

# Ischemic Stroke as a Manifestation of Cholesterol Embolization Syndrome Following Percutaneous Coronary Intervention

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## INTRODUCTION

Cholesterol embolization syndrome refers to embolization of the contents of an atherosclerotic plaque (primarily cholesterol crystals) from a proximal large-caliber artery to distal arteries causing an end-organ damage by mechanical plugging and inflammatory response.<sup>1</sup> CES is more commonly precipitated by invasive vascular procedure.<sup>2</sup> It is important to recognize the disease as it has a very high mortality and morbidity.<sup>3</sup> The clinical spectrum of CES ranges from asymptomatic or incidental findings to a fulminant presentation with multiorgan ischemia and failure.<sup>4</sup> The following case report is an example where a patient developed ischemic stroke in addition to cutaneous manifestations and acute kidney injury following PCI for acute ST-elevation myocardial infarction (STEMI).

## ABSTRACT

Cholesterol embolization syndrome (CES) is one of the major, yet under-diagnosed cause of morbidity and mortality following invasive coronary interventions. The major risk factors are elderly, male, atherosclerotic disease, anticoagulation and femoral access route. This multisystem disease affects skin, kidney, brain, eye and gastrointestinal tract. Only few cases of cholesterol embolization syndrome manifesting as an ischemic stroke are reported. We present a case of an elderly man, admitted to our ICU after percutaneous coronary intervention (PCI) who developed neurological deficits along with skin changes and renal failure. Cholesterol embolization syndrome was suspected based upon the presence of cardiovascular risk factors, invasive cardiovascular intervention and clinical signs. The diagnosis of ischemic stroke made through plain MRI brain, revealed multiple areas of lacunar infarcts. He was treated with intermittent hemodialysis, statins and anti-platelet agents. On follow up, skin lesions and renal functions were improved; but slurring of speech and paresis persisted.

## KEY WORDS

*Cholesterol embolization syndrome, Ischemic stroke, Percutaneous coronary intervention*

## CASE REPORT

A 70 year old hypertensive, ex-smoker presented to the emergency department with complaints of sudden onset chest pain. His heart rate was 110/min and blood pressure were 100/70 mmHg. Electrocardiogram showed sinus rhythm with ST-segment elevation over leads V1-V4. Echocardiography revealed hypokinesia of anterior wall with left ventricular ejection fraction of 40% and absence of thrombi in any cardiac chambers. His preprocedural serum creatinine and total leukocyte counts were within the normal range. Coronary angiography revealed severe occlusion of right circumflex artery (RCX) for which a drug eluting stent was inserted via right femoral arterial approach within 30 minutes. The total amount of contrast used for the whole procedure was less than 100 ml. The final angiography showed TIMI 3 flow (Thrombolysis in Myocardial Infarction).

The post procedural course was uneventful. But from the 4<sup>th</sup> day, his condition started to deteriorate with decrease in urinary output and creatinine reaching 4.5 mg/dl in a few days' time requiring dialysis and respiratory distress requiring intubation. Clinically, we noticed bluish discoloration of his toes bilaterally with palpable arterial pulses and normal arterial Doppler. Echocardiography also revealed no new findings. Hematological report was normal except for significant eosinophilia (12%). Peripheral blood smear showed normochromia and normocytosis. Rheumatologic markers were all negative, including ANA, anti-CCP, and ANCA. Serum complement levels (C3, C4) were normal. Urinalysis and retinal examination were normal. He could be extubated after 3 days when his condition improved after which slurring of speech and paresis of left side of the body (Power 3/5) was detected. He was oriented and obeying commands. An immediate MRI brain revealed infarction in posterolateral aspect of right parieto-occipital lobe with features of hemorrhagic transformation and multiple lacunar infarctions.

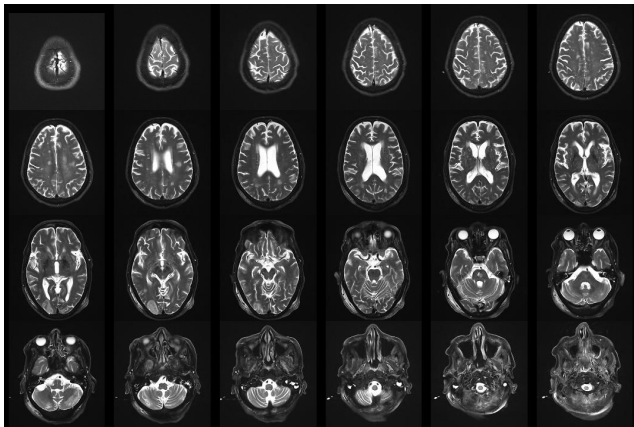


Figure 1. MRI of the patient

The patient was discharged a week later with intermittent hemodialysis twice weekly and rehabilitation. On follow up, skin lesions and renal functions were improved but slurring of speech and paresis of left side of the body were persisting.

A diagnosis of probable CES was made based upon the presence of cardiovascular risk factors, recent coronary intervention, clinical signs and the laboratory reports.

## DISCUSSION

CES is characterized by distal showering of cholesterol crystals from aortic atheromatous plaques. Due to its

predisposition to more severe atherosclerosis, the aorta is the most frequent source of atheroemboli. Procedures involving mechanical injury by catheters could potentially disrupt plaque material and induce CES. The incidence of CES after coronary interventions is 1.4%.<sup>5</sup> CES predominantly affects elderly men with multiple atherosclerotic risk factors such as hypertension, hypercholesterolemia, diabetes mellitus and smoking.<sup>3</sup> Femoral approach of coronary interventions may be associated with a higher risk of CES than the brachial approach.<sup>6</sup> CES can affect any organ depending upon the location of plaque rupture. Cholesterol emboli originating in the descending thoracic and abdominal aorta may lead to renal failure, gut ischemia, and skin manifestations (Livedo reticularis, Blue-toe syndrome). Cholesterol emboli originating in the ascending aorta may in addition cause neurological damage.<sup>1</sup> Cholesterol emboli are often large enough to occlude the penetrating arterioles of the cerebral cortex.<sup>7</sup>

The classic triad of antecedent vascular procedure, acute kidney injury and livedo reticularis is considered sufficient for clinical diagnosis.<sup>5</sup> Biopsy of any target organ such as kidney or skin could also be obtained for histopathological confirmation.<sup>3</sup> Elevation of serum creatinine and proteinuria are the main laboratory findings. In the present case, serum creatinine level increased progressively but with supportive care, did not reach end-stage renal disease. Leukocytosis, a rise in erythrocyte sedimentation rate and C-reactive protein and a decrease in serum complement level may be seen in laboratory tests. Hypereosinophilia has been reported in up to 80% of the patients with CES and its proportion may vary from 6% to 18% of the total leukocyte count.<sup>8</sup> It was also present in our case. Brain imaging reveals small ischemic lesions and border zone infarct when CNS is involved.<sup>9</sup> Transcranial Doppler (TCD) ultrasonography detects microemboli as high intensity transient signals superimposed on standard spectral Doppler flow velocity tracings in the cerebral circulation but cannot distinguish cholesterol from other cerebral microemboli.<sup>1,10</sup>

Cholesterol embolization syndrome is still an underdiagnosed entity. It is an iatrogenic, periprocedural complication of cardiac catheterization. The findings can range from skin and renal complications to neurological manifestations like stroke. High clinical suspicion is necessary for the timely diagnosis and management of the disease. A working protocol for the management of CES should be established by the centers providing cardiac catheterization services.

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