CARDIOLOGIE TUNISIENNE

CASE REPORT

Contrast-Induced Encephalopathy: A Clinical Puzzle

Encéphalopathie induite au produit de contraste : un puzzle clinique

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Summary

Contrast-induced encephalopathy (CIE) is a rare complication associated with arterial administration of iodinated contrast agents during percutaneous coronary intervention. It is mostly a benign phenomenon but with a large spectrum of symptoms miming severe neurological events such as motor and sensory deficit or transient cortical blindness. The exact underlying mechanism is not well understood. Radiological signs such as cerebral edema and cortical enhancement are useful for the diagnosis, but imaging may be without specific abnormalities. Prognosis is excellent with supportive management only.

We report 3 cases of patients with a typical presentation of contrast-induced encephalopathy following coronary angiography. All the three patients identified have recovered without any neurological deficit.

Those cases highlight that CIE may not always present with the typical radiological described signs. CIE is a diagnosis of exclusion and is a clinical entity to consider in the differential diagnosis of stroke following cardiac catheterization.

Keywords

complications of cardiac catheterization; contrast-induced encephalopathy; iodine neurotoxicity; stroke.

Résumé

L'encéphalopathie induite par les produits de contraste (EIPC) est une complication rare associée à l'administration artérielle de produits de contraste iodés lors d'une intervention coronaire percutanée. Il s'agit généralement d'un phénomène bénin, mais présentant un large spectre de symptômes simulant des événements neurologiques graves, tels qu'un déficit moteur et sensoriel ou une cécité corticale transitoire. Le mécanisme sous-jacent exact n'est pas bien compris. Les signes radiologiques, tels que l'œdème cérébral et le rehaussement cortical, sont utiles pour le diagnostic, mais l'imagerie peut ne présenter aucune anomalie spécifique. Le pronostic est excellent avec une prise en charge uniquement symptomatique. Nous rapportons 3 cas de patients présentant une présentation typique d'encéphalopathie induite par les produits de contraste suite à une coronarographie. Les trois patients identifiés se sont rétablis sans aucun déficit neurologique.

Ces cas soulignent que l'EIPC ne se manifeste pas toujours par les signes radiologiques typiques décrits. L'EIPC est un diagnostic d'exclusion et constitue une entité clinique à prendre en compte dans le diagnostic différentiel de l'accident vasculaire cérébral (AVC) faisant suite à un cathétérisme cardiaque.

Mots-clés

Complications du cathétérisme cardiaque, Encéphalopathie induite par les produits de contraste, Neurotoxicité iodée, Accident vasculaire cérébral

Correspondance

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INTRODUCTION

Contrast-induced encephalopathy (CIE) is a rare complication associated with arterial administration of iodinated contrast agents during angiography and vascular interventions such as percutaneous coronary intervention. It is mostly a benign phenomenon but with multiple clinical expressions that may mimic. Mostly, the outcomes are good with supportive management only. The blood–brain barrier disruption by the neurotoxic effect of contrast media is the most incriminated mechanism. However, the exact underlying mechanism is still not well-understood [1].

We present three cases of patients with a typical presentation of CIE.

CASE 1

We report the case of a 63-year-old patient with a history of hypertension and dyslipidemia who presented with non-ST-elevation myocardial infarction. He was on dual antiplatelet therapy in addition to heparin, β-blockers, ACE inhibitors, and statin therapy.

A coronary angiography (CAG) was performed using the right radial artery approach and revealed severe three-vessel disease. With those findings, the operator decided to opt for surgical revascularization.

The CAG was uneventful. The total administrated amount of a low-osmolar nonionic iodinated contrast agent (Omnipaque 300: Iohexol) was 70 mL. The patient also had the standard 2,500 IU heparin intra-arterially during CAG.

Six hours later, the patient became rapidly drowsy, confused, and disorientated. The vital signs were satisfactory, as were serum glucose, ECG, and neurological examination. The cranial nerve and the sensory evaluation were normal.

He had preserved limbs' movement and tone. The coordination was not affected.

Cerebral computed tomography (CT) scanning without additional contrast performed within 30 min of symptoms onset didn't show any lesion (Figure1).

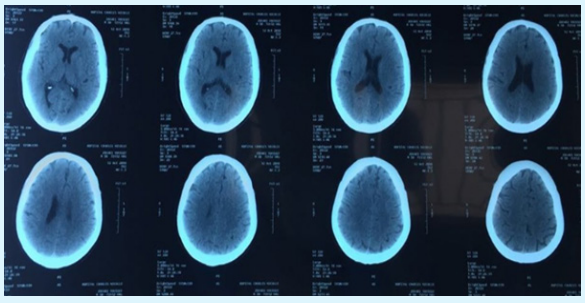

Figure 1. Cerebral non-enhanced computed tomography performed shortly after the onset of symptoms without abnormalities.

Because there was no objective evidence to suggest an evolving stroke and based on a low National Institutes of Health Stroke Scale (NIHSS) score, the patient was only under supportive therapy in the form of intravenous fluids (normal saline), close observation, in addition to his conventional secondary prevention therapy.

After 12 hours, the symptoms resolved and, he recovered completely without any neurological deficit or cardiac complication. Transient cerebral ischemia appeared unlikely given the non-localizing neurological symptom complex. Contrast-induced encephalopathy (CIE) was the most likely diagnosis.

CASE 2

A 65-year-old man with a history of diabetes mellitus, hypertension, dyslipidemia, and acute ischemic stroke in 2018 without sequels, was admitted for non-elective CAG following inferior and basal STE-ACS.

The patient had coronary angiography via the right radial artery using a 5-French sheath and 5-French catheters. The left coronary system showed a mild coronary disease. The right coronary artery was very difficult to engage and therefore required more contrast than the usual dose for routine diagnostic coronary angiography, and it was occluded. A total of 120 mL of iohexol (Omnipaque 300), a low-osmolar nonionic iodinated contrast agent, was administered during the procedure. The recanalization of the occlusion failed.

Post-procedure, the patient became confused and aggressive, expressing verbal profanities. The neurological evaluation was satisfying, as were the vital signs, EKG, and renal function. A non-contrast cerebral CT showed a slight enhancement of the venous sinuses, and high-intensity areas in the cortex, without intracranial bleeding. (Figure 2)

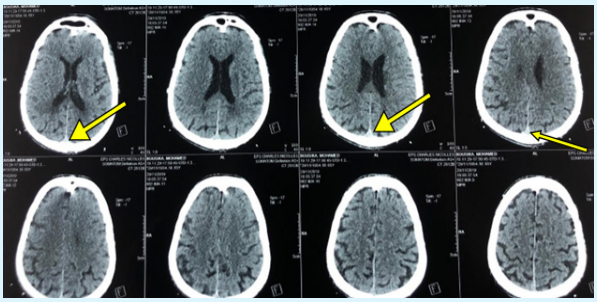

Figure 2. Cerebral non-enhanced computed tomography performed shortly after the onset of symptoms showed a slight enhancement of the venous sinuses and high-intensity areas in the cortex, however, was otherwise normal.

After two days with supportive management, he recovered spontaneously with no confusion or residual neurological deficits.

However, 24 hours later, the patient presented with a nephrotoxic-induced acute tubular necrosis (ATN). Treated with hydration, he recovered after seven days.

CASE 3

A 55-year-old male patient with no relevant previous medical history was admitted to our hospital, complaining of typical chest pain for four hours. Electrocardiography on admission showed a left bundle branch block. We transferred the patient to the catheterization lab. His angiography showed a 90% obstruction on the proximal part of the left anterior descending artery (LAD) with a TIMI 3 flow. During the procedure, the patient received a total of 100 mL of iohexol.

Within one hour, the patient became confused. A cerebral CT scan revealed extravascular localized contrast media in the sagittal sinus. (Figure 3)

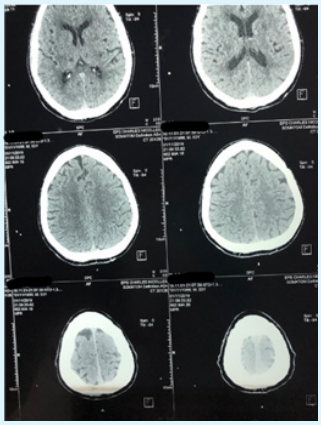

Figure 3. Contrast agent in superior sagittal sinus.

After 12 hours, he recovered completely without any neurologic deficits under supportive medications and adequate hydration.

DISCUSSION

CIE is a reversible neurological complication associated with intra-arterial administration of contrast media. [2] It is a rare complication of coronary angiography and offers an initial diagnostic challenge due to its close resemblance to acute stroke, a dreaded complication of the same procedure. [1]

CIE was first reported in 1970, manifesting as transient cortical blindness following CAG. Its incidence was 0.06% following diagnostic cardiac catheterization. [3]

Direct neurotoxicity to the cerebral cortex by iodinated contrast medium with disruption of the blood-brain barrier and direct neuronal toxicity and contrast-induced transient vasoconstriction are involved in the pathophysiological mechanism behind CIE. [2, 4]

Transient cortical blindness is the most prevalent manifestation of CIE, reported in half of all described cases. The clinical presentation of this syndrome is highly variable. It ranges from subtle symptoms such as headache to more alarming features such as confusion, convulsions, coma, or unresponsiveness. [2] It is noteworthy that CIE mimicked an ischemic or hemorrhagic stroke. [5]

Symptoms typically appear 2- 12 hours after contrast administration and resolve completely within 24–72 hours [4]. However, recovery may take a more prolonged course. The prognosis of most CIE is generally favorable. There were Only rare cases with persistent deficits. Notably, there were 8 cases of autopsy-proven fatal cerebral edema due to contrast neurotoxicity in the early stage of angiography, and 5 of these patients underwent cardiac angiography. [6]

Cortical or subcortical contrast enhancement, hemispheric contrast staining of the cortical sulci, and hyperdensity of the subarachnoid space attributable to iodinated contrast extravasation are typical findings on non-enhanced CT study performed soon after presentation. The lesion density on the Hounsfield scale is a useful characteristic distinguishing subarachnoid hemorrhage from contrast extravasation. Blood density ranges between 40 and 60 Hounsfield units [HU]. Contrast media have higher attenuation values than blood. [4] Characteristic brain MRI findings consist of hyperintense signals on T2, DWI, and FLAIR modalities in the affected regions. Moreover, in acute ischemic or hemorrhagic stroke, abnormalities remain on follow-up imaging, whereas they resolve by 25 hours in most cases. (Table 1)

Tableau 2. Major differences between embolic/hemorrhagic stroke and chemotoxic injury of CIE

	Embolic/ Hemorrhagic injury	Chemotoxic injury
Symptoms	Limb weakness, headache, vertigo, sudden decrease of the level of consciousness	Headache, visual disturbance, coma or unresponsiveness, confusion, seizures, loss of coordination
Visual disturbance	Monocular or binocular visual loss Visual field defects, diplopia	Cortical blindness
Weakness	Hemiparesis, monoparesis or rarely quadriparesis, Facial droop	Hemiparesis
Speech	Aphasia, dysarthria	aphasia
Risk factors	HTN, DM, Hypercholesterolemia, smoking, history of CAD, CABG or FA	HTN, male gender, TIA, impaired cerebral autoregulation and impaired renal function
Course	Less benign	Benign course
CT/ MRI	Ischemic changes (artery occlusion) or haemorrhage	Cerebral oedema, enhancement in the cortical, subarachnoid or striatal spaces
Management	Acute stroke management, for example thrombolysis, conservative, interventional	Supportive treatment Anticonvulsants

In some cases, as in our first patient, the imaging may be without specific abnormalities.

Risk factors may include hypertension, diabetes mellitus, renal impairment, the administration of large volumes of iodinated contrast, percutaneous coronary intervention, as well as a previous adverse reaction to iodinated contrast. [7]

Hyper-osmolality, especially with older high osmolar contrast agents, is hypothesized to cause endothelial cell shrinkage and open tight junctions. However, it is not a requirement to induce blood-brain barrier disruption. Although non-ionic agents are far less neurotoxic, CIE was associated with iodixanol, a non-ionic dimer with osmolality equivalent to plasma. [8]

CIE is hard to predict and may occur during catheterization procedures in patients with no particular predispositions, such as our third case.

The rare occurrence of severe contrast-induced complications renders their prevention very difficult. Further studies are needed to define the risk factors and the mechanism of the iodinated contrast agent neurotoxicity. Adhering to appropriate pre-assessment checks in making sure patients' renal function is optimized, keeping them well hydrated, and being conscious about the amount of injected contrast medium, all reduce the risk. [1]

There was no specific treatment because of the transient and rare nature of this complication. The mainstay in the management of CIE is supportive treatment with intravenous hydration and anticonvulsants for seizure control. In sporadic patients with renal insufficiency on dialysis who develop CIE, hemodialysis has proven beneficial. [1] Intravenous dexamethasone, mannitol [1,7], and continuous blood purification were usable for critical CIE cases.

We diagnosed contrast-induced encephalopathy in our three cases after coronary angiography. The symptoms started within few hours after the percutaneous intervention and resolved spontaneously. Investigations did not show any other etiologies or contributing causes for confusion, such as metabolic abnormalities and drugs. Spontaneous recovery of the patients' clinical status by only supportive medications and radiographic investigations showed that the encephalopathy had been a toxic reaction to the contrast agent.

CONCLUSION

CIE is a diagnosis of exclusion and clinical entity to consider in the differential diagnosis of stroke following cardiac catheterization.

Its scarcity makes it a challenging diagnosis. Our review demonstrates that CIE occurs with modern lowest osmolality (iso-) osmolar agents and can affect patients with no particular predispositions. Doctors using contrast media should be aware of this complication.

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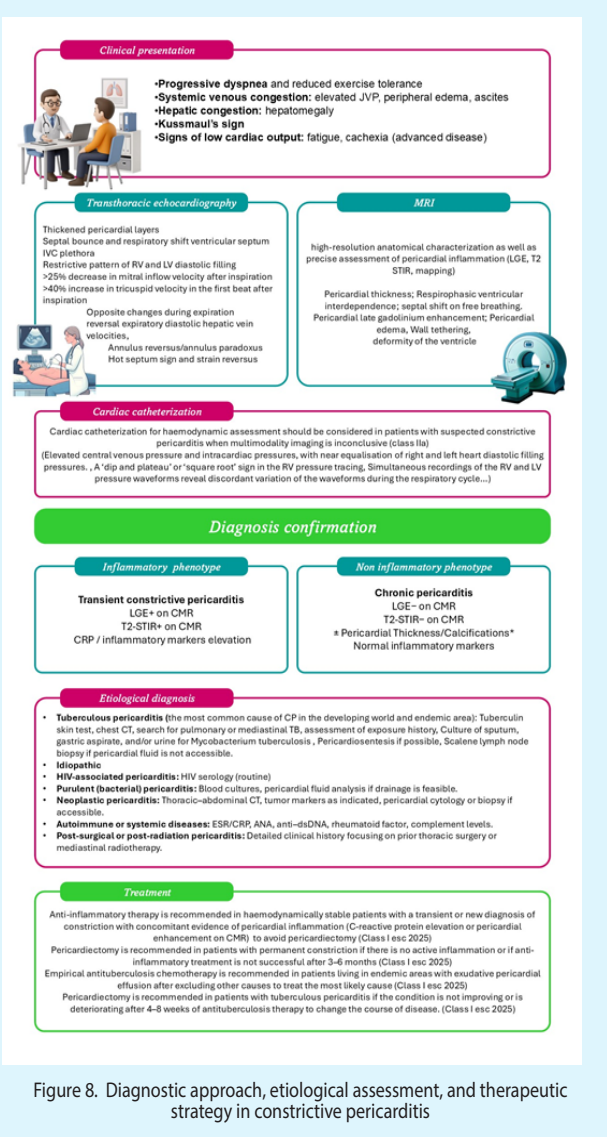

Figure 8. Diagnostic approach, etiological assessment, and therapeutic strategy in constrictive pericarditis