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ATRIAL SEPTAL DEFECT (ASD), TRANS-CATHETER CLOSURE – CASE REPORT

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1. INTODUCTION

Atrial septal defect (ASD) is one of the most common types of congenital heart defects, occurring in about 25% of children. An atrial septal defect occurs when there is a failure to close the communication between the right and left atria. It encompasses defects involving both the true septal membrane and other defects that allow for communication between both atria. There are five types of atrial septal defects ranging from most frequent to least: patent foramen ovale, ostium secundum defect, ostium primum defect, sinus venosus defect, and coronary sinus defect. Small atrial septal defects usually spontaneously close in childhood. Large defects that do not close spontaneously may require percutaneous or surgical intervention to prevent further complications such as stroke, dysrhythmias, and pulmonary hypertension. This activity describes the evaluation, diagnosis, and management of atrial septal defect and highlights the role of team-based interprofessional care for affected patients. (1)

Atrial septal defects are frequently asymptomatic. The characteristic murmur is a soft, systolic ejection murmur over the pulmonic area (second intercostal space) combined with a wide, fixed splitting of S2. Many ASDs go undiagnosed until adulthood; therefore, treatment, especially of large defects, is often delayed. Untreated large defects can cause exercise intolerance, cardiac dysrhythmias, palpitations, increased incidence of pneumonia, pulmonary hypertension and increased mortality.(2)

2. CASE REPORT

A patient who was diagnosed with ASD accidentally, during a cardiological check-up, is hospitalized at the Department of Interventional Cardiology for an interventional procedure to close ASD fatigue, denies chest pains, difficulty breathing and vegetative symptomatology. She had no nausea and vomiting. He was not febrile, negates lkasalj and expectoration. Previous illnesses: cholecystectomy 8 months ago. Functions; appetites good, negates TM oscillations; urination. Habits: non-smoker, does not consume alcohol Allergies unknown (spring allergic rhinitis).

The patient is in a normal state of consciousness and orientation, communicative, eupnoic at rest, afebrile. TA on examination 142 /71 mmHg; heart rate 75/min. The skin and visible mucous membranes are normocolored. Head: neat configurations. Neck: actively and passively movable. I hear no carotid murmurs. Chest basket symmetrically respiratory movable. Pulmo: regular auscultatory breath murmur, without obstructive and stagnant phenomena. Cor: rhythmic action, the tones are clear, I don't hear noises. Abdomen: at the level of the chest, soft, painless on palpation, I do not palpate the liver and spleen, peristalsis is audible. Extremities: symmetrical, without edema.

The procedure is performed in the cardiac catheterization room under the control of diascopy and transesophageal ultrasound.

The patient is put under general anesthesia with constant monitoring of hemodynamics and ECG. A transesophageal ultrasound probe is placed. TEE defect with a diameter of about 17 mm, dominated by the right heart cavities and adequate edges of the defect. Sheeth 6 Fr is introduced in vein femoralis l. dex. Over diagnostic wire 0.035, introduced MPA catheter 6 Fr. The wire is positioned in the upper left pleural vein. Replace the stiff wire over the MPA catheter. Ballon 24 mm, inflated with contrast in adequate position controlled with TEE and diascopy. TEE measure the defect with the sizing plate, about 18 mm, and with the diascopy, about 18.5 mm. (Fig.1)

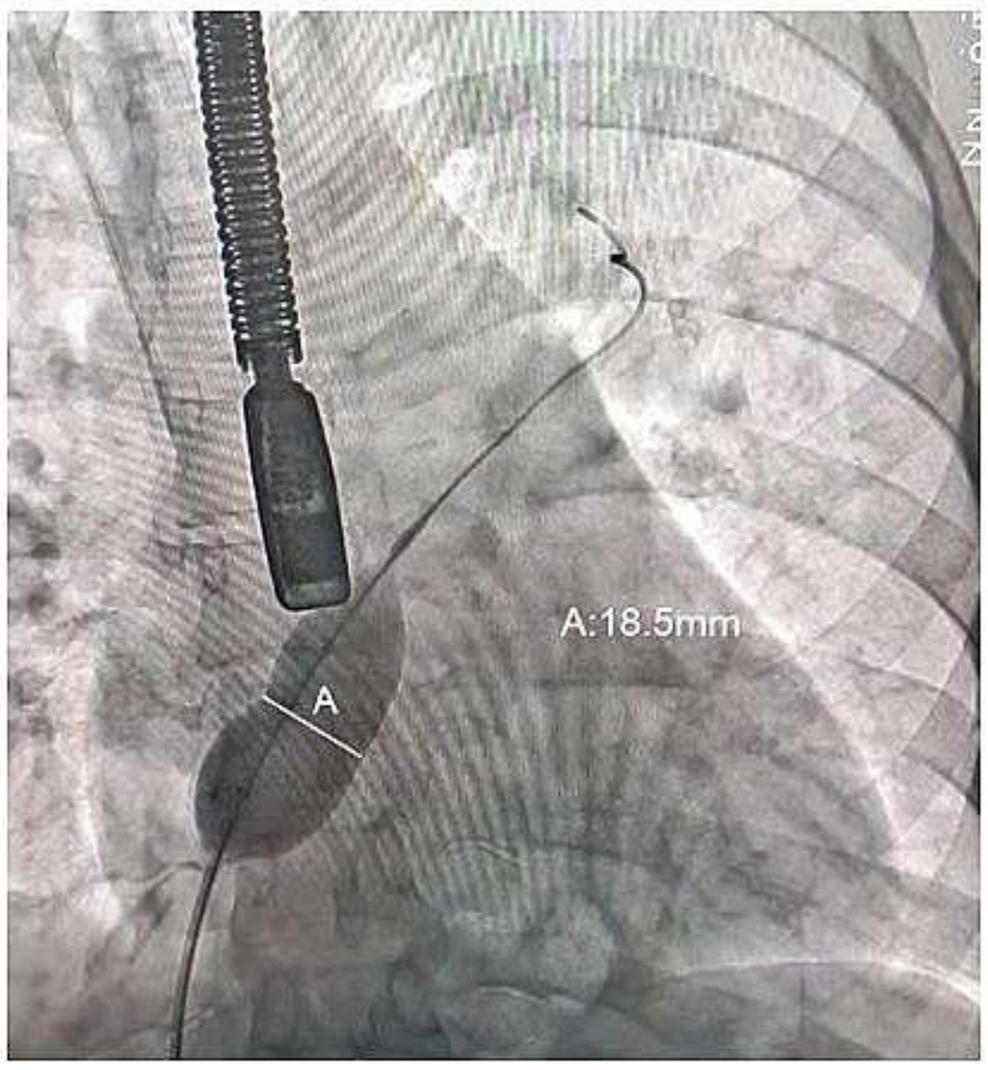

image source: Clinic for diseases of the heart, blood vessels and rheumatism, Clinical Center University of Sarajevo

Figure 1.

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We decide on occluder 20. Replace sheeth 6...10Fr, and introduce long sheet that is positioned in the cavum LA. Occluder is introduced and, opened the left disk in LA and then the right one in DA. Position check is performed by dragging with TEE control, and Ocluder was stable. (Fig.2)

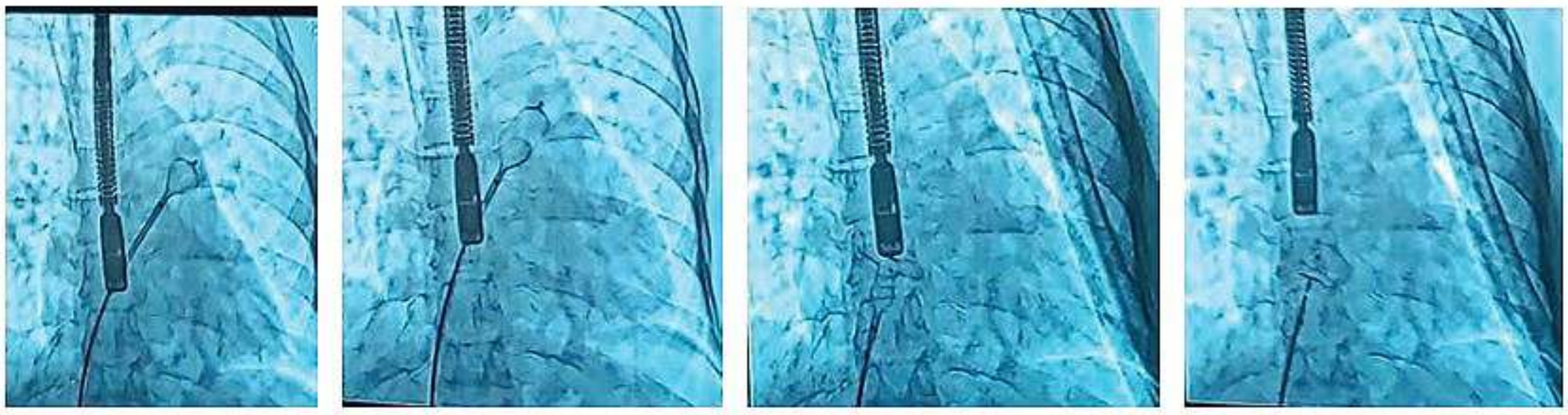

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Figure 2.

Occluder is released, remains in expected position, TEE realized after release: occluder in expected position (Fig.3), with minimal residual shunt, without flow obstruction on the Aortic and mitral valves. During the procedure, she received a dose of antibiotics (kefzol), as well as heparin (7000 IU). Hemostasis of the puncture site. The procedure passed without immediate complications. The patient was moved, extubated, hemodynamically stable to the intensive care unit.

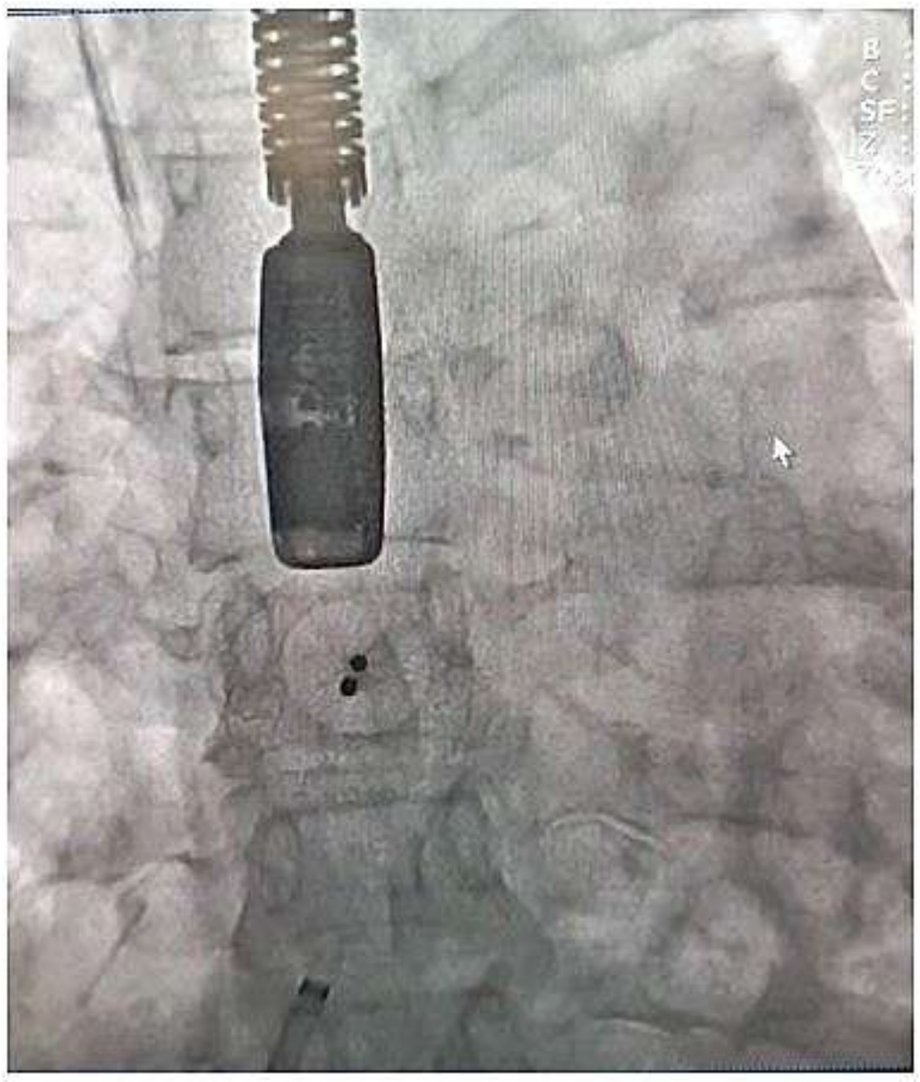

image source: Clinic for diseases of the heart, blood vessels and rheumatism, Clinical Center University of Sarajevo
Figure 3.

3. Discussion

A study published in 2008 reported new-onset AR or worsening of AR in 9% of patients with an ASD and in 10% of patients with a PFO at 12 months. Cabau et al. reported the incidence of migraine headache attack with or without aura in 7% of patients post-ASD-PFO closure at a median 27-month follow-up. Data were gathered via a questionnaire (International Headache Society Criteria for migraine) in 185 (without a history of migraine) patients who underwent ASD-PFO closure. Migraine, mostly with aura, was associated with younger age (26 ± 16 vs. 39 ± 21 years; p = 0.02). These were patients who would have more likely undergone ASD closure (100% vs. 58%; p = 0.001). (3)

Trials of patent foramen ovale (PFO) closure to prevent recurrent stroke have been inconclusive. We investigated whether patients with cryptogenic stroke and echocardiographic features representing risk of stroke would benefit from PFO closure or anticoagulation, as compared with antiplatelet therapy. A total of 663 patients underwent randomization and were followed for a mean (±SD) of 5.3±2.0 years. In the analysis of randomization groups 1 and 2, no stroke occurred among the 238 patients in the PFO closure group, whereas stroke occurred in 14 of the 235 patients in the antiplatelet-only group (hazard ratio, 0.03; 95% confidence interval, 0 to 0.26; P<0.001). Procedural complications from PFO closure occurred in 14 patients (5.9%). The rate of atrial fibrillation was higher in the PFO closure group than in the antiplatelet-only group (4.6% vs. 0.9%, P=0.02). The number of serious adverse events did not differ significantly between the treatment groups (P=0.56). In the analysis of randomization groups 1 and 3, stroke occurred in 3 of 187 patients assigned to oral anticoagulants and in 7 of 174 patients assigned to antiplatelet therapy alone. Among patients who had had a recent cryptogenic stroke attributed to PFO with an associated atrial septal aneurysm or large interatrial shunt, the rate of stroke recurrence was lower among those assigned to PFO closure combined with antiplatelet therapy than among those assigned to antiplatelet therapy alone. PFO closure was associated with an increased risk of atrial fibrillation. (4)

Transcatheter closure is a widespread technique used to treat secundum atrial septal defects (ASDs). When compared to surgery, it provides a less invasive approach with quicker recovery and reduced physical and psychological impact. Nowadays, almost 85–90% of all secundum ASD can be closed by using a transcatheter approach. However, several limitations may have a significant impact on the feasibility and success of percutaneous ASD closure. Limitations can be grouped as: (I) anatomical; (II) device-related; (III) associated defects and natural history associated issues; (IV) physiological; (V) complications. Physician should be aware of potential limits of percutaneous ASD closure. A common underlying structure apply to all available devices: they are made of two disks and a connecting segment that keeps them together across the ASD. Two different engineering concepts have been developed, so that occluder devices can be classified as self-centering and non-self-centering ones. The Amplatzer and the Amplatzer-like devices, in which a central connecting waist fills the defect improving stability and occlusion, belong to the former, while devices such as GSO, where the connecting segment is linear, belong to the latter. All the currently available devices need to have surrounding "walls" supporting their stability. In particular, the disks of non-self-centering ones should be 1.8–2 times the diameter of the defect in order to have complete defect closure and avoid mal position or embolization. Main

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anatomical limitations to percutaneous ASD closure may be insufficient surrounding rims, multiple defects and excessively bulging atrial septal aneurisms (ASA). As previously reported, devices are currently made according to two different concepts: the self-centering and the non-self-centering idea. ASO and Amplatzer-like devices (Figulla Flexible Occlutech septal occluder, Cocoon, CeraFlex™ ASD Occluder) belong to the self-centering group. The range of defects amenable to closure depends on the available waist diameter of the different devices. In particular, ASO waist ranges from 4 to 38 mm, Occlutech from 4 to 40 mm, Cocoon from 8 to 40 mm, and CeraFlex from 6 to 32 mm. GSO and Helex septal occluder belong to the non-self-centering device types and the range of defect amenable to closure is up to 15–18 mm. Device embolization may occur in up to 1% of cases. The commonest reasons for occluder dislodgement are the use of an undersized ASD device, greater defect size, left atrium too small to accommodate the device, an inadequate or floppy rim, device mobility post-implantation, and operator-related technical issues. The most of dislodgement occurs within 24 hours post implantation and takes place into left atrium (24.6%), aorta (18.4%), and right ventricle (16.7%). The majority of the devices can be retrieved percutaneously after early embolization. In such cases the defect is re-evaluated and, if a misevaluation or misplacement of the device occurred during the first procedure, a correct second procedure may end up in success. On the other hand, late embolization usually requires surgical treatment because of epithelization. (5)

Complex ostium secundum type atrial septal defect (ASD) is a definition used for large (stretched diameter over 26 mm with deficient rim) or multiple ASDs or multifenestrated septum or ASDs with redundant and aneurysmal septal rims. Compared to simple defects, transcatheter ASD closure with Amplatzer septal occluder (ASO) is relatively challenging in these cases, and different techniques have been defined to increase procedure success. We report three adult patients with complex ostium secundum type ASDs that were closed with ASO device using three different techniques. The first case was a 36-year-old female patient with complaints of dyspnea, palpitation and fatigue. A complex ostium secundum type ASD was diagnosed, and the defect was closed with a 36 mm ASO device using a left upper pulmonary vein technique. The second case was a 47-year-old female patient with complaints of dyspnea and palpitation. A large and complex ASD was detected, and the defect was closed with a 28 mm device using a left atrial roof technique supported by non-inflated balloon. The third case was a 40-year-old female patient who presented with complaints of dyspnea and palpitation. Complex ASD was diagnosed, and the defect was closed with a 32 mm device using a partially inflated balloon technique. In large and complex ASDs, the classical implantation technique of an ASO device may fail at any time. The knowledge and application of different techniques that orient the left atrial disc parallel to the septum may increase the procedure success and decrease complications. (6)

Fourteen cohort studies involving 9695 patients were comprehensively analyzed. Regarding complications, the pediatric patients in the surgery group exhibited higher occurrences of cardiac arrhythmia (odds ratio [OR]: 1.87, 95% confidence interval [CI]: 1.22-2.87, p=0.004), pericardial effusion (OR: 14.80, 95% CI: 6.97-31.43, p<0.00001), and pulmonary complications (OR: 2.58, 95% CI: 1.73-3.85, p<0.00001) compared with those in the transcatheter group. However, no significant difference in fever incidence was observed (OR: 2.57, 95% CI: 0.90-7.34, p=0.08). Furthermore, length of hospital stay was notably shorter in the

pediatric transcatheter group (mean difference [MD]: 4.00, 95% CI: 1.71-6.29, p=0.0006). Regarding efficacies, both groups demonstrated similar rates of successful closure (OR: 1.97, 95% CI: 0.56-6.92, p=0.29) and residual shunting (OR: 0.55, 95% CI: 0.17-1.77, p=0.31) in the pediatric cohort. Subgroup analyses revealed that surgical residual shunting was notably lower in the European pediatric population (OR: 0.18, 95% CI: 0.07-0.45, p=0.0002), in cases with ASD size exceeding 15 mm (OR: 0.19, 95% CI: 0.08-0.49, p=0.0006), and in pediatric patients younger than 8 years (OR: 0.33, 95% CI: 0.12-0.92, p=0.03). Interestingly, residual shunting involving complex ASD with rim deficiency was more pronounced in the surgery group (OR: 2.66, 95% CI: 1.33-5.32, p=0.006). (7)

4. CONCLUSION

Both surgical and transcatheter closures are equally effective. Transcatheter closure showing significantly fewer complications, and is the method of choice for children and adults if the diameter is not significantly large. So far 3 adults patients have been treated, by transcatheter closure of the ASD, in the invasive cardiology department KCUS, without significant complications.

REFERENCE

1. Menillo AM, Lee LS, Pearson-Shaver AL. Atrial Septal Defect. [Updated 2023 Aug 7]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK535440/

2. El-Segaier M, Pesonen E, Lukkarinen S, Peters K, Ingemansson J, Sörnmo L, Sepponen R. Atrial septal defect: a diagnostic approach. Med Biol Eng Comput. 2006 Sep;44(9):739-45. doi: 10.1007/s11517-006-0094-5. Epub 2006 Aug 29. PMID: 16941100. https://pubmed.ncbi.nlm.nih.gov/16941100/

3. 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**:844-847 https://heart.bmj.com/content/94/7/844

4. Mas JL, Derumeaux G, Guillon B, Massardier E, Hosseini H, Mechtouff L, Arquizan C, Béjot Y, Vuillier F, Detante O, Guidoux C, Canaple S, Vaduva C, Dequatre-Ponchelle N, Sibon I, Garnier P, Ferrier A, Timsit S, Robinet-Borgomano E, Sablot D, Lacour JC, Zuber M, Favrole P, Pinel JF, Apoil M, Reiner P, Lefebvre C, Guérin P, Piot C, Rossi R, Dubois-Randé JL, Eicher JC, Meneveau N, Lusson JR, Bertrand B, Schleich JM, Godart F, Thambo JB, Leborgne L, Michel P, Pierard L, Turc G, Barthelet M, Charles-Nelson A, Weimar C, Moulin T, Juliard JM, Chatellier G; CLOSE Investigators. Patent Foramen Ovale Closure or Anticoagulation vs. Antiplatelets after Stroke. N Engl J Med. 2017 Sep 14;377(11):1011-1021. doi: 10.1056/NEJMoa1705915. PMID: 28902593. https://pubmed.ncbi.nlm.nih.gov/28902593/

5. Faccini, A., & Butera, G. (2018). Atrial septal defect (ASD) device trans-catheter closure: limitations. *Journal Of Thoracic Disease, 10*(Suppl 24), S2923-S2930. doi:10.21037/jtd.2018.07.128 https://jtd.amegroups.org/article/view/23101/18013

Print: ISSN 2232-8726
Online: ISSN 2637-3297

6. Kılıç, T., Şahin, T., & Ural, E. (2013). Short-Term Renal Function Outcomes after Renal Artery Stenting in Atherosclerotic Renal Artery Stenosis. Turk Kardiyol Dern Ars, 41(2), 148-153. https://doi.org/10.5543/tkda.2013.79745.

7. de Liyis BG, Kosasih AM, Jagannatha GNP, Dewangga MSY. Complications and Efficacies of Surgical Versus Transcatheter Closure for Pediatric Ostium Secundum Atrial Septal Defect: A Meta-Analysis. J Endovasc Ther. 2024 Apr 10:15266028241245599. doi: 10.1177/15266028241245599. Epub ahead of print. PMID: 38597284. https://pubmed.ncbi.nlm.nih.gov/38597284/