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Case Report

CASE REPORT

Facing a dilemma in the treatment of an internal mammary artery mycotic pseudoaneurysm: coil embolization or surgery? A case report and brief literature review

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Abstract

While aneurysms of the internal mammary artery (IMA) complicate occasionally surgical procedures employing median sternotomy, or are associated with direct thoracic trauma, mycotic pseudoaneurysms of the vessel are rarely reported in the literature. We herein report a case of a 22-year-old man who developed a mycotic internal mammary artery pseudoaneurysm secondary to staphylococcal chest wall abscesses and was effectively treated by coil embolization. Additionally, the report provides a brief review focusing on the current state of treatment options for internal mammary artery aneurysms.

INTRODUTION

Medical literature provides scant reports of internal mammary artery (IMA) aneurysms, especially if they are of infectious origin. In general those vessel deformities have been described in patients with connective tissue disorders, infection, vasculitis, thoracic trauma and following median sternotomy or attempted subclavian venous puncture. Due to the risk of increasing in size and eventually pseudoaneurysmatic sac rupturing, treatment including various approaches is always recommended [1]. We report one case of staphylococcal left IMA pseudoaneurysm in a 22-year-old man, treated successfully by coil embolization.

The patient described here has consented to publication of all case details and associated images.

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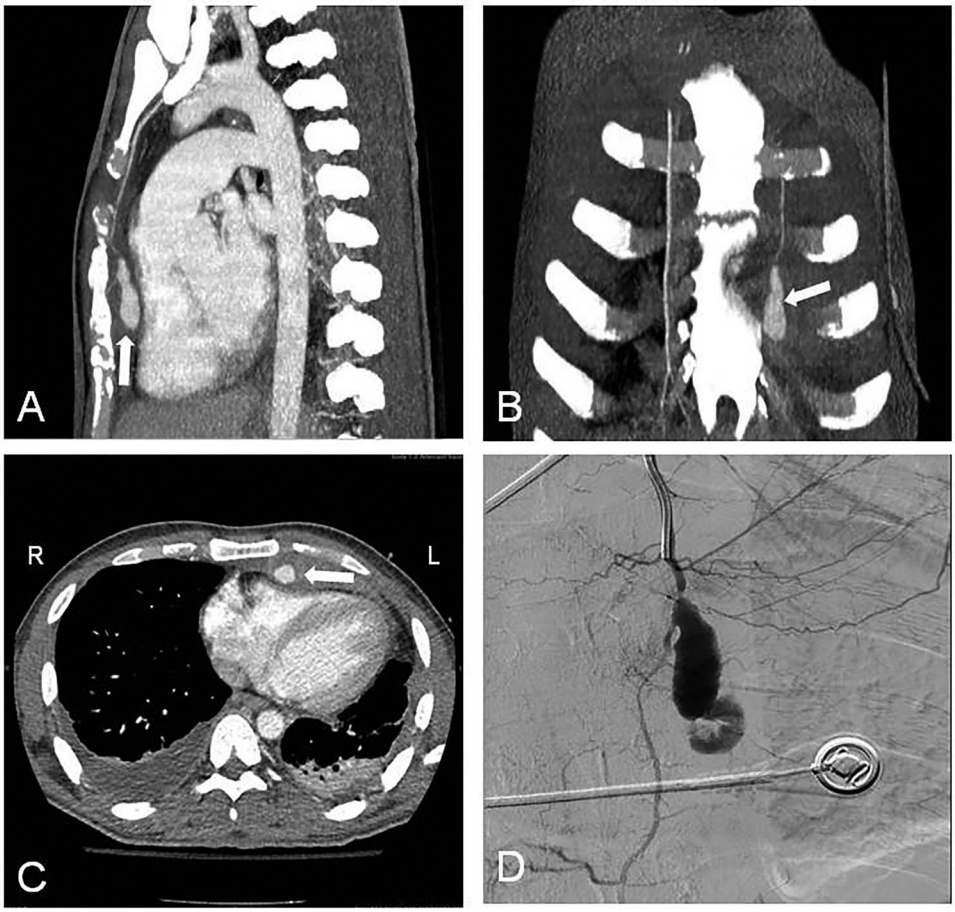

Figure 1: Contrast-enhanced CT with LIMA pseudoaneurysm (white arrow). (**A**) Sagittal plane; (**B**) coronal plane; (**C**) transverse plane with LIMA pseudoaneurysm (white arrow) and bilateral pleural effusions; (**D**) selective LIMA angiography demonstrating the aneurysm.

CASE REPORT

A 22-year-old man was admitted to our emergency department suffering of blunt thoracic trauma due to traffic accident. Clinical examination and performed radiological studies revealed fractures of multiple left-sided ribs, the sternum as well the Th11 and Th12 vertebral bodies. The patient was initially treated conservatively, but on the fifth day, he developed a left-sided pleural effusion, necessitating a thoracostomy tube. Additionally, there were subpectoral chest wall abscesses, which were surgically incised and drained. Blood as well pus cultures from the abscess cavities revealed the growth of *Staphylococcus aureus*; therefore, intravenous antistaphylococcal antibiotics were administered. However, in the further course, a control contrast-enhanced computed tomography (CT) scan demonstrated a big left IMA pseudoaneurysm (Fig. 1: white arrow) accompanied by an ipsilateral localized hemothorax (Fig. 1A–C). The effusion was drained again, and concerning the aneurysm, we preferred a minimally invasive treatment via coil embolization in order to avoid a potential extensive mobilization of the patient, contraindicated by his spinal injuries, while the positioning on the operating table in case of a surgical treatment through a lateral thoracotomy.

The embolization was performed after obtaining three consecutive negative blood cultures accompanied by a significant decrease of the laboratory infection parameters. The angiographic approach was done through the left brachial artery (Fig. 1D), and a microcatheter was placed into the aneurysm neck. Through coiling we aimed to occlude the IMA distally and proximally adjacent to the aneurysmatic sac, but attempts to cannulate the vessel distal to the aneurysm were unsuccessful. Therefore multiple (5x) coils were placed (VortX^{TM} 35 (3×) and Complex Helical 18 (2×); Boston Scientific; Boston, MA, USA) into the aneurysmatic neck and sac (Fig. 2A).

The completion angiogram demonstrated no filling in the coiled pseudoaneurysmal sac (Fig. 2B), while at follow-up 1, 3 weeks and 6 months after the procedure, CT scans showed initially shrinkage and finally complete regression of the pseudoaneurysm with no flow into it (Fig. 2C and D; white arrow). Early post-interventional course was unremarkable, and the patient was discharged after completing an intravenous antibiotic treatment over 6 weeks.

DISCUSSION

Although IMA aneurysms are occasionally observed secondary to thoracic trauma, cardiac surgical procedures including sternotomy, connective tissue disorders, vasculitis, fibromuscular hyperplasia and atherosclerotic disease [1], mycotic pseudoaneurysms of the vessel are even rarely reported in the literature [2, 3].

In general aneurysms may rupture and lead to arterial bleeding with subsequent hemomediastinum or hemothorax. In order

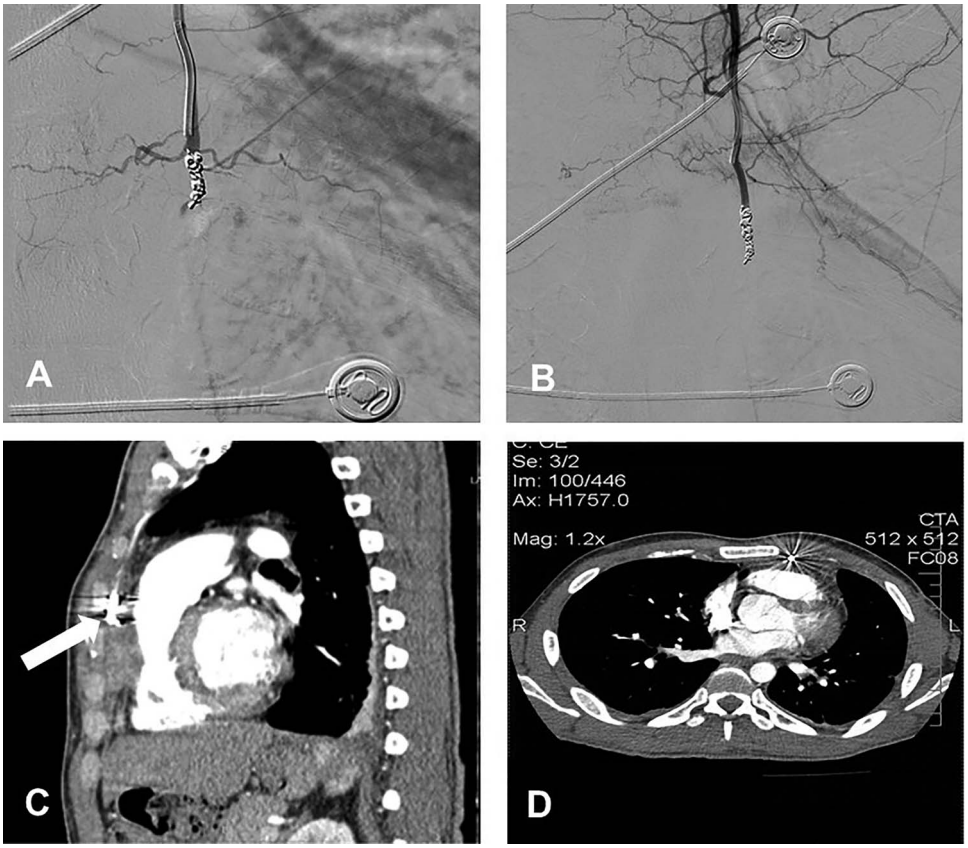

Figure 2: (**A**) Coil embolization of the aneurysm; (**B**) postembolization completion angiogram; (**C**) follow-up contrast-enhanced CT scan at 3 weeks after the embolization with complete regression of the pseudoaneurysm without flow into it (white arrow); (**D**) follow-up contrast-enhanced CT scan at 6 months after the embolization.

to avoid these potentially catastrophic complications, treatment is mandatory in all cases once the diagnosis is established. Unspecific clinical signs indicating the presence of an IMA aneurysm are dyspnea, cough or hemoptysis accompanying usually a bulging chest mass. CT angiography with MDCT scan of the thorax represents the cornerstone in the diagnosis enabling exact size assessment and anatomical allocation of the aneurysm [4], while selective vessel angiography is on the one hand essential to localize the source of bleeding, in case of sac rupture, and on the other an important prerequisite for endovascular treatment [5].

In our patient the close vessel proximity to the concomitant subpectoral chest wall abscesses, as well as a potential traumatic insult during the abscess drainage and the history of blunt thoracic injuries, may have forced through hematogenous spreading an IMA wall involvement with subsequent pseudoaneurysm formation.

Reviewing the literature regarding the management of non-iatrogenic, non-traumatic IMA aneurysms and pseudoaneurysms (Table 1), there is a shift from the traditional surgical repair toward minimally invasive endovascular techniques including coil embolization [1–3, 5] and recently stent-graft repair [6, 7].

Transcatheter embolization is performed using predominantly steel coils placed either within the aneurismal sac or in the feeding vessel [5], while IMA embolization distally to the pathology precludes retrograde collateral flow into the aneurysm [8]. Although this method is rapidly becoming the treatment of choice for arteriovenous fistulas and small aneurysms, some authors still advocate the classical surgical repair especially in bigger, wall-thinned, non-iatrogenic aneurysms, which enables complete ablation of the aneurysm, ensures long-term patient survival and provides histological information. Adjacent infective processes like anterior chest wall abscesses should be treated aggressively to prevent transthoracic infection spreading with subsequent vascular complications [2].

Nevertheless, indications for embolic coiling in case of mycotic aneurysms like in the presented case remain controversial and still under debate. The major concern is either the persistent infection or a reinfection of the coil fabric, constituting an unresolved issue in patients with ongoing bacterial inflammation [9]. As long as the reported post-embolic infectious complications in noninfected arteries are very low, below 1% [10], one would predict a much higher infection incidence in cases of infected aneurysms. In our case, we avoided the surgical approach through a lateral thoracotomy with the required positioning on the operating table, due to the patient's coexisting spine injuries. We proceeded therefore with a transcatheter treatment after controlling the infection. Aiming to minimize the infection recurrence risk, the patient was set for 6 weeks postoperatively on intravenous broad-spectrum antibiotics. The literature provides only a few reports of coiling in mycotic IMA pseudoaneurysms, with a maximum follow-up of 3 months in one case [2], while our patient was closely observed radiologically over 6 and clinically over 12 months.

In conclusion IMA aneurysms are rare but potentially morbid. Percutaneous transcatheter coil embolization of a mycotic IMA pseudoaneurysm may offer under circumstances a safe, efficient

Table 1. Literature review of case reports regarding non-iatrogenic/non-traumatic IMA aneurysms

Author, year, [reference-citation]	Aneurysm location	Etiology	Treatment	Outcomes
Otter GD, 1978	LIMA	Unknown	Exploratory thoracotomy and ligation of aneurysm	Uneventful recovery
Sanchez FW, 1985	LIMA	CGD	Angiographic embolization	Uneventful recovery
Giles JA, 1990	BL IMA	Polyarteritis nodosa	Thoracotomy with bilateral aneurysmectomy	Uneventful recovery
Wildhirt S, 1994	RIMA	Atherosclerosis	Open ligation and resection	Uneventful recovery
Chan LW, 1996	LIMA	No risk factors	Angiographic embolization, thoracotomy for hematoma evacuation	Uneventful recovery
Phan TG, 1998	LIMA	Ehlers–Danlos syndrome	Thoracotomy with ligation of the LIMA, drainage of hemothorax	Uneventful recovery
Common AA, 1999	LIMA	Marfan syndrome, previous MVC	Coil embolization	Uneventful recovery; died years later from type A dissection
Deshmukh H, 2001 [2]	*n*: two pts LIMA RIMA	Staphylococcal chest wall infection Tuberculous chest wall abscess	Coil embolization Coil embolization	Uneventful recovery Uneventful recovery; at 3-month follow-up successful aneurismal obliteration
Kim SJ, 2005	LIMA	NF type I	Urgent coil embolization	Uneventful recovery; 2-month follow-up unremarkable
Dell'Amore A, 2006	LIMA	Atherosclerosis	Surgical repair via median sternotomy due to interventional approach failure	Uneventful recovery
Urso S, 2007	RIMA	NF type I	Emergent surgery with CPB due to rupture	Pt died during operation
Wani NA, 2010 [3]	LIMA	Pulmonary actinomycosis	Surgical repair planed	Pt died prior surgery
Rose JF, 2011	LIMA	Marfan syndrome	Coil embolization	Uneventful recovery 4- and 9-month follow-up unremarkable
Ohman JW, 2012	RIMA	Loeys–Dietz syndrome	Coil embolization	Uneventful recovery; At 24-month follow-up complete thrombosis of aneurysm
Okura Y,	RIMA	Idiopathic CMD	Surgical ligation and removal	Uneventful recovery; 1-year follow-up unremarkable
Sareli AE, 2012	RIMA	NF type I	Emergent surgery due to rupture	Pt died due to anoxic brain injury
Lindblom RPF, 2013	LIMA	Idiopathic or possibly very late post-traumatic	Emergent coil embolization	Uneventful recovery
Heyn J, 2014	LIMA	Idiopathic	Open surgical resection	Uneventful recovery, at 6 months unremarkable
Burke C, 2015	LIMA	SMAD3 mutation	Coil embolization	Uneventful recovery
Piffaretti G, 2015 [6]	LIMA	Sneddon's syndrome	Stent-graft repair	Uneventful recovery, at 6 months: exclusion of aneurysm, patent ITA, absence of endoleak or edge stenosis
Ouldsalek EH, 2016	LIMA	Unknown	Surgical resection	Uneventful recovery
Kwon OY, 2016	RIMA	NF type I	Emergent staged management: coil embolization, and a subsequent VATS procedure	At 6 months: clinically asymptomatic

(*Continued*)

Table 1. Continue

Author, year, [reference-citation]	Aneurysm location	Etiology	Treatment	Outcomes
Alhawasli H, 2016	BL IMA	Marfan syndrome	Endovascular stent-graft repair	Uneventful recovery, at 2-year follow-up: unremarkable
Nevidomskyte D, 2017 [7]	*n*: two pts (siblings) LIMA, RIMA	SMAD3 Mutation	Endovascular stent-graft repair	Uneventful recovery
Wong WJ, 2017	RIMA	Idiopathic	Coil embolization	Uneventful recovery
Kim DW, 2017	LIMA	NF type I	Emergent coil embolization	Uneventful recovery, at 18 months unremarkable
Almerey T, 2017	RIMA	Idiopathic in the setting of aberrant subclavian artery	Coil embolization	Uneventful recovery, at 18 days unremarkable
Fujiyoshi T, 2018	BL IMA	Marfan syndrome	Coil embolization	Uneventful recovery, 7-year follow-up completed
Ho K, 2018	RIMA	Immunoglobulin G4-related	Hybrid surgical approach: open ligation of IMA origin and VAT-aneurysmectomy	Uneventful recovery
Miyazaki M, 2019	RIMA	Related to previous DeBakey III acute aortic dissection	Surgical thoracoscopic resection	Uneventful recovery
Chen JF, 2019	BL IMA	Heterozygous missense variant of unknown significance in COL5A1-gene and fibromuscular dysplasia	Coil embolization	Uneventful recovery
Mertens RA, 2020	BL IMA	Marfan syndrome	Coil embolization, stent grafting of the left subclavian artery	Uneventful recovery

and minimally invasive therapeutic alternative to the standard treatment of open surgical repair.

Adjacent infective processes like anterior chest wall abscesses should be treated aggressively to prevent transthoracic infection spreading with subsequent vascular complications.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

DATA AVAILABILITY

The authors declare that data supporting the findings of this study are available within the article.

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