Introduction

Contrast-induced encephalopathy (CIEP) is a rare complication after endovascular therapy. The precise etiological mechanisms via which this occurs is still a matter of debate. Nevertheless, osmotic disruption of the blood-brain barrier (BBB) arising from repeated contrast injections into a single vessel has been speculated as a cause of this complication. Chronic hypertension, transient ischemia attack, compromised cerebral autoregulation, renal failure, enormous contrast volumes, selective vertebralbasilar arteriography (VAG) and male gender have been implicated as predisposing factors of CIEP. The symtomatology of CIEP often commence during the procedure but become apparent few hours after the procedure. Most symptoms are typically self-limiting, resolving within 2-4 days of onset. Nevertheless, full recovery may take as long as few weeks in a few patients.

Anomalous cortical contrast enhancement with mild to severe edema, subarachnoid contrast enhancement, as well as striatal contrast enhancement are the typical postprocedural CT findings. Adequate hydration with intravenous crystalloids as well as anticonvulsants are the supportive treatment modalities for this post procedural complication. The observation of CIEP in a known hypertensive and type 2 diabetic patient after endovascular coiling of cerebral aneurysm is very rare and has not been reported in literature. We present a case of CIEP after endovascular coiling of cerebral aneurysm in a hypertensive and type 2 diabetic patient with left oculomotor nerve palsy (OMNP).

Case Report

We present a 68-year old female, with seven days history of headache and left ptosis or blepharoptosis with mild mydriasis. The headaches were localized mainly at the left side of the nose, orbit, and upper forehead while the left ptosis was associated with blurred vision. Computed tomography angiography revealed an aneurysm in between the C4 segment of the left internal carotid artery (ICA) and the bifurcation of the left posterior communicating artery. Digital subtraction angiography further confirmed the aneurysm. We used the transarterial approach to assess the aneurysm and subsequent coils. Iohexol (Omnipaque) contrast agent was used during the endovascular procedure. The patient’s condition deteriorated into acute confusion state with cardinal symptomology of CIEP immediately after the operation. Computed tomography scan revealed cortical contrast enhancement in the vascular territory of the ICA as well as edema. Her symptomatology resolved 48 hours after treated with anticonvulsants, intracranial pressure reduction and hydration.

Chronic hypertension as well as type 2 diabetics may be critical predisposing factors to CIEP. CIEP should be suspected in patients presenting with acute confusion state after endovascular therapy. Massive edema with ischemic brain changes in white matter of the brain before endovascular procedure should rise suspicion of CIEP.

Abstract

Contrast-induced encephalopathy (CIEP) is a rare complication after endovascular therapy. The etiology of CIEP is still a matter of debate. We present a rare occurrence of CIEP in a known hypertensive and type 2 diabetic patient after endovascular coiling of cerebral aneurysm with oculomotor nerve palsy.

A 68-year old female presented with seven days history of headache and left ptosis or blepharoptosis with mild mydriasis. The headaches were localized mainly at the left side of the nose, orbit, and upper forehead while the left ptosis was associated with blurred vision. Computed tomography angiography revealed an aneurysm in between the C4 segment of the left internal carotid artery (ICA) and the bifurcation of the left posterior communicating artery. Digital subtraction angiography further confirmed the aneurysm. We used the transarterial approach to assess the aneurysm and subsequent coils. Iohexol (Omnipaque) contrast agent was used during the endovascular procedure. The patient’s condition deteriorated into acute confusion state with cardinal symptomology of CIEP immediately after the operation. Computed tomography scan revealed cortical contrast enhancement in the vascular territory of the ICA as well as edema. Her symptomatology resolved 48 hours after treated with anticonvulsants, intracranial pressure reduction and hydration.

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Key words: Contrast agent; coiling; diabetics; encephalopathy; endovascular; hypertension.

Funding: Technology Innovation Fund-Social Development Project of Zhenjiang City (SH2017017).

Contributions: all authors contributed toward data analysis, drafting and critically revising the paper and agree to be accountable for all aspects of the work. Seidu A. Richard wrote the final paper.

Conflict of interests: all the authors declare no potential conflict of interest.

Ethics approval and consent to participate: this case was reported or written in according to ethical committee of the Affiliated Hospital of Jiangsu University’s criteria for reporting or writing case reports. The patient and relatives were informed about our intention to involve him in a case study and they agreed to partake in the study.

Patient consent for publication: the patient and relatives were dually informed about our intention to publish his case and they fully concerted to the use of these documents. A written informed consent was obtained. A written consent for publication was signed. The hospital also concerted to the use of this information for publication.

Accepted for publication: 19 March 2021.

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aneurysm in between the C4 segment of the left internal carotid artery (ICA) and the bifurcation of the left posterior communicating artery (PCA) (Figure 1). The aneurysm was large in size measuring about 3.0×5.3 mm diameter. Massive edema with ischemic brain changes in white matter of the brain with paranasal sinus inflammation were also observed during CTA evaluation. Digital subtraction angiography (DSA) further confirmed the parameters of the aneurysm (Figure 2). Therefore, a diagnosis of left OMNP as a result of compression by an aneurysm at the bifurcation of PCA in a known hypertensive as well as type 2 diabetic patient was made.

After comprehensive evaluation of her co-morbid conditions and current illness, we opted to treat her aneurysm via endovascular coil instead of surgical clipping of the aneurysm. Iohexol (Omnipaque) contrast agent was used during the endovascular procedure. We used the trans-arterial approach to assess the aneurysm and subsequently coiling. After positioning her on the surgical table, we insert the 6F arterial sheath through the right femoral artery according to the Seldinger method. Using a 5F single-curved angiography tube under the guidance of the ultra-sliding guide wire, via the left ICA, we identified the aneurysm at the bifurcation of the PCA and left ICA. The PCA was however not visible. The left anterior choroidal artery was slightly dilated. A total of seven coils (MicrVention Inc, California, USA) were used to completely occlude the aneurysm during the operation (Figure 3). Post-operative CT scan showed no intracranial hemorrhage, air embolism as well as cerebral infarction. Nevertheless, we observed cortical contrast enhancement in the vascular territory of the left ICA as well as edema (Figure 4).

The patient’s condition deteriorated into acute confusion state immediately after the operation and become apparent 2 hour after the procedure. She also showed symptoms of motor and sensory disturbances; vision disturbances, such as cortical blindness, ophthalmoplegia, aphasia; as well as seizures which lasted for 24 h. After thorough evaluation of the patient’s condition, we arrived at conclusion that, she developed a post contrast-enhanced encephalopathy. She was treated with anticonvulsants, intracranial pressure reduction and hydration. The above symptomatology resolved 48 hours after the operation. A repeated CT scan done a week later revealed a resolution of the cortical contrast enhancement in the vascular territory of the left ICA as well as edema (Figure 5). The patient was discharged home two weeks later after scheduled post-operative visits were arranged.

**Figure 1. A-B) Computed tomography angiography images showing an aneurysm in between the C4 segment of the left internal carotid artery and the bifurcation of the left posterior communicating artery. White arrows = aneurysm.**

**Figure 2. A-B) Digital subtraction angiography images confirming the aneurysm in between the C4 segment of the left internal carotid artery and the bifurcation of the left posterior communicating artery. Red arrow = aneurysm.**

**Figure 3. A-B) Intraoperative digital subtraction angiography images showing coils in situ and disappearance of the aneurysm. Red arrow = casted view of the aneurysm.**
every six months. She was also referred to hypertension as well as diabetic clinics for further assessment and management. We observed massive improvement in her condition during the first six months scheduled visit. Two years follow-up revealed no recurrence of symptomatology and massive improvement of quality of life.

**Discussion**

PCA aneurysms are the most common types of aneurysms to form in the basal cistern and frequently involves in isolated OMNP due to their anatomical location.\textsuperscript{14,15} The oculomotor nerve originates from the midbrain on the medial side of the cerebral peduncles and extends forward and laterally between the posterior cerebral artery and superior cerebellar artery.\textsuperscript{15} Our patients presented with OMNP as result of compression by an aneurysm at the bifurcation of PCA. She is a known hypertensive as well as type 2 diabetic patient. Apart from the intraocular muscular involvement during OMNP, pupillary involvement is also higher suspicion of compression because the pupillomotor fibers and their vascular component originates from overlying pia course along the superficial as well as superomedial aspect of the oculomotor nerve.\textsuperscript{14,16} Also, trauma, stroke, post-surgical inflammation, neoplasms as well as microvascular damage from chronic disease have been implicated as cause of OMNP.\textsuperscript{14,17}

Our patient condition was initially misdiagnosed as an acute cerebral infarction and treated with aspirin, clopidogrel, fluvastatin and mecobalamin with no improvement. We utilized CTA to detect the aneurysm between the C4 segment of the left ICA and the bifurcation of the left PCA. The gold standard radiological evaluation modality for aneurysms compressing on the OMNT are CTA, magnetic resonance angiography (MRA), and digital subtraction angiography (DSA).\textsuperscript{18} It essential to note that, CTA, MRA, DSA necessitates the use of iodinated contrast material as well as ionizing radiation.\textsuperscript{18} The massive edema with ischemic brain changes in white matter of the brain with paranasal sinus inflammation observed during CTA evaluation may have contributed to the development of post-operative CIEP. We successfully treated the aneurysm via endovascular coil instead of surgical clipping after a comprehensive evaluation of her co-morbid conditions and her current presentation. Endovascular coiling is an effective technique for treating unruptured, ruptured aneurysms as well as preventing the rupture of cerebral aneurysms.\textsuperscript{1}

Studies have shown that, after endovascular interventions, a few patients experience complications such as thromboembolic events, aneurysm rupture, and peri-aneurysmal edema, which may be suggestive of symptomatic inflammatory responses.\textsuperscript{1,19,20} Also, reversible encephalopathy syndrome has been observed in patients after endovascular interventions.\textsuperscript{1,19,22} The possible mechanism of CIEP is as a result of disruption of the BBB leading to leakage of contrast agent into the cortex as well as sub-arachnoid space. This event causes neurotoxicity as well as cortical edema.\textsuperscript{6,23}

Furthermore, the cause of BBB disruption is associated with hyperosmolality as well as chemotoxicity of contrast agent.\textsuperscript{13,24} Iodinated contrast agents have been implicated in CIEP related neurotoxicity as a result of temporary BBB disruption.\textsuperscript{22,24} Temporal break of CIEP related BBB was first observed by Uchiyama et al who detected elevated concentration of iodine contrast agent in cerebrospinal fluid of their index cases and not in 4 control cases.\textsuperscript{25}

Studies have showed that a compromised BBB may lead to brain edema, resulting in the influx of proteins, electrolytes, as well as water across the anomalous permeability.
able cerebral vessels into the extracellular space.26,27 The clinical presentation of CIEP often starts immediately after endovascular procedure with symptoms such as transient cortical blindness, depicted with unilateral or bilateral amaurosis fugax, normal pupillary light reflexes, and extraocular dysfunction.3,10 Also, patient present with headache, hemiparesis, aphasia, memory loss, as well as decrease in advanced mental functions like agaphria, loss of coordination, confusion, seizures, and coma.5,31 Most often the patient is misdiagnosed as acute stroke after the procedure.3 Our patient’s condition deteriorated into acute confusion state with the above symptomology immediately after the operation.

In our index case, post-operative CT scan showed no intracranial hemorrhage, air embolism as well as cerebral infarction. Nevertheless, we observed cortical contrast enhancement in the vascular territory of the ICA as well as edema. It is fundamental to exclude embolic or hemorrhagic complications so as to initiate the right treatment early.5,8,11 Studies have shown that, approximately half of all patients with transient CIEP after intra-arterial contrast administration have histories of chronic hypertension.5,7 Our patient had chronic hypertension as well as type 2 diabetics. We are of the view that, the initially misdiagnoses of her condition as an acute cerebral infarction and the long-standing compromise of the vascular territory of the ICA as well as edema contributed to the CIEP.

Long exposure and reduced clearance of contrast agent has been associated with CIEP in patients with impaired renal function.5,10 Our patient’s routine laboratory investigations, most especially renal function tests were grossly at normal ranges. Furthermore, selective VAG has been implicated as a high risk of CIEP due to the association of the arterial supply to the brain stem, medulla oblongata, cerebellum, as well as basal parts of the temporal and occipital lobes.5,9 A study revealed that, the volume of contrast agent capable of triggering CIEP ranged from 80–400 mL while the long-induced half of all patients with transient CIEP may result in CIEP,5,7 CT scan with-

DWI.5,20,32 Nevertheless, a trustworthy image modality that can differentiate CIEP from cerebral ischemia is apparent diffuse coefficient (ADC), which often reveal no anomalous intensity in patients with CIEP.5,8,11 The management of CIEP involves aggressive intravenous hydration as well as daily hemodialysis with a short course of corticosteroids.5,30 Also, symptomatic treatments, such as anticonvulsant therapy for seizures, are mostly advocated.3,11,13 Our patient had chronic hypertension as well as type 2 diabetics. We are of the view that, the initially misdiagnoses of her condition as an acute cerebral infarction and the long-standing compromise of the vascular territory of the ICA as well as edema contributed to the CIEP.

Conclusions

Chronic hypertension as well as type 2 diabetics may be critical predisposing factors to CIEP. We are of the view that, the initially misdiagnosis of the patient condition as an acute cerebral infarction and the long-standing compromise of the vascular territory of the ICA as well as edema led to the CIEP. The diagnosis of CIEP should be based on both clinical and radiological evaluation of patients who received endovascular therapy. Nevertheless, in some cases, radiological evaluation may be negative and thus, diagnosis will solely rely on clinical findings.

References

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