

# Comparison of floating wire and single wire techniques in right coronary ostial lesions in terms of procedural features and one-year clinical follow-up results

Ahmet Taştan, Erdem Özel, Ali Öztürk, Samet Uyar, Emin Evren Özcan, Ömer Şenarslan, Talat Tavlı

Department of Cardiology, Faculty of Medicine, Şifa University; İzmir-Turkey

## ABSTRACT

**Objective:** The floating wire technique is a special technique for solving interventional problems in aorta-ostial lesions. There are no long-term data in the literature for the floating wire technique in right aorto-ostial lesions.

**Methods:** One hundred twenty six patients were retrospectively analyzed in this study. All of these patients had a critical right coronary aorto-ostial lesion. The floating wire technique was performed on 64 patients, and the single wire technique was performed on 62 patients. The two groups were compared with each other in terms of lesional and procedural properties. Additionally, 1-year clinical follow-up results were compared between the two groups.

**Results:** There was no significant difference in terms of lesion properties between the groups. In the floating wire group, mean stent length, number of stents, mean procedure time, mean contrast volume, and mean fluoroscopy time were significantly lower than in the single wire group. At 1 year, 1 patient from each group had myocardial infarction, and no mortality was observed. In the floating wire group, the number of patients who experienced angina and the target lesion revascularization rate were both significantly lower than in the single wire group.

**Conclusion:** The floating wire technique in right coronary ostial lesions provides a significant advantage over the single wire technique according to procedural and clinical follow-up results. (*Anatol J Cardiol* 2015; 15: 830-5)

**Keywords:** right coronary, aorto-ostial, floating wire

## Introduction

Aorto-ostial lesions arise within 3 mm of the origin of the coronary arteries. The incidence of aorto-ostial disease is not well known but is seen more often in females and in older age. In addition, right coronary artery (RCA) aorto-ostial lesions are more frequent than left main coronary artery (LMCA) ostial lesions (1-3).

Percutaneous coronary intervention on an aorto-ostial lesion involves many difficulties, like retrograde dissection, acute vessel closure, pressure dampening, recoil, restenosis, and no reflow. These procedural complications can be due both to the morphological properties of aorto-ostial disease and to the technical difficulties of intervention (4). Anatomically, aorto-ostial lesions are usually calcific and tortuous in nature and have a tendency to recoil because of the thick muscular and elastic tissue of the

aorta (5). Inadequate guiding catheter support and pressure dampening, unsuccessful balloon angioplasty due to lesion rigidity, suboptimal stent positioning, and geographical miss are the main technical challenges of aorto-ostial interventions (6).

Right coronary aorto-ostial stenting can be performed with low in-hospital complication rates (7), but restenosis seems to be a problem at the long-term follow-up (8). In addition, percutaneous intervention on ostial RCA lesions has higher mortality and target lesion revascularization (TLR) rates during long-term follow-up compared to intervention on non-ostial RCA lesions (9).

There are different methods for performing aorto-ostial intervention. In the conventional single wire technique, a guiding catheter has to be disengaged from the ostium to the aorta for proper stent implantation (Fig. 1), but in this position, passing a balloon or a stent through the lesion or stabilizing the guiding catheter in the same position and visualizing the coronary ostium can be difficult

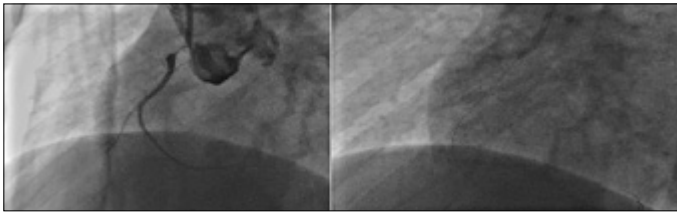
**Address for Correspondence:** Dr. Erdem Özel, Şifa Üniversitesi Tıp Fakültesi, Kardiyoloji Anabilim Dalı, 1800 Sok. No:1 35540 Karşıyaka, İzmir-Türkiye

Phone: +90 232 308 00 00 Fax: +90 232 362 89 89 E-mail: erdem.ozel@hotmail.com

**Accepted Date:** 19.09.2014 **Available Online Date:** 31.10.2014

© Copyright 2015 by Turkish Society of Cardiology - Available online at [www.anatoljcardiol.com](http://www.anatoljcardiol.com)  
DOI:10.5152/akd.2014.5730





**Figure 1. Conventional single wire technique on right aorto-ostial lesion**

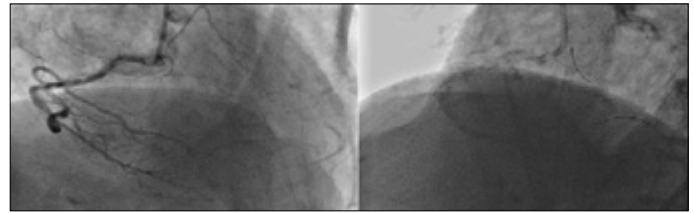
(10). These difficulties have led to the invention of novel devices and interventional techniques for aorto-ostial stenting. The floating wire technique and the Szabo (tail-wire) technique are the main techniques for facilitating aorto-ostial intervention (11). Atherectomy devices and cutting balloons can be used to prepare the lesion for stenting (12). An Ostial Pro (Ostial Solutions, Kalamazoo, MI, USA) device can be used for optimal positioning of the stent in the coronary ostium (13), and special self-expandable ostial stents have been developed in recent years (14).

In the floating wire technique, the guiding catheter is placed in the ostium, and the main guidewire is advanced through the lesion. Then, a second wire is placed in the aortic root after the guiding catheter is backed out of the ostium (Fig. 2). This second guidewire prevents the guiding catheter from deep engagement and provides more supportive back-up. Although the floating wire technique is often used in daily practice, procedural outcomes and long-term results of this technique for right aorto-ostial lesions are still lacking in the literature.

In this study, we aimed to compare the floating wire and single wire techniques for right aorto-ostial interventions. Our hypothesis is that the floating wire technique is a practical approach that could improve procedural outcomes and, in the long term, reduce death, anginal recurrence, and TLR rates.

## Methods

For the present study, we retrospectively analyzed consecutive patients admitted to our cardiology clinic at Şifa University in Izmir-Turkey, between January 2005 and April 2012. Our study was approved by the local Ethics Committee. During this period, 22,168 percutaneous coronary intervention (PCI) procedures were performed in our clinic. Right coronary aorto-ostial intervention was performed on 126 patients in this group (the prevalence of right aorto-ostial lesions in the whole PCI group was 0.56%). Patients with acute coronary syndrome or stable angina pectoris with a positive stress test were included in the study. On coronary angiography, all of the 126 patients were found to have critical right coronary aorto-ostial stenosis. Patients with serious comorbidities, chronic renal failure, and a prior stent in the right aorta ostium were excluded. The main factors that can affect re-stenosis, such as diabetes incidence, renal status, balloon and stent types, and stent diameter, were also analyzed. The floating wire technique was performed on 64 patients, and the conventional single wire technique was performed on 62 patients. The procedures were performed by three different



**Figure 2. Floating wire technique on right aorto-ostial lesion**

interventionalists in our institute who were experienced in both techniques. Operators performed both the single wire and floating wire techniques in a similar proportion of patients from each group. The final angiographic data and 1-year clinical follow-up results were analyzed by a different interventional cardiologist who was blind to the technique. Lesion properties were determined by quantitative coronary angiography (QCA) measurements. First follow-up visits were made 1 month after each intervention. Following the first control, if there was no problem with the patient, 6-month and 1-year follow-up visits were made. During these visits, cardiovascular stress tests (treadmill test or myocardial perfusion imaging test) were performed to explore if there was an ischemic situation associated with the intervention. Coronary angiography and revascularization were performed as necessary. Extra visits were made in the case of anginal recurrence or any condition thought to be related to the intervention.

We used a standard Judkins right (JR) catheter (Boston Scientific Cardiovascular, Massachusetts, USA) on the majority of the patients. The size of our guiding catheters was 6 French in almost all lesions, since we did not use any adjunctive devices for the cases. Standard hydrophilic guidewires were used in most of the lesions, and the rest were done using non-hydrophilic guidewires. In the floating wire technique, non-hydrophilic guidewires were used as the second wire in the aortic root. Both drug-eluting and bare metal stents were used for stenting.

The two groups were compared in terms of lesion properties (minimal lumen diameter, reference vessel diameter, mean lesion length, and minimal lumen diameter after percutaneous intervention) and procedural properties (number and mean length of coronary stents, mean contrast volume, mean fluoroscopy time, and procedure time). Additionally, 1-year clinical follow-up results (angina, myocardial infarction frequency, death, and TLR rates) were compared between the two groups.

## Statistical analysis

Data were described as mean and standard deviation for measurements. Chi-square test was performed for demographic and clinical characteristics. Independent sample t-test was performed to compare lesional and procedural properties and clinical follow-up results between the two groups. The level of statistical significance accepted was 0.05. Data were analyzed with the use of SPSS 17.0 software (SPSS IBM, Chicago, IL, USA).

## Results

The demographic and clinical characteristics were similar between the two study groups. The rate of the used medications was similar at baseline and during follow-up between groups (especially clopidogrel). We used drug-eluting stents in 71.9% of the patients in the floating wire group and in 82.3% of the patients in the single wire group. A cutting balloon was used for pre-dilatation in 21.9% of the patients in the floating wire group and in 25.8% of the patients in the single wire group. A hydrophilic guidewire was used as the main guidewire in 65.6% of the patients in the floating wire group and in 74.2% of the patients in the single wire group. Non-hydrophilic guidewires were used as the main guidewire in the rest of the lesions. A standard JR catheter was used on 93.8% of patients in the floating wire group and in 74.2% of the patients in the single wire group. In 22.6% of the patients, an Amplatz right (AR) catheter was used in the single wire group, and this was statistically significantly higher than in the floating wire group. An Amplatz left (AL) catheter was used in 1 patient in the single wire group and in 2 patients in the floating wire group (Table 1).

Table 2 shows the comparison of lesion properties and procedural properties between the two groups. Minimal lumen diameter ( $1\pm 0.3$  mm vs.  $1\pm 0.4$  mm;  $p=NS$ ), reference vessel diameter ( $3.4\pm 0.2$  mm vs.  $3.3\pm 0.21$  mm;  $p=NS$ ), lesion length ( $13\pm 4$  mm vs.  $14\pm 4$  mm;  $p=NS$ ), and minimal lumen diameter after PCI ( $3.2\pm 0.25$  vs.  $3.2\pm 0.2$ ;  $p=NS$ ) were similar between the two groups. The total number of implanted stents in the floating wire group was significantly lower than in the single wire group (67 vs 75;  $p<0.05$ ). Mean stent length was significantly shorter in the floating wire group ( $18\pm 5$  mm vs.  $23\pm 6$  mm;  $p=0.01$ ). Also, procedure time ( $22$  min. $\pm 15$  vs.  $32\pm 16$  min.;  $p=0.01$ ), fluoroscopy time ( $6.8\pm 4$  min. vs.  $8.2\pm 5$  min.;  $p<0.05$ ), and contrast volume ( $90\pm 18$  mL vs.  $135\pm 20$  mL;  $p=0.01$ ) were significantly lower in the floating wire group than in the single wire group.

Table 3 shows the 1-year clinical follow-up results in the two groups. No serious anginal attack, stent thrombosis, or revascularization need occurred among patients during the hospital period. At the end of the first year, the number of patients who had recurrent angina was significantly less in the floating wire group than in the single wire group (7 vs. 13;  $p<0.05$ ). TLR rates were significantly lower in the floating wire group (12 vs. 18;  $p<0.05$ ). One patient from each group had a lesion-related myocardial infarction, and no death was observed in either group.

## Discussion

When we compared the two techniques, we saw that although minimal lumen diameter after PCI was similar between the groups, the total number of implanted stents was lower and mean stent length was shorter in the floating wire group. In addition, procedure time, related fluoroscopy time, and contrast volume used were lower in the floating wire group. According to

**Table 1. Clinical and procedural characteristics**

	Floating wire (n=64)	Single wire (n=62)	P
Age, years	63.2 $\pm$ 9.2	61.3 $\pm$ 10.1	0.43
<b>Gender</b>			
Male	39 (60.9%)	38 (61.3%)	1.0
Female	25 (39.1%)	24 (38.7%)	
Diabetes	11 (17.2%)	12 (19.4%)	0.82
Hypertension	48 (75%)	44 (71%)	0.69
<b>Guiding catheter</b>			
Judkins right	60 (93.8%)	46 (74.2%)	0.01
Amplatz right	3 (4.7%)	14 (22.6%)	
Amplatz left	1 (1.6%)	2 (3.2%)	
<b>Guidewire</b>			
Hydrophilic	42 (65.6%)	46 (74.2%)	0.33
Non-hydrophilic	22 (34.4%)	16 (25.8%)	
<b>Balloon</b>			
Compliant balloon	50 (78.1%)	46 (74.2%)	0.67
Cutting balloon	14 (21.9%)	16 (25.8%)	
<b>Stent</b>			
Drug-eluting stent	46 (71.9%)	51 (82.3%)	0.2
Bare metal stent	18 (28.1%)	11 (17.7%)	
<b>Indication</b>			
Acute coronary syndrome	23 (35.9%)	17 (27.4%)	0.3
Stable angina pectoris	41 (64.1%)	45 (72.6%)	
Creatinine level, mg/dL	1.03 $\pm$ 0.19	1.06 $\pm$ 0.15	0.37
Stent diameter, cm	2.94 $\pm$ 0.34	2.99 $\pm$ 0.32	0.43
Chi-square test was performed			

the follow-up results, there were no deaths, and only 1 patient from each group was suffering from lesion-related MI. However, anginal recurrence and TLR were seen more often in the single wire group.

The best treatment method in right aorto-ostial intervention is not very clear. In the floating wire technique, a step-by-step approach is mandatory, from proper guiding catheter selection to optimal stent implantation.

We used a standard JR catheter for the majority of the lesions in the floating wire technique. JR is a less aggressive catheter and avoids deep engagement more effectively. In a few patients, we used an AR catheter for proper engagement when we needed a more supportive back-up. In the single wire group, the rate of AR catheter use was significantly higher than in the floating wire group. This is because using the second wire in the floating wire group decreased the need for a more supportive backup catheter. So, a JR catheter was sufficient in most of the lesions in the floating wire group. In our experience, the AR

**Table 2. Comparison of lesion properties and procedural properties between the two groups**

	Floating wire (n=64)	Single wire (n=62)	P
Minimal lumen diameter, mm	1±0.3	1±0.4	NS
Reference vessel diameter, mm	3.4±0.2	3.3±0.21	NS
Lesion length, mm	13±4	14±4	NS
Minimal lumen diameter after PCI, mm	3.2±0.25	3.2±0.2	NS
Stent length, mm	18±5	23±6	0.01
Number of stents	67	75	<0.05
Procedure time, min	22±15	32±16	0.01
Contrast volume, mL	90±18	135±20	0.01
Fluoroscopy time, min	6.8±4	8.2±5	<0.05
PCI - percutaneous coronary intervention. Independent sample t test was performed			

**Table 3. One-year clinical follow-up results between the two groups**

	Floating wire (n=64)	Single wire (n=62)	P
Number of patients who had angina recurrence	7 (11%)	13 (20%)	<0.05
Number of patients who had lesion-related MI	1	1	NS
Death	0	0	-
Target lesion revascularization	12 (19%)	18 (29%)	<0.05
MI - myocardial infarction. Independent sample t test was performed			

catheter raises the risk of dissection, especially at very calcific aorto-ostial lesions; so, we did not choose this catheter often.

Because of the calcific and tortuous nature of aorto-ostial lesions, we preferred hydrophilic guidewires with better crossability for the main wire in the floating wire technique. However, we preferred non-hydrophilic guidewires for the second wire at the aortic root, because the risk of dissection at the aortic root is less than with hydrophilic wires.

In our study, the total number of stents was significantly lower, and mean stent length was significantly shorter than in the floating wire group. These results may be due to both suboptimal positioning of the stents and procedural complications during the intervention in the single wire group. Optimal positioning and full coverage of the ostium by the stent are very important points in ostial interventions. Eight patients from the single wire group had suboptimal stent coverage of the lesion after stent implantation and needed a second stent, but in the floating wire group, the number of patients who needed a second stent because of suboptimal coverage was only 2. In the floating wire technique, the second wire in the aortic root behaves as a marker at the real ostium and provides more optimal stent positioning. In the single wire technique, however, since there is no marker for the coronary ostium, a geographical miss can occur and a second stent may be needed. Also, distal dissection after

stent implantation was seen more often in the single wire group because of suboptimal stent positioning. Five patients from the single wire group and only 1 patient from the floating wire group had distal dissection after the first stent, and these patients needed a second stent to be implanted. This may also be a reason for the greater number of stent implantations in the single wire group.

Procedure time, fluoroscopy time, and contrast volume used were significantly higher in the single wire group in our study. This result may be for technical reasons while implanting the stents. Especially, unexpected deep catheter engagement and pressure dampening make aorto-ostial interventions more complex, and these can be prevented by using the floating wire technique. In this technique, a second wire at the aortic root prevents unexpectedly deep engagement and dampening of the guiding catheter. This can prevent hemodynamic compromise and dissection and also makes visualization better. In the single wire technique, the guiding catheter has to be disengaged from the ostium during stent positioning, resulting in reduced stability and visualization. For these reasons, procedure time, fluoroscopy time, and opaque volume rise significantly.

There are also other devices and technical options for exact stent positioning in aorto-ostial lesions. The Ostial Pro device uses self-expanding nitinol legs that mark the aortic wall to determine the real ostium while implanting the stent. The Ostial Pro can be superior for positioning the ostial stent, since precise positioning is made only by angiographic views in the floating wire technique. However, although a high rate of angiographic success has been reported with the Ostial Pro, long-term results are still unknown (15). In addition, the exact positioning of the self-expandable legs can be difficult with this device, especially if the guiding catheter support is not sufficient. The Szabo (tail-wire) technique, which is used for optimal positioning of the aorto-ostial stent, was developed in 2005 and has been tested in many patients (11, 16). In this technique, the proximal portion of a buddy wire is inserted through the most proximal stent strut, and then the stent is re-crimped. At the ostium, the buddy wire stops the main wire and helps to implant the stent at the real ostium. Gutierrez-Chico et al. (17) performed the Szabo technique on 78 aorto-ostial and side branch ostial lesions and reported an 86% acute procedural success rate and a 78% 30-day procedural success rate. In our study, 11% in the floating wire group had recurrent angina at the 1-year follow-up, and 19% needed a revascularization procedure. Although the study by Gutierrez-Chico et al. (17) was not related only to aorto-ostial lesions, the floating wire technique seems to be more effective than the Szabo technique in terms of follow-up results (11).

Intravascular ultrasound (IVUS) and fractional flow reserve (FFR) examinations can be used to assess the severity of aorto-ostial lesions. IVUS examinations of aorto-ostial interventions can help to assess real lesion severity, proper stent size, and adequacy of stent expansion. There were not enough clinical IVUS data to compare the interventional techniques, but for the Szabo Technique (11), significant stent protrusion was deter-



mined in an IVUS study (18). We did not perform IVUS in our cases, and this could be a limitation of our study, even though we had satisfactory angiographic results.

At 1 year, the number of patients who had anginal recurrence and TLR rates were both significantly higher in the single wire group. Most of the patients who experienced recurrent angina had critical in-stent restenosis in the control angiography. The number of patients in our study who needed revascularization was higher in both groups than the number of patients who had angina recurrence. This was because we performed exercise stress testing on the patients in their follow-up visits. Thus, even though they did not have angina, we performed coronary angiography and a revascularization procedure when needed if their stress test was positive. Since the main factors that affect long-term restenosis rates, like minimal lumen diameter after PCI, diabetes incidence, renal status, use of balloon, stent type, and stent diameters, were similar between the two groups, we thought that the lower TLR rates in the floating wire group were due solely to the technique that was used. Also, baseline and follow-up medications were similar between groups. Especially, the rate of clopidogrel use was similar during follow-up. So, the used medications can not make a bias for TLR rates. No deaths and only 1 myocardial infarction occurred in each group; so, we can not make any comments about these endpoints. According to previous studies, longer stents have higher restenosis rates during follow-up (19). Therefore, the higher restenosis rate in the single wire group may be due to the higher number of stents and longer stent length in this group. Since right aorto-ostial lesions are tortuous, calcific, and prone to more restenosis, the floating wire method, which necessitates the use of fewer and shorter stents, could be advantageous.

## Study limitations

Our study has some limitations. The retrospective design of our study is a limitation, since prospective results are more valuable in this kind of interventional study. Although all three of the operators were experienced in both techniques, interventional approaches, independent of the chosen technique, may have been different among the operators, and this could have affected the procedure time and contrast volume. Not using IVUS in our interventions is another disadvantage, since IVUS is strongly recommended in aorto-ostial lesions. Assessing the lesions only by angiography may have affected the procedural results.

## Conclusion

In conclusion, the floating wire technique in right coronary ostial lesions provides a significant advantage over the single wire technique in terms of total procedure and fluoroscopy time, contrast volume, number of stents, and stent length. In addition, angina frequency and TLR rates were significantly lower at the 1-year follow up in the floating wire group. According to the results of the present study, the use of the floating wire tech-

nique in right coronary aorto-ostial lesions seems to be safer and more effective than using the single wire technique.

**Conflict of interest:** None declared.

**Peer-review:** Externally peer-reviewed.

**Authorship contributions:** Concept - A.T., E.Ö.; Design - E.Ö., A.Ö., E.E.Ö.; Supervision - A.T., E.E.Ö.; Resource - A.Ö., E.E.Ö., Ö.Ş.; Materials - A.T., A.Ö.; Data collection &/or processing - A.T., Ö.Ş., E.E.Ö.; Analysis &/or interpretation - E.Ö., S.U., T.T.; Literature search - E.Ö., S.U.; Writing - E.Ö., Ö.Ş.; Critical review - A.T., T.T.; Other - S.U., T.T.

## References

1. Freeman M, Clark DJ, Andrianopoulos N, Duffy SJ, Lim HS, Brennan A, et al. Melbourne Interventional Group. Outcomes after percutaneous coronary intervention of ostial lesions in the era of drug-eluting stents. *Catheter Cardiovasc Interv* 2009; 73: 763-8. [\[CrossRef\]](#)
2. Stewart JT, Ward DE, Davies MJ, Pepper JR. Isolated coronary ostial stenosis: observations on the pathology. *Eur Heart J* 1987; 8: 917-20.
3. Rissanen V. Occurrence of coronary ostial stenosis in a necropsy series of myocardial infarction, sudden death, and violent death. *Br Heart J* 1975; 37: 182-91. [\[CrossRef\]](#)
4. Tan KH, Sulke N, Taub N, Sowton E. Percutaneous transluminal coronary angioplasty of aorta ostial, non-aorta ostial, and branch ostial stenoses: acute and long-term outcome. *Eur Heart J* 1995; 16: 631-9.
5. Ellis SG, Vandormael MG, Cowley MJ, DiSciascio G, Deligönlü U, Topol EJ, et al. Coronary morphologic and clinical determinants of procedural outcome with angioplasty for multivessel coronary disease. Implications for patient selection. Multivessel Angioplasty Prognosis Study Group. *Circulation* 1990; 82: 1193-202. [\[CrossRef\]](#)
6. Chin K. An approach to ostial lesion management. *Curr Interv Cardiol Rep* 2001; 3: 87-9.
7. Luz A, Hughes C, Magalhães R, Biscaglia T, Descoutures F, Tamamm K, et al. Stent implantation in aorto-ostial lesions: long-term follow-up and predictors of outcome. *EuroIntervention* 2012; 7: 1069-76. [\[CrossRef\]](#)
8. Topol EJ, Ellis SG, Fishman J, Leimgruber P, Myler RK, Stertz SH, et al. Multicenter study of percutaneous transluminal angioplasty for right coronary artery ostial stenosis. *J Am Coll Cardiol* 1987; 9: 1214-8. [\[CrossRef\]](#)
9. Ko E, Natsuaki M, Toyofuku M, Morimoto T, Matsumura Y, Oi M, et al. Sirolimus-eluting stent implantation for ostial right coronary artery lesions: five-year outcomes from the j-Cypher registry. *Cardiovasc Interv Ther* 2014; 29: 200-8. [\[CrossRef\]](#)
10. Zampieri P, Colombo A, Almagor Y, Maiello L, Finci L. Results of coronary stenting of ostial lesions. *Am J Cardiol* 1994; 73: 901-3. [\[CrossRef\]](#)
11. Szabo S, Abramowitz B, Vaitkus PT. New technique of aorto-ostial stent placement. *Am J Cardiol* 2005; 96: 212H.
12. Kurbaan AS, Kelly PA, Sigwart U. Cutting balloon angioplasty and stenting for aorto-ostial lesions. *Heart* 1997; 77: 350-2.
13. Fischell TA, Malhotra S, Khan S. A new ostial stent positioning system (Ostial Pro) for the accurate placement of stents to treat aorto-ostial lesions. *Catheter Cardiovasc Interv* 2008; 71: 353-7. [\[CrossRef\]](#)

14. Latib A, Chieffo A. The Cappella Sideguard stent. *EuroIntervention* 2010; 6: J143-6. [\[CrossRef\]](#)
15. Fischell TA, Saltiel FS, Foster MT, Wong SC, Dishman DA, Moses J. Initial clinical experience using an ostial stent positioning system (Ostial Pro) for the accurate placement of stents in the treatment of coronary aorto-ostial lesion. *J Invasive Cardiol* 2009; 21: 53-9.
16. Applegate RJ, Davis JM, Leonard JC. Treatment of ostial lesions using the Szabo technique: a case series. *Catheter Cardiovasc Interv* 2008; 72: 823-8. [\[CrossRef\]](#)
17. Gutiérrez-Chico JL, Villanueva-Benito I, Villanueva-Montoto L, Vázquez-Fernández S, Kleinecke C, Gielen S, et al. Szabo technique versus conventional angiographic placement in bifurcations 010-001 of Medina and in aorto-ostial stenting: angiographic and procedural results. *EuroIntervention* 2010; 5: 801-8. [\[CrossRef\]](#)
18. Vaquerizo B, Serra A, Ormiston J, Miranda-Guardiola F, Webber B, Fantuzzi A, et al. Bench top evaluation and clinical experience with the Szabo technique: new questions for a complex lesion. *Catheter Cardiovasc Interv* 2012; 79: 378-89. [\[CrossRef\]](#)
19. Cassese S, Byrne RA, Tada T, Pinięck S, Joner M, Ibrahim T, et al. Incidence and predictors of restenosis after coronary stenting in 10 004 patients with surveillance angiography. *Heart* 2014; 100: 153-9. [\[CrossRef\]](#)