

# Perioperative Management of Patients with Non-Cardiac Tumors Extending to the Cardiac Chambers and Great Vessels

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## Abstract

**Background:** Some tumors arise surrounding the heart, aorta and venacava. Malignant tumors have distant location with metastasis or encroachment to IVC, aorta and heart. Surgical removal requires cardio-vascular-thoracic surgery and anesthesia facilities to overcome the devastating complications. Hence the perioperative anaesthetic management and outcome of the non-cardiac tumors with cardiovascular involvement are studied.

**Method:** Patients operated in CTVS OR for non-cardiac tumors with extension to heart and major vessels were studied. It was a retrospective cohort study. The anesthetic management, techniques, special cardiac supports, complications and outcomes were analysed from the medical records over 2.5yrs. Intraoperative transesophageal echocardiography (TEE) monitoring was used to guide the management. The data was presented in mean  $\pm$  SD and percentages.

**Result:** Sixteen patients of  $46.5 \pm 14.84$ yr age, weight  $64.8 \pm 9.81$ kg were evaluated. Four patients required CPB, deep hypothermic circulatory arrest (DHCA)-1 patient, one lung ventilation-1 patient, cardiac chamber thrombus formation-4, aorta-IVC-SVC-carotid artery encasement were found in 11. Duration of surgery was  $7.87 \pm 2.78$ hrs. Blood loss was from 400-5000ml. Two patients had oliguria, who recovered in 2 days. Eleven patients had malignancy. One patient required lower body DHCA. Para-paresis was observed in 1 patient after 36hrs of surgery and recovered in 7days. Five patients were extubated in the OR. Four patients required inotropic support. One patient died on 8<sup>th</sup> day from MODS.

**Conclusion:** The perioperative management of non-cardiac tumors with cardiovascular extension is unique and challenging. The facilities of cardiovascular team with CPB, one

lung ventilation, DHCA, rapid transfusion and TEE were useful for a perfect outcome.

**Keywords:** Perioperative, Cardiac Anaesthesia, non-cardiac tumors, Cardiopulmonary Bypass, one lung ventilation, Deep hypothermic circulatory arrest, Transesophageal Echocardiography.

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## INTRODUCTION

Some tumors arise surrounding the heart, aorta and venacava.<sup>1,2</sup> It can be benign or malignant. Malignant tumors may have distant metastasis or encroachment to IVC, aorta and heart chambers.<sup>3</sup> The great vessels like aorta, vena cava and cardiac chambers were compressed or normal functions got jeopardised. This leads to compromised hemodynamic functions of heart and the great vessels. The surgical removal of the tumor or mass also needed for correction and prevention of the disease.

Surgical removal requires cardio-vascular-thoracic surgery (CTVS) and cardiac anaesthesia facilities to overcome the occasional devastating complications. Hence the perioperative anaesthetic management and outcome of the non-cardiac tumors with cardiovascular involvement are studied here.

## METHODS

Patients operated in CTVS operation room (OR) for non-cardiac tumors with extension to heart and major vessels like inferior and superior vena cava (SVC, IVC) and aorta (Ao) were included. It was a retrospective cohort study. All the medical records of these patients were examined from the data bank.

Involvements of Ao, SVC and IVC from other causes and any patient operated in emergency, unstable vitals and neuronal injury were excluded from study. The period of study was 2.5 years, from June 2020 to December 2023.

The objectives of the study were anaesthetic management techniques, special cardiac supports, complications and outcomes were analysed from the medical records. Preoperative CT and MRI reports were assessed for the degree of extension of the tumor. Intraoperative TEE monitoring was

used to guide the management.

Statistical analysis: The data was entered in a Microsoft excel sheet and analysed by SPSS 20 software program. The data was presented in mean  $\pm$  SD and percentages (%). Categorical parameters analysed by Chi-square test and continuous parameters analysed by Student's t-test. A p-value of  $<0.05$  was considered significant.

## RESULT

Sixteen (16) patients were detected from the records. The demographic details were mentioned in table 1.

**Table 1:** Demographic detail of the patients

Age (year)	46.5 $\pm$ 14.84
Weight (Kg)	64.8 $\pm$ 9.81
Gender (M:F)	11:5
Malignant tumor	11 (70%)
CPB required	4 (25%)
Deep hypothermic circulatory arrest (DHCA)	1 patient
One lung ventilation	1 patient
Cardiac chamber thrombus formation	4 (25%)
Aorta/IVC/SVC/carotid artery encasement	11 (70%)
Duration of surgery (hours)	7.87 $\pm$ 2.78
Blood loss (mL)	400 - 5000

All the patients were administered balanced general anaesthesia with tracheal intubation. Intraoperative TEE was used in all cases. The surgical details were mentioned in table 2.

**Table 2:** Diagnosis and surgical details

Diagnosis	Surgery	Duration	Bleeding
Pericardial Tumor	Tumor Excision	9 Hrs.	400
Rt. Kidney Tumor	Partial Nephrectomy	6 Hrs.	800
Post Undescended Test, Germ Cell Tumor, Metastast to Abdomen, Para Aortic Nords & Abuting to IVC	Tumor Resection	9 Hrs (09:00 am to 06:00 Pm)	800

*Table Cont...*

Malignant Renal Tumor - Secondary in Abdomen and IVC	Resection of Tumor	7 Hrs (09:30 Am to 04:30 Pm)	600
Retroperitoneal Malignant Tumor Encroaching Abdominal Aorta & IVC	Tumor Resection Vascular Dissection & Removal of Tumor Reconstruction of Lt Ureter	12 Hrs	5000
Renal Cell Carcinoma with IVC, Ra Thrombosis Extension	Nephrectomy + Thrombectomy	10 1/2 Hrs.	1000
Rt. Renal Cell Carcinoma with IVC Thrombus	Rt. Nephrectomy & Thrombectomy	8 Hrs	900
Rt Renal Carcinoma + IVC Thrombus Extending into Rt Atrium	Lt. Mephrectomy	7 1/2 Hrs	2000
IVC Thrombus Extending to Ra	IVC & Ra Thrombus Removal	6 Hrs	500
Suprarenal Mass, IVC Thrombus Htn, Hypothyroid, Ascitis	Suprarenal Tumor Excision IVC Thrombectomy + Hepatic Wedge Resection	10 Hrs	2500
(L) Carotid Body Tumor	(L) Carotid Body Tumor Excision	5 Hrs	450
Thymomo, Compressing (R) Lung, SVC.	Thymectomy	6 Hrs	400
Carotid Body Tumor (Right), Hypertension	Tumor Resection	4Hr	400
Carcinoma Head of Pancreas Encasing Aorta, IVC, Renal Vessels + Portal Vein, Biventricular Functions - Normal.	Whipple's Operation	12 Hr	800
Rcc with Level 4 Ivc Thrombus/Single Vessel Disease/Normal Lv/Htn+	Rt, Nephrecromy + IVC Thrombectomy + CABG	12 Hr	1500
Paraganglioma	Excision of Tumor	5 Hrs	1200

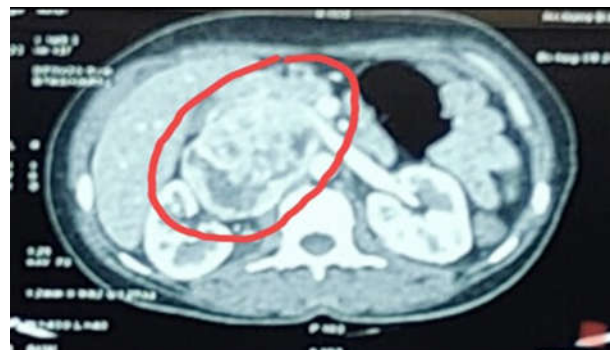
The surgical approach was from different sites. It was by laparotomy, midline sternotomy, thoracotomy and from neck incision. The perioperative course and complications were mentioned in table 3.

**Table 3:** Complications during perioperative period

Oliguria, who recovered in 2 days	2 (13.50%)
Required lower body DHCA.	1 patient
Para-paresis	1 patient
Severe hypotension	3 (18.75%)
Required inotropic support	4 (25%)
Death	1 (6.25%)

Eleven (70%) patients had malignant tumors and 5 (30%) patients had benign pathology. Out of which cardiac chamber thrombus formation was detected in 4 patients (25%). Aorta, IVC, SVC and carotid artery encasement was observed in 11 patients (70%). Very close proximity in 5 (30%) patients (Fig. 1, 2 and 3). Two patients had oliguria,

who recovered in 2 days. Para-paresis was observed in 1 patient after 36 hrs of surgery and recovered in 7 days. Five (30%) patients were extubated in OR with regional nerve block analgesia. Four (25%) patients required inotropic support. Multimodal analgesia was adopted in all patients. One patient died on 8<sup>th</sup> postoperative day from multi-organ dysfunction syndrome (MODS).



**Fig. 1:** Renal cell carcinoma (red circle) compressing IVC and aorta.

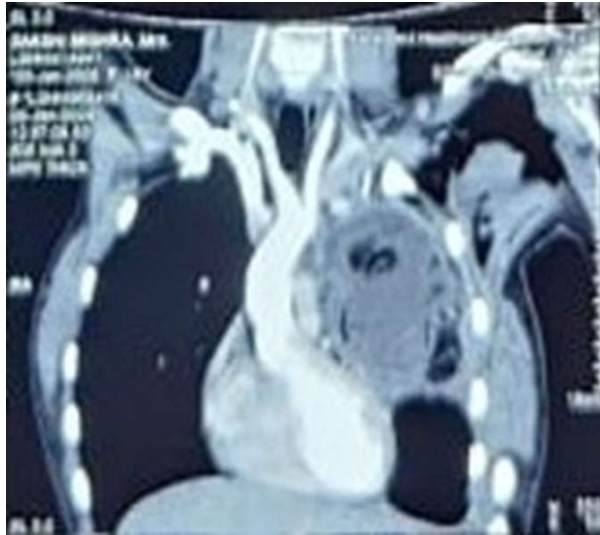


Fig. 2: Paraganglioma extending to aorta and SVC.

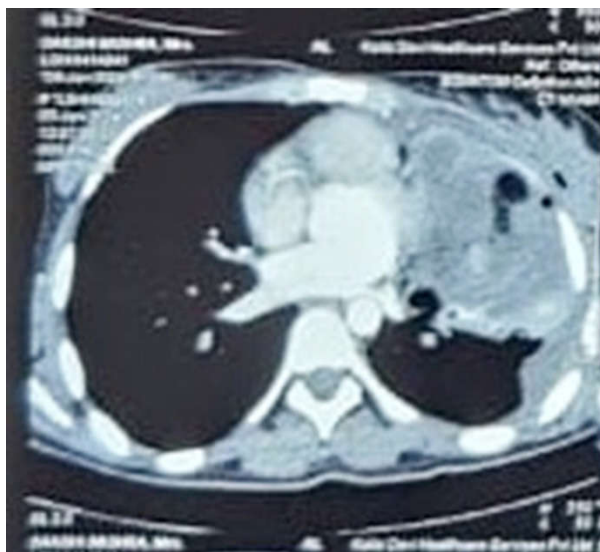


Fig. 3: Thoracic tumor in close vicinity to heart.

## DISCUSSION

In this cohort of 16 patients surgery was successful with mortality in 1 patient. The surgeries and so anaesthesia were for a long duration with significant blood loss. The surgical procedures were extensive and combined with exposure of heart and great vessels. The incidence of puncture to the vessels and injury to cardiovascular structures was high; which was managed promptly. Apart from conventional anaesthesia techniques, special care and techniques for OLV, CPB and DHCA was executed for cardiac, lungs, vascular and

gastro-intestinal surgery. On the table extubation in OR was also possible in selected cases.

The structures close to heart, aorta, IVC and SVC may have occasional pathological benign and malignant tumors.<sup>1</sup> The tumors of lungs, thymus, thyroid, esophagus, trachea, liver, pancreas, intestine, kidney, adrenal gland and even uterus may invade or come near to great vessels and heart. Surgical resection of the tumors required team work of different surgeons in CTVS OR.<sup>2,4,5</sup> However cardiac anesthetist has to provide the care to patient as per the different surgical approach.<sup>6</sup> Preoperative assessment is important to find out the pathology and the extent of involvement. Computed tomography and MRI help for the surgical plan and anesthesia concerns.<sup>6,7</sup> Intra-operatively injury to heart and vessels may cause acute blood loss with hemodynamic collapse. Preparedness for cardiopulmonary bypass, one lung ventilation, DHCA, massive transfusion, organ protection and problems of long duration surgery are essential.<sup>3</sup> Transesophageal echocardiography guides for examining the heart, vessels, fluid status and cardiac functions.<sup>8</sup> Postoperative care for hemodynamic stability, pain relief, respiratory care, infection control and vital organ stability are prime importance for better outcome.<sup>3</sup>

## CONCLUSION

The perioperative management of non-cardiac tumors with cardiovascular extension is challenging and a team work of multiple departments. The long duration of surgery, possibility of excessive bleeding and vascular injury are major concerns. The facilities of cardiovascular team with CPB, one lung ventilation, DHCA, rapid transfusion and TEE were very much useful for a perfect outcome.

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