

# Outcomes after ASD Repair in Adulthood : Surgical Closure vs. Percutaneous Device Closure

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## Abstract

Various studies comparing surgical and percutaneous device closure in adult ASD patients showed different results. Thus, this literature review aims to determine outcomes in adult patients receiving surgical and percutaneous device closure by comparing articles. The articles were searched and filtered in PubMed, Google Scholar, and ScienceDirect databases. The years for articles included in this review were between 2017 and 2022. Only articles discussed the comparison between surgical and device differences included in this review. The exclusion criteria are articles containing only surgical or device closure outcomes. Eight articles met the criteria and were reviewed and chosen based on the aims, sample criteria, repair technique, and the result. This review resulted in similar outcomes in both surgical and device groups. There were slight differences, such as more extended hospital stays, more ECG abnormalities in surgical groups, and incomplete closure in device groups. It was concluded that both techniques effectively treat ASD without significant problems.

Keywords: ASD in adults; percutaneous device closure; surgical closure; ASD repair

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## 1. Introduction

Atrial septal defect (ASD) is one of the most common congenital heart defects. It is usually asymptomatic when ASD is the only abnormality present [1] [2]. However, it might show clinical symptoms during adulthood and be found accidentally during medical checkups [2]. During adulthood, patients might experience gradual exercise limitation [3]. The repair to stop the shunt is indicated when a significant hemodynamic dysfunction can cause enlargement of the right ventricle presence [1]. There were two options for closure management, surgery closure or device closure [1], [3]. Surgical closure for atrial septal defect has been practiced for ages. The usual approach for surgical closure is through median sternotomy. It has been effective with minimal mortalities and morbidities [4]. Another treatment to close the shunt is through device closure, which is a more minimally invasive technique than surgery [1], [3], [5]. The best time for ASD repair was immediately after diagnosis and preferably at school age [4]. However, due to its pathophysiology, the defect was found during adulthood; thus, the outcomes might differ. Besides, the need to observe medical approaches for the best result in the closure of ASD in adulthood was critical. Despite many previous surgical and device closure studies, there are still many differences between one study and another. This literature review aimed to find any outcome

differences in adult patients who underwent percutaneous device closure and surgery closure by comparing various studies.

## 2. Methods

The method used in this study is a literature review. The strategy to search the article was using keywords related to the topics (a result of the atrial septal defect, atrial septal defect in adulthood, atrial septal defect closure). The article databases used in this study were PubMed, ScienceDirect, and Google Scholar. This study excluded articles published more than five years before 2022. In addition, articles containing only device or surgical closure were not included. The inclusion criteria were articles comparing surgical and device closure in adult patients. From the databases, there were 136 articles. However, only eight articles met the inclusion criteria.

## 3. Result

Table 1. Results of article reviews

Author	Sample criteria	Study Design	Repair technique	Result
Boudiche [6]	Adult patient (Age $\geq$ 20 years old) with ostium secundum type of atrial septal defect that underwent surgical closure or percutaneous closure and followed up to 12 months.	Retrospective cohort study	Percutaneous closure, surgery	Surgical and percutaneous closure were both influential in correcting the defect. However, patients who underwent surgical closure needed more extended hospital stays than the other groups who underwent percutaneous closure
Brida [7]	Patients equal to or more than 16 years old with ostium secundum or sinus venous atrial septal defect who underwent surgical or catheter closure.	Retrospective cohort study	Catheter device closure, surgery	Results after catheter closure and surgical closure were similar. The difference was the extended hospital stay in patients who underwent surgical closure. Thirty days follow-ups result in no mortality during a hospital stay. However, 16 patients died during a median follow-up (6.7 years).
Rigatelli [8]	Articles about the comparison between percutaneous closure and surgical technique closure in adulthood between January 2000 and October 2020 range.	Systematic review and meta-analysis	Surgical closure and transcatheter device closure of ASD	A higher mortality rate was found in patients who underwent surgical techniques to close ASD than in transcatheter closure.
Bashir [9]	Medical records were used for the data then they followed up with the patients for 20 months. There were a total of 64 patients.	Cohort observational study	Percutaneous device closure using amplatzer.	Short-term outcomes (24 hours after the procedure) showed an excellent outcome (no significant complications were present). After being followed up after 20 months, the size of the right ventricle was decreased, and pulmonary hypertension improved.
Askari [10]	102 patients with a history of secundum atrial septal defect were included in their studies.	Retrospective cohort study	Surgical closure, transcatheter closure,	The hospital stay was longer in surgical groups. Among the surgery and device closure groups, the complete closure was significantly higher in the surgery closure

groups. Moreover, the device closure groups had higher chances of experiencing pulmonary hypertension in the future. Mortality between the two groups was 0.

Rudzitis [11]	Retrospective study comparing surgical and transcatheter device closure. They only followed up on patients who underwent transcatheter device closure. Their data were obtained from 334 patients of secundum ASD.	Retrospective cohort study	Arterial septal defect, closure, grown-up	There was no significant difference in success rate in both groups, but an insignificant result about 50% of patients had residual flow in the device group. The conclusion was good outcomes (early and late) in both groups and shorter hospitalization time in the transcatheter device group.
Seo [12]	Compares left atrium function after surgical and percutaneous device closure using medical records and transthoracic echocardiographic images. Eighty-four patients were included.	Retrospective study	Devices, surgery, the function of left atrial, congenital heart disease	No left atrium function and structure differences between a device and surgical closure.
Fujii [13]	Data were obtained and analyzed from medical records of patients $\geq 40$ years old with ASD and no history of atrial fibrillation and or atrial flutter who underwent transcatheter device (281 patients) and surgical closure (24 patients).	Retrospective study	Atrial fibrillation, transcatheter closure, surgical closure, adult	Patients aged $\geq 40$ years who underwent surgical closure have lower atrial fibrillation rates and atrial flutter rates than whom underwent transcatheter closure.

#### 4. Discussion

After reviewing the articles, the surgery or device approach was effective in treating atrial septal defect [6], [7], [9], [11], [12]. However, there were slightly different outcomes between surgery or device approach in adulthood for atrial septal defect closure. The study conducted by three different researchers in different settings stated that surgery closure was related to more extended hospital stay compared to percutaneous closure [6], [7], [10]. According to a study by Askari, the longer duration of hospital stay was due to higher-risk patients indicated for surgery closure rather than percutaneous [10]. In addition, the prolonged hospital stay was caused by the need to be closely monitored after the surgery [14]. Patients who received surgical closure procedures showed a higher rate of atrial fibrillation and stroke before, during, or soon after the surgery than patients who received transcatheter device closure [8]. This research is in line with other studies that stated that AF and atrial flutter are more common in patients who underwent surgical closure [13]. A study by Bashir, found right ventricle size improvement and decreased systolic pulmonary pressure after percutaneous closure during a 20-month followed up. They also observed no displacement of the device [9]. Despite the same success rate in other findings, another study found that surgical closure of ASD is more likely to close wholly compared to patients who underwent the device group [10]. Incomplete closure of ASD in device groups might progress into pulmonary hypertension and additional procedure in the future [10].

The defect size and location were related to the presence of complications. The surgical closure for ostium primum parallel to the closure of the ventricle septal defect could cause AV Block [15]. A more significant defect on the septum was more likely to show a complication soon after transcatheter device closure. The complications found were arrhythmias and small leaks [16]. However, this review observed all atrial septal defects without grouping them according to the defect location and size. Thus, it became the limitation of this study. It is suggested to do further research about factors of ECG abnormalities after ASD closure.

## 5. Conclusion

After comparing various studies, it can be concluded that the outcomes of surgery and percutaneous device closure in adults with ASD are similar and effective in treating ASD in adults. There is a possibility that ECG abnormalities are not only caused by the closure technique, so further research is needed.

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