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Prevalence of coarctation recurrence after stenting treatment for aortic coarctation in Iran: a systematic review and meta-analysis

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Abstract

Objective: This study was conducted to analyze the incidence of recurrent coarctation following angioplasty and stenting due to the high prevalence of aortic coarctation and disagreement on reconstructive surgical procedures due to the necessity to treat this illness and the lack of a universal study.
Methods: Two reviewers independently assessed research on aortic coarctation recurrence the following stenting. The MEDLINE and EMBASE databases were used to find studies. The keywords "aorta coarctation," "recurrence rate," "stenting," and "complication" were used to find relevant papers. Stata 10.0 was used to conduct all meta-analyses (Stata Corporation, College Station, TX, USA).
Results: 5 studies were selected for the final review. The overall prevalence of coarctation recurrence after stenting treatment was 8.7%(95%CI: 6.1%-11.2%).
Conclusion: This is the first meta-analysis of patient stent reports for aortic coarctation in an Iranian community with patients ranging in age from infancy to the elderly. Despite the fact that we experienced a level of mortality in our trial that is seldom seen in previous studies, the rate of aortic coarctation recurrence was just.....Therefore, stenting has been proved to be a safe and successful procedure when done properly and in well-equipped clinics on selected patients.

Keywords: Coarctation, Aorta, Recurrence, Stenting

Introduction

Aortic coarctation is proximal stenosis of the aorta that is accompanied by an increase in systemic blood pressure and a difference in systolic pressure greater than or equal to 20 mm Hg between the upper and lower extremities (1), and it is the sixth most common congenital heart defect, with a prevalence of 5-8 percent (2). Aortic coarctation is a stoppage of arterial blood flow that can develop anywhere along the aorta, although it most commonly happens when the left subclavian artery splits. As a result, blood flow to

the lower extremities and legs is diminished, as is blood pressure in these organs. Blood flow and pressure in the upper extremities, on the other hand, rise. As a result, the heart has to work harder to cope with the stress (3-4). Aortic coarctation is a life-threatening condition. This is because stenosis in any portion of the aorta can bring catastrophic problems in the long term, such as heart failure and aortic rupture (5). Patients who do not receive treatment are unlikely to live to be 50 years old (6). Although there is complete agreement among specialists on the need for coarctation correction, there is the disagreement that this disagreement is more widespread in the treatment of cases of recurrence of coarctation, i.e., recurrence of the disease after initially successful treatment and residual coarctation, i.e., failure of initial successful treatment, due to the expansion of new methods of treatment (7). A balloon catheterization operation is used to treat aortic coarctation surgically; however, selecting the right approach might be difficult (8). In virtually all situations, surgery is recommended if the disease's symptoms do not respond to medicinal therapy. However, every attempt is taken to postpone surgery until the infant is older (for example, by 10). The constricted part of the aorta is removed during surgery, and the two ends of the aorta are anastomosed. For anastomosis, angioplasty using artificial vessels (dacron patch) or tube graft is performed when the stenosis is long. A flap of neighboring vascular tissue (typically the left subclavian artery) is often used to bridge the gap between the two ends. Early intervention (before the age of 10) has been shown to enhance life expectancy, and 70% of patients are effectively treated (5, 8). The first balloon angioplasty and the first intravascular stent were done in 1970 and 1981, respectively, and are now widely used to treat aortic coarctation (9).Compared to surgical repair and angioplasty balloons, the stent minimizes recurrence by forming a retaining wall and the risk of aortic wall dissection and delayed aneurysm (10). This study was conducted to analyze the incidence of recurrent coarctation following angioplasty and stenting due to the high prevalence of aortic coarctation and disagreement on reconstructive surgical procedures due to the necessity to treat this illness and the lack of a universal study.

Methods

Data search

Two reviewers independently assessed research on aortic coarctation recurrence the following stenting. The MEDLINE and EMBASE databases were used to find studies. The keywords "aorta coarctation," "recurrence rate," "stenting," and "complication" were used to find relevant papers.

Criteria for acceptance and rejection of studies

Both reviewers assessed the articles separately based on the following admission criteria:

(A) Studies must be written in English or Persian. The stenting approach has been utilized to treat aortic coarctation. The rate of coarctation recurrence is calculated. Studies were rejected in the following cases: If samples are fewer than ten or if other coarctation therapies have been assessed. It should be mentioned that the ethical committees at both the institutional and municipal levels have given their approval to this study.

Data extraction and quality assessment

Two arbitrators worked together to retrieve the data. If the arbitrators couldn't agree, a third arbitrator would assess and settle any disagreements. Each research extracts information on the following variables: first author, journal, year of publication, country of conducting the study, study design (retrospective or prospective), characteristics of the study population (percentage of women), number of patients, age of patients, and prevalence of coarctation recurrence. The diagnostic study quality evaluation criteria were used to appropriately assess the methodological quality of chosen papers.

Statistical analysis

Stata 10.0 was used to conduct all meta-analyses (Stata Corporation, College Station, TX, USA).

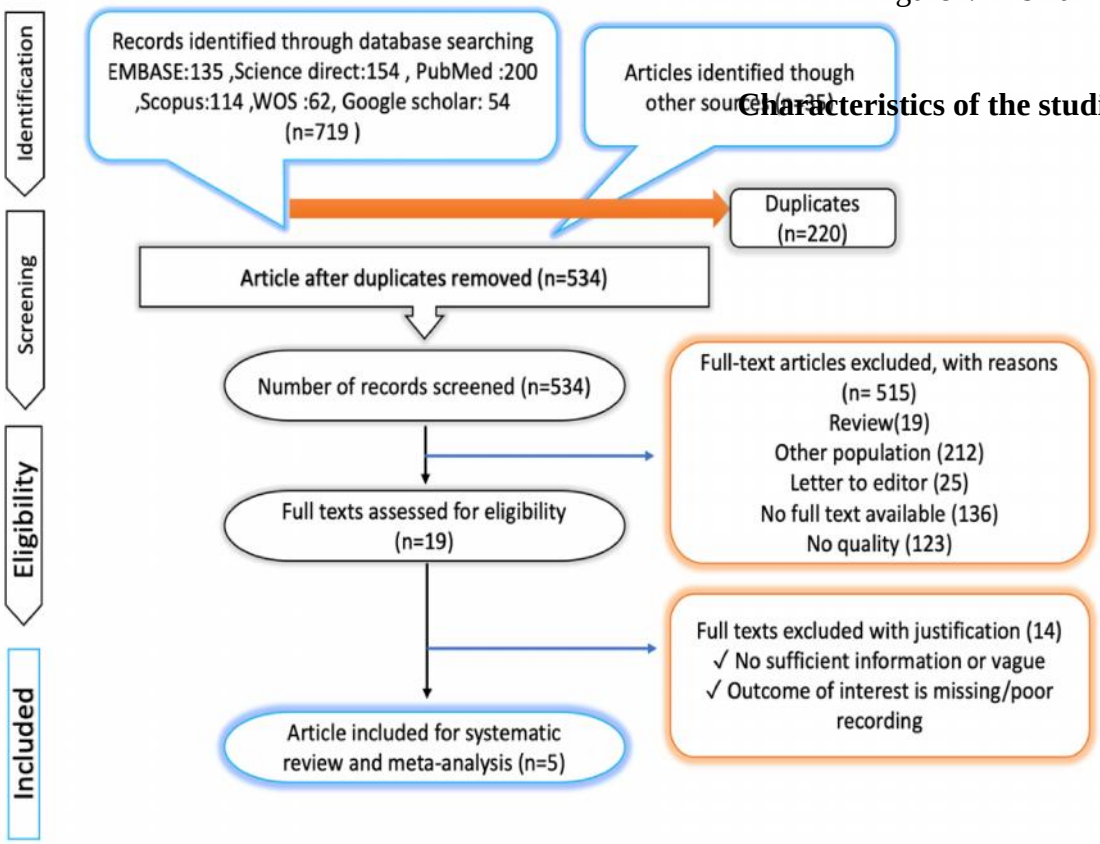
The effect value was calculated using incidence rates with 95 percent confidence intervals (CIs). The Cochrane Q test I2 test was used to determine study heterogeneity. When the P-value of Q was less than 0.05 or the value of I2 was greater than 50%, statistically significant heterogeneity across the studies was evaluated, and the estimates were integrated using a random effect meta-analysis model. The fixed-effect model was utilized in the other cases.

Results

Study selection

Based on the searching strategy, as many as 754 studies were selected. After analyzing the correspondence of the studies with the required criteria, 5 studies were selected for the final review . (figure 1)

Figure1. Prisma flow diagram



Characteristics of the studies

The required characteristics of each selected study has been indicated in table 1. In total, 298 patients undergone aortic coarctation surgery were investigated in 5 studies. All of the studies were retrospective. The studies were conducted in Tehran, Isfahan, Shiraz and Tabriz.

Table 1. The characteristics of the included studies evaluating th recurrence rate of coarctation

Author	Year	province	Sample size	Design	Male/Female	Mean age	Prevalence of recurrence
Nokhostin Davari	2007	Tabriz	209	Retro	145/64	6.51± 9.91	30(14.3%)
Haji-Zeinali	2006	Tehran	8	Retro	N/A	55 ± 15	2(25%)
Mansouri	2017	Isfahan	132	Retro	93/39	17.18 ± 7. 19	17(12.9%)
Sadeghipour	2022	N/A	105	Retro	N/A	N/A	5(5.4%)
Ostovan	2014	Shiraz	33	Retro	16/17	26.64±16.30	1(3%)

Prevalence of coarctation recurrence after stenting treatment

The overall prevalence of coarctation recurrence after stenting treatment was 8.7%(95%CI: 6.1%-11.2%)(figure2).

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            Study |     ES    [95% Conf. Interval]     % Weight
------------------+-----------------------------------------------
Davari (2007)     |  0.140       0.093     0.187         27.56
Zeinali (2006)    |  0.250      -0.050     0.550          0.68
Mansouri (2017)   |  0.130       0.073     0.187         18.62
Sadeghipour (2022)|  0.050       0.008     0.092         35.13
Ostovan (2014)    |  0.030      -0.028     0.088         18.01
------------------+-----------------------------------------------
I-V pooled ES     |  0.087       0.063     0.112        100.00
------------------+-----------------------------------------------

  Heterogeneity chi-squared =  14.89 (d.f. = 4) p = 0.005
  I-squared (variation in ES attributable to heterogeneity) =  73.1%
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Figure 2. Meta-analysis of the prevalence of coarctation recurrence after stenting treatment for aortic coarctation

Discussion:

Percutaneous balloon angioplasty has been utilized to treat recurrent coagulation and native coarctation for over two decades. Balloon dilatation improves aortic occlusion with an intimal rupture that extends into the media, according to histological investigations (12) and intravascular ultrasonography (13) in various groups. This technique has several drawbacks, including aneurysm development, partial alleviation, and restenosis. After angioplasty, endovascular stent insertion has been shown to enhance outcomes in a number of congenital vascular stenotic lesions (14). The first use of an endovascular stent to treat CoA was described by O'Laughlin et al. (15) in 1991. Since then, the effectiveness of stent implantation in the treatment of CoA has been studied. Because the stent, when dilated, maintains the aorta wall and inhibits elastic rejection, the stent has the potential to outperform balloon angioplasty alone in terms of sustaining an increase in diameter. This eliminates the need to over-expand the coarctated section (16). Restenosis can be reduced by providing continuous blockage alleviation. Patients with unfavorable anatomies, such as long tubular coarctation and isthmic hypoplasia, should pay extra attention to this. Furthermore, because the stent joins the intima to the media, it has the potential to inhibit aneurysm formation (16-19).The efficacy of aortic coarctation (CoA) stenting in Iranian patients is examined in this systematic study.According to studies, CoA stenting considerably improves aortic occlusion in the early postoperative period, as demonstrated by an increase in CoA diameter and a reduction in systolic blood pressure and systolic peak gradient. Complications occur seldom. CoA stenting is both effective and safe in this regard. Technical problems (10.4 percent) and aortic wall issues are among the consequences of stenting in the treatment of coarctation, according to the Congenital Cardiovascular Interventional Study Consortium (CCISC) (1-4 percent). Balloon rupture (2.3 percent), vascular-cerebral accidents, and peripheral embolism (0.8 percent) are the most common technical complications of stent migration (4.5 percent), while dissection, dissection, and rupture of the aortic wall are the most common aortic septal wall complications (4.5 percent) (20). The patient follow-up program is one of the most significant aspects of stenting. This is usually accomplished by performing a thorough examination of the patient, which includes checking the pulse and measuring the pressure in the upper and lower limbs, listening to the patient's symptoms, drawing a 12-lead strip, inspecting the chest, and lastly, performing echocardiography(21). Although the number of samples may be insufficient for statistical analysis, a comparison of the systolic gradient peak determined in catheterization immediately after less than 24 hours following the surgery reveals a difference. The use of Doppler echocardiography to calculate the systolic peak gradient may not be the best approach for monitoring patients after stenting for recurrence diagnosis (22).In Zilberman's study, thirty-four individuals were catheterized with temporary stents to establish echocardiographic indices that were most compatible with the gradients determined directly via catheterization. In addition, when the results from the two methods were compared, it was discovered that the gradient measured during catheterization had a very weak correlation with the systolic peak gradient obtained with Doppler echocardiography. This led to the development of an index that accurately depicts the relationship between real gradients across the stent and echocardiographic data (23). All coarctation patients treated with stents should be monitored using angiography, computed tomography angiography, or magnetic resonance imaging (MRI) (24). The outcomes of our investigation, when compared to the findings of the previous studies, show that the stent may be utilized as an effective and low-risk therapy for both coarctation and re-coarctation. This holds true for groupings weighing less than 25 kg and children under the age of ten. Furthermore, age and weight constraints in employing this procedure might be abolished by introducing suitable devices based on the patient's age or weight, and until then, by changing the stent implantation techniques.

Conclusion

This is the first meta-analysis of patient stent reports for aortic coarctation in an Iranian community with patients ranging in age from infancy to the elderly. Despite the fact that we experienced a level of mortality in our trial that is seldom seen in previous studies, the rate of aortic coarctation recurrence was just 8.7%. Therefore, stenting has been proved to be a safe and successful procedure when done properly and in well-equipped clinics on selected patients.

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