Contrast-induced encephalopathy with acute stroke symptomatic: a case report

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European Journal of Medical Case Reports
Volume 7(10):01–04
https://doi.org/10.24911/ejmcr/173-1685732612

ABSTRACT

Background: Contrast-induced encephalopathy (CIE) is an infrequent complication of contrast media administration. It is usually transient but occasionally leads to permanent neurological deficits and death.

Case Presentation: We report here a case of nonionic iodized CIE after an urgent coronary angiography, in a 62-year-old woman who developed symptoms of acute stroke. Although diagnostic challenge and under not specific but supportive therapy the symptoms resolved completely within 72 hours without further complications.

Conclusion: CIE is a rare entity whose frequency is dependent on the increasing use of diagnostic/interventional procedures with contrast media. The exclusion of more common complications of such procedures should be prompt. The clinical scenario is challenging and should be considered, in particular in high-risk patients. The course is generally benign and requires supportive therapy.

Keywords: Contrast-induced encephalopathy, case report, complication, iodine-contrast, coronary angiography, stroke.

Received: 02 June 2023 **Accepted:** 29 March 2024 **Type of Article:** CASE REPORT **Specialty:** Intensive Care Medicine

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Background

Contrast-induced encephalopathy (CIE) is a rare but potentially lethal form of neurotoxicity after intravenous or intra-arterial exposure to ionic and nonionic iodized contrast [1]. The potential extent of the issue is enormous: it has been estimated that over 100 million procedures with iodine-based contrast media are performed yearly [2]. The clinical manifestations range from transient low-grade symptoms, such as headache, nausea and vomiting, and memory loss, to more severe sequelae [1], such as hemiparesis, psychiatric disorders, epilepsy, and coma [3]. The time between contrast injection and clinical manifestation ranges from some minutes to several hours [4], mostly resolving spontaneously within 72h hours. Occasionally, permanent neurological deficits and death due to cerebral edema have been described [5]. Since the symptoms are unspecific and thromboembolic events are by far the most common complication, imaging is an important diagnostic tool: the evidence of brain edema, cortical enhancement and hyperdensity in the subarachnoid space are typical findings of CIE. Associated co-morbidities include chronic hypertension, kidney failure, diabetes mellitus, intracranial diseases, and previous reactions to contrast media [6]; moreover, high contrast load represents an independent risk factor [7]. Interestingly while the male sex is more prone to CIE following coronary angiography (CAG) [8], the prognosis is worse in female patients [5]. The pathophysiology of CIE is not completely understood and involves both leakage of the agent into the brain and a direct toxic effect on the vascular endothelium [9]. To date, around 80 cases of CIE after CAG have been reported in the literature [8].

We describe here a case of CIE in a 62-year-old female patient.

Case Presentation

The 62-year-old female patient was admitted to our hospital with atypical and recurrent angina pectoris. The patient had a medical history of dyslipidemia and hypertension, smoking, and familiarity with cardiovascular events. The clinical examination was unremarkable: she was afebrile, HR was 65 bpm, Blood pressure (BP) was 130/70 mmHg, and respiratory rate (RR) was 12/minute. Troponin elevation (358 ng/ml) and ECG findings were suggestive of non-ST segment elevation myocardial infarction (ST-segment depression in anterolateral leads V2-V6, max. 1.5 mm). A primary CAG was performed via

a radial artery access. A standard dose of 5,000 IE heparin was administered. The CAG revealed stenosis of the left circumflex coronary artery as a culprit lesion, which was successfully stented.

During the procedure, 190 ml of the iodinated nonionic low osmolality contrast agent Iomeprol® (Iomeron 350, Bracco Österreich GmbH) was administered. This was the patient's first exposure to a contrast medium. Iomeprol® has rapid distribution and a slow elimination phase (half-lives 0.5 hours). At the end of the procedure, a short temporary loss of consciousness (10 seconds) was observed, spontaneous recovery was then followed by a transient left-sided neglect. To rule out a thombo-embolic event an emergency brain computed tomography scan with contrast was performed, which showed no acute pathological findings. The patient was seen by a neurologist, who found no evidence of a cerebrovascular event. The patient was admitted to the intermediate care station for close observation. Headache persisted but no focal neurology could be detected national institutes of health stroke scale (NIHSS 0). After 2 hours, she developed a sudden qualitative and quantitative consciousness disorder (disorientation and somnolence, Glasgow Coma scale of 13 points). The neurological examination revealed a hemineglect and a motorial hemisyndome on the left side with a decrease in the upper and lower extremity motor strength (M4/5), a minor facial paresis, and an anomic aphasia NIHSS 8 points. The clinical examination showed a rise in BP to a maximum of 185/85 mmHg with a pulse rate of 100 bpm and an RR of 20/minute. Temperature was 37.9°C. BP management was performed with intravenous urapidil and oral ACE inhibitors. A brain CT scan was immediately repeated, showing cortical asymmetry and a right hemispherical diffuse edema. In addition, the outer liquor spaces on the right side appeared to increase in density due to diffuse contrast medium in the cerebro-spinal flow, as a possible consequence of the blood–brain barrier disruption (Figure 1). The perfusion analysis on the acquired images showed again no sign of local ischemia (Figure 2). Due to temperature rise and initial C-reactive protein value of 9 mg/dl, empiric antimicrobial treatment with Cephtriaxon and Acyclovir was started. Since the patient was on dual antiplatelet therapy, a cerebrospinal fluid analysis was not performed.

Over the following 24 hours the clinical pattern improved to a complete recovery. On the next day, a brain magnetic resonance imaging (MRI) showed a regression of the morphological abnormalities (Figure 3) but confirmed the presence of chronic microangiopathy. Empiric antimicrobial treatment was stopped after the patient fully recovered. The initial CT scan findings, the clinical course, consistent with a complete recovery in less than 24 hours, together with the resolution of the cerebral imaging, confirmed the diagnosis of CIE. After 2 days the patient was discharged home without symptoms.

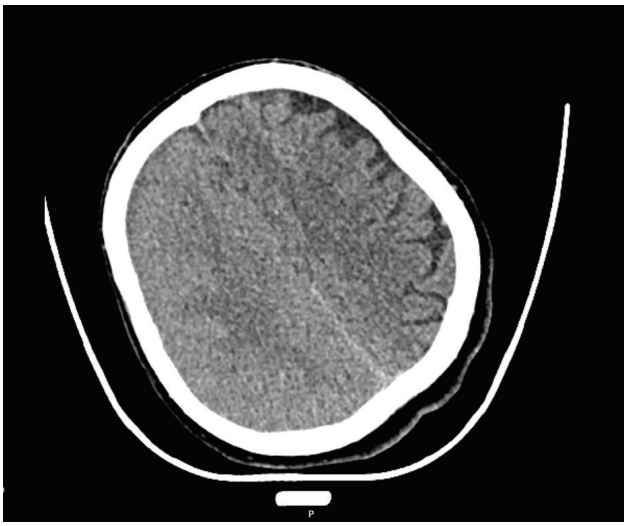

Figure 1. *CT without contrast media.*

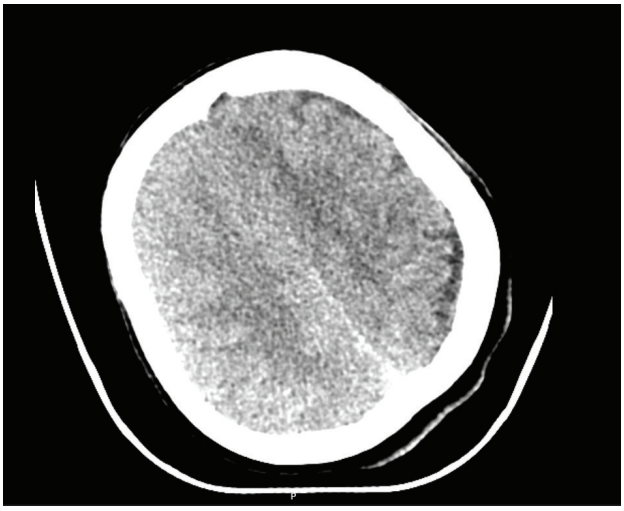

Figure 2. *CT-perfusion.*

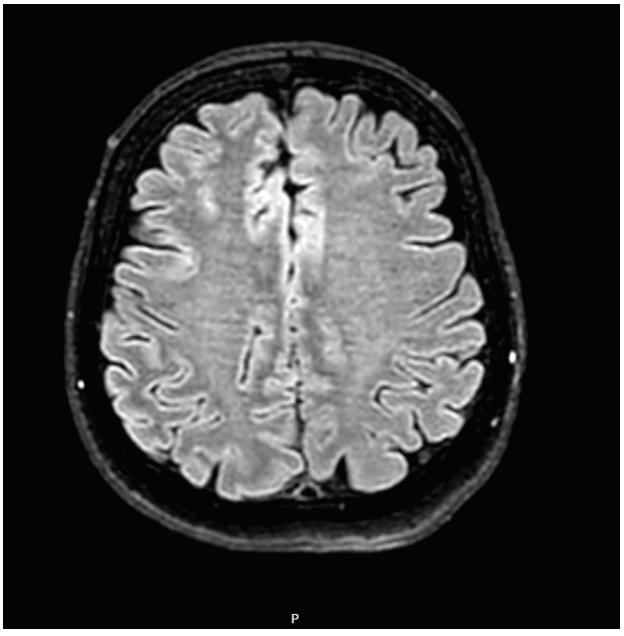

Figure 3. *MRI flair sequence.*

Discussion

CIE is a relatively rare clinical scenario; the recent literature estimates its frequency varying from 0.3% to 4% depending on the contrast media osmolarity [4]. The exact mechanism of toxicity remains mostly unexplained, whereas it seems reasonable the coexistence of a double effect of contrast media upon the endothelial cells: first, the hyperosmolarity modifies their structure disrupting the tight junctions, second, the inhibition of nitric oxide production causes vasoconstriction, relative peripheral ischemia, and endothelium damage. The net effect is the penetration of contrast media into the central nervous system (CNS) worsening the osmotic imbalance resulting in brain edema and local hypo/hyperexcitation [9]. In our patient, the disruption of the blood–brain barrier induced a contrast medium extravasation in the CNS.

As previously described, the most significant risk factors are hypertension, diabetes, chronic kidney disease, or previous cerebral and vascular events [5]. Chronic and overall uncontrolled hypertension is a known cause of micro and macrovascular dysregulation, which could amplify the contrast media toxicity [10]. Furthermore, *in vitro* data suggest that the consequence of chronic and accelerated vascular aging increases the adverse effect of contrast media over the glial and neuronal tissue [9].

CIE may overlap with posterior reversible encephalopathy syndrome (PRES), associated with an arterial hypertensive episode; like PRES, CIE is mostly a transient phenomenon with a favorable outcome [6]. Typically, PRES-associated radiographic findings include bilateral regions of subcortical vasogenic edema that resolve within days or weeks [11]. The posterior brain regions can be particularly susceptible to hyperperfusion because little sympathetic innervation exists in the posterior fossa [9].

CIE also most commonly affects the parieto-occipital cortex. It is believed that this is due to the posterior circulation being more sensitive to BP changes and at increased susceptibility to damage due to less vascular autoregulation [12]. Our patient had a unilateral hemispheric cerebral involvement, which is uncommon: the cause remains unexplained. We speculate that the damaged areas may have been more sensitive to contrast media, due to hypertension-induced chronic microangiopathy.

Given the localization of the brain edema PRES and CIE overlapping syndrome seems to be unlikely in this case.

Our patient developed symptoms in two stages: initially, the loss of consciousness with complete recovery followed after 2 hours by the overt stroke symptomatic. Remarkably, we have administered contrast media three times in a short time range (during angiographic procedures and during the 2 CT scans within 5 hours from the first symptomatic). As previously described, the longer the circulation time of contrast media, the larger are the detrimental effect due to accumulation. Due to the heterogeneity of the clinical presentation and the broad differential diagnosis, neuroimaging has a crucial role in the diagnosis of CIE while excluding other more frequent causes, such as cerebral ischemia, hemorrhage, and PRES. Nevertheless, the effect of repeated contrast media administration may have worsened the symptoms in our patient. To avoid the cumulative contrast load, the execution of an early MRI can be encouraged.

Conclusion

CIE is a rare entity whose frequency is dependent on the increasing use of diagnostic/interventional procedures with contrast media. The exclusion of more common complications of such procedures, should be prompt. The clinical scenario is challenging and should be considered, in particular in high-risk patients. The course is generally benign and requires supportive therapy.

What is new?

The CIE is a not well-known clinical entity, which could follow the intravascular administration of iodine-based contrast media. Specifically, after CAG less than 100 cases till now have been reported, whose treatment and prognosis were various. This case is the first described in Switzerland and reported, even after repeated administration of contrast media, a good prognosis without specific treatment.

List of Abbreviations

BP	Blood pressure
CAG	Coronary angiography
CIE	Contrast induced encephalopathy
CNS	Central nervous system
MRI	Magnetic resonance imaging.
NIHSS	National institutes of health stroke scale
PRES	Posterior reversible encephalopathy syndrome
RR	Respiratory rate

Conflicts of interest

The authors declare that they have no conflict of interest regarding the publication of this case report.

Funding

None.

Consent for publication

Written informed consent was obtained from the patient.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

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References

1. Zhao W, Zhang J, Song Y, Sun L, Zheng M, Yin H, et al. Irreversible fatal contrast-induced encephalopathy: a case report. BMC Neurol. 2019 Mar;19(1):46. https://doi.org/10.1186/s12883-019-1279-5
2. Bruen R, Stirling A, Ryan M, Sheehan M, MacMahon P. Shelling the myth: allergies to iodine containing substances and risk of reaction to Iodinated contrast media. Emerg Radiol. 2022 Feb;29(1):67–73. https://doi.org/10.1007/s10140-021-01989-0
3. Dattani A, Au L, Tay KH, Davey P. Contrast-induced encephalopathy following coronary angiography with no radiological features: a case report and literature review. Cardiology. 2018;139(3):197–201. https://doi.org/10.1159/000486636
4. Zevallos CB, Dandapat S, Ansari S, Farooqui M, Quispe-Orozco D, Mendez-Ruiz A, et al. Clinical and imaging features of contrast-induced neurotoxicity after neurointerventional surgery. World Neurosurg. 2020 Oct;142:e316–24. https://doi.org/10.1016/j.wneu.2020.06.218
5. Zhang Y, Zhang J, Yuan S, Shu H. Contrast-induced encephalopathy and permanent neurological deficit following cerebral angiography: a case report and review of the literature. Front Cell Neurosci. 2023 Jan;16:1070357. https://doi.org/10.3389/fncel.2022.1070357
6. Liu MR, Jiang H, Li XL, Yang P. Case report and literature review on low-osmolar, non-ionic iodine-based contrast-induced encephalopathy. Clin Interv Aging. 2020 Dec;15:2277–89. https://doi.org/10.2147/CIA.S280931
7. Hrdlicka CM, Wang J, Selim M. Neurological complications of cardiac procedures. Semin Neurol. 2021 Aug;41(4):398–410. https://doi.org/10.1055/s-0041-1728761
8. Theetha Kariyanna P, Aurora L, Jayarangaiah A, Das S, Gonzalez JC, Hegde S, et al. Neurotoxicity associated with radiological contrast agents used during coronary angiography: a systematic review. Am J Med Case Rep. 2020;8(2):60–6. https://doi.org/10.12691/ajmcr-8-2-6
9. Zhang G. The role of blood-brain barrier damage in the pathogenesis of contrast-induced encephalopathy. Arch Gen Intern Med. 2018;2(2):34–40. Available via https://www.alliedacademies.org/articles/the-role-of-blood-brain-barrier-damage-in-the-pathogenesis-of-contrastinduced-encephalopathy-9960.html
10. Andone S, Balasa R, Barcutean L, Bajko Z, Ion V, Motataianu A, et al. Contrast medium-induced encephalopathy after coronary angiography- case report. J Crit Care Med (Targu Mures). 2021 May;7(2):145–9. https://doi.org/10.2478/jccm-2021-0010
11. Fugate JE, Rabinstein AA. Posterior reversible encephalopathy syndrome: clinical and radiological manifestations, pathophysiology, and outstanding questions. Lancet Neurol. 2015 Sep;14(9):914–25. https://doi.org/10.1016/S1474-4422(15)00111-8
12. Guimaraens L, Vivas E, Fonnegra A, Sola T, Soler L, Balaguer E, et al. Transient encephalopathy from angiographic contrast: a rare complication in neurointerventional procedures. Cardiovasc Intervent Radiol. 2010 Apr;33(2):383–8. https://doi.org/10.1007/s00270-009-9609-4

Summary of the case

1	**Patient (gender, age)**	Female, 62 years
2	**Final diagnosis**	Contrast induced encephylopathy
3	**Symptoms**	Loss of consciousness, left-side neglect, motorial hemisyndrome, ammonic aphasia
4	**Medications**	Cephtriaxone, acyclovir
5	**Clinical procedure**	Coronary angiography
6	**Specialty**	Neurology, cardiology, intensive care medicine, internal medicine