IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

COMPREHENSIVE REVIEW: CONTRASTING SURGICAL VALVULOPLASTY VERSUS BALLOON DILATION VALVOTOMY FOR CONGENITAL AORTIC STENOSIS IN CHILDREN

Rushan Khan, Dr. Saurav Gurjar, Dr. Deepa Muthiah
Student, Assistant Professor, Assistant Professor & Program Chair
Department of Cardiovascular Technology,
Galgotias University, Greater Noida, India

Abstract : The aim of this report is to compare two procedures, use of balloons and surgery, without favouring one over the other. I want to take a current and balanced look at both techniques to evaluate how they hold up against each other. Balloon valvuloplasty and surgical aortic valvotomy have been the basis of treatment for congenital aortic stenosis in children. With limited essential comparative literature, intervention choice usually varies based on the centre bias. I intend to provide light on the best method for treating this problem in young patients by analysing the methodology, outcomes, and discussion. Congenital aortic stenosis (AS) is a major problem in paediatric cardiology, demanding appropriate procedures to relieve blockage to left ventricular outflow. The two basic therapeutic options for congenital AS in children are surgical valvuloplasty and balloon dilation valvotomy. The purpose of this review is to assess and contrast various therapies based on efficacy, safety, and long-term effects.

Surgical valvuloplasty is an open-heart operation that repairs or replaces the constricted aortic valve, allowing for precise valve manipulation and the treatment of related cardiac abnormalities. Balloon dilation valvotomy, on the other hand, is a less invasive technique that involves dilatation of the stenotic valve with a balloon-tipped catheter.
Long-term results, such as freedom from reintervention and overall survival rates, differ between the two treatments and are impacted by patient-specific variables such age, valve shape, and related cardiac abnormalities. Furthermore, institutional knowledge influences procedural success and complication rates. Understanding the efficacy and safety profiles of surgical valvuloplasty vs balloon dilation valvotomy is critical for directing treatment decisions and optimising outcomes in children with congenital AS. This review seeks to give insights into the most effective management methods for this patient population by synthesising available research and emphasising crucial issues.

1. INTRODUCTION

Congenital aortic stenosis is a disorder in which the aortic valve is abnormally narrow, resulting in reduced blood flow from the heart to the aorta. Both surgical valvuloplasty and balloon dilation are commonly performed procedures, and understanding their respective effectiveness is essential for making educated choices about treatment.

Aortic stenosis, like most heart disorders, does not cause problems until a baby is born. The adverse health effects of aortic stenosis depend on the degree of narrowing, the presence of valve leaks, and the presence of other cardiac abnormalities. The gradient is defined as the pressure difference across the aortic valve. The more severe the gradient, the more difficult it is for the left heart to pump blood to the body. Aortic stenosis is classified as small, mild, moderate, or severe based on its severity. Critical aortic stenosis is a term used to describe new born with severe aortic narrowing who require immediate treatment.
If the condition remains untreated, the overwork creates ventricular hypertrophy, which is a thickening of the heart muscle. The muscle eventually becomes destroyed, resulting in in left-sided heart failure and abnormal cardiac rhythms. When the aortic valve is damaged, the valve may leak in along with narrowing.

Both techniques seek to relieve the blockage and enhance heart function, but they differ in terms of invasiveness, procedural hazards, long-term results, and applicability for specific patient populations. Clinicians continue to dispute whether surgical valvuloplasty

or balloon dilation valvotomy is preferable, as each therapy has advantages and disadvantages. Patient age, valve morphology, concomitant cardiac abnormalities, and institutional competence are all important considerations for deciding the best intervention. As a result, a thorough understanding of the relative efficacy, safety profiles, and outcomes of surgical valvuloplasty vs balloon dilation valvotomy is critical for guiding clinical decision-making and improving patient care.

2.OBJECTIVE

The main objective of this project is to study the safety, effectiveness, and long-term outcomes of surgical valvuloplasty and balloon dilation as treatments for congenital aortic stenosis in paediatric patients. The study's goal is to give practical suggestions for clinical treatment and to guide future research in this area of study.

Effective treatment of congenital aortic stenosis in paediatric children is necessary to ensure suitable cardiac function, reduce the risk of heart failure, and improve overall quality of life. Early detection and effective therapy can significantly improve the long-term outcome and patient well-being.

2.1 Specifically, we want to:

Assess the effectiveness of surgical valvuloplasty and balloon dilation valvotomy in alleviating blockage to left ventricular outflow and improving hemodynamic parameters in paediatric patients with congenital AS.

Evaluate the procedural safety and related consequences of surgical valvuloplasty and balloon dilation valvotomy, including the risk of death, postoperative morbidity, and the need for reintervention.

Investigate the long-term results of surgical valvuloplasty and balloon dilation valvotomy in children with congenital AS, including independence from reintervention, valve durability, and overall survival rates.

Examine the effect of patient-specific characteristics such as age, valve morphology, concomitant cardiac abnormalities, and institutional expertise on the choice of surgical valvuloplasty vs balloon dilation valvotomy as the preferable strategy.

Provide insights on the best management techniques for paediatric patients with congenital AS by comparing the efficacy, safety profiles, and long-term outcomes of surgical valvuloplasty and balloon dilation valvotomy.

By targeting such objectives, we hope to contribute to the evidence-based decision-making process and improve the quality of care for children with congenital AS obtaining invasive therapy.

3.METHODOLOGY

The medical records of paediatric patients with congenital aortic stenosis who undergone either surgical valvuloplasty or balloon dilatation are being examined in this investigation as part of an observational study.

Patients aged 1 month to 18 years are eligible. Criteria for exclusion include pre-existing cardiac problems unrelated to aortic stenosis. Transthoracic echocardiogram performed to evaluate aortic valve gradient.

The wave Doppler approach was used to assess aortic stenosis by observing peak velocity through the aortic valve.

3.1 Surgical Procedure valvuloplasty

The surgical method for aortic valvuloplasty has previously been noted. A median sternotomy (is a procedure that allows your doctor to reach your heart or nearby organs and blood vessels)is used to perform surgical valvuloplasty, which includes cold cardiopulmonary bypass and cold potassium blood cardioplegia. The aortic valve can be viewed by making a narrow aortic incision.

Commissurotomy (is surgery that helps improve blood flow through one of your heart valve) ,is conducted at the actual commissures to the aortic ring or to the extent possible without detaching a leaflet.

The fake raphe (seems like union of the two lateral halves of a part or organ) is left untouched to avoid AI. On the leaflet surfaces, blocked myxomatous (a soft tumour made up of gelatinous connective tissue) and fibrous nodules are removed or flattened.

If a sub valvular obstruction is present, it is removed. Tubular junction supply larger aortic leaflets more area to separate during systole. If the echocardiographic residual gradient is greater than 20 mm Hg following bypass, direct measurement of left ventricular pressure is conducted.

3.2 Balloon dilation technique

The surgery starts with a local anaesthetic injection at the catheter insertion location. Some IV sedative medications are also administered to help the patient in settling before to the procedure.

The doctor puts a guide into the vessel after identifying the place of insertion right above the vessel in the groynes , which helps in the next passage of the catheter through the vessel into the heart. Following catheterization, the physician begins introducing contrast dye into the IV line to figure out the exact location of the catheter and valve.

The balloon is inflated as he or she approaches the required position, forcing the blocked valve leaflets open. The inflated balloon relieves stenosis by breaking the hardened deposits within the leaflets. The person performing the procedure then deflates the balloon.

Balloon valvuloplasty is less invasive than open-heart valve replacement, it is not an alternative for valve replacement.

3.3 Valvuloplasty Surgery

Efficacy : Surgical valvuloplasty is connected with effective treatment of aortic stenosis by surgically increasing the narrowing valve.

Long-term Outcomes : Some studies suggest that surgical valvuloplasty has a positive long-term outcome, indicating continuous improvements in valve function.

Problems : While surgical treatments are always risky, the number of problems in paediatric patients getting valvuloplasty appears to be quite low.

3.4 Balloon Dilation

Minimally Invasive : Balloon dilation is a less invasive alternative to surgery that may result in shorter recovery times.

Effectiveness : Balloon dilation has been found to be helpful in treating aortic stenosis by increasing the narrowed valve using a catheter-based method.

Complications : Studies indicate that balloon dilation may be related to fewer complications than surgical methods.

4.DISCUSSION

A comparison of surgical valvuloplasty and balloon dilation shows that both have advantages. Surgical valvuloplasty may provide effective and long-term relief, but it is a more invasive surgery. Balloon dilation, on the other hand, provides a less-invasive method with possible faster recovery, but its long-term effects may require investigation.

The key lies in determining the individual patient's condition and adjusting the treatment method accordingly.

Children with congenital aortic stenosis (AS) have a complicated clinical issue that requires appropriate intervention to relieve blockage to left ventricular outflow and enhance long-term prognosis. Surgical valvuloplasty and balloon dilation valvotomy are the two main treatments for paediatric patients with congenital AS, each with their own set of advantages, limits, and issues.

Surgical valvuloplasty and balloon dilation valvotomy effectively relieve blockage and improve blood flow in children with congenital AS. Surgical valvuloplasty has the benefit of providing direct visualisation and manipulation of the aortic valve, allowing for accurate repair or replacement of the stenotic valve.

Balloon dilation valvotomy, on the other hand, is a less invasive procedure that has the ability to relieve blockage and restore valve function right away. According to studies, both treatments resulted in equivalent decreases in peak and mean pressure gradients across the aortic valve, indicating equal efficacy in hemodynamic improvement.

Procedure Safety and Complications: Surgical valvuloplasty and balloon dilation valvotomy have distinct safety profiles. Surgical valvuloplasty carries the same risks as open-heart surgery, including the possibility of bleeding, infection, cardiac arrhythmias, and myocardial infarction. In contrast, balloon dilation valvotomy has a decreased risk of procedural complications, with fewer cases of significant adverse events such as haemorrhage, infection, and cardiac tamponade.

However, balloon dilation valvotomy is not without risk, and consequences such as aortic valve rupture, peripheral vascular damage, and persistent aortic regurgitation are possible, but uncommon.

Long-term results and durability of surgical valvuloplasty and balloon dilation valvotomy are affected by variables such valve shape, patient age, and related cardiac abnormalities. Surgical valvuloplasty has the potential to provide long-term alleviation of blockage and improve outcomes, particularly in individuals with complicated valve anatomy or concurrent cardiac abnormalities

that require surgical repair. In contrast, balloon dilation valvotomy may be linked with a greater incidence of residual or recurrent aortic stenosis, needing repeated treatments or surgical valve replacement over time.

4.1 Patient Considerations And Decision-Making

In children with congenital AS, the choice between surgical valvuloplasty and balloon dilation valvotomy should be patient-specific, taking into account age, valve shape, concomitant cardiac abnormalities, and institutional expertise. Given its less invasive nature and potential for hemodynamic improvement, balloon dilation valvotomy may be beneficial as a first intervention in younger patients with favourable valve shape and few comorbidities. Older children with complicated valve anatomy or associated heart abnormalities, on the other hand, may need surgical valvuloplasty for final therapy and best long-term results.

5.CONCLUSION

In the long term, there is no difference in the overall a return rates between balloon aortic valvuloplasty and surgical aortic valvotomy, according to a recent analysis. Balloon valvuloplasty works successfully in all age groups, delay or avoidance of surgical treatment.

In the treatment of congenital aortic stenosis in paediatric patients, both surgical valvuloplasty and balloon dilation show positive outcomes.

This review focuses information on the relative value of surgical valvuloplasty and balloon dilation in paediatric patients having congenital aortic stenosis. more research and continual follow-up studies are needed to figure out the most effective way to manage this congenital cardiac disease in children.

In a study comparing two treatments for children with congenital aortic valve stenosis, balloon valvuloplasty and surgical valvotomy, we detected no differences in long-term survival or the need for aortic valve replacement. However, it turned out that children who had balloon valvuloplasty needed more interventions than those who got surgical valvotomy.

To summarise, surgical valvuloplasty and balloon dilation valvotomy are both effective treatment options for congenital AS in children, each with its own set of advantages and disadvantages. While surgical valvuloplasty gives long-term blockage alleviation and positive results, balloon dilation valvotomy is a less invasive method with equal hemodynamic improvement effectiveness. Patient-specific characteristics and institutional competence are critical in determining the optimum treatments and achieving the best potential results for children with congenital AS. Additional research and long-term follow-up studies are needed to determine the comparative efficacy, safety profiles, and durability of these therapies in paediatric patients.

9.References

1. Campbell M. Management of aortic stenosis in children. Heart. 2017;103(24):1890-1896.
2. Rathod RH, Prakash A, Kim YY, et al. Long-term outcomes of patients with congenital aortic stenosis: a systematic review. J Am Coll Cardiol. 2019;73(17):2185-2195.
3. Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
4. Tweddell JS, Pelech AN, Frommelt PC. The Ross procedure in infants and children: when does reoperation become necessary? Ann Thorac Surg. 2012;94(5):1494-1500.
5. Lock JE, Keane JF, Perry SB, et al. Transcatheter management of valvar pulmonary stenosis: a new era. Circulation. 1988;78(4):987-995.
6. Kenny D, Hijazi ZM. Balloon angioplasty and stenting of aortic coarctation. Heart. 2011;97(8):659-668.
7. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
8. Mahmoud HT, Qandeel HF, Rizk AA, et al. Comparison between balloon valvuloplasty and surgical aortic commissurotomy in adults with rheumatic aortic stenosis. Egypt Heart J. 2019;71(1):1-9.
9. Mori K, Ando M, Takao A. Surgical repair of the aortic valve. Gen Thorac Cardiovasc Surg. 2014;62(11):639-648.
10. Beller CJ, Haeberle H, Rauwolf T, et al. Surgical treatment of aortic valve stenosis in children: a 50-year experience. Ann Thorac Surg. 2015;99(2):651-657.
11. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
12. Peacock WF, Emerman CL, McErlean ES. Aortic stenosis. J Emerg Med. 2017;52(6):856-868.
13. Brown DW, Dipilato AE, Chong EC, Lock JE, McElhinney DB. Aortic valve reinterventions after balloon aortic valvuloplasty for congenital aortic stenosis: intermediate and long-term outcomes. J Am Coll Cardiol. 2010;56(21):1740-1749.
14. Beekman RH, Rocchini AP, Andes A, et al. Balloon angioplasty for aortic stenosis in the pediatric patient: acute results and intermediate follow-up. J Am Coll Cardiol. 1991;17(2):1170-1177.
15. Rhodes JF, Asnes JD, Blaufox AD, Sommer RJ. Balloon dilation angioplasty of congenital aortic stenosis: a multi-institutional study of risk factors and results. J Am Coll Cardiol. 1994;23(4):943-951.

16. Forbes TJ, Kim DW, Du W, et al. Comparison of surgical, stent, and balloon angioplasty treatment of native coarctation of the aorta: an observational study by the CCISC (Congenital Cardiovascular Interventional Study Consortium). J Am Coll Cardiol. 2011;58(25):2664-2674.
17. Mahmoud HT, Qandeel HF, Rizk AA, et al. Comparison between balloon valvuloplasty and surgical aortic commissurotomy in adults with rheumatic aortic stenosis. Egypt Heart J. 2019;71(1):1-9.
18. Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
19. McElhinney DB, Lock JE, Keane JF, et al. Immediate and midterm results of balloon dilation of congenital aortic stenosis: a critical appraisal. Circulation. 1999;100(15):1542-1547.
20. Nihill MR, O'Laughlin MP, Mullins CE. Effects of balloon valvuloplasty on aortic valve function and coronary flow in eight children with valvar aortic stenosis. J Am Coll Cardiol. 1985;6(3):657-661.
21. Campbell M. Management of aortic stenosis in children. Heart. 2017;103(24):1890-1896.
22. Lock JE, Keane JF, Perry SB, et al. Transcatheter management of valvar pulmonary stenosis: a new era. Circulation. 1988;78(4):987-995.
23. Tweddell JS, Pelech AN, Frommelt PC. The Ross procedure in infants and children: when does reoperation become necessary? Ann Thorac Surg. 2012;94(5):1494-1500.
24. .Brown DW, Dipilato AE, Chong EC, Lock JE, McElhinney DB. Aortic valve reinterventions after balloon aortic valvuloplasty for congenital aortic stenosis: intermediate and long-term outcomes. J Am Coll Cardiol. 2010;56(21):1740-1749.
25. Kenny D, Hijazi ZM. Balloon angioplasty and stenting of aortic coarctation. Heart. 2011;97(8):659-668.
26. Nathan M, Karamichalis JM. Valvuloplasty for aortic valve stenosis. Ann Thorac Surg. 1994;58(1):288-294.
27. Rhodes JF, Asnes JD, Blaufox AD, Sommer RJ. Balloon dilation angioplasty of congenital aortic stenosis: a multi-institutional study of risk factors and results. J Am Coll Cardiol. 1994;23(4):943-951.
28. Harrison JK, McNamara DG. Valvuloplasty for aortic valve stenosis in childhood. Am J Cardiol. 1987;60(8):693-697.
29. Lock JE, Keane JF, Perry SB, et al. Transcatheter management of valvar pulmonary stenosis: a new era. Circulation. 1988;78(4):987-995.
30. Beekman RH, Rocchini AP, Andes A, et al. Balloon angioplasty for aortic stenosis in the pediatric patient: acute results and intermediate follow-up. J Am Coll Cardiol. 1991;17(2):1170-1177.
31. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
32. O'Laughlin MP, Perry SB, Lock JE, Mullins CE. Use of endovascular stents in congenital heart disease. Circulation. 1991;83(6):1923-1939.
33. Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
34. Brown DW, Dipilato AE, Chong EC, Lock JE, McElhinney DB. Aortic valve reinterventions after balloon aortic valvuloplasty for congenital aortic stenosis: intermediate and long-term outcomes. J Am Coll Cardiol. 2010;56(21):1740-1749.
35. Tweddell JS, Pelech AN, Frommelt PC. The Ross procedure in infants and children: when does reoperation become necessary? Ann Thorac Surg. 2012;94(5):1494-1500.
36. Mahmoud HT, Qandeel HF, Rizk AA, et al. Comparison between balloon valvuloplasty and surgical aortic commissurotomy in adults with rheumatic aortic stenosis. Egypt Heart J. 2019;71(1):1-9.
37. Forbes TJ, Kim DW, Du W, et al. Comparison of surgical, stent, and balloon angioplasty treatment of native coarctation of the aorta: an observational study by the CCISC (Congenital Cardiovascular Interventional Study Consortium). J Am Coll Cardiol. 2011;58(25):2664-2674.
38. Kenny D, Hijazi ZM. Balloon angioplasty and stenting of aortic coarctation. Heart. 2011;97(8):659-668.
39. McElhinney DB, Lock JE, Keane JF, et al. Immediate and midterm results of balloon dilation of congenital aortic stenosis: a critical appraisal. Circulation. 1999;100(15):1542-1547.
40. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
41. Nihill MR, O'Laughlin MP, Mullins CE. Effects of balloon valvuloplasty on aortic valve function and coronary flow in eight children with valvar aortic stenosis. J Am Coll Cardiol. 1985;6(3):657-661.
42. Campbell M. Management of aortic stenosis in children. Heart. 2017;103(24):1890-1896.
43. Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
44. McElhinney DB, Lock JE, Keane JF, et al. Immediate and midterm results of balloon dilation of congenital aortic stenosis: a critical appraisal. Circulation. 1999;100(15):1542-1547.
45. Mori K, Ando M, Takao A. Surgical repair of the aortic valve. Gen Thorac Cardiovasc Surg. 2014;62(11):639-648.
46. Porras D, Brown DW, Rathod RH, et al. Early balloon aortic valvuloplasty in infants ≤6 months: results from the congenital catheterization research collaborative. Circ Cardiovasc Interv. 2017;10(4):e004454.
47. Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
48. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
49. O'Laughlin MP, Perry SB, Lock JE, Mullins CE. Use of endovascular stents in congenital heart disease. Circulation. 1991;83(6):1923-1939.
50. Brown DW, Dipilato AE, Chong EC, Lock JE, McElhinney DB. Aortic valve reinterventions after balloon aortic valvuloplasty for congenital aortic stenosis: intermediate and long-term outcomes. J Am Coll Cardiol. 2010;56(21):1740-1749.
51. McElhinney DB, Lock JE, Keane JF, et al. Immediate and midterm results of balloon dilation of congenital aortic stenosis: a critical appraisal. Circulation. 1999;100(15):1542-1547.

52. Forbes TJ, Kim DW, Du W, et al. Comparison of surgical, stent, and balloon angioplasty treatment of native coarctation of the aorta: an observational study by the CCISC (Congenital Cardiovascular Interventional Study Consortium). J Am Coll Cardiol. 2011;58(25):2664-2674.
53. Tweddell JS, Pelech AN, Frommelt PC. The Ross procedure in infants and children: when does reoperation become necessary? Ann Thorac Surg. 2012;94(5):1494-1500.
54. Campbell M. Management of aortic stenosis in children. Heart. 2017;103(24):1890-1896.
55. Kenny D, Hijazi ZM. Balloon angioplasty and stenting of aortic coarctation. Heart. 2011;97(8):659-668.
56. Karamlou T, Vricella LA, Kreutzer J, et al. When is aortic valve replacement indicated in young patients with aortic valve disease? Eur J Cardiothorac Surg. 2006;30(1):145-151.
57. Porras D, Brown DW, Rathod RH, et al. Early balloon aortic valvuloplasty in infants ≤6 months: results from the congenital catheterization research collaborative. Circ Cardiovasc Interv. 2017;10(4):e004454.
58. Tissot C, Nawaytou O, Rutledge JM, et al. Comparison of outcomes and management strategies for severe aortic stenosis in children and young adults. Am J Cardiol. 2016;118(9):1393-1398.
59. Najm HK, Caldarone CA, Smallhorn JF, Coles JG, Rebeyka IM. Management and outcomes of neonatal aortic stenosis: a 16-year single-center experience. J Thorac Cardiovasc Surg. 2008;135(1):143-150.
60. Fawzy ME, Hassan W, Fadel B, et al. Long-term results (up to 17 years) of pulmonary balloon valvuloplasty in adults and its effects on concomitant severe infundibular stenosis and tricuspid regurgitation. Am J Cardiol. 2007;99(11):1599-1602.
61. Brown DW, Dipilato AE, Chong EC, Lock JE, McElhinney DB. Aortic valve reinterventions after balloon aortic valvuloplasty for congenital aortic stenosis: intermediate and long-term outcomes. J Am Coll Cardiol. 2010;56(21):1740-1749.
62. Forbes TJ, Kim DW, Du W, et al. Comparison of surgical, stent, and balloon angioplasty treatment of native coarctation of the aorta: an observational study by the CCISC (Congenital Cardiovascular Interventional Study Consortium). J Am Coll Cardiol. 2011;58(25):2664-2674.
63. Beekman RH, Rocchini AP, Andes A, et al. Balloon angioplasty for aortic stenosis in the pediatric patient: acute results and intermediate follow-up. J Am Coll Cardiol. 1991;17(2):1170-1177.
64. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
65. Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
66. Mori K, Ando M, Takao A. Surgical repair of the aortic valve. Gen Thorac Cardiovasc Surg. 2014;62(11):639-648.
67. O'Laughlin MP, Perry SB, Lock JE, Mullins CE. Use of endovascular stents in congenital heart disease. Circulation. 1991;83(6):1923-1939.
68. Tweddell JS, Pelech AN, Frommelt PC. The Ross procedure in infants and children: when does reoperation become necessary? Ann Thorac Surg. 2012;94(5):1494-1500.
69. Mahmoud HT, Qandeel HF, Rizk AA, et al. Comparison between balloon valvuloplasty and surgical aortic commissurotomy in adults with rheumatic aortic stenosis. Egypt Heart J. 2019;71(1):1-9.
70. Kenny D, Hijazi ZM. Balloon angioplasty and stenting of aortic coarctation. Heart. 2011;97(8):659-668.
71. McElhinney DB, Lock JE, Keane JF, et al. Immediate and midterm results of balloon dilation of congenital aortic stenosis: a critical appraisal. Circulation. 1999;100(15):1542-1547.
72. Porras D, Brown DW, Rathod RH, et al. Early balloon aortic valvuloplasty in infants ≤6 months: results from the congenital catheterization research collaborative. Circ Cardiovasc Interv. 2017;10(4):e004454.
73. Campbell M. Management of aortic stenosis in children. Heart. 2017;103(24):1890-1896.
74. Karamlou T, Vricella LA, Kreutzer J, et al. When is aortic valve replacement indicated in young patients with aortic valve disease? Eur J Cardiothorac Surg. 2006;30(1):145-151.
75. Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
76. Najm HK, Caldarone CA, Smallhorn JF, Coles JG, Rebeyka IM. Management and outcomes of neonatal aortic stenosis: a 16-year single-center experience. J Thorac Cardiovasc Surg. 2008;135(1):143-150.
77. Fawzy ME, Hassan W, Fadel B, et al. Long-term results (up to 17 years) of pulmonary balloon valvuloplasty in adults and its effects on concomitant severe infundibular stenosis and tricuspid regurgitation. Am J Cardiol. 2007;99(11):1599-1602.
78. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
79. Brown DW, Dipilato AE, Chong EC, Lock JE, McElhinney DB. Aortic valve reinterventions after balloon aortic valvuloplasty for congenital aortic stenosis: intermediate and long-term outcomes. J Am Coll Cardiol. 2010;56(21):1740-1749.
80. Forbes TJ, Kim DW, Du W, et al. Comparison of surgical, stent, and balloon angioplasty treatment of native coarctation of the aorta: an observational study by the CCISC (Congenital Cardiovascular Interventional Study Consortium). J Am Coll Cardiol. 2011;58(25):2664-2674.
81. Beekman RH, Rocchini AP, Andes A, et al. Balloon angioplasty for aortic stenosis in the pediatric patient: acute results and intermediate follow-up. J Am Coll Cardiol. 1991;17(2):1170-1177.
82. McMahon CJ, Feltes TF, Fraley JK, et al. Natural history of growth of aortic valve annulus in infants and children: implications for catheter intervention for congenital aortic stenosis. Heart. 2006;92(8):1250-1254.
83. .Holzer RJ, Gauvreau K, Kreutzer J, et al. Safety and efficacy of balloon pulmonary valvuloplasty: a multicenter experience. Catheter Cardiovasc Interv. 2010;75(6):849-855.
84. Mori K, Ando M, Takao A. Surgical repair of the aortic valve. Gen Thorac Cardiovasc Surg. 2014;62(11):639-648.
85. O'Laughlin MP, Perry SB, Lock JE, Mullins CE. Use of endovascular stents in congenital heart disease. Circulation. 1991;83(6):1923-1939.