surgical information

Patient n	Sex	Age	Diagnosis	Vessel invasion	NACT	Procedure	Radical resection	Complications	Outcome
1	F	14 years	SPN of pancreas	Portal vein, hepatic artery	No	Whipple pr + PV resection and anastomosis; hepatic artery dissected from tumour	R0	No	Disease free at 5 years FU
2	M	7 years	Pancreatoblastoma	Portal vein, coeliac trunk	4 cycles	Whipple pr + PV resection and anastomosis; coeliac trunk dissected from tumour	R0	No	Disease free at 2 years FU
3	M	11 years	Bilateral paraganglioma	IVC, right renal artery, coeliac trunk	No	Resection, dissection of arteries, partial cavectomy with primary repair	R0	No	Disease free at 5 years FU
4	M	14 years	Bilateral paraganglioma	IVC	No	Tumour resection, cavectomy with PTFE grafting	R0	Haemodynamic shock for anastomotic leak; graft infection and thrombosis	Progression-free survival at 3 years FU. Lost at FU thereafter
5	M	3 years	Right Wilms tumour	IVC	Defaulted	En-bloc right nephrectomy + suprarenal cavectomy no reconstruction	R0	No	Died 3 years later for metastatic disease
6	F	7 years	Relapse of left Wilms tumour	Tumour relapse in suprarenal IVC	Yes	Cavectomy with no reconstruction	R1	No	Disease free at 1 year FU
7	F	0,75 years	Hepatoblastoma	Retro-hepatic IVC	6 cycles	En-bloc extended right hepatectomy and cavectomy with no reconstruction	R1	No	Disease free at 1 year FU

NACT – Neoadjuvant chemotherapy, SPN – Solid pseudopapillary neoplasm, PV – Portal vein, FU – Follow-up, IVC – Inferior vena cava, PTFE – Polytetrafluoroethylene

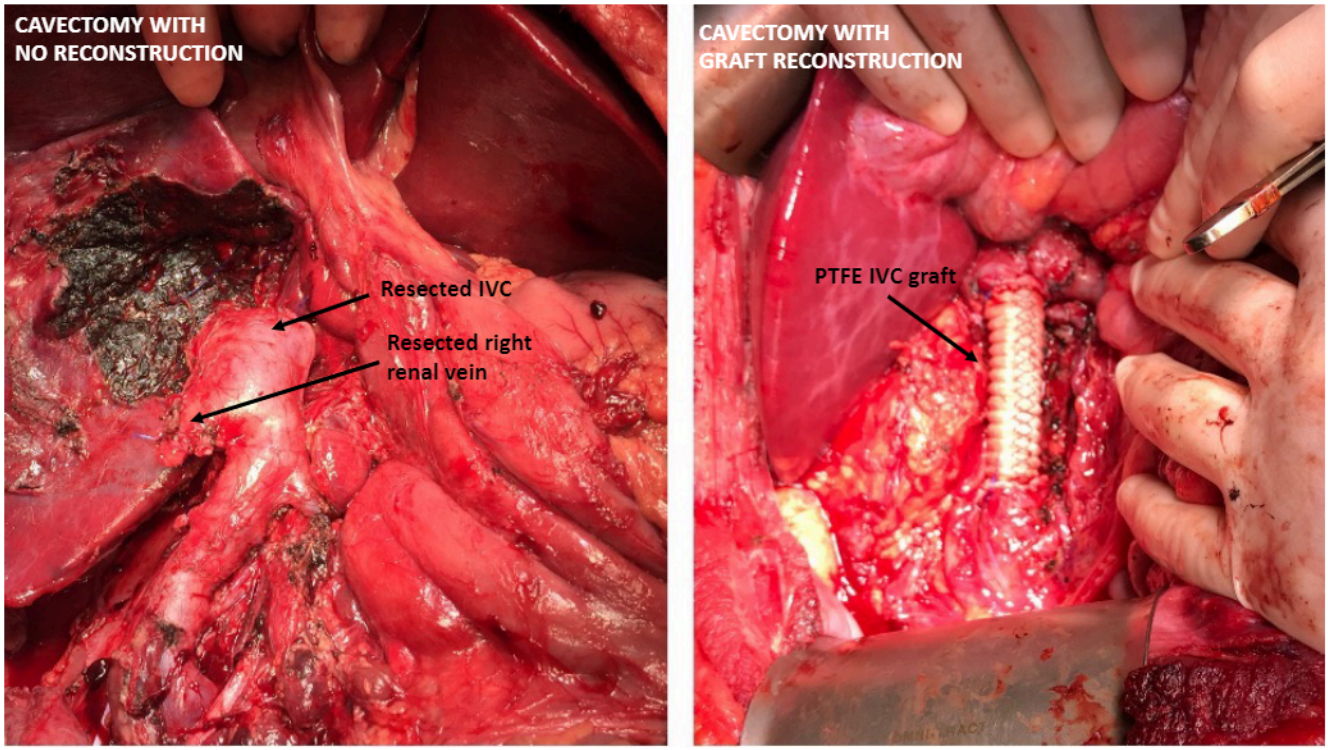

Figure 1

was presented to the transplant unit which assessed her as an unsuitable candidate for transplant, based on the presence of persistent extrahepatic disease. An extended right hepatectomy and caudate lobe resection with an en-bloc suprarenal cavectomy and preservation of the left hepatic vein was performed. No intra- or postoperative complications were noted. Whilst the vascular resection margin was tumour-free, microscopically residual disease was reported by the pathologist in the form of necrotic tumour cells present at the parenchymal resection margin. The patient underwent adjuvant chemotherapy and there has been no evidence of recurrence on serial follow-up CT scans.

Of the two patients who presented with bilateral paraganglioma infiltrating the IVC, one underwent bilateral resection of the mass together with a partial caval resection with primary reconstruction, as well as a partial resection and primary repair of the right renal artery. Complete resection was achieved and no complications occurred. The second patient with a paraganglioma underwent resection of the right-sided tumour together with an infrarenal cavectomy and prosthetic graft (PTFE) interposition (Figure 1). This procedure was complicated by an anastomotic bleed which required a relook laparotomy at 48 hours, as well as by graft infection 1-week post-surgery. The infected graft was completely thrombosed and was removed, leaving the IVC interrupted. Postoperatively, the patient recovered and was subsequently discharged. Subsequently, a supraclavicular nodal metastasis with active uptake on meta-iodobenzylguanidine scan (MIBG) was detected. The family refused surgery of the contralateral lesion, until he presented with severe haematemesis requiring emergency surgery and resection of the residual mass with a sleeve of duodenum as well as the kidney. The patient was lost to follow-up thereafter.

The last two patients underwent Whipple procedures with concomitant resection and reconstruction of the PV for pancreatic head tumours – one pancreatoblastoma and one SPN. The former underwent resection after four cycles of NACT for an unresponsive mass encasing the PV and coeliac trunk while the latter had a primary resection. In both cases, the celiac axis and superior mesenteric artery were dissected off the tumour, while the PV was completely encased by the mass. In both cases, PV resection with tension-free end-to-end anastomosis was possible. Histology demonstrated resection margins clear of tumour in both cases. Postoperative Doppler demonstrated excellent portal flow in both cases. Both patients are disease-free and doing well on follow-up.

Discussion

Oncovascular surgery is a recently introduced term, defined by Ghosh et al. as cancer resection with concurrent ligation or reconstruction of a major vascular structure.[3] Oncovascular surgery is performed after considering the balance between the prognosis of the particular tumour and the expected morbidity of the procedure.[3]

Oncovascular surgery is classified into three categories – surgery for tumours of primary vascular origin, rescue surgery for complications encountered during tumour resection, or planned en-bloc vascular and tumour resection. This paper focuses on the latter category. The most common applications of this strategy in adult surgery are pancreatic tumours encasing the PV or the hepatic artery, retroperitoneal sarcomas invading major vasculature, or limb salvage surgery for extremity sarcomas. Although oncovascular procedures are performed internationally for a wide range of oncological diseases in adults, no uniformity exists regarding strategy, operative technique and follow-up.[4] Oncovascular surgery is even more rare in children, and is only reported anecdotally.[2]

Arterial resection and reconstruction, whilst common practice in specialised centres treating adult tumours, is rarely performed in children.[3] Resection of major arteries mandates reconstruction. Primary anastomosis is the preferred option, but it is rarely feasible. Autologous graft with the iliac or saphenous vein, or prosthetic graft are the other options described.[5] Prosthetic grafts are usually not preferred due to high risk of infection and thrombosis. However, they are the prevailing substitute for abdominal reconstruction. A successful PTFE grafting of the infrarenal aorta for a recurrent ganglioneuroma in a 11-year old has been described.[6] Other arterial reconstructions in children are reported as part of bigger series including adult patients but are not discussed separately.[7]

Various childhood tumours are prone to vascular involvement. Neuroblastoma typically grows around vessels and the traditional recommendation is vessel definition, vessel clearance, followed by tumour removal ensuring that the integrity of the vessel is left intact.[8] Whilst vascular resection for neuroblastoma has been described, it remains controversial.[2] In our institution we do not perform vascular resections for neuroblastoma as the current evidence on the benefit of a complete resection (R0) does not add to a survival benefit, therefore we believe that the risks of resective vascular procedures outweigh the benefits.[9] On the contrary, for other malignancies, complete surgical resection remains the curative treatment goal.[10]

Involvement of major venous vasculature such as the IVC is particularly challenging. The most common tumours associated with invasion of the vena cava in childhood are hepatic and retroperitoneal malignancies, whereas direct intravascular extension and tumour thrombi are commonly associated with renal tumours, especially WT.[2] Thrombus removal in WT rarely requires vascular resection.[11] However, in rare occasions the thrombus is not separable from the vein wall and en-bloc resection may be needed to achieve complete tumour resection.[12] The higher incidence of WT in the African population together with a large rural community with poor access to healthcare make late presentation of these tumours common. As in a number of our cases, it is not uncommon for patients to default chemotherapy or radiotherapy, or refuse surgery, further contributing to disease progression and complications.

The IVC may also be involved by other retroperitoneal tumours such as teratomas and paragangliomas.[13] Pheochromocytomas and paragangliomas can encase the IVC, occasionally requiring aggressive resection – cavectomy for invasive paragangliomas has been described in both adults and children.[10,14] Retroperitoneal sarcomas may also involve the IVC and cavectomy for such tumours is also reported.[2]

The IVC may be involved in hepatoblastomas as well.[15] Involvement of the IVC is not an absolute contraindication to tumour resection, and en-bloc tumour resection with the IVC is contemplated in the International Childhood Liver Tumours Strategy Group 4 (SIOPEL4) protocol). In our institution, relatively reduced access to transplantation together with significant experience in hepatobiliary surgery have induced a preference for more extensive primary resections of HBL unless absolutely contraindicated. The case in our series is an example of the success of advanced resection for a borderline resectable HBL, similar to what is reported for adults patients.[15]

With respect to invasion of the main PV in HBL, this is generally considered an absolute indication for transplant. PV resection, however, may be necessary for other paediatric malignancies, mostly pancreatic in origin.[16] Pancreatoblastoma and SPN are the most common pancreatic malignancies in childhood and hence the main indications for PV resection in children.[17,18] Both of these tumours are rare, hence specific protocols are not available. Surgical resection is the mainstay of treatment for both of these tumours, so when involved, PV resection is the only option to achieve complete tumour resection.[16] Generally, in cases presenting with vascular involvement, NACT is ideal in an attempt to shrink the tumour and avoid these extended surgical techniques.[1] Of our two cases, the 7-year-old patient was reported to be a pancreatoblastoma on the diagnostic biopsy; four cycles of NACT were administered but with poor response. The second older patient had imaging consistent with an SPN and upfront surgery was performed.

For more common tumours like WT and HBL, protocols are available, and they mandate NACT. On the contrary, paragangliomas have typically a poor response to NACT and therefore primary en-bloc resection of mass and vessels must be considered.[19,20]

After resection of the involved vessel, a decision needs to be made regarding simple ligation, or reconstruction.[21] This will depend on whether an artery or vein is involved, and what it supplies – most arteries and the PV will require reconstruction, whilst the IVC can be ligated with impunity. Primary end-to-end anastomosis is the preferred option when feasible, as it is associated with improved outcomes,[22] which is consistent with the two cases in our series. When primary anastomosis is not feasible, vascular reconstruction has been described, this including patch angioplasty, or interposition grafting using either autologous vein or prosthetic material.[21,23] There is currently no published consensus about the optimal graft for PV repair, although prosthetic graft appears to have a higher incidence of thrombosis, considering also the lack of consensus on anticoagulation regimen after vascular surgery in children.[24]

Iliac vein,[25] pericardium,[17] and recanalised umbilical vein[26] have been described as options. In our institution, the preferred graft for PV reconstruction is the internal jugular vein, this based on our experience with shunts for portal hypertension and transplant surgery. However, we have not required interposition grafts in our portal venous reconstructions to date.

Prosthetic grafting for IVC reconstruction has seldom been described in the paediatric population.[2] Grimaldi et al. reported a series of four patients who underwent PTFE replacement of the IVC, three of whom developed graft thrombosis, although asymptomatic.[2] The high rate of complications after PTFE replacement of the IVC has also been reported in adult literature.[27] In our series, we utilised this strategy in one case with post-operative anticoagulant at prophylactic dose. The patient complicated with bleeding, and subsequent infection and thrombosis.

The alternative, resection without reconstruction, is well reported.[27] In adults presenting with IVC occlusion and no chronic venous disease, ligation is well tolerated, and may be associated with less blood loss and pulmonary thromboembolism. Ligation relies on collateral venous drainage in the retroperitoneum, and it should be noted that extensive local resections may compromise further

development of this venous drainage. For this reason, where the IVC is partially obstructed, or when pre-existing collaterals are disrupted intraoperatively, reconstruction is preferred.[27] Children tolerate ligation of the IVC particularly well, due to their ability to rapidly develop venous collaterals.[28,12] This is particularly true in cases of progressive occlusion due to tumour ingrowth, which allows the venous return to be gradually diverted through collaterals, usually demonstrated by a dilated azygos vein on preoperative CT scan.[28,12]

Grimaldi et al. reported routine prosthetic grafting of the IVC as a bridge solution to allow better recovery and development of collaterals as the graft slowly thromboses.[2] In our opinion this can be considered, however, the high risk of complications, including graft infection, is a significant consideration in favour of avoiding IVC reconstruction.[27] In our institution, if cavectomy is necessary, a trial of intraoperative caval exclusion is performed and reconstruction is considered only if the patient shows signs of haemodynamic instability. Another potential advantage of cavectomy without reconstruction is the avoidance of long-term thromboprophylaxis.[12] In our experience, cavectomy was well tolerated by children and was not associated with any short- nor long-term complications.

In adults, elective procedures performed with the aim of achieving complete resection including vascular resections did not demonstrate additional morbidity when compared to those patients that underwent tumour resection alone,[1] unless the former were performed as emergencies.[29] Achieving complete resection is the ultimate goal for which oncovascular surgery is usually contemplated. In our series, this was possible in five of seven cases, whilst in two patients histology showed microscopically positive resection margins. The HBL patient had tumour present at the hepatectomy margin, with the resection line at the absolute limit of leaving adequate functional liver with appropriate vascular inflow and outflow to the remaining segments. The caval vascular margin of resection was clear. Since leaving microscopically positive margin is acceptable in the context of complex liver resections,[30] particularly when liver transplantation is contraindicated, or less accessible, this strategy allowed our patient to be cured. In our WT patient, cavectomy allowed us at least to achieve gross tumour resection, followed by adjuvant chemo and radiotherapy as per recognised treatment guidelines.

Conclusion

Oncovascular paediatric surgery can allow the surgical team to achieve complete tumour resection in some cases of locally advanced tumours, previously deemed non-resectable. This may decrease the intensity of treatment and treatment-related-toxicity and in some cases change the aim of treatment from palliative to curative. PV resection and reconstruction, cavectomy with or without reconstruction, are valid options in appropriately selected paediatric cases, with little morbidity. Whilst at present not enough data is available proving any long-term benefit in children, we believe this case series may support oncovascular procedures in particular paediatric cases. As more evidence emerges, hopefully it will be possible to identify criteria for selecting the patients who may be appropriate candidates for paediatric oncovascular surgical procedures.

Conflict of interest

The authors declare no conflict of interest.

Funding source

No funding was required.

Ethical approval

Ethical approval was obtained from the University of the Witwatersrand Research Ethics Committee (HREC M220202).

ORCID

A Zanini https://orcid.org/0000-0001-6857-0518
D Harrison https://orcid.org/0000-0002-7093-1383
J Loveland https://orcid.org/0000-0002-3341-0749

REFERENCES

1. DiPerna CA, Bowdish ME, Weaver FE, et al. Concomitant vascular procedures for malignancies with vascular invasion. Arch Surg. 2002;137(8):901-907. https://doi.org/10.1001/archsurg.137.8.901.
2. Grimaldi C, Bertocchini A, Crocoli A, et al. Caval replacement strategy in paediatric retroperitoneal tumours encasing the vena cava: a single-centre experience and review of literature. J Paediatr Surg. 2019;54(3):557-61. https://doi.org/10.1016/j.jpedsurg.2018.06.008.
3. Ghosh J, Bhowmick A, Baguneid M. Oncovascular surgery. Eur J Surg Oncol. 2011;37(12):1017-24. https://doi.org/10.1016/j.ejso.2011.08.131.
4. Baláž P, Vikatmaa P, Björck M, et al. Oncovascular surgery: The current situation and future perspectives in Europe. Eur J Vasc Endovasc Surg. 2022;63(2):350-1. https://doi.org/10.1016/j.ejvs.2021.11.015.
5. Han A, Ahn S, Min SK. Oncovascular surgery: Essential roles of vascular surgeons in cancer surgery. Vasc Spec Int. 2019;35(2):60-9. https://doi.org/10.5758/vsi.2019.35.2.60.
6. Fueglistaler P, Gurke L, Stierli P, et al. Major vascular resection and prosthetic replacement for retroperitoneal tumours. World J Surg. 2006;30(7):1344-9. https://doi.org/10.1007/s00268-005-0555-2.
7. Poultsides GA, Tran TB, Zambrano E, et al. Sarcoma resection with and without vascular reconstruction - a matched case-control study. Ann Surg. 2015;262(4):632-40. https://doi.org/10.1097/SLA.0000000000001455.
8. Kiely EM. Radical surgery for abdominal neuroblastoma. Semin Surg Oncol. 1993;9(6):489-92. https://doi.org/10.1002/ssu.2980090606.
9. Ryan AL, Akinkuotu A, Pierro A, Morgenstern DA, Irwin MS. The role of surgery in high-risk neuroblastoma. J Paediatr Hematol Oncol. 2020;42(1):1-7. https://doi.org/10.1097/MPH.0000000000001607.
10. Orbach L, Nachmany I, Goykhman Y, et al. Surgical approach to abdominal tumours involving the inferior vena cava. Isr Med Assoc J. 2020;22(6):364-8.
11. Cox S, Büyükünal C, Millar AJW. Surgery for the complex Wilms tumour. Paediatr Surg Int. 2020;36(2):113-27. https://doi.org/10.1007/s00383-019-04596-w.
12. Ceccanti S, Büyükünal C, Emre Ş, et al. Resection of Inferior vena cava without reconstruction for intravascular intrusion of Wilms tumour. Urology. 2021;149:e29-e33. https://doi.org/10.1016/j.urology.2020.11.004.

13. Jones VS, Burns CR. Operative considerations in pediatric retroperitoneal teratomas: A review. Eur J Pediatr Surg. 2012;23(04):265-9. https://doi.org/10.1055/s-0032-1313338.
14. Mannina EM, Xiong Z, Self R, Kandil E. Resection of a catecholamine-elaborating retroperitoneal paraganglioma invading the inferior vena cava. Case Rep Surg. 2014;2014:1-4. https://doi.org/10.1155/2014/837054.
15. Hemming AW, Reed AI, Langham MR, Fujita S, Howard RJ. Combined resection of the liver and inferior vena cava for hepatic malignancy. Ann Surg. 2004;239(5):712-21. https://doi.org/10.1097/01.sla.0000124387.87757.eb.
16. d'Ambrosio G, del Prete L, Grimaldi C, et al. Pancreaticoduodenectomy for malignancies in children. J Paediatr Surg. 2014;49(4):534-8. https://doi.org/10.1016/j.jpedsurg.2013.09.010.
17. Yonekura T, Kosumi T, Hokim M, et al. Aggressive surgical and chemotherapeutic treatment of advanced pancreatoblastoma associated with tumour thrombus in portal vein. J Paediatr Surg. 2006;41(3):596-8. https://doi.org/10.1016/j.jpedsurg.2005.11.071.
18. Yu P, Cheng X, Du Y, et al. Solid pseudopapillary neoplasms of the pancreas: A 19-year multicentre experience in China. J Gastrointest Surg. 2015;19(8):1433-40. https://doi.org/10.1007/s11605-015-2862-8.
19. Hu H, Huang B, Zhao J, et al. En-bloc resection with major blood vessel reconstruction for locally invasive retroperitoneal paragangliomas: A 15-year experience with literature review. World J Surg. 2017;41(4):997-1004. https://doi.org/10.1007/s00268-016-3846-x.
20. Srirangalingam U, Gunganah K, Carpenter R, et al. Phaeochromocytoma and Paraganglioma excision involving the great vessels. EJVES Short Rep. 2017;35:1-6. https://doi.org/10.1016/j.ejvssr.2017.02.002.
21. Ruiz CS, Kalbaugh CA, Browder SE, et al. Operative strategies for inferior vena cava repair in oncologic surgery. J Vasc Surg Venous Lymphat Disord. 2020;8(3):396-404. https://doi.org/10.1016/j.jvsv.2019.09.012.
22. Dua MM, Tran TB, Klausner J, et al. Pancreatectomy with vein reconstruction: technique matters. HPB. 2015;17(9):824-31. https://doi.org/10.1111/hpb.12463.
23. Gaignard E, Bergeat D, Robin F, et al. Inferior vena cava leiomyosarcoma: What method of reconstruction for which type of resection? World J Surg. 2020;44(10):3537-44. https://doi.org/10.1007/s00268-020-05602-2.
24. Labori KJ, Kleive D, Khan A, et al. Graft type for superior mesenteric and portal vein reconstruction in pancreatic surgery: A systematic review. HPB. 2021;23(4):483-94. https://doi.org/10.1016/j.hpb.2020.11.008.
25. Kanai T, Miyazaki S, Akatsu T, Nakagawa M, Kameyama K. Long-term follow-up after pancreatoduodenectomy with portal vein resection for a huge solid pseudopapillary neoplasm in an adolescent girl. Keio J Med. 2014;63(3):52-9. https://doi.org/10.2302/kjm.2014-0003-CR.
26. Shinkai M, Mochizuki K, Kitagawa N, et al. Usefulness of a recanalised umbilical vein for vascular reconstruction in paediatric hepatic surgery. Paediatr Surg Int. 2016;32(6):553-8. https://doi.org/10.1007/s00383-016-3893-2.
27. Wysocki AP, Hetherington R, Nicol D, Gibbs HH. Haemodynamic assessment following inferior vena cava resection without replacement. ANZ J Surg. 2004;74(8):667-70. https://doi.org/10.1111/j.1445-1433.2004.03127.x.
28. Jones VS, Shun A. Is the inferior vena cava dispensable? Paediatr Surg Int. 2007;23(9):885-8. https://doi.org/10.1007/s00383-007-1969-8.
29. Aronson DC, Weeda VB, Maibach R, et al. Microscopically positive resection margin after hepatoblastoma resection: What is the impact on prognosis? A Childhood Liver Tumours Strategy Group (SIOPEL) report. Eur J Cancer. 2019;106:126-32. https://doi.org/10.1016/j.ejca.2018.10.013.
30. Bianchi C, Ballard JL, Bergan JH, Killeen JD. Vascular reconstruction and major resection for malignancy. Arch Surg Chic Ill 1960. 1999;134(8):851-5. https://doi.org/10.1001/archsurg.134.8.851.