VIA MEDICA

CASE REPORT

Cardiology Journal
2009, Vol. 16, No. 5, pp. 469–472

ISSN 1897–5593

Transpulmonary closing of left internal mammary artery to pulmonary artery fistula with polytetrafluoroethylene covered stent: A case report and review of literature

Peiman Jamshidi, Samad Ghaffari, Khalil Mahmoodi

Cardiovascular Research Department of Tabriz University of Medical Sciences, Tabriz, Iran

Abstract

Internal mammary artery (IMA) to pulmonary vasculature fistula is a rare condition that can be congenital or associated with coronary artery bypass grafting surgery (CABG), trauma, inflammation, or neoplasia. This complication may cause myocardial ischemia. CABG with an IMA conduit accounts for most iatrogenic cases, thus this problem may be encountered more in the future as the number of patients undergoing CABG and redo-CABG increases. The natural history of IMA-to-pulmonary artery (PA) fistulas is unknown and therefore optimal treatment remains controversial. We describe a case of left IMA-to-PA fistula treated with balloon expandable covered stent with a transpulmonary approach, and we review previously reported cases. (Cardiol J 2009; 16, 5: 469–472)

Key words: fistula, mammary artery, covered stent

Case report

A 49 year-old man with a history of anterior myocardial infarction (MI) and mild hypertension presented with progressive dyspnea on exertion, and angina. Two years before, he underwent coronary artery bypass grafting (CABG) using left internal mammary artery (LIMA) graft to left anterior descending artery (LAD) and two saphenous vein grafts to the main obtuse marginal and right coronary arteries. Resting electrocardiography (ECG) showed sinus tachycardia and old anterior MI. Echocardiographic examination revealed severe hypokinesia of mid and distal septal and anterior segments with an ejection fraction of 40%. The exercise stress test was positive for a moderate risk ischemia. The Tc-99m scintigraphy showed a reversible defect in the anterior wall of the left ventricle. The coronary angiography revealed patent saphenous vein grafts and the totally occluded LAD at proximal part. Selective LIMA injection showed a dilated LIMA with severe tortuosity and a large fistula originating from this vessel and draining into a lower left pulmonary artery branch (Fig. 1). Considering the angina and the results of perfusion scintigraphy, we decided to occlude the fistula. Due to the severe tortuosity of LIMA, we chose a transpulmonary approach. The distal anastomosis site of fistula to pulmonary artery (PA) branch had a reverse Y shape appearance. So, using a 7 Fr right Judkins guiding catheter and after selective cannulation of the target left PA branch, a 3.5/19 covered stent (Jomed®) was deployed up to 22 atmospheres to ensure complete sealing of the fistula connection (Fig. 2). The post-procedure course was uneventful. Sinus tachycardia was resolved 24 hours after the procedure, and the patient had no recurrent angina or dyspnea during an 18 month follow-up.

Address for correspondence: Samad Ghaffari, MD, Cardiovascular Research Department of Tabriz University of Medical Sciences, Tabriz, Iran, tel: 0098 411 335 7770, fax: 0098 411 3344021, e-mail: ghafaris@gmail.com

Received: 11.01.2009 Accepted: 7.02.2009

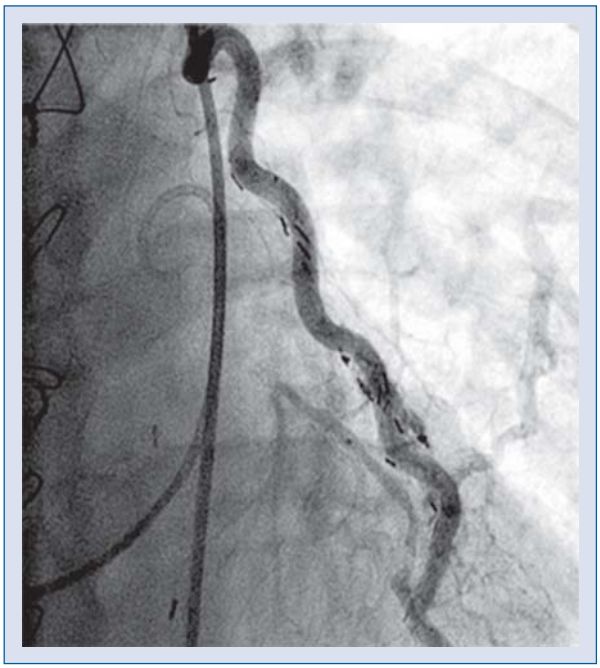

Figure 1. AP-cranial projection after left internal mammary injection demonstrating the native left anterior descending, the mammary graft, and the large fistula connection to the left pulmonary artery.

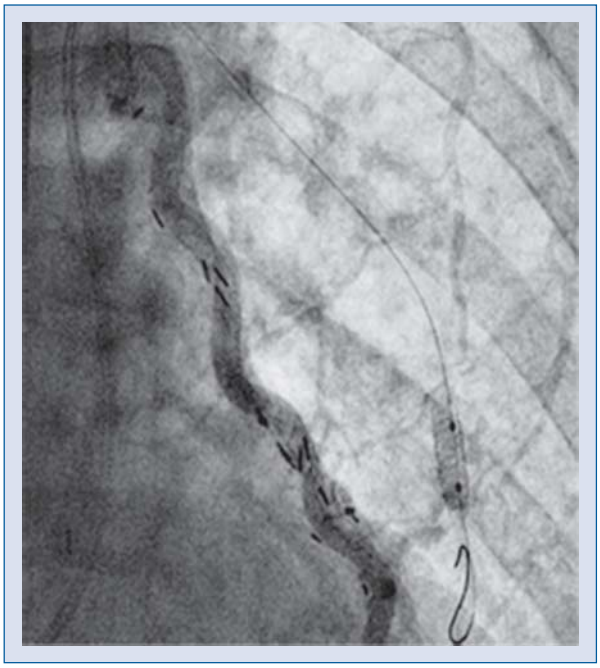

Figure 2. Selective angiogram of left internal mammary artery after deployment of 3.5 × 19 mm covered stent. The fistulas completely disappeared.

He refused control coronary angiography but exercise treadmill test was negative for ischemia with an excellent exercise capacity.

Discussion

Internal mammary artery to pulmonary vasculature (PV) fistula was first reported in 1947 by Burchell and Clagett. In this report, we present a fistulous communication between the LIMA and the pulmonary artery, which is a first in the literature, because it was treated with a covered stent via PA. We also summarize previously reported cases with an IMA-PV fistula occurring following CABG surgery (Table 1) [1–20].

The pathophysiology of the IMA-PA fistulas after CABG surgery is unclear, although there are some possible predisposing factors. Side branches of the IMA might be a potential origin, especially if electro coagulation rather than clipping is used [17]. Direct contact of the dissected mammary artery with the injured visceral pleura and PA could also be an etiologic factor [2]. Separation of the IMA from the lung by interposing a pericardial flap might be a way to prevent an IMA-PA fistula [9]. The inflammatory process in the nearby myocardium or lung parenchyma after surgery is another possible factor promoting neovascularization and fistulous communication [6, 9]. Minimally invasive coronary bypass surgery (four of 29 cases) might be associated with an IMA-PA fistula development because of difficulty in the application of the above preventive measures [9]. Redo-CABG (four cases) might also increase the risk of fistula formation compared to first-time surgery [4, 7, 10].

It is an interesting point whether sex is a predisposing factor, because all reported cases except one were male. This might be explained, at least partly, by the higher prevalence of CABG in men, but other differences, especially hormonal and anatomical variations, may be responsible.

The clinical manifestations of IMA-PV fistula range from asymptomatic, with or without a heart murmur, to congestive heart failure, angina pectoris, endocarditis, aneurysmal formation or rupture. Angina, the commonest symptom and likely due to coronary steal phenomenon is frequently misdiagnosed as the natural progression of coronary artery disease [20].

The time elapsed between the surgery and the diagnosis of IMAPV fistulas varies between two months and 14 years. This indicates that IMA-PV

Table 1. Reported cases with fistula between internal mammary artery and pulmonary vasculature following coronary bypass surgery.

Age/sex	Redo-CABG	Time from surgery	Symptom	Fistula	Treatment	References
59/M	No	2 years	Angina + ST	LIMA-LPV	Surgical	1
57/M	No	5 years	Incidental*	LIMA-LPV	Coil spring	2
45/M	No	5 months	ST	RIMA-RPV	N/A	2
55/M	No	2 years	Angina	LIMA-LPV	Surgical	3
53/M	Yes	4 years	Angina + SCIN	LIMA-LPA	Medical	4
57/M	No	4 years	Angina + SCIN	Bilateral-PA	Medical	5
56/M	No	6 months	CHF	LIMA-LPA	Surgical	6
65/M	Yes	3 years	Angina	LIMA-LPA	Medical	7
51/F	No	7 years	Angina	LIMA-PA	Medical	8
57/M	No	2 years	Angina	LIMA-PA	Medical	8
56/M	MIDCAB	2 months	SCIN	LIMA-LPV	N/A	9
57/M	No	8 years	SCIN	LIMA-LPA	Medical	10
60/M	Yes	> 4 years	Angina	LIMA-LPA	N/A	10
55/M	No	1 years	Angina + SCIN	LIMA-LPA	N/A	10
64/M	Yes	> 6 years	Angina	LIMA-LPV	N/A	10
49/M	No	7 years	Angina	LIMA-LPA	Surgical	11
59/M	MIDCAB	1 years	Angina	LIMA-LPA	Surgical	12
55/M	MIDCAB	6 months	Angina + SCIN	LIMA-LPV	Surgical	13
63/M	No	1 years	Angina + ST	LIMA-LPA	Covered stent	14
58/M	No	2 years	Angina	LIMA-LPV	Medical	15
79/M	No	14 years	Angina	LIMA-LPV	Covered stent	16
63/M	No	2 years	Angina	LIMA-PA	Covered stent	17
73/M	No	6 years	Dyspnea + SCIN	LIMA-LPA	Surgical	18
49/M	No	3 months	Angina + SCIN	LIMA-LPA	Coil spring	19
55/M	MIDCAB	6 months	Angina + SCIN	LIMA-LPV	Surgical	20
50/M	No	1 years	Angina + SCIN	LIMA-LPA	Medical	20
78/M	No	9 years	Dyspnea + SCIN	LIMA-LPV	Medical	20
57/M	No	3 years	Angina + SCIN	LIMA-PA	Medical	20
49/M	No	1 years	Angina + SCIN	LIMA-PA	Medical	20

M — male, F — female, LIMA — left internal mammary artery, RIMA — right internal mammary artery, LPV — left pulmonary vasculature, RPV — right pulmonary vasculature, LPA — left pulmonary artery, RPA — right pulmonary artery, CABG — coronary artery bypass grafting, MIDCAB — minimally invasive coronary artery bypass, CHF — congestive heart failure, ST — stress test, SCIN — scintigraphy, N/A — not available; * LIMA was dissected but was not used as a graft in CABG surgery

fistula might develop a very long time after the operation. Because some patients with IMA-PV fistulas are asymptomatic and, in theory, patients should have an asymptomatic period until the coronary–pulmonary steal becomes functionally significant, it is not unexpected that the real incidence of these fistulas is higher than reported [12].

Previously reported cases have been managed conservatively, with medication for coronary ischemia (11 cases), or with surgical ligation of the fistula connections (8 cases) or with endovascular techniques using covered stents via LIMA in three cases and coil embolization in two cases. In another five cases, the treatment option was not available.

Optimal management is controversial, as the long-term outcome of patients followed conservatively is not known. In asymptomatic patients with small fistulas, conservative management might be suitable [2].

Of note, complications of fistulas in general such as endocarditis, aneurysm, rupture, congestive heart failure, and pulmonary hypertension should be kept in mind during follow-up in this group. Patients with large shunt flow as well as with recurrent angina unresponsive to medical treatment are good candidates for the closure of the fistulas. Demonstration of the fistula as the cause of the ischemia before intervention is important. Surgical ligation requires a left thoracotomy with the asso-

ciated operative and anesthetic risks, and percutaneous coil springs can cause thrombosis and distal embolization [17].

Three cases in the literature were treated with a covered stent successfully [14, 16, 17]. Unfortunately, re-stenosis was reported in one of them. Less flexibility in tortuous vessels because of their relatively large profile and re-stenosis are potential problems for covered stents [17].

In our approach, there is no procedural risk for LIMA and in-stent restenosis is not a problem. Thrombosis or embolization risk of coils are also avoided but possible growth of new fistula connections from the remaining intrapulmonary segments of fistula is a problem and should be followed carefully.

In conclusion, IMA-PV fistulas are rare, but reported cases are increasing in the literature. Our case shows that transpulmonary occlusion of fistula using covered stents might be a good therapeutic option with minimal procedural risk in the management of IMA-PV fistulas.

Acknowledgements

The authors do not report any conflict of interest regarding this work

References

1. Johnson JA, Schmaltz R, Landreneau RJ et al. Internal mammary artery graft to pulmonary vasculature fistula: a cause of recurrent angina. Ann Thorac Surg, 1990; 50: 297–298.
2. Blanche C, Eigler N, Bairey CN. Internal mammary artery to lung parenchyma fistula after aortocoronary bypass grafting. Ann Thorac Surg, 1991; 52: 141–142.
3. Birnbaum Y, Wurzel M, Nili M et al. An unusual cause of recurrent angina two years after coronary artery bypass grafting: Fistula between internal mammary artery graft to pulmonary vasculature. Cathet Cardiovasc Diagn, 1992; 27: 130–132.
4. Kimmelstiel CD, Udelson J, Salem D et al. Recurrent angina due to a left internal mammary artery-to-pulmonary artery fistula. Am Heart J, 1993; 125: 234–236.
5. Groh WJ, Hovaguimian H, Morton MJ. Bilateral internal mammary-to-pulmonary artery fistulas after a coronary operation. Ann Thorac Surg, 1994; 57: 1642–1643.
6. Imawaki S, Arioka I, Nakai M et al. Development of a fistula between an internal mammary artery graft and the pulmonary vasculature following coronary artery bypass grafting: Report of a case. Surg Today, 1995; 25: 461–464.
7. Najm HK, Gill IS, FitzGibbon GM et al. Coronary-pulmonary steal syndrome. Ann Thorac Surg, 1996; 62: 264–265.
8. Kieso HA, Trivedi D, Qazi M et al. Acquired internal mammary artery to pulmonary artery fistula following bypass surgery. J Invasive Cardiol, 2000; 12: 280–282.
9. Liu Y, Noveck H, Moreyra AE. Plexus between internal mammary graft and pulmonary vasculature after minimally invasive coronary surgery. Tex Heart Inst J, 2000; 27: 395–397.
10. Madu EC, Hanumanthu SK, Kim C et al. Recurrent ischemia resulting from left internal mammary artery-to-pulmonary artery fistula. Angiology, 2001; 52: 185–188.
11. Musleh G, Jalal A, Deiraniya AK. Post-coronary artery bypass grafting left internal mammary artery to pulmonary artery fistula: A 6 year follow-up following successful surgical division. Eur J Cardiothorac Surg, 2001; 20: 1258–1260.
12. Maiello L, Franciosi G, Presbitero P et al. Left internal mammary artery to pulmonary artery fistula after minimally invasive coronary bypass. Ann Thorac Surg, 2002; 73: 317.
13. Ferreira AC, Marchena E, Liester M et al. Internal mammary to pulmonary artery fistula presenting as early recurrent angina after coronary bypass. Arq Bras Cardiol, 2002; 79: 181–182.
14. Abbott JD, Brennan JJ, Remetz MS. Treatment of a left internal mammary artery to pulmonary artery fistula with polytetrafluoroethylene covered stents. Cardiovasc Intervent Radiol, 2004; 27: 74–76.
15. Guray U, Guray Y, Ozbakir C et al. Fistulous connection between internal mammary graft and pulmonary vasculature after coronary artery bypass grafting: a rare cause of continuous murmur. Int J Cardiol, 2004; 96: 489–492.
16. Glover BM, Khan MM. The novel use of a covered stent in the management of a left internal mammary artery to pulmonary vasculature fistula. J Invasive Cardiol, 2004; 16: 663–664.
17. Heper G, Barcin C, Iyisoy A, Tore H.F. Treatment of an iatrogenic left internal mammary artery to pulmonary artery fistula with a bovine pericardium covered stent. Cardiovasc Intervent Radiol, 2006; 29: 879–882.
18. Almeida Júnior GL, Jorge JK, Neno AC et al. Left internal thoracic artery to left pulmonary artery fistula after coronary artery bypass graft surgery. A rare cause of myocardial ischemia. Arq Bras Cardiol, 2005; 85: 337–339.
19. Nielson JL, Kang PS. Endovascular treatment of a coronary artery bypass graft to pulmonary artery fistula with coil embolization. Cardiovasc Intervent Radiol, 2006; 29: 302–305.
20. Peter AA, Ferreira AC, Zelnick K et al. Internal mammary artery to pulmonary vasculature fistula: Case series. Int J Cardiol, 2006; 108: 135–138.