Disseminated intravascular coagulation (DIC) is an acquired coagulation disorder and is caused by various predisposing diseases and clinical conditions, including infections, trauma, obstetrical syndromes or malignant diseases. DIC has also been reported in association with a variety of aneurysms since the first report by Fine et al. in 1967 of a case with a dissecting aortic aneurysm. In the present case, DIC occurred when a popliteal aneurysm was suddenly thrombosed. DIC associated with popliteal aneurysms is extremely rare and has seldom been reported till now.

A 75-year-old man with a history of hypertension presented to our hospital with pain and numbness in the right leg. He had had right leg pain when walking for six months, which had progressively worsened over a 5-day period, and started to feel pain even when resting. He also had bleeding gums, nasal bleeding and multiple purpura. There was no history of anticoagulation therapy. Physical examination revealed an absence of pedal and popliteal arterial pulses in the right leg and a palpable mass in the left popliteal artery. Multiple purpura was present over the trunk and extremities. Initial laboratory assessment of this patient included: hemoglobin of 12.7 g/dl (normal: 13.5 to 17.5 g/dl), platelets of 2.4 × 10^4/μl (normal: 1 to 38 × 10^4/μl) and total leukocytes of 59.6 × 10^2/μl (normal: 35 to 85 × 10^2/μl). The prothrombin activity was 33.5% (normal: 80 to 120%), INR was 2.35 (normal: 0.9 to 1.1), the activated partial thromboplastin time was 46.3 seconds (normal: 27 to 40 seconds), the fibrinogen was < 50 mg/dl (normal: 150 to 350 mg/dl), the fibrin/fibrinogen degradation products were 264 μg/ml (normal: ≤ 10 μg/ml) and the D-dimer was 168 μg/ml (normal: ≤ 1.0 μg/ml). Serum concentration of liver enzymes was normal.

Contrast enhanced computed tomography revealed diffusely enlarged bilateral popliteal aneurysms measuring 35 mm × 33 mm × 140 mm in the right leg and 25 mm × 25 mm × 130 mm in the left, respectively (Fig. 1). The right aneurysm was completely occluded with thrombus. The other was patent with small mural thrombus and 3 curves at the middle and both ends. The clinical and laboratory findings were suggestive of overt disseminated intravascular coagulation (DIC) associated with an acutely thrombosed popliteal aneurysm. There were no other identifiable causes of coagulopathy after close assessment.

**Key words:** disseminated intravascular coagulation, popliteal aneurysm, acute thrombosis
Coagulopathy and Popliteal Aneurysm


He was transfused 4 units of fresh frozen plasma (FFP) to maintain plasma fibrinogen level of greater than 100 mg/dl. Low-dose heparin was started at 300 units/hour without an initial bolus and gabexate mesilate was also started at 40mg/hour. The patient remained on heparin and gabexate mesilate drips on hospital days 1 through 5 until his coagulation profiles were stabilized (Table 1). The ischemic symptom in the right leg had also gradually improved and rest pain was vanished within a day.

On angiographic examination, the right popliteal artery was completely occluded at its proximal site and only a part of the tibioperoneal artery could be visualized due to poor collateral circulation (Fig. 2). Without thrombolytic therapy to attain good runoff vessels, surgical repair for the aneurysm seemed to be difficult. However, there was a risk of bleeding complications in thrombolytic therapy because hemostatic instability would still exist latently. Considering the symptom had considerably improved with medication and the risk of distal embolism was small because of the complete occlusion, the right aneurysm was decided to be treated conservatively without either thrombolytic therapy or surgical repair. On the other hand, having sufficient runoff vessels, the left aneurysm needed to be repaired to avoid an occurring ischemic event. The maximum diameter of the left aneurysm was 22 mm and the aneurysm was replaced by a 10 mm i.d. polytetrafluoroethylene straight graft without complication. Subsequent recovery was smooth and he was discharged after two weeks. Although his right popliteal artery was completely occluded, he could walk 100 m without claudicating. Subclinical coagulopathy still existed at discharge: fibrin/fibrinogen degeneration products were 17 μg/ml and D-dimer was 11.3 μg/ml.

After discharge, the patency of tibioperoneal artery in the right leg had gradually improved in subsequent contrast enhanced computed tomography and the right aneurysm was repaired one year later after discharge. DIC is a disorder characterized by systemic intravascular activation of coagulation. This leads to widespread fibrin deposition in the circulation, which results in thrombotic complications, and to bleeding as a consequence of the consumption of platelets and coagulation factors. DIC has been associated with a variety of aneurysms such as thoracic or abdominal aneurysms since the first report by Fine et al. in 1967. Among preoperative patients with aortic aneurysms, 40% have elevated levels of fibrinogen split products and 4% experience clinically overt DIC. However, DIC associated with popliteal aneurysms is extremely rare. To our knowledge, only two

Fig. 1 Contrast computed tomography showed bilateral popliteal aneurysms, the right side of which was occluded with thrombus (arrows).

Table 1
cases have been reported in literature.\(^4\) One of the reasons may be their size. It is reported that the diameter of aneurysms is correlated with the activation of coagulation and fibrinolysis in patients with aortic aneurysms.\(^5\) Compared with thoracic or abdominal aneurysms, popliteal aneurysms are relatively small.

In the current case, clinically overt DIC occurred when the popliteal aneurysm was suddenly thrombosed. Although other causes of DIC were investigated by performing close examinations such as laboratory evaluation, cultures of urine, blood and sputum, chest and abdominal CT scan, and bone marrow aspiration, there was no evidence of other diseases. It is plausible that the popliteal aneurysm itself caused overt DIC. However, acute thrombosis did not seem to be the initiator. Unlike aortic dissection, which can cause consumptive coagulopathy during the acute phase, acute thrombosis of popliteal aneurysms seldom causes consumptive coagulopathy.\(^7\) There is only one case that reports DIC in association with acute thrombosis of a popliteal aneurysm.\(^4\) The patient already had subclinical chronic coagulopathy resulting from extensive arterial aneurysms in an abdominal aorta, both femoral arteries and both popliteal arteries, and clinically overt DIC occurred when acute thrombosis in the popliteal aneurysm was added to this condition. So, in the current case, chronic compensated coagulopathy caused by bilateral popliteal aneurysm may have already existed before thrombosis occurred. The aneurysms were not so large in diameter, but their morphology may have been suitable to proceed to chronic coagulopathy. It is reported that the strong tortuosity of abdominal aortic aneurysms is associated with the increased level of thrombin-anti thrombin III complex(TAT), D-dimer and free form of tissue factor pathway inhibitor(F-TFPI).\(^6\)

The pathogenesis of chronic coagulopathy in aortic aneurysms is unclear. Within the atheromatous aneurysms, a loss of regulatory function resulting from an exposure of denuded endothelial surfaces may lead to intrinsic coagulation dysfunction and thromboplastins released from either disturbed endothelium or breakdown products of hemolyzed erythrocytes and aggregated platelets to extrinsic coagulation dysfunction.\(^8\) Prentice et al. demon-

*Fig. 2* On peripheral angiography, only a part of the right tibio-оперонеal artery could be visualized due to poor collateral circulation (arrows). On the other hand, there were good runoff vessels in the left leg.
strate that platelet adhesion is the greatest at the atheromatous area of aorta and is a relevant factor in the process of activating prothrombin, and Straub and Kessler et al. and later ten Cate et al. showed that iodine-131-labelled fibrinogen localized selectively to the aneurysm site.\textsuperscript{7,9)\

The outcome of emergency surgery for acute limb ischemia depends on the state of the infra-popliteal arteries. Regarding the five-year graft patency and limb salvage rates, patients with the presence of 2 or 3 runoff vessels had good results compared with single or no runoff vessel.\textsuperscript{10)\

Thrombolytic therapy is useful to clear a thrombosed popliteal aneurysm and to open occluded infra-popliteal arteries. But thrombolysis can cause severe complications including major local bleeding or intracranial bleeding. Intracranial bleeding can be fatal and its risk is reported to be 1\% during thrombolysis. When a popliteal aneurysm is thrombosed with clinically overt DIC, neither emergency thrombolysis nor emergency operative repair can be performed due to the possibility of bleeding complications occurring. Thus, at first, coagulation profiles should be stabilized with medical treatment for DIC including replacement therapies, anticoagulants and anti-fibrinolytic agents, and then, operative repair should be performed to salvage the limb.

We report the rare case of a patient who had DIC caused by acute thrombosis of the popliteal aneurysm. Although he could not be treated with thrombolytic therapy or surgical repair due to the possibility of bleeding complications occurring, the ischemic symptom in the right leg could be improved with medication and finally, he could avoid losing his leg.

REFERENCES