Chapter 9

EVALUATION of TRANSCATHETER ASD CLOSURE FROM THE PERSPECTIVE OF A CARDIAC SURGEON

Mehmet DEDEMOĞLU[1], Mehmet Erin TÜYSÜZ[2]

Introduction

Today, transcatheter procedures have become an alternative to surgical procedures. Transcatheter ASD closure was first described By King and Mills (1). Their double-disk technique was successful in only selected patients because the delivery system was 23F (1). Later, Raskind developed a single-umbrella technique (2) and Lock et al. developed a double hinged umbrella device called clamshell (3). However, the transcatheter techniques have not been accepted in those years due to the surgical superiority (4). In addition, Sideris et al. introduced a buttoned double-disc device for successful transcatheter ASD closure (4). However, this procedure has lost its popularity because of the complexity of procedure and the high shunt rates. After the development of various device models, Amplatzer septal occluder device was introduced and successful transcatheter ASD closure procedures were applied by it (5,6,7). Amplatzer septal occluder and Gore Helex septal occluder devices, which are the most preferable devices nowadays, are approved by FDA (Food and Drug Administration) (8).

In this chapter, the indications and brief information about transcatheter applications and the possible complications after procedure will be discussed.

Indications and Contraindications for Transcatheter ASD Closure

Indications

- In patients with isolated secundum ASD causing impaired functional capacity, right atrial and/or right ventricular enlargement, large left-to-right shunt (pulmonary-systemic blood flow ratio, Qp:Qs≥1.5:1,) to cause physiological sequelae without cyanosis at rest or during exercise, transcatheter or surgical closure to reduce right ventricle volume and improve exercise tolerance is recommended as class 1 consideration , provided that systolic pulmonary artery pressure is less than 50% of systolic systemic pressure and pulmonary vascular resistance is less than one third of the systemic vascular resistance.

[1]MD, Mersin City Training and Research Hospital, Department of Pediatric Cardiovascular Surgery, Mersin, Turkey, mehmetdedemoglu@gmail.com
[2]MD, Mersin City Training and Research Hospital, Department of Cardiovascular Surgery, Mersin, Turkey, drmehmeterin@yahoo.com

Another minor complication is the presence of migraine after the procedure (37). It is caused by microembolization-related device. The use of antiplatelet drugs can be reduced device-related migraine (38).

The incidence of ASD occluder infection is also low, most of them occur early after implantation (39). Besides, late infections of occluder devices are rare and infective endocarditis caused by occluder devices have been reported (40,41). It has been reported a case in which late infection occurs due to occluder device 4 year after the transcatheter ASD closure (42).

There may be the new developing of mitral regurgitation or the worsening of existing mitral regurgitation after the percutaneous ASD closure (43). This is caused due the fact that the atrial stiffness leads to the geometric shape change on the mitral annulus after using occluder device in especially older women (44). Aortic valve may also be affected after the percutaneous ASD closure. Aortic valve regurgitation may occur because the septal geometry is changed by placing occluder device and causes the traction of non-coronary sinus (45). In addition, functional tricuspid regurgitation is commonly seen in patients with ASD. After placing occluder device, resistant tricuspid valve regurgitation may occur in about half of the patients due to device-related structural changes (46).

Summary

Transcatheter ASD closure have been an alternative method to the surgical ASD closure. This procedure is safe and has some advantages in the selected patients. Although there is no need for sternotomy and cardiopulmonary bypass, the life-threatening complications may be encountered during or after the procedure. Hence, the patient selection should be done carefully for the procedure, the technical manipulations should be performed carefully and meticulously and the cardiac surgeon absolutely must be found in the background.

References

1. King TD, Mills NL. Secundum atrial septal defect: Nonoperative closure during cardiac catheterization. JAMA. 1976;235:2506-09.
2. Rashkind WJ. Transcatheter treatment of congenital heart disease. Circulation. 1983;67:711-16.
3. Lock JE, Rome JJ, Davis R, et al. Transcatheter closure of atrial septal defects. Experimental studies. Circulation. 1989;79:1091-9.
4. Sideris EB, Sideris SE, Fowlkes JP et al. Transvenous atrial septal defect occlusion in piglets with a "buttoned" double-disk device. Circulation. 1990;81:312-8.
5. Zabal-Cerderia C, Garcia-Montes JA, Sandoval-Jones JP, et al. Percutaneous closure of atrial septal defects with the Amplatzer device: 15 years of experience. Arch Cardiol Mex. 2014;84:250-5.
6. Diab KA, Hijazi ZM, Cao QL, et al. A truly hybrid approach to perventricular closure of multiple muscular ventricular septal defects. J Thorac Cardiovasc Surg. 2005;130:892-3.
7. Diab KA, Cao QL, Bacha EA, et al. Device closure of atrial septal defects with the Amplatzer septal occluder: safety and outcomes in infants. J Thorac Cardiovasc Surg. 2007;134:960-6.
8. Bissessor N. Current perspectives in percutaneous atrial septal defect closure devices. Med Devices (Auckl). 2015;8:297-303.

9. Stout K, Daniels C, Aboulhosn J, et al. 2018 AHA/ACC guideline for the management of adults congenital heart disease: A report of the American College of Cardiology/ American Heart Association task force on clinical practice guidelines. J Am Coll Cardiol. 2018. pii: S0735-1097(18)36846-3.
10. Marie Valente A, Rhodes JF. Current indications and contraindications for transcatheter atrial septal defect and paten foramen ovale device closure. Am Heart J. 2007;153:81-4.
11. Van Praagh S, Carrera ME, Sanders SP, et al. Sinus venosus defects; unroofing of the right pulmonary veins anatomic and echocardiographic findings and surgical treatment. Am Heart J. 1994;128(365-79.
12. Silverman NH, Zuberbuhler JR, Anderson RH. Atrioventricular septal defects; cross-sectional echocardiographic and morphologic comparisons. Int J Cardiol. 1986;13:309-31.
13. Cragun DT, Butman SM. Lood before you close: atrial septal defect with undiagnosed partial anomalous pulmonary venous return. Catheter Cardiovasc Interv. 2005;66:432-5.
14. Topol EJ, Teirstein PS. Textbook of interventional cardiology. 7th ed. Philadelphia: Elsevier: 747-770.
15. Xu B, Zaman S, Harper R. Successful closure of a large secundum atrial septal defect via the transjugular approach after failed transfemoral approach. Int J Cardiol. 2015;186:322–24.
16. Narin N, Pamukcu O, Baykan A, et al. Percutaneous atrial septal defect closure by using jugular venous access in a case with interrupted inferior vena cava. Postepy Kardiol Interwencyjnej. 2014;38:267–69.
17. Shim D, Lloyd T, Beekman RH 3rd. Transhepatic therapeutic cardiac catheterization: a new option for the pediatric interventionalist. Catheter Cardiovasc Interv. 1999;47:41–5.
18. Yixin J, Xu M, Yan L, et al. Percutaneous occluder device closure through femoral vein guidance by transthoracic echocardiography in adult atrial septal defect patients. J Thorac Dis 2018;10:1460-67.
19. Du ZD, Koenig P, Cao QL, et al. Comparison of transcatheter closure of secundum atrial septal defect using the Amplatzer septal occluder associated with deficient versus sufficient rims. Am J Cardiol. 2002;90:865-9.
20. Aytemir K, Oto A, Özkutlu S, et al. Transcatheter interatrial septal defect closure in a large cohort: midterm follow-up results. Congenit Heart Dis. 2013;8:418-27.
21. Hayes N, Rosenthal E. Tulip malformation of the left atrial disc in the. Lifetech Cera ASD device: a novel complication of percutaneous ASD closure. Catheter Cardiovasc Interv. 2012;79:675-7.
22. Akagi T. Currrent concept of transcatheter closure of atrial septal defect in adults. J Cardiol. 2015;65:17-25.
23. Alnasser S, Lee D, Austin PC, et al. Long term outcomes among adults post transcatheter a trial septal defect closure: systematic review and meta-analysis. Int J Cardiol. 2018;270:126-32.
24. Amin Z, Hijazi ZM, Bass JL, et al. Erosion of Amplatzer septal occluder device after closure of secundum atrial septal defects: review of registry of complications and recommendations to minimize future risk. Catheter Cardiovasc Interv. 2004;63:496-502.
25. Abaci A, Unlu S, Alsancak Y, et al. Short and long term complications of device closure of atrial septal defect and patent foramen ovale: meta-analysis of 28142 patients from 203 studies. Catheter Cardiovasc Interv. 2013;82:1123-38.
26. Kijima Y, Akagi T, Nakagawa K, et al. Cardiac erosion after catheter closure of atrial septal defect: septal malalignment may be a novel risk factor for erosion. JC Cases. 2014;9:134-7.
27. Diab K, Kenny D, Hijazi ZM. Erosions, erosions, and erosions! Device closure of atrial septal defects: how safe is safe? Catheter Cardiovasc Interv. 2012;80:168-74.
28. Amin Z. Echocardiographic predictors of cardiac erosion after Amplatzer septal occluder placement. Catheter Cardiovasc Interv. 2014;83:84-92.
29. Akujuo AC, Rao A, Musuku SR, et al. Cardiogenic shock following Amplatzer device embolization due to left ventricular outflow tract obstruction. J Card Surg. 2016;31:100-1.
30. Kutty S, Hazeem AA, Brown K, et al. Long-term (5-to-20-year) outcomes after transcatheter or surgical treatment of hemodynamically significant isolated secundum atrial septal defect. Am J Cardiol. 2012;109:1348-52.
31. Kefer J, Sluysmans T, Hermans C, et al. Percutaneous transcatheter closure of interatrial septal defect in adults: procedural outcome and long-term results. Catheter Cardiovasc Interv. 2012;79:322-30.
32. Knepp MD, Rocchini AP, Lloyd TR, et al. Long-term follow-up secundum atrial septal defect closure with the amplatzer septal occluder. Congenit Heart Dis. 2010;5:32-7.

33. Scacciatella P, Marra S, Pullara A, et al. Percutaneous closure of atrial septal defect in adults: very long-term clinical outcome and effects on aortic and mitral valve function. J Invasive Cardiol. 2015;27:65-9.
34. Mills NL, King TD. Late follow-up of nonoperative closure of secundum atrial septal defects using the King-Mills double-umbrella device. Am J Cardiol. 2003;92:353-5.
35. Honari G, Ellis SG, Wilkoff BL, et al. Hypersensitivity reactions associated with endovascular devices. Contact Dermatitis. 2008;59:7-22.
36. Cammalleri V, Ussia GP, Marchei M, et al. Percutaneous closure of patent foramen ovale with Atriasept II device in nickel allergic patients. J Cardiovasc Med (Hagerstown). 2014;15:350-2.
37. Rodes-Cabau J, Mineau S, Marrero A, et al. Incidence, timing, and predictive factors of new-onset migraine headache attack after transcatheter closure of atrial septal defect or patent foramen ovale. Am J Cardiol. 2008;101:688-92.
38. Sharifi M, Burks J. Efficacy of clopidogrel in the treatment of post-ASD closure migraines. Catheter Cardiovasc Interv. 2004;63:255.
39. Walpot J, Amsel B, Rodrigus I, et al. Late infective endocarditis of an atrial septal occluder device presenting as a cystic mass. Echocardiography. 2011;28:131-3.
40. Aruni B, Sharifian A, Eryazici P, et al. Late bacterial endocarditis of an Amplatzer atrial septal device. Indian Heart J. 2013;65:450-1.
41. Slesnick TC, Nugent AW, Fraser CD, et al. Incomplete endothelization and late development of acute bacterial endocarditis after implantation of an Amplatzer septal occluder device. Circulation. 2008;117:326-7.
42. Thibodeau-Jarry N, Ibrahim R, Ducharme A, et al. Late infection of an atrial septal defect closure device: a possible complication. Can J Cardiol. 2015;31:e9-11.
43. Hiraishi M, Tanaka H, Motoji Y, et al. Impact of right ventricular geometry on mitral regurgitation after transcatheter closure of atrial septal defect. Int Heart J. 2015;56:516-21.
44. Wilson NJ, Smith J, Prommete B, et al. Transcatheter closure of secundum atrial septal defects with the Amplatzer septal occluder in adults and children-follow-up closure rates, degree of mitral regurgitation and evolution of arrhythmias. Heart Lung Circ. 2008;17:318-24.
45. Schoen SP, Boscheri A, Lange SA, et al. Incidence of aortic valve regurgitation and outcome after percutaneous closure of atrial septal defects and patent foramen ovale. Heart. 2008;94:844-7.
46. Sadiq M, Kazmi T, Rehman AU, et al. Device closure of atrial septal defect: medium-term outcome with special reference to complications. Cardiol Young. 2012;22:71-8.