support should be thoroughly planned for to optimize success. Complete surgical resection is the treatment.

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Commentary: What lessons can a surgeon learn from something rare?

Kenza Rahmouni, MDCM, and
Fraser D. Rubens, MD, MSc, FACS, FRCSC

Primary cardiac paragangliomas (PCPs) are rare neuroendocrine tumors of the heart. In this issue of the *Journal*, Chan and colleagues¹ share their center's experience in managing patients with PCP, presenting a cohort of 19 patients with a perioperative mortality of 10.6%. The surgical steps are complex yet through experience and wise application of oncologic principles, this center is now a site of established excellence.

So how does the average cardiac surgeon interpret this type of presentation? Even in academic centers, one anticipates that these cases will be few and far between, and it should be recognized that we should support focusing this cohort into the hands of a few experts in each country. A better lesson from this manuscript is a template of how to address rare surgical diseases in general, be they from cancer or from other uncommon cardiac mechanical problems.

The authors have identified several principles that are critical to success. First, they have emphasized the importance of a large volume to efficiently turn experience into

Kenza Rahmouni, MDCM (left), and Fraser D. Rubens, MD, MSc, FACS, FRCSC (right)

CENTRAL MESSAGE

Surgical outcomes are intimately related to surgeon and institution expertise. We therefore must further centralize the care of rare cardiac tumors and refer patients to specialists earlier.

reproducible surgical strategies. We know well the intimate relationship of surgical outcomes with institution expertise. A concrete example of this correlation is the experience in San Diego in managing chronic thromboembolic pulmonary hypertension with pulmonary endarterectomy.² Over 50 years, their surgical outcomes for this highly subspecialized operation have consistently improved despite growing complexity of their cases. They are the center of excellence, frequently managing patients with chronic thromboembolic pulmonary hypertension deemed non-surgical in other centers.

The second important facet of success involves contribution from a multidisciplinary team, a strategy that has been recommended for more than 25 years for patients with

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cancer.³ In Chan and colleagues' series, there is close participation of surgeons, critical care specialists, cardiologists, endocrinologists, oncologists, and imaging physicians to optimize strategy.

So where do we expect the next surgical reporting for these rare tumors to progress? We already have access to meta-analyses to give us an understanding of the long-term outcomes after surgery for PCP.⁴ The results from this team are in keeping with what is known, recognizing the limited patient numbers in any series. Surgical teams with focused expertise have tremendous opportunity to pioneer new technologies to add to our understanding of rare diseases. We would hope that the next communication from this group will introduce the use of advanced imaging techniques to improve intraoperative outcomes, such as 3-dimensional printing of patient-specific heart models, providing surgeons with a hands-on experience of what to expect in the operation, and the ability to prepare for potential complications.⁵ With diagnostic imaging data, a personalized high-fidelity heart model can be created for patients with cardiac tumor with complex anatomy, helping determine surgical approaches by identifying surrounding structures at risk.^{6,7}

In summary, we applaud Chan and colleagues for their superb outcomes in the care for these complex patients and for defining the steps to reach such results: targeted referral with a dedicated multidisciplinary team with cardiac tumor expertise and conscientious preoperative planning. We look forward to their future accomplishments, with the rise of new adjuvant technologies being the focus of their next communication.

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Commentary: Resection of cardiac paragangliomas: All roads lead to Texas

Morgan Harloff, MD, Kareem Bedeir, MD, and Sary F. Aranki, MD

Cardiac paragangliomas are rare neuroendocrine tumors arising from chromaffin cells that can secrete catecholamines.¹ They typically present with atypical chest pain

Morgan Harloff, MD, Kareem Bedeir, MD, and Sary F. Aranki, MD

CENTRAL MESSAGE

Cardiac paragangliomas are highly vascular, locally invasive, and difficult to resect. In experienced hands, however, resection can be safe and potentially curative.

and palpitations.¹ Complete surgical resection is the mainstay of therapy and often curative.¹ However, resection is a challenging endeavor because they are notoriously

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