

CASE REPORT

False Lumen Embolization with the Candy Plug Technique for Consumptive Coagulopathy after Aortic Repair for Chronic Dissection

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Introduction: Chronic aortic dissection rarely causes consumptive coagulopathy due to disseminated intravascular coagulation (DIC).

Report: A 69 year old man who had previously undergone total arch replacement with the frozen elephant trunk procedure for chronic aortic dissection was transferred to our hospital because of sudden back pain. He had a bleeding from the right subscapular artery due to consumptive DIC caused by retrograde blood flow into a residual false lumen (FL). Percutaneous transcatheter embolisation was successfully performed, but DIC findings persisted. Thoracic endovascular aortic repair and FL embolisation with the candy plug technique were performed. Subsequently, DIC improved and FL thrombosis was safely accomplished.

Discussion: In this case, FL thrombosis was safely accomplished with the candy plug technique. This strategy expands options in patients with high risk for open repair.

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INTRODUCTION

Chronic aortic dissection rarely causes consumptive coagulopathy due to disseminated intravascular coagulation (DIC). It is uncommon for a patient to have clinical symptoms from DIC due to residual dissection after aortic repair. The use of false lumen (FL) embolisation with the candy plug technique is described for consumptive coagulopathy after aortic repair.

CASE REPORT

A 69 year old man, who had previously undergone hemi-arch replacement for DeBakey type I aortic dis years ago, underwent total arch replacement (TAR) with the frozen elephant trunk (FET) procedure because the diameter of his aortic arch was slowly expanding to 53 mm. The post-operative course was uneventful. He fully recovered at the time of the discharge. He had no other relevant medical history. Two months after TAR, he was transferred to hospital because of sudden back pain and swelling in the right chest. His regular medications were a beta blocker and a proton pump inhibitor at that time. His vital signs were stable. Laboratory data were complete blood count; haemoglobin 9.6 g/dL, haematocrit 28.2%, platelet 59 000/μL,

activated partial thromboplastin time 28 seconds, and prothrombin time international normalised ratio 1.43. Serum chemistries, blood urea nitrogen, creatinine, total protein, albumin, total bilirubin, aspartate transferase, alanine transferase, and alkaline phosphatase levels were normal. D-dimer was markedly elevated to 179 μg/mL. Fibrinogen was significantly decreasing to 66 mg/dL. Laboratory data indicated anaemia, thrombocytopenia, hyperfibrinolysis, and hypofibrinogenaemia. Computed tomography angiography (CTA) showed bleeding from the right subscapular artery and retrograde blood flow into the FL from multiple re-entry tears located by the visceral arteries at the level of the distal end of the FET, which were not seen earlier (Figs. 1 and 2). His aorta was dissected from distal aortic arch to left femoral artery. The celiac artery and the superior mesenteric artery originated from both true and false lumen. The right renal artery originated from the true lumen (TL) and the left renal artery originated from the FL. The diameter of the TL above the celiac artery was 24 mm and that of the FL was 31 mm.

It was speculated that DIC and consumptive coagulopathy were caused by retrograde blood flow into the FL from re-entry that led to intramuscular bleeding.

Percutaneous transcatheter embolisation for the right subscapular artery was successfully performed. After this procedure, anaemia improved. The findings of hyperfibrinolysis and hypofibrinogenaemia improved temporarily by infusion of coagulation factor and tranexamic acid. It was decided to perform surgical treatment because DIC findings persisted (Fig. 3).

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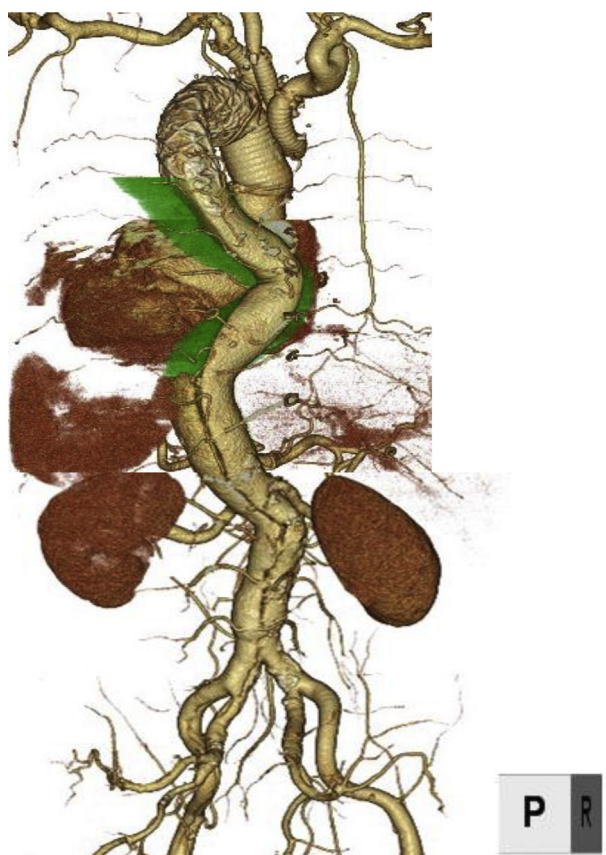


Figure 1. Three-dimensional computed tomography angiography after total arch replacement with the frozen elephant technique. P: posterior face, R: right side face.

Thoracic endovascular aortic repair (TEVAR) and FL embolisation with the candy plug technique were performed 24 days after admission. The TL was catheterised from the right femoral artery. Two Zenith TX-2 stent grafts (Cook Medical, Bloomington, IN, USA), with a proximal of 34×152 mm and a distal of 32×160 mm tapered to 28

mm so as to prevent distal stent graft induced new entry, were deployed from the site of the previous FET to the level of the celiac trunk. The FL was cannulated through the left femoral artery, and a Lunderquist extra-stiff wire was placed carefully in the FL. To prepare the candy plug, a 34×77 mm TX-2 aortic extension was modified on a sterile side table by adding a diameter restricting suture with a 4-0 polypropylene 2 thread between two intermediate stents. The customised candy plug was delivered and deployed into the FL at the level of the distal end of the stent graft in the TL. Post-procedural angiography demonstrated decreased retrograde blood flow; however, DIC findings persisted, and CTA showed retrograde flow at the level of distal arch in the FL. Then, additional coil embolisation of the proximal plug was performed 11 days after the procedure.

DIC improved and CTA at 1 month post-operatively showed complete FL thrombosis above the plug (Figs. 2 and 3). Furthermore, post-operative CTA showed that the stent graft in the TL was expanded satisfactorily and the FL distal the stent graft was diminishing (Fig. 4). Wound healing was delayed due to infection, but the patient was discharged 54 days after the procedure.

DISCUSSION

DIC is rarely caused by aortic dissection regardless of the time after onset. McLeod et al.¹ described a patient who had consumption coagulopathy associated with chronic dissection. Nakajima and colleagues² presumed that DIC associated with residual dissection may be caused by turbulent flow in the FL, rather than changes in the aorta occurring in the acute phase. In this case, the blood flow in once thrombosed the FL was resumed. This caused consumptive DIC and triggered the bleeding. The reason that the blood flow resumed is unclear.

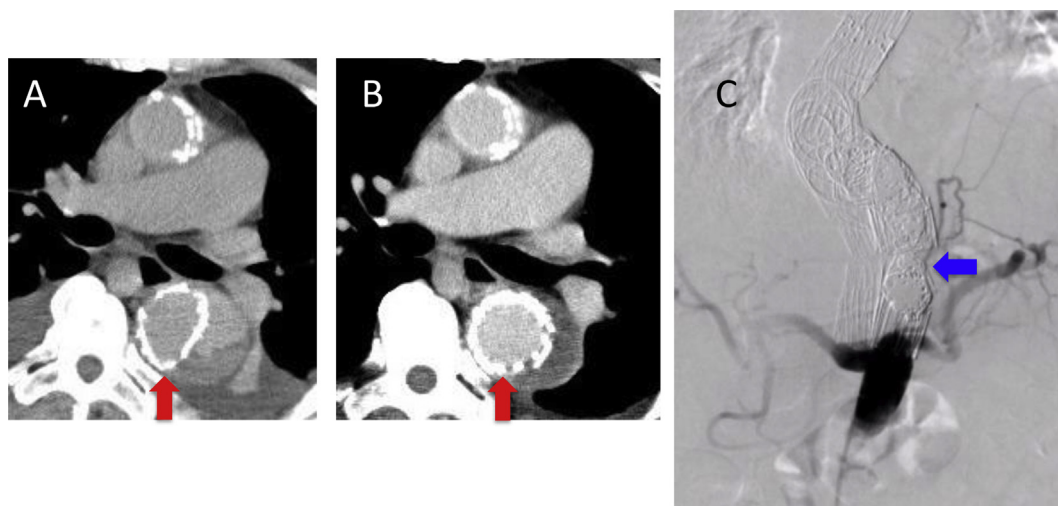
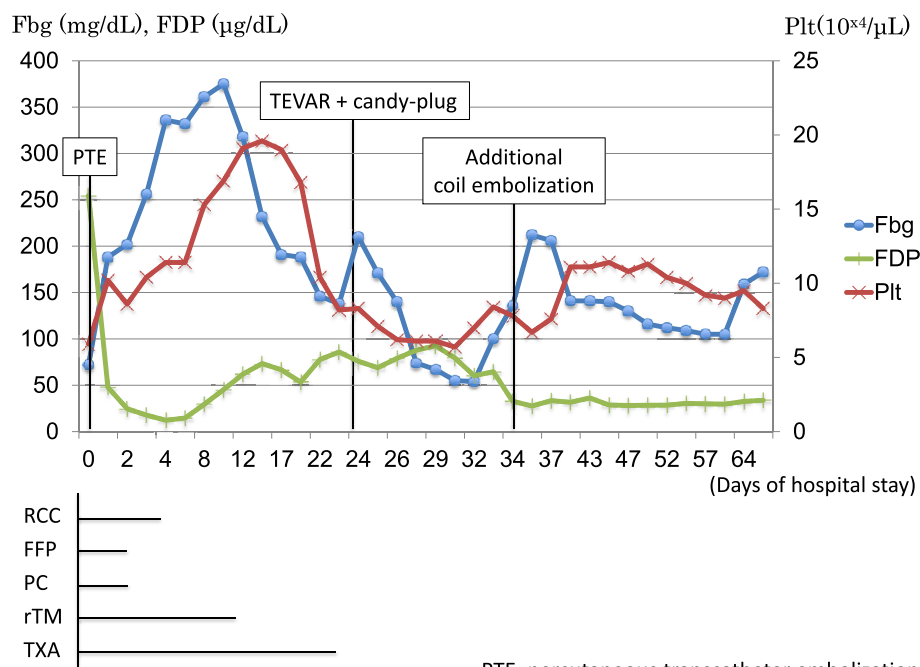


Figure 2. (A) Computed tomography angiography (CTA) on admission demonstrating retrograde blood flow to the level of distal end of the frozen elephant trunk (red arrow). (B) CTA at 1 month post-operatively showing complete false lumen (FL) thrombosis above the plug (red arrow). (C) Post-procedural aortography shows no blood flow into the FL above the plug (blue arrow) in C indicates the candy plug.



PTE: percutaneous transcatheter embolization

Figure 3. Serial coagulation studies on the response of fibrinogen, FDP, and platelet counts to intervention. The medical management with recombinant human rTM and TXA and transfusion. Fbg = fibrinogen; FDP = fibrin/fibrinogen degradation product; Plt = platelets; RCC = red cell concentrate; FFP = fresh frozen plasma; PC = platelet concentrate; PTE = percutaneous transcatheter embolisation; rTM = thrombomodulin; TEVAR = thoracic endovascular aortic repair; TXA = tranexamic acid.

When DIC findings persisted, turbulent flow into the residual FL from the distal re-entry should be surgically controlled. However, consumptive coagulopathy is difficult to control with infusion of coagulation factors, and excessive blood loss during the intervention is associated with

high mortality.² Herein, thoraco-abdominal aortic replacement was a treatment choice, but the high risk of bleeding prevented the use of open repair.

Embolisation of the re-entry tear was considered, but the patient had multiple re-entry tears in the visceral vessels,

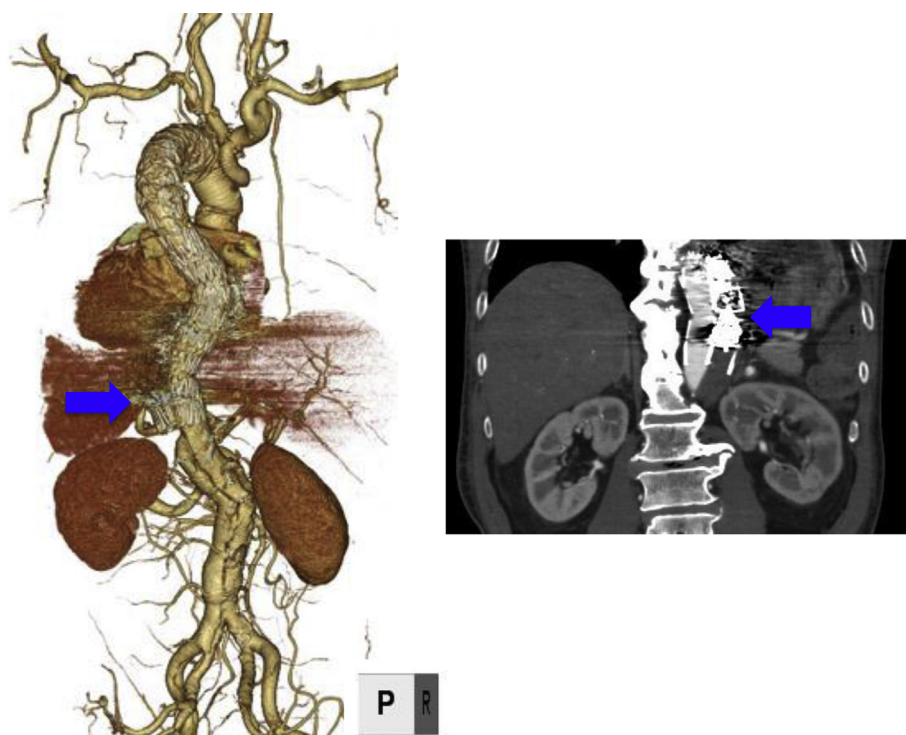


Figure 4. Computed tomography angiography after false lumen embolisation with the candy plug technique. The plug is indicated by a blue arrow.

which were challenging to embolise with endovascular therapy. Idrees and colleagues³ reported that endovascular embolisation of FL with covered stent devices is a safe and effective valuable adjunct to standard TEVAR for interrupting retrograde FL perfusion in patients with chronic dissection. Similarly, FL embolisation with the candy plug technique is a feasible endovascular method to achieve thoracic FL embolisation in chronic aortic dissection and is associated with low morbidity and mortality.^{4,5} In the current case, FL thrombosis was safely accomplished with the candy plug technique. This strategy expands options in patients with high risk for open repair.

CONFLICT OF INTEREST

None.

FUNDING

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