Immunoglobulin G4-related solitary aneurysm of the deep femoral artery

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ABSTRACT

We have reported the case of an 83-year-old man with a rare immunoglobulin G4 (IgG4)-related solitary deep femoral artery aneurysm. The patient successfully underwent aneurysmectomy and vascular reconstruction with an expanded polytetrafluoroethylene graft. A definitive diagnosis was determined from the comprehensive diagnostic criteria, including histopathologic features of chronic inflammation indicated by massive infiltration of IgG4-positive plasma cells. IgG4-related aneurysmal diseases should be included in the differential diagnosis of deep femoral artery aneurysms, which have traditionally been considered to develop owing to previous trauma or surgery, intervention, infection, and autoimmune or collagen disease. (J Vasc Surg Cases Innov Tech 2022;8:358-61.)

Keywords: Deep femoral artery aneurysm; Immunoglobulin G4; Immunoglobulin G4-related disease; Periarteritis

The occurrence of solitary deep femoral artery (DFA) aneurysms (DFAAs) has been considerably rare because of the femoral anatomic features, the five groin muscles that protect the DFA from external force damage, and the copious muscle layers with few elastic fibers.[1,2] The diagnosis can be difficult until the DFA has expanded, at which point the DFAA will have a high risk of rupture and thromboembolism.[3]

Immunoglobulin G4 (IgG4)-related disease (RD) is a systemic fibrous disease, featuring high serum IgG4 levels. Histopathologically, numerous infiltrations of IgG4-positive plasma cells, storiform fibrosis, and obstructive phlebitis will be found, which cause nodules or thickening of the adventitia. IgG4-RD affects various organs and can also involve the cardiovascular system.[4-6]

In the present report, we have described the case of a patient with an extremely rare IgG4-related DFAA that was successfully repaired with aneurysmectomy and vascular reconstruction using an expanded polytetrafluoroethylene graft. The patient provided written informed consent for the report of his case details and accompanying imaging studies.

CASE REPORT

An 83-year-old man had been referred because of a rapidly expanding pulsatile mass in his right groin but without neurologic symptoms due to aneurysmal compression. Other findings from his physical examination were noncontributory. The patient had no history of trauma, previous interventions, surgical treatment, infection, drug abuse, autoimmune disease, collagen disease, or diabetes mellitus. However, he was a smoker and hypertensive.

The pulses in his right peripheral arteries were palpable, and the ankle brachial index was 1.09. A radiologist's interpretation of the computed tomography scan revealed a 56-mm × 62-mm aneurysm in the midportion of the DFA. No other aneurysms were observed. Femoral arteriography also revealed a solitary DFAA (Fig 1, *A*). The patient's nephelometric serum IgG4 concentration was 138 mg/dL (normal range, <135 mg/dL).

Although critical symptoms were absent, the patient underwent surgery because of the risky nature of DFAAs. DFAAs have shown a high incidence of rupture and have been associated with high rates of major amputation.[7] The DFAA in our patient was treated by initiating a longitudinal groin incision along the DFA (Fig 1, *B*). Although moderate adhesions were observed, the DFAA was exposed without technical difficulties and repaired by aneurysmectomy and subsequent vascular reconstruction using an expanded polytetrafluoroethylene graft with a 6-mm diameter because the patient's great saphenous vein was unsuitable for reconstruction. The volume of intraoperative blood loss was 180 mL.

Microscopically, the resected specimen revealed features suggestive of adventitial thickening, diffuse infiltration with numerous IgG4-positive plasma cells (Fig 2, *A*), and obstructive phlebitis (Fig 2, *B*), indicating the presence of chronic inflammation. An IgG and IgG4 immunohistochemical staining revealed 31 positive plasma cells in high power field. The IgG4/IgG-positive cell ratio was 43.2% (Fig 2, *C and D*).

Cases of IgG4-RD are diagnosed by comprehensive histologic diagnostic criteria.[8] These include (1) radiographic findings

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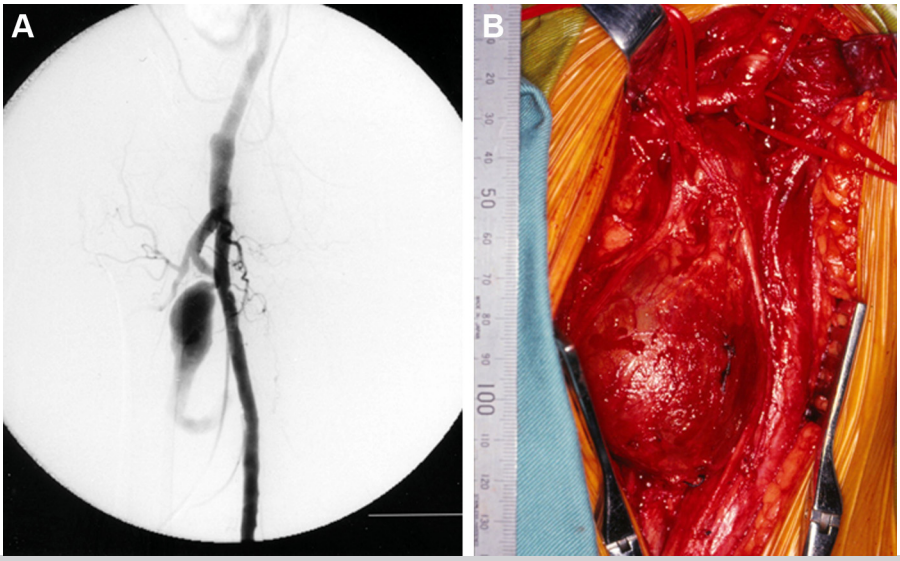

Fig 1. A, Femoral arteriogram revealing a 56-mm × 62-mm solitary aneurysm in the mid-portion of the deep femoral artery (DFA). **B,** An aneurysm repair was performed through a longitudinal groin incision along the DFA and was exposed without technical difficulty.

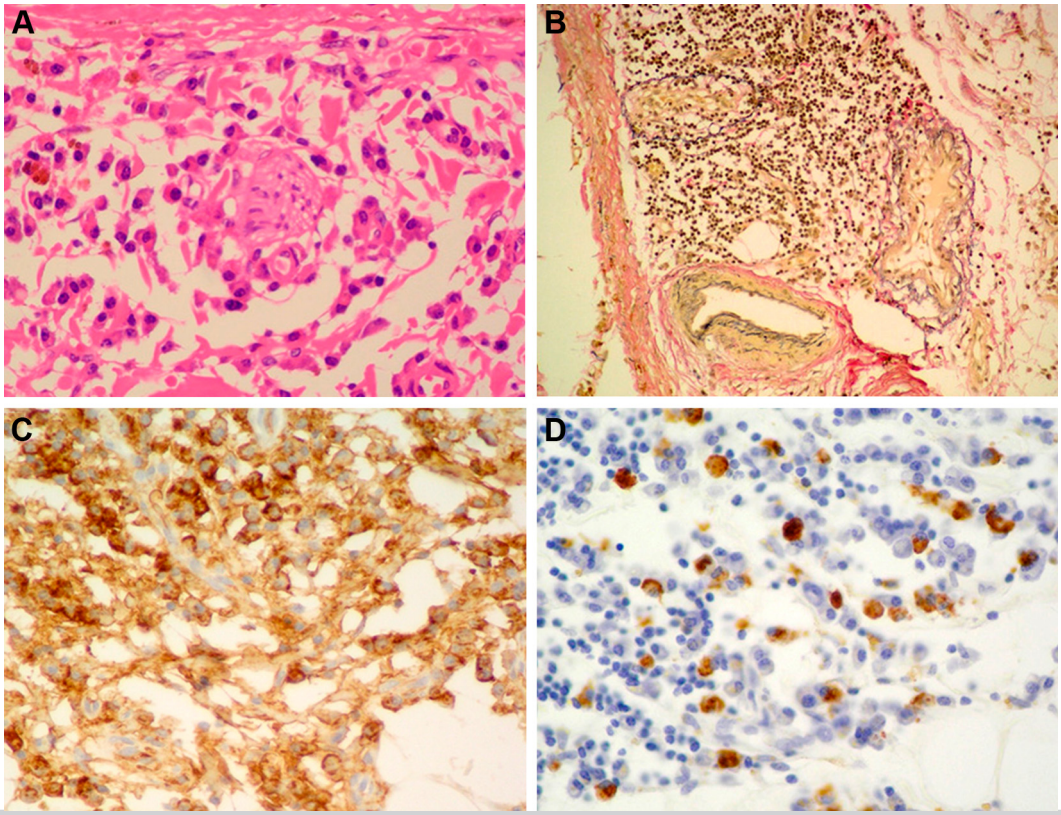

Fig 2. Infiltration of numerous immunoglobulin G4 (IgG4)-positive plasma cells (**A**), with obstructive phlebitis that increased the probability of IgG4-related disease (IgG4-RD) diagnosis (**B**; hematoxylin and eosin stain; original magnification ×400). **C,D,** IgG and IgG4 immunohistochemical staining revealing a count of 31 positive plasma cells (**D**). The IgG4/IgG-positive cell ratio was 43.2 (original magnification ×400).

with one or more organs showing diffuse or localized swelling or a mass; (2) elevated serum IgG4 levels >135 mg/dL; and (3) histopathologic findings of dense lymphocytes and plasma cell infiltrations with fibrosis, IgG4-positive plasma cells >10/high power field, and an IgG4/IgG-positive cell ratio of >40% accompanied by storiform fibrosis or obliterative phlebitis. The present

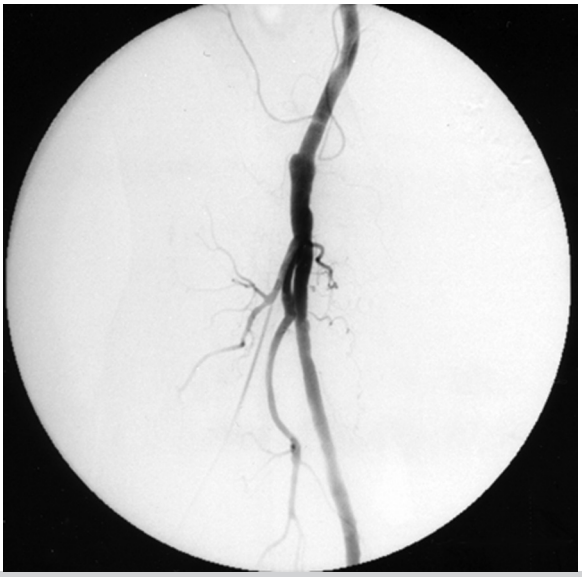

Fig 3. Postoperative arteriogram revealing the disappearance of the deep femoral artery (DFA) aneurysm (DFAA) and confirming the patency of the replaced graft.

case met all these criteria, and the definitive diagnosis was confirmed.

His postoperative course was uneventful. Postoperative arteriography revealed the disappearance of the DFAA, and patency of the replaced graft was confirmed (Fig 3). The serum IgG4 concentration had become normalized postoperatively (89 mg/dL).

DISCUSSION

An isolated DFAA is a rare pathology that accounts for only 0.5% to 2.6% of peripheral aneurysms.[8] Also, the clinical symptoms will often not be apparent because of the deep anatomic setting, and DFAAs often remain undiagnosed until rupture occurs.[7]

Concerning the etiology of DFAAs, most cases have been attributed to atherosclerosis.[7] Other important etiologies include trauma, infection, complications of coronary intervention, and an inflammatory disorder or autoimmune disease.[7] Although the present patient did not have a clinical history or any comorbidities that have classically been associated with DFAAs, a definitive diagnosis of IgG4-RD was possible because of the elevated serum IgG4 levels and histopathologic characteristics. The findings from the present case have reinforced that IgG4-RD should be considered in the differential diagnosis of DFAAs.

An IgG4-RD is a novel immune disorder that can affect various organs simultaneously or metachronously. It is characterized by elevated serum IgG4 levels and tumorous swelling of the involved organs. IgG4-RD is prevalent in elderly men and shows a drastic response to corticosteroid therapy.[9] IgG4-RD is pathologically characterized by numerous infiltrations of lymphoplasmacytes and IgG4-positive plasma cells, storiform fibrosis, or obliterative phlebitis, which indicative of chronic inflammation.[7,9] A diagnosis of IgG4-RD should be determined from comprehensive histologic diagnostic criteria.[7] It is exceedingly important to prove any pathologic findings of chronic inflammation and infiltration of IgG4-positive plasmacytes because such infiltration can result from acute surgical inflammation.[10]

Vascular IgG4-RD can develop with the occurrence of an aortic or medium-size arterial aneurysm and will predominantly affect the adventitia and surrounding tissues. We have managed 41 cases of IgG4-related aortic aneurysm and reported the possibility of aortic wall injury due to matrix metalloproteinase-9 expressed by mediation with interleukin-6.[4,6,11] However, regarding IgG4-RD that develops in the primary branches of the aorta or distal arteries, only a few cases of coronary artery,[5] renal artery,[12] deep femoral artery, and popliteal artery[13] aneurysms have been reported. Considering the etiology, the case of a renal artery aneurysm reported by Meadors et al[12] is interesting, because it can be regarded as a part of an IgG4 lesion of the entire retroperitoneal space. In contrast, all other cases were of isolated lesions. Therefore, the cause of IgG4 lesions in the aortic branch should not be discussed solely by its continuity with aortic lesions, and further investigation is required.

Regarding the treatment of IgG4-RD, steroids can promote the shrinkage of the tumorous lesions and reduce the thickness of the arterial walls and dense periaortic and/or arterial fibrous tissues of IgG4-RD.[9,14] However, steroid therapy can also cause thinning of the arterial walls because the connective tissue will become more friable.[15] Aneurysmectomy has been deemed an appropriate treatment option because the aneurysms can rupture or dissection can occur during steroid therapy.[15] The surgical removal of IgG4 lesions will eliminate the symptoms and lower the serum IgG4 levels.[5]

Various approaches have been reported for the surgical treatment of DFAAs, including the use of simple ligation,[16] embolization,[17] aneurysmectomy with or without revascularization using autologous[18,19] or synthetic grafts,[20] and endovascular techniques (EVTs) with covered stents.[21] Ligation or embolization should be avoided because it can be difficult to completely prevent backflow from the side branches of the DFA. An EVT will generally be less invasive and feasible. However, it was unsuitable for the present patient because the contralateral approach is indicated for patients with anatomic issues (eg, a short landing zone, type II endoleaks due to DFA branches), and the long-term patency of the peripheral covered stents has not been confirmed.

Regarding EVT of IgG4-related aneurysms, we have reported 14 cases of endovascular aneurysmal repair for abdominal aortic aneurysms.[22] However, in that study, we found that EVT did not improve lesions related to IgG4-RD.[22] Thus, open surgical repair has been recommended.[22] Furthermore, the number of reported cases

of IgG4-related medium-size arterial aneurysms has been extremely small. Considering these issues, open surgical repair was performed for all cases.

Aneurysmectomy with reconstruction of the DFA is the optimal option, and graft selection for reconstruction should be determined by the diameter of the DFA at the reconstruction site and the availability of a superficial or deep vein thick enough for grafting. Other usable graft materials include the deep vein and a pericardial patch tube.[23,24] These can be an alternative for reconstruction, especially when vascular reconstruction is required in the context of infected fields such as an infectious DFAA.

CONCLUSIONS

We have reported the case of a patient with a rare IgG4-related DFAA that was successfully treated by aneurysmectomy with synthetic graft reconstruction. IgG4-RD should be considered an additional etiology for DFAAs.

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