# A rare complication of percutaneous coronary intervention: Coronary pseudoaneurysm formation

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**Abstract:** Coronary pseudoaneurysms (CPAs) are rare complications developed after percutaneous coronary interventions. They may cause stent thrombosis, distal embolization, and coronary rupture leading to cardiac tamponade. Therefore, high-risk CPA should be promptly treated after diagnosis. They can be managed with percutaneous or surgical intervention. Herein, we aimed to present a patient who developed CPA 3 weeks after percutaneous coronary intervention and successfully treated with percutaneous intervention using a covered stent.

**Keywords:** coronary artery, covered stent, myocardial infarction, percutaneous coronary intervention, pseudoaneurysm

## Introduction

Coronary artery aneurysms (CAA) may rarely develop following percutaneous coronary intervention. Among them, coronary pseudoaneurysms (CPAs) are more frequently observed. Symptomatic and large CPAs carry risk of complications including stent thrombosis, distal embolization, and coronary rupture. Treatment strategies include surgical or percutaneous interventions with covered stents. Herein, we aimed to present a patient who developed CPA 3 weeks after percutaneous coronary intervention and successfully treated with percutaneous intervention using a covered stent.

## Case Report

A 34-year-old female patient was admitted to emergency department with typical chest pain persisted for 2 days. She was treated with percutaneous coronary intervention after the diagnosis of diffuse anterior wall ST-segment elevation myocardial infarction. A bare metal stent (BMS; 3.5 × 20 mm, 18 atmospheric pressure) was implanted in the 99% lesion of the proximal segment of the left anterior descending (LAD) coronary artery *(Fig. 1, Video 1)*. She had a family history of coronary artery disease and active smoking. Three weeks later, coronary angiography was performed due to ongoing chest pain and revealed patent LAD and a narrow-necked CPA originating from the previously stented coronary segment *(Fig. 2, Video 2)*. Coronary bypass was recommended to the patient. Since the patient declined surgical intervention and an infectious origin was unlikely based on the clinical setting, a covered stent (3.5 × 16 mm, 12 atmospheric pressure) was implanted *(Fig. 3)*. The patient did not develop any complication during 3-month follow-up period.

## Discussion

CAA is defined as dilation of coronary artery ≥2 times of the diameter of the adjacent normal coronary artery segment [1]. One third of the cases are asymptomatic and incidentally detected during coronary angiography.

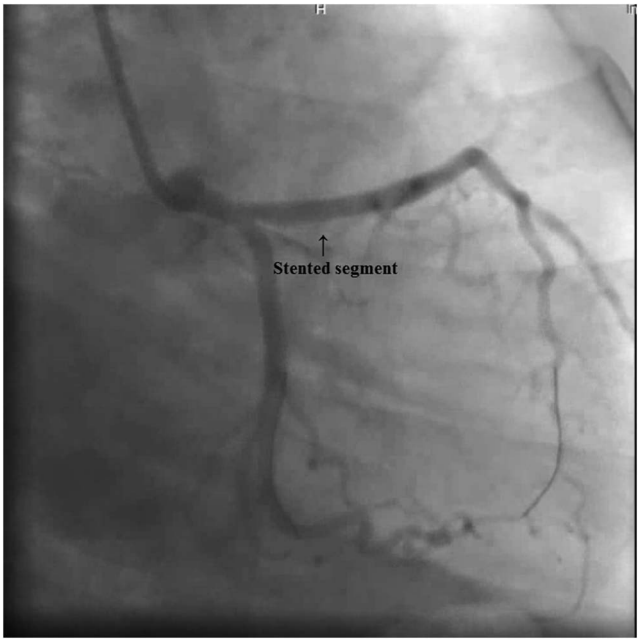


**Fig. 1.** Coronary angiography after implantation of a bare metal stent in the 99% lesion of the proximal left anterior descending coronary artery during the first intervention before coronary pseudoaneurysm formation

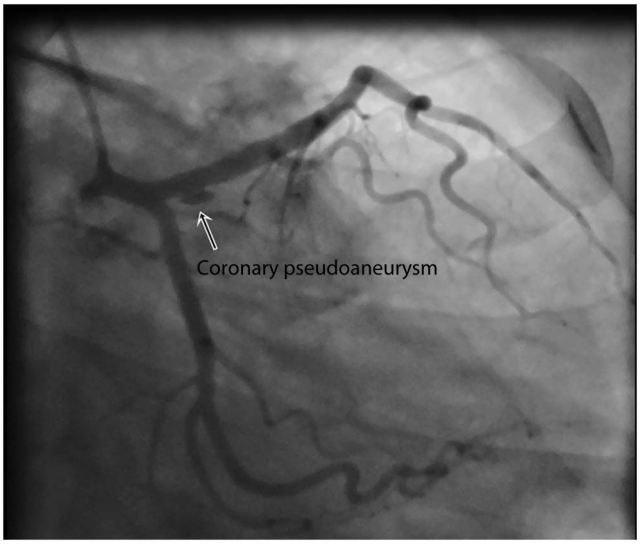


**Fig. 2.** Right anterior caudal angiographic view of coronary pseudoaneurysm originating from left anterior descending cononary artery

CAAs can be secondary to atherosclerosis, Kawasaki disease, congenital factors or endocarditis, or it can occur after percutaneous coronary intervention [2]. Incidence of CAA following coronary artery intervention ranges between 0.3% and 6% [3–6]. CAAs can be classified as acute presentation with pseudoaneurysm formation (Type 1), "subacute to chronic" (Type 2), and mycotic aneurysms (Type 3). Among them, pseudoaneurysms are

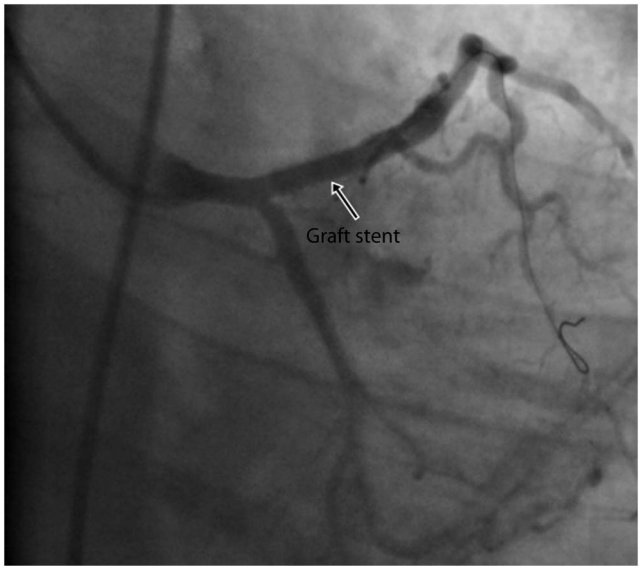


**Fig. 3.** The orifice of coronary pseudoaneurysm was closed after covered stent implantation

more frequently observed [7]. The use of balloons with greater diameters, dilatation of balloon or stent with high pressure, atherectomy, laser angioplasty, or iatrogenic dissection can injure arterial wall leading to the development of CPA [3–5].

The first method in the diagnosis of CAA is coronary angiography. However, since it is a lumenography, it does not provide information about vascular wall anatomy of CAA. Gold standard method in the evaluation of structural and anatomical characteristics of CAA is intravascular ultrasound (IVUS), which is recommended in the discrimination between true aneurysm and pseudoaneurysm [8–10].

Drug-eluting stents (DES) and BMS can cause formation of CAA because of their effects on vascular structures [7]. In addition, it has been thought that DES can increase the risk of CAA formation because of delayed healing and incomplete endothelialization. However, in studies where DES and BMS were compared, similar risks of CAA development were reported [7, 11–13].

CPA generally develops within 4 weeks following coronary stenting. In these patients, clinical manifestation can be typical chest pain or it can be pericardial pain [14, 15]. CPAs have a risk of rupture; however, they may regress spontaneously [16]. They can disturb coronary blood flow by causing stent thrombosis or can induce turbulent flow leading to distal embolization [17, 18].

In a patient who developed CAA following percutaneous coronary intervention, the priority is to exclude type 3 aneurysm. If an aneurysm secondary to infection can be excluded, then discrimination between pseudo- and true aneurysm can be made by using IVUS. If CPAs are smaller in size (smaller than twofold compared with the diameter of the reference vessel) or the patient has no

complaints, then angiographic monitorization at 3- to 6-month intervals is recommended. If the CPA does not enlarge during follow-up period, the patient can follow-up under dual antiplatelet therapy. However, if a large CPA exists in an asymptomatic patient or the diameter of the CPA increases during follow-up, percutaneous coronary intervention using covered stent or surgical intervention may be preferred [7].

Main problems related to covered stent are loss of side branches and high incidence of stent restenosis. Besides sufficient information about duration of the dual antiaggregant use in the treatment of the patients with implanted covered stents is not available [19].

When compared with true aneurysms, CPAs develop at a relatively early stage. In our case, CPA developed at an early stage (after 3 weeks) following stent implantation. In symptomatic cases, interventional therapy is recommended regardless of the type of CAA [7]. Since our patient manifested symptoms, we performed successful percutaneous coronary intervention with implantation of a covered stent.

## Conclusions

CPAs are rarely seen complications of coronary interventions. These can cause fatal complications without treatment. In their treatment, the covered stent can be a successful alternative to surgery.

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## References

1. Falsetti HL, Carrol RJ: Coronary artery aneurysm. A review of the literature with a report of 11 new cases. Chest 69, 630–636 (1976)
2. Syed M, Lesch M: Coronary artery aneurysm: A review. Prog Cardiovasc Dis 40, 77–84 (1997)
3. Bell MR, Garratt KN, Bresnahan JF, Edwards WD, Holmes DR Jr: Relation of deep arterial resection and coronary artery aneurysms after directional coronary atherectomy. J Am Coll Cardiol 20, 1474–1481 (1992)
4. Baumbach A, Bittl JA, Fleck E, Geschwind HJ, Sanborn TA, Tcheng JE, Karsch KR: Acute complications of excimer laser coronary angioplasty: A detailed analysis of multicenter results. Coinvestigators of the U.S. and European Percutaneous Excimer Laser Coronary Angioplasty (PELCA) Registries. J Am Coll Cardiol 23, 1305–1313 (1994)
5. Slota PA, Fischman DL, Savage MP, Rake R, Goldberg S; STRESS Trial Investigators: Frequency and outcome of development of coronary artery aneurysm after intracoronary stent placement and angioplasty. Am J Cardiol 79, 1104–1106 (1997)
6. Condado JA, Waksman R, Gurdiel O, Espinosa R, Gonzalez J, Burger B, Villoria G, Acquatella H, Crocker IR, Seung KB, Liprie SF: Long-term angiographic and clinical outcome after percutaneous transluminal coronary angioplasty and intracoronary radiation therapy in humans. Circulation 96, 727–732 (1997)
7. Aoki J, Kirtane A, Leon MB, Dangas G: Coronary artery aneurysms after drug-eluting stent implantation. JACC Cardiovasc Interv 1, 14–21 (2008)
8. Maehara A, Mintz GS, Ahmed JM, Fuchs S, Castagna MT, Pichard AD, Satler LF, Waksman R, Suddath WO, Kent KM, Weissman NJ: An intravascular ultrasound classification of angiographic coronary artery aneurysms. Am J Cardiol 88, 365–370 (2001)
9. Porto I, MacDonald S, Banning AP: Intravascular ultrasound as a significant tool for diagnosis and management of coronary aneurysms. Cardiovasc Intervent Radiol 27, 666–668 (2004)
10. Ge J, Liu F, Kearney P, Gorge G, Haude M, Baumgart D, Ashry M, Erbel R: Intravascular ultrasound approach to the diagnosis of coronary artery aneurysms. Am Heart J 130, 765–771 (1995)
11. Popma JJ, Leon MB, Moses JW, Holmes DR Jr, Cox N, Fitzpatrick M, Douglas J, Lambert C, Mooney M, Yakubov S, Kuntz RE; SIRIUS Investigators: Quantitative assessment of angiographic restenosis after sirolimus-eluting stent implantation in native coronary arteries. Circulation 110, 3773–3780 (2004)
12. Stone GW, Ellis SG, Cox DA, Hermiller J, O'Shaughnessy C, Mann JT, Turco M, Caputo R, Bergin P, Greenberg J, Popma JJ, Russell ME; TAXUS-IV Investigators: A polymer-based, paclitaxel-eluting stent in patients with coronary artery disease. N Engl J Med 350, 221–231 (2004)
13. Stone GW, Ellis SG, Cannon L, Mann JT, Greenberg JD, Spriggs D, O'Shaughnessy CD, DeMaio S, Hall P, Popma JJ, Koglin J, Russell ME; TAXUS V Investigators: Comparison of a polymer-based paclitaxel-eluting stent with a bare metal stent in patients with complex coronary artery disease: A randomized controlled trial. JAMA 294, 1215–1223 (2005)
14. Gupta RK, Sapra R, Kaul U: Early aneurysm formation after drug-eluting stent implantation: An unusual life-threatening complication. J Invasive Cardiol 18, E140–E142 (2006)
15. Nohara H, Shida T, Mukohara N, Obo H, Yoshida M: A case of the coronary artery aneurysm including stent device after percutaneous coronary intervention. Ann Thorac Cardiovasc Surg 10, 202–204 (2004)
16. Nunes RA, Cade JR, Silva RC, Brito Junior FS, Freitas HF: Spontaneous closure of post-intervention left anterior descending coronary pseudoaneurysm. Rev Port Cardiol 33, 381.e1–384.e4 (2014)
17. Aziz S, Morris JL, Perry RA: Late stent thrombosis associated with coronary aneurysm formation after sirolimus-eluting stent implantation. J Invasive Cardiol 19, E96–E98 (2007)
18. Feres F, Costa JR Jr, Abizaid A: Very late thrombosis after drug-eluting stents. Catheter Cardiovasc Interv 68, 83–88 (2006)
19. Takano M, Yamamoto M, Inami S, Xie Y, Murakami D, Okamatsu K, Ohba T, Seino Y, Mizuno K: Delayed endothelialization after polytetrafluoroethylene-covered stent implantation for coronary aneurysm. Circ J 73, 190–193 (2009)

## Electronic Supplementary Material (ESM)

Electronic Supplementary Material (ESM) associated with this article can be found at the website www.akademiai.com/doi/suppl/10.1556/1646.9.2017.33

### ESM1

**Video 1.** Coronary angiography after implantation of a bare metal stent in the 99% lesion of the proximal left anterior descending coronary artery during the first intervention before coronary pseudoaneurysm formation

**Video 2.** Right anterior caudal angiographic view revealing extravasation of the contrast medium into the coronary pseudoaneurysm originating from left anterior descending cononary artery