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A 64-year-old man experienced out-of-hospital cardiac arrest and achieved return of spontaneous circulation after automated external defibrillator use by bystanders. During transport, ventricular fibrillation recurred and persisted after hospital arrival, necessitating initiation of venoarterial extracorporeal membrane oxygenation (VA-ECMO). A 12-lead electrocardiogram after resuscitation suggested ST-elevation acute myocardial infarction. Computed tomography revealed traumatic subarachnoid hemorrhage and acute subdural hematoma in the right frontal region, multiple rib fractures, and liver injury. Coronary angiography demonstrated a 99% stenosis at the ostium of the left anterior descending artery (LAD #6). Because antithrombotic therapy was expected to exacerbate intracranial hemorrhage, neurological prognosis was initially uncertain, and emergent revascularization was deferred. VA-ECMO was managed without systemic anticoagulation, and no progression of intracranial bleeding was observed on Day 2, allowing low-dose heparin initiation. By Day 4, with stable intracranial findings, Impella CP was introduced. As the contralateral femoral artery was occupied by ECMO, percutaneous coronary intervention (PCI) was performed via single access through the Impella insertion sheath. Given concerns regarding hemorrhagic worsening with antiplatelet therapy, PCI was performed using heparin alone, avoiding stent implantation. Directional coronary atherectomy followed by plain balloon angioplasty was performed for the ostial LAD lesion. Hemodynamic stability was maintained with Impella CP, enabling VA-ECMO removal, and Impella was successfully weaned the following day. No progression of traumatic or intracranial bleeding occurred thereafter. Prasugrel was initiated on Day 6 and aspirin on Day 11, followed by definitive stent implantation from the left main trunk to the LAD on Day 20. The patient experienced no thrombotic complications and was discharged home. This case illustrates that directional coronary atherectomy can facilitate acute-phase management with minimal antithrombotic therapy in patients with severe LAD stenosis complicated by traumatic intracranial hemorrhage, leading to a favorable outcome.