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Perspective

Innovations in Surgical and Interventional Care for Eisenmenger Syndrome

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DESCRIPTION

Eisenmenger syndrome represents a complex and challenging condition characterized by severe pulmonary hypertension, right-to-left shunting, and cyanosis due to congenital heart defects. Traditional management approaches have focused on palliative measures to alleviate symptoms and improve quality of life. However, recent advancements in surgical and interventional therapies offer promising options for addressing the underlying pathophysiology and improving outcomes in Eisenmenger syndrome patients. This article explains about the innovations in surgical and interventional care for Eisenmenger syndrome, including emerging techniques, challenges, and future directions.

Pulmonary Artery Banding (PAB) is a surgical technique that involves placing a band around the main pulmonary artery to restrict blood flow and reduce pulmonary vascular resistance. PAB aims to balance pulmonary and systemic blood flow, alleviate symptoms of pulmonary hypertension, and improve oxygenation in Eisenmenger syndrome patients. Recent innovations in PAB techniques, including adjustable bands and minimally invasive approaches, offer improved precision and customization of treatment, resulting in better outcomes and reduced perioperative morbidity. Percutaneous Pulmonary Valve Implantation (PPVI) is an interventional procedure used to replace dysfunctional pulmonary valves without open-heart surgery. In Eisenmenger syndrome patients with pulmonary valve regurgitation or stenosis, PPVI can improve pulmonary blood flow, relieve right ventricular strain, and reduce cyanosis. Advances in PPVI technology, such as the development of transcatheter valve systems and delivery techniques, have expanded the applicability of this procedure to a broader range of patients, including those with complex anatomies or previous surgical interventions.

Atrial septostomy is a catheter-based procedure that creates or enlarges an Atrial Septal Defect (ASD) to decompress the right heart and improve systemic oxygenation in Eisenmenger syndrome patients. By enhancing right-to-left shunting, atrial septostomy reduces right atrial pressure, decreases cyanosis, and relieves symptoms of hypoxemia. Innovations in atrial septostomy techniques, such as balloon sizing, controlled tears, and covered stent placement, offer greater precision and safety, minimizing the risk of complications such as cardiac perforation or arrhythmias. Lung transplantation remains the definitive treatment option for selected Eisenmenger syndrome patients with end-stage pulmonary vascular disease refractory to medical and surgical therapies. Innovations in lung transplantation techniques, including donor selection criteria, organ preservation methods, and perioperative management strategies, have led to improved survival and outcomes in Eisenmenger syndrome recipients. Additionally, advances in immunosuppressive regimens and post-transplant care have reduced the risk of rejection and infection, enhancing long-term graft function and patient survival.

Emerging evidence suggests that combining surgical and interventional therapies may offer synergistic benefits in Eisenmenger syndrome management. For example, a multimodal approach integrating PAB with PPVI or atrial septostomy may optimize hemodynamic balance, improve oxygenation, and reduce cyanosis in select patients. Furthermore, combining surgical interventions with targeted medical therapies, such as pulmonary vasodilators or antithrombotic agents, may enhance treatment efficacy and long-term outcomes by addressing multiple pathophysiological pathways simultaneously. Despite the promise of innovative surgical and interventional approaches, several challenges and considerations exist in the management of Eisenmenger syndrome. Patient selection is paramount, and careful evaluation of individual anatomy, hemodynamics, and comorbidities is essential to identify candidates who may benefit from these interventions. Additionally, procedural risks, such as perioperative bleeding, thrombosis, or hemodynamic instability, must be carefully weighed against potential benefits, particularly in high-risk patients with advanced disease. Continued research and innovation are needed to further advance surgical and interventional care for Eisenmenger syndrome. Future directions may include the development of novel catheter-based therapies, such as targeted pulmonary vasodilators or gene therapy approaches, to directly address pulmonary vascular remodeling and improve hemodynamics. Additionally, advancements in

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imaging modalities, such as three-dimensional echocardiography or cardiac MRI, may enhance pre-procedural planning and intraoperative guidance, optimizing treatment outcomes and patient safety.

CONCLUSION

Innovations in surgical and interventional care offer promising options for improving outcomes in Eisenmenger syndrome patients. By leveraging advancements in technology, technique, and multidisciplinary collaboration, clinicians can optimize treatment strategies, alleviate symptoms, and enhance quality of life for individuals affected by this complex and challenging condition. However, careful patient selection, comprehensive evaluation, and ongoing research are essential to maximize the benefits of these innovative approaches and address the unmet needs of Eisenmenger syndrome patients in the future.