Successful Simultaneous Revascularization for Acute Limb Ischemia and Concomitant Acute Myocardial Infarction

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Acute limb ischemia (ALI) is associated with high morbidity and mortality rates, even with the advent of technical advances. Although myocardial infarction is one of the causes of ALI along with intraventricular thrombus formation and subsequent embolism, ALI with concomitant acute myocardial infarction (AMI) is extremely rare. Here, we report a complicated ALI case with concurrent AMI and prolonged limb ischemic duration. The cause may be attributed to thrombosis with atherosclerotic disease of the coronary and peripheral arteries triggered by dehydration. We successfully treated the patient using simultaneous revascularization in a hybrid operating room with the aid of intraoperative hemodialysis for preventing life-threatening reperfusion syndrome.

**Keywords:** acute limb ischemia, myocardial infarction, hemodialysis

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**Case Report**

A 73-year-old man with a medical history of untreated arteriosclerosis obliterans (ASO) in a previous hospital and with current smoking status presented with right leg cyanosis and rest pain. He was transferred to the emergency department of our hospital 7 h after symptom onset, showing both sensory and motor loss with a dropped foot. The Doppler auscultation of the dorsalis pedis artery was inaudible, and auscultation of the vein was barely audible. The electrocardiogram simultaneously showed a marked ST elevation in leads II, III, and aVf and a complete atrioventricular block pattern (Fig. 1), indicating concomitant AMI even though the patient had no recent chest symptoms. Blood test findings showed an elevated level of creatinine kinase (CK, 5714 U/L); CK-MB (835 U/L); %CK-MB (14.6%); aspartate aminotransferase (AST, 561 U/L); alanine aminotransferase (ALT, 171 U/L); lactate dehydrogenase (LDH, 1165 U/L); creatinine (Cr, 2.8 mg/dL); and urea nitrogen (UN, 34.9 mg/dL). Cardiac ultrasonography showed asynergy on the inferior wall
of the left ventricle without showing intraventricular thrombus formation. Computed tomography angiography (CTA) findings revealed the presence of an occluded external iliac artery extending to the proximal half of the superficial femoral artery and a patent deep femoral artery, while the tibial vessels were not depicted because of slow blood flow (Fig. 2).

In the context of the prolonged limb ischemic duration involving the considerable risk of reperfusion syndrome and concurrent AMI, immediate and simultaneous revascularization for both AMI and ALI and intraoperative hemodialysis were planned in the hybrid operating room. The angio suite system used was Artis Zeego (Siemens Healthcare, Forcheim, Germany). The door-to-hybrid operating room time was 90 min and the door-to-skin incision time was 120 min. Under local anesthesia, through a longitudinal groin incision, common, superficial, and deep femoral arteries were dissected. Simultaneously, the common femoral vein was dissected. Next, thrombectomy for the external iliac artery to common femoral artery (CFA) occlusion with a 5-Fr balloon (LeMaitre Vascular®, Burlington, MA, USA) via transverse arteriotomy of the CFA was performed, securing straight and direct blood flow from the iliac artery to the deep femoral artery (Fig. 3A). The arteriotomy was closed and hemodialysis was simultaneously initiated via a catheter inserted into the internal jugular vein. Even though residual iliac artery stenosis was detected, this lesion was not treated at that time for minimizing the cardiac ischemic time. Coronary intervention was then initiated by cardiologists. After temporary pacing wire placement in the right ventricle via the exposed femoral vein, coronary angiography (CAG) was performed through the ipsilateral CFA. CAG detected the total occlusion of the right coronary artery (RCA). Cath-

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**Fig. 1** Electrocardiogram on admission showing ST elevation in leads II, III, and aVF and complete atrioventricular block.

**Fig. 2** Preoperative computed tomography angiography (CTA) showing total occlusion of the external iliac artery (arrow) extending to the proximal half of the superficial femoral artery (bracket). The tibial arteries are not depicted because of poor tibial perfusion.
Acute Limb Ischemia with Myocardial Infarction

Acute Limb Ischemia with Myocardial Infarction

eter-directed thrombectomy for RCA occlusion showed
organic stenosis of the RCA, and balloon angioplasty with
subsequent stent placement was performed (Figs. 3B–3D).
The door-to-balloon time was 180 min. Balloon angioplasty
and subsequent stent deployment for the residual
stenosis of the external iliac artery were then performed. A
complete angiogram showed a residual superficial femoral
artery occlusion but detected sufficient blood flow to the
ischemic foot through the collateral arteries (Fig. 3E).

The patient’s postoperative course was uneventful.
Although he required temporary pacing for bradycardia
because of a first-degree atrioventricular block and tem-
porary hemodialysis, they were terminated on postopera-
tive day 2 after the patient regained normal sinus node
function and adequate renal function. His electrolyte level
was consistently within normal limits, while his serum CK
level rapidly decreased and was normalized by postopera-
tive day 5. He also regained his leg motor function with-
out dropped foot, and he was discharged with ambulatory
status on postoperative day 10. Postoperative blood tests
showed markedly decreased Cr and UN levels, 1.25 mg/dL
and 14.5 mg/dL, respectively, indicating underlying dehy-
dration. Patient consent was obtained for publishing this
report.

Discussion

ALI remains a significant cause of morbidity and mortal-
ity, with a 30-day amputation rate of 5%–12% and a
30-day mortality rate of 10%–38%.1,3,4) The etiology of
ALI is often an embolism from a cardiac source; for ex-
ample, thrombus formation in the left atrium due to atrial
fibrillation or in the left ventricle after a previous myocar-
dial infarction is common.1,2) The other mechanism is in
situ thrombosis, which is commonly observed in patients
with underlying ASO, as is noted in the present case.

Regarding thrombosis formation, the mechanisms in
ALI and AMI are similar; namely, acute thrombotic oc-
closure of an artery causes ischemia and, unless promptly
relieved, tissue death. Just as the onset of chest pain oc-
curs with AMI, ALI manifests as the acute onset of limb
pain, often with paresthesia, weakness, or paralysis.3,5) Theoretically, ALI and AMI may be caused by the same
reason; however, simultaneous occurrence is extremely
rare. In this case, preoperative blood tests showed no signs
of coagulopathy but did reveal the patient’s relatively de-
hydrated status, and this relatively higher viscosity caused
by dehydration may simultaneously predispose a patient
to thrombosis in diseased iliac and coronary arteries.

In this case, both the ALI and AMI required immediate
revascularization because they are associated with high
morbidity and mortality rates. For achieving an optimal
outcome, a hybrid operating room is the ideal setting
where both vascular surgeons and cardiologists can simulta-
nously collaborate. Regarding the ALI, because of the
prolonged ischemic time, the possibility of limb salvage
was marginal; the ALI grade was between category IIb
and III in the Rutherford Society for Vascular Surgery
ALI classification, and revascularization could lead to
life-threatening myonephropathic metabolic syndrome
(MNMS).6) The mortality rate of MNMS reportedly rang-
es from 30% to 80% because of the reentry of reperfusate
with its various metabolites into the systemic circulation
and subsequent multiple organ failure.7,8) Various meth-
ods have been studied for preventing MNMS, including
controlled reperfusion and intraoperative continuous
hemodialysis.1,8,9) The evidence of the efficacy of intraop-
erative hemodialysis is not sufficient, but it is reported to
be effective in maintaining a normal electrolyte balance,
rapidly reducing and normalizing serum CK levels, and removing various metabolites for preventing MNMS in a limited number of cases.8) In this case, we prevented fatal complications despite the prolonged limb ischemic duration with the help of hemodialysis.

We successfully treated a complicated ALI case with concurrent AMI without severe systemic complications with simultaneous and immediate revascularization in a hybrid operating room and intraoperative hemodialysis.

**Conclusion**

ALI with concurrent AMI is an extremely rare but challenging condition, as both ALI and AMI require immediate and adequate treatment, especially when the ischemic duration of ALI is prolonged. Simultaneous revascularization in a hybrid operating room combined with intraoperative hemodialysis enabled the achievement of the optimal outcome.

**Disclosure Statement**

The authors declare that they have no conflicts of interest to disclose.

**Author Contributions**

Study conception: KM
Data collection: KM
Writing: KM
Critical review and revision: all authors
Final approval of the article: all authors
Accountability for all aspects of the work: all authors

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