

Contrast agent neurotoxicity mimicking subarachnoid haemorrhage

Nedim Hadzikaric, Ibrahim Al Luwimi

Abstract: We are presenting an unusual complication of the intravascular angiographic contrast agent in a 58-year-old male patient with the diagnosis of subarachnoid haemorrhage (SAH). After cerebral angiography, his clinical condition deteriorates. Computed tomography scan of the brain showed the picture of SAH due to the contrast agent of extravasation. Appropriate treatment, with avoidance of additional contrast agent administration was resolved in complete neuroradiological recovery within 2 days. (p128-130)

Key words: Cerebral angiography, contrast agent, neurotoxicity and subarachnoid haemorrhage

Introduction

Contemporary computed tomography (CT) scan of the brain has become the most convenient and principal evidence of the presence of blood in the subarachnoid space. In more than 95% of cases, CT scan of the brain can detect blood in the subarachnoid space, if scan is carried out within 48 hours of subarachnoid haemorrhage. It presents with a characteristic appearance of high density of blood within the subarachnoid space, cisterns, fissures, or ventricles indicating aneurysm location in 70% of cases.¹

There are several reports regarding neurological complications caused by angiography contrast agents.^{1,2,3} We present a case of central nervous system (CNS) toxicity caused by the contrast agent, with post-contrast CT scan, mimicking subarachnoid haemorrhage.

Case Report

A 58-year-old male patient presented in the emergency room with history of sudden attack of severe occipital headache and neck pain for 4 hours. The patient had vomited once and complained of transient diplopia.

Initially, the patient was conscious, oriented with stable vital signs. After a short period, he became confused, irritable and uncooperative. Physical examination revealed no focal neurological deficit, but severe neck rigidity and bilateral up-going plantar reflexes. Computed tomography scan of the brain showed acute subarachnoid haemorrhage, with blood in the 3rd, 4th and lateral ventricles, as well as along the falx and tentorium cerebelli, and mild to moderate brain oedema. An urgent 4-vessel cerebral angiogram (performed with OMNIPAQUE 300 mg I/ml, (Amersham Health Cork, Ireland); each 1 ml contains iohexol 647 mg, trometamol 1-2 mg, sodium calcium edetate 0.1 mg in sterile aqueous solution) did not show evidence of aneurysm or any other vascular malformation. Twelve hours after admission, a follow-up CT scan of the brain revealed development of diffuse ventricle dilatation, periventricular brain oedema and increased generalised brain oedema (Figs. 1 and 2). An urgent external ventricular drainage was inserted, and subsequently removed 10 days later. Computed tomography scan of the brain 3 weeks later revealed complete resolution of haemorrhage and brain oedema, as well as reduction of the ventricle dilatation. Patient was in a stable condition, without any neurologic deficit.

At this time, a repeated 4-vessel cerebral angiogram (performed with the same contrast agent as the first angiography), did not show any vascular malformation. Patient's level of consciousness deteriorated shortly after angiography and he had to be intubated. Urgent CT scan of the brain was done, and showed subarachnoid haemorrhage (Figs. 3 and 4). The patient's condition was complicated with renal failure and gastritis, with bleeding via nasogastric tube. His condition was stabilised within 2-3 days. Three days later, a repeat CT scan of the brain showed complete hyperdensity resolution confirming the

Department of Neurosurgery
King Fahd Hospital of the University
Al Khobar, Saudi Arabia

King Faisal University
Dammam, Saudi Arabia

Correspondence:

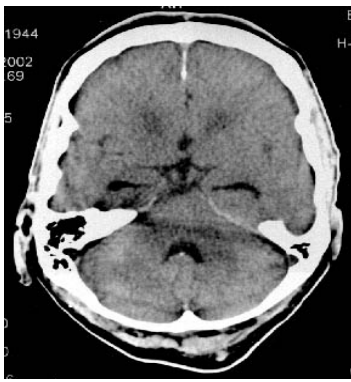
Dr. Ibrahim Al Luwimi
Department of Neurosurgery
King Fahd Hospital of the University
P O Box 40106
Al Khobar 31952
Saudi Arabia
Tel: (966 3) 895 4891
Fax: (966 3) 865 0596
Email: iluwimi@health.net.sa



Figures 1 and 2 - CT scan 12 hours after admission revealing the presence of SAH, intraventricular haemorrhage, dilatation of lateral ventricles and periventricular oedema



Figures 3 and 4 - CT scan showing status immediately after cerebral angiography and patient's deterioration



Figures 5 and 6 - CT scan three days after angiography. Observe the absence of abnormal hyperdensity in both figures

presence of contrast agent and neurotoxicity (Figs. 5 and 6). Patient's recovery was somewhat prolonged, but he was discharged home with unremarkable neurologic status and in good general condition.

Discussion

The awareness of toxicity and the risk elements of contrast media has to be remembered with any radiographic study, and contrast agent must always be used with caution and tailored to the individual patient's needs and medical condition.

In this case, immediately following the second negative

cerebral angiogram examination, the patient deteriorated severely and the finding of the CT scan was consistent with acute subarachnoid haemorrhage. During angiography procedure, this patient received a significant amount of contrast agent. Rare cases, causing dramatic neurotoxic effect could have radiological evidence on CT scan of the brain mimicking subarachnoid haemorrhage.^{2,3}

Clinically, this condition leads to a decrease in the level of consciousness, followed by various focal neurologic signs i.e. monoparesis, hemiparesis, cortical blindness, seizures, etc.⁴⁻⁶ Eckel postulates that the presence of higher concentration of contrast agent in the lower (posterior)

parts of the brain, (when patient is in supine position), is a result of sedimentation of the contrast agent with a higher specific gravity than serum and cerebrospinal fluid.⁶ This makes posterior parts of the brain more exposed to neurotoxic agent and that can explain evident predominance of symptoms attributed to parieto-occipital lobes such as cortical blindness, etc. Merchut and Richie believe that the blood-brain barrier is more vulnerable in posterior circulation.⁷ "The sympathetic innervation of the vertebrobasilar arterial system is not extensive or complete just like the other arterial systems, lacking protective, sympathetically mediated arteriolar vasoconstriction".⁷ The blood-brain barrier of the vertebrobasilar system seems easier to breach in the presence of different co-existing factors and under certain conditions. These factors include arterial hypertension, renal insufficiency, immunosuppressive drugs, etc. The administration of iodinated contrast agent seems to be one of these conditions.⁷ All these clinical signs and symptoms were transient in almost all of the reported cases.⁸⁻¹⁰

In general, transient contrast agent neurotoxicity is caused by extravasation of the contrast medium into the extracellular and subarachnoid space, as a consequence of the damage of the endothelial integrity and alterations of the blood-brain barrier. The reports differentiated two predominant types of these processes, with two different neuroradiologic presentations: First, presented radiologically as abnormal parenchymal contrast enhancement (hyperdensity in the affected brain area) is caused by accumulation of iodinated contrast into the extracellular space. Such hyperdensity in different brain areas, radiologically, could imitate various pathologic processes as space occupying infarction of the brain, thrombosis of the cerebral veins, acute haemorrhage, brain injury, etc.⁸ Second, the described type of the radiological presentation is contrast agent, accumulating mainly in the subarachnoid space, radiologically mimicking subarachnoid haemorrhage.^{2,3,9}

Pathophysiological explanation of this event includes hyper-osmolarity in the intravascular fluid due to contrast agent, which causes immediate reflux of fluid from intracellular to extracellular-intravascular space, shrinkage of cells and subsequent opening of 'tight intercellular junctions' within the endothelium of the capillaries in the outermost layers of the arachnoid. This process enables extravasation of the contrast agent. In addition, the contrast agent's chemical structure and hyper-osmolarity causes damage to the blood-brain barrier, increasing permeability

of the barrier and enabling possible penetration of contrast agent into the brain.^{8,10}

Our patient was diagnosed with intoxication by contrast agent with transient renal function impairment. Computed tomography scan of the brain showed dominant subarachnoid accumulation of contrast, presenting as enhancement in the subarachnoid space and mimicking subarachnoid haemorrhage (Figs. 3 and 4). Three days later, a repeated CT scan of the brain showed complete resolution of contrast (Figs. 5 and 6), thus additionally confirming diagnosis of intoxication by contrast agent. Patient was treated with an adequate fluid intake and supportive care. His neurologic status became normal and following improvement of renal functions he was discharged in good health.

We believe that all physicians should be aware of the risk of neurotoxicity with intravascular contrast agents. Awareness of this rare condition, caused by cerebral, coronary, spinal, renal, or other angiography procedures could be very important; firstly for prompt and adequate treatment of the patient's severe condition, secondly to avoid further unnecessary radiological investigations and other investigations including aggressive catheterisation.

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