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Non-Traumatic Intraventricular Hemorrhage With Hydrocephalus

Rosha Aulia Fadhilah Hafidz[1], El Varel Baby Berlianza[2]

[1]Fakultas Kedokteran, Universitas Tarumanagara, Indonesia ; roshaaulia6@gmail.com
[2]Fakultas Kedokteran, Universitas Tarumanagara, Indonesia; elvarelbaby@yahoo.com

*(Korespondensi e-mail: roshaaulia6@gmail.com)

ABSTRACT

Background: Non-traumatic intracerebral hemorrhage (ICH) in younger population is a relatively rare event but is associated with considerable mortality and poor functional outcome. Imaging plays a crucial role in determining the underlying cause and guide treatment of ICH.

Method: A 67-year-old man was brought by his family members to Royal Taruma Hospital emergency department in an unconscious state. The patient has been unconscious for almost 4.5 hours before presenting to the hospital. Before the incidence, the patient was claimed to be normal and able to carry out daily activities normally. The patient had a history of hypertension, diabetes mellitus, and ischaemic stroke (exact history of disease couldn't be assessed due to guardian's inability to recall), and has stopped going for monthly follow-up appointments due to personal reasons.

Result: On physical examination, the patient was comatose with GCS of 6 (E1M3V2), vital signs were measured and results are as follow : blood pressure 208/133 mmHg, pulse 98 x/min, respiration rate 16x/min, temperature 36.6°c, oxygen saturation 98%. Cranial nerve examination revealed isochore pupils, with diameters of 3 mm, light reflex (+). Laboratory examination results were as follow : Hemoglobin 15.3 mg/dL, leucocytes 198500/ uL, hematocrit 4%, thrombocytes 248000/uL, erythrocyte sedimentation rate (ESR) 10 mm/hour. Renal and liver functions were within normal limits. Blood glucose was found elevated to 226 mg/dL. Electrolytes, including calcium, sodium, potassium, chloride were within normal limits. Magnesium was decreased to 1.6 mg/dL.

Conclusion: Hydrocephalus is very sensitive for detecting the underlying structural and local causes of ICH in young adults. Thus, Hydrocephalus should be considered in the diagnostic work-up of all young Hydrocephalus patients to enable targeted secondary prevention.

Kata kunci: Non-traumatic intracerebral haemorrhage; hydrocephalus; spontaneous subarachnoid hemorrhage

ABSTRAK

Latar belakang: Perdarahan intraserebral non-traumatik (ICH) pada populasi yang lebih muda adalah peristiwa yang relatif jarang tetapi berhubungan dengan kematian yang cukup besar dan hasil fungsional yang buruk. Pencitraan memainkan peran penting dalam menentukan penyebab yang mendasari dan memandu pengobatan ICH.

Metode: Seorang laki-laki berusia 67 tahun dibawa oleh anggota keluarganya ke UGD Rumah Sakit Royal Taruma dalam keadaan tidak sadarkan diri. Pasien tidak sadarkan diri selama hampir 4,5 jam sebelum dibawa ke rumah sakit. Sebelum kejadian, pasien mengaku normal dan dapat melakukan aktivitas sehari-hari dengan normal. Pasien memiliki riwayat hipertensi, diabetes mellitus, dan stroke iskemik (riwayat pasti penyakit tidak dapat dinilai karena ketidakmampuan wali untuk mengingat), dan telah berhenti untuk janji tindak lanjut bulanan karena alasan pribadi.

Hasil: Pada pemeriksaan fisik didapatkan pasien koma dengan GCS 6 (E1M3V2), dilakukan pengukuran vital sign dan didapatkan hasil sebagai berikut : tekanan darah 208/133 mmHg, nadi 98

x/menit, laju pernafasan 16x/menit, suhu 36,6° c, saturasi oksigen 98%. Pemeriksaan saraf kranial mengungkapkan pupil isochore, dengan diameter 3 mm, refleks cahaya (+). Hasil pemeriksaan laboratorium sebagai berikut : Hemoglobin 15,3 mg/dL, Leukosit 198500/ul, Hematokrit 4%, Trombosit 248000/uL, Laju Endapan Eritrosit (ESR) 10 mm/jam. Fungsi ginjal dan hati dalam batas normal. Glukosa darah ditemukan meningkat menjadi 226 mg/dL. Elektrolit, termasuk kalsium, natrium, kalium, klorida berada dalam batas normal. Magnesium diturunkan menjadi 1,6 mg/dL.

Kesimpulan: Hidrosefalus sangat sensitif untuk mendeteksi penyebab struktural dan lokal yang mendasari ICH pada orang dewasa muda. Dengan demikian, Hidrosefalus harus dipertimbangkan dalam pemeriksaan diagnostik semua pasien Hidrosefalus muda untuk mengaktifkan pencegahan sekunder yang ditargetkan.

Kata kunci: Perdarahan intraserebral non traumatik; hidrosefalus; perdarahan subaraknoid spontan

INTRODUCTION

Non-traumatic intracerebral hemorrhage (ICH) is relatively uncommon in younger people, between the ages of 18 and 50, yet it is linked to high mortality and poor long-term functional outcomes. In a recent study comparing the functional outcomes of the major subtypes of young stroke, it was shown that 49.3% of all young stroke patients with poor functional outcomes had ICH, 36.5% had ischemic stroke, and 16.8% had transient ischemic attack. It is crucial to identify the likely cause of ICH in order to target ancillary testing, limit the risk of rebleeding, and provide patients with counseling. Nevertheless, etiological diagnosis in young ICH patients is sometimes difficult. Many investigations have been done to identify the typical underlying reasons up to 41% (mean 22%) of ICH in young people was attributed to an unknown source (1). Hypertensive microangiopathy (25%) and vascular malformations (25%) were the most frequently documented causes of ICH in young children, with cavernous hemangiomas being the most prevalent vascular deformity. Illicit drug use and cerebral venous thrombosis (CVT) were less frequent causes (1, 3). Rare causes of ICH in the young included neoplasms and inflammatory or non-inflammatory vasculopathies like vasculitis, posterior reversible encephalopathy syndrome (PRES), reversible cerebral vasoconstriction syndrome (RCVS), and vasculitis. Finding the underlying cause of ICH is highly dependent on imaging. Emergent CT is advised as the initial imaging to distinguish between an ischemic stroke and an intracranial hemorrhage, according to the most recent American Stroke Association (ASA) recommendations (4). Nevertheless, ICH in younger individuals almost always necessitates additional research. To identify the underlying abnormalities, such as vascular malformations, neoplasms, and CVT, contrast-enhanced CT or MR with angiography and/or venography, as well as digital subtraction angiography (DSA), may be useful.

An independent risk factor for poor outcomes is the occurrence of an intraventricular hemorrhage (IVH) in subarachnoid hemorrhage (SAH), intra-parenchymal hemorrhage (IPH), and, to a lesser extent, traumatic brain injury. IVH can produce acute hydrocephalus by impeding the flow of cerebrospinal fluid (CSF), necessitating CSF diversion, usually in the form of an external ventricular drain (EVD). Blood clots blocking the shunt during management of severe EVD frequently make it difficult to control intracranial pressure and increase infection risk. While treating post-IVH hydrocephalus, multiple EVD replacements and prolonged EVD drainage are frequently required and both are associated with an elevated risk of ventriculitis. In addition to hydrocephalus, the bulk effect of the blood clot might impair local tissue perfusion. While blood and blood-degradation products in the CSF cause periventricular edema, neural cell death, and arachnoidal fibrosis, they also cause ischemia, arachnoidal fibrosis, and periventricular edema. These variables work together to cause communicative

hydrocephalus, and many patients continue to require CSF diversion even after the original blood clot dissolves, necessitating the implantation of permanent shunts.

Stroke is defined as a sudden focal neurological deficit lasting more than 24 hours. The condition is also known as cerebrovascular accident (CVA) (Campbell et al., 2023). Hemorrhagic stroke is divided into intracerebral hemorrhage (ICH) and spontaneous subarachnoid hemorrhage (SAH) (Sundararajan, 2022). ICH occurs when a blood vessel in the brain rupture, causing blood to collect in the brain parenchyma and harming the brain. Subarachnoid hemorrhage (SAH) is a condition in which a blood vessel ruptures in the subarachnoid space (Barbu, 2022;Schrag & Kirshner, 2020;Kuriakose & Xiao, 2020).

Hemorrhagic stroke accounts for only around 20% of all stroke instances overall, whereas ischemic stroke accounts for roughly 80% of all stroke cases. Hypertension is the main contributor to hemorrhagic stroke (Picetti et al., 2022;Greenberg et al., 2022). AVM, vasculitis, cerebral artery dissection, dural sinus thrombosis, and pituitary apoplexy are a few of the conditions that can cause atraumatic SAH. Up to 85% of atraumatic SAH cases are brought on by aneurysm rupture. Aneurysms typically develop in the anterior or posterior location of the cerebral artery branching. Aneurysms come in two different varieties: saccular aneurysms and fusiform aneurysms (Cydulka et al., 2018;Stretz et al., 2017). Out of all types of ICH, intraventricular hemorrhage (IVH) is associated with a higher mortality rate. This article reports a case of hypertension-induced intraventricular hemorrhage with suspected brainstem death in a 67-year-old man (Gaberel et al., 2012;Starnoni et al., 2017).

CASE PRESENTATION

A 67-year-old man was brought by his family members to Royal Taruma Hospital emergency department in an unconscious state. According to his legal guardian, he was sleeping when suddenly his whole body and extremities became rigid, and not long after that, the whole body was shaking like he was in convulsion. The patient has been unconscious for almost 4.5 hours before presenting to the hospital. Before the incidence, the patient was claimed to be normal and able to carry out daily activities normally. The patient had a history of hypertension, diabetes mellitus, and ischaemic stroke (exact history of disease couldn't be assessed due to guardian's inability to recall), and has stopped going for monthly follow-up appointments due to personal reasons (Bu et al., 2016). History of fall, head trauma, headache, nausea and vomiting were denied.

On physical examination, the patient was comatose with GCS of 6 (E1M3V2), vital signs were measured and results are as follow : blood pressure 208/133 mmHg, pulse 98 x/min, respiration rate 16x/min, temperature 36.6°c, oxygen saturation 98%. Cranial nerve examination revealed isochore pupils, with diameters of 3 mm, light reflex (+). Laboratory examination results were as follow : Hemoglobin 15.3 mg/dL, leucocytes 198500/ uL, hematocrit 4%, thrombocytes 248000/uL, erythrocyte sedimentation rate (ESR) 10 mm/hour. Renal and liver functions were within normal limits. Blood glucose was found elevated to 226 mg/dL. Electrolytes, including calcium, sodium, potassium, chloride were within normal limits. Magnesium was decreased to 1.6 mg/dL. The patient underwent head CT-scan examination, and showed an extensive basal subarachnoid hemorrhage (Figure 1), intraventricular hemorrhage (IVH) with hydrocephalus and cerebral edema (Figure 2). The patient was diagnosed with hemorrhagic stroke caused by suspected aneurism rupture with hydrocephalus. The patient was then given mannitol, phenytoin, nimodipine accordingly; and scheduled for emergency extra-ventricular drainage (EVD) placement. After the procedure, the patient was placed on ventilator on mechanical ventilation. During post-procedure observation, light reflex on both pupils became diminished and pupils were only 2 mm/2mm

in diameter. However, the patient's consicoussness improved the day after with GCS of 8 (Miller et al., 2020).

Computed tomography angiopgraphy (CTA) was done on the second day of admission and revealed a large saccular aneurysm measured 1.61 x 0.99 x 1 cm on the posterior cerebral artery (PCA) and fusiform aneurysm on the right middle cerebral artery (MCA) measured 0.54 x 0.46 x 1.05 cm, vertebral artery occlusion from the proximal to distal segments, left MCA artery occlusion with collaterals seen on the left temporal lobe (Figure 3). Improvements regarding IVH size was seen. The patient is currently still in an unconscious state and under observation.

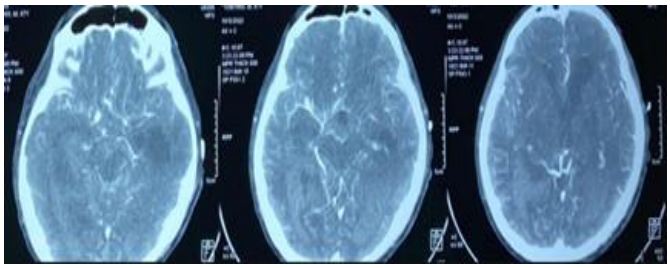

Figure 1. Head CT-scan of the patient showing basal SAH (yellow arrow)

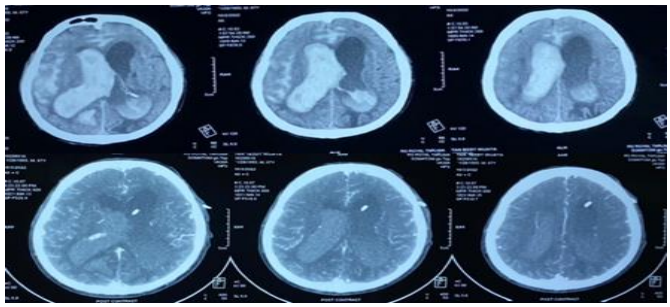

Figure 2. Head CT-scan of the patient showing IVH and hydrocephalus (yellow arrow) with cerebral edema (green arrow) pre-EVD (upper row) and post-EVD (lower row)

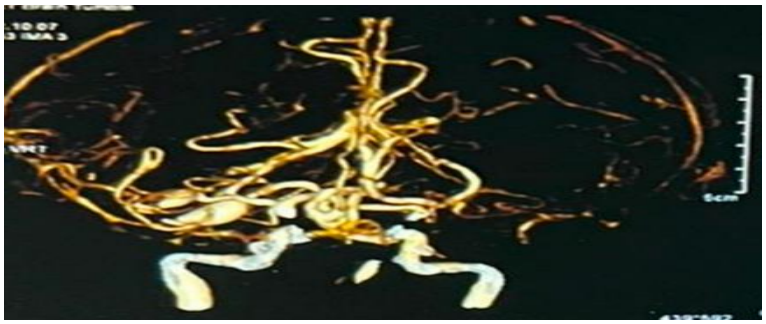

Figure 3. CTA of the patient showing occlusion from left MCA M1 segment (green circle) and aneurysms on right PCA and MCA (red circle)

DISCUSSION

Stroke is defined as a sudden focal neurological deficit lasting more than 24 hours. The condition is also known as cerebrovascular accident (CVA). Hemorrhagic stroke is divided into intracerebral hemorrhage (ICH) and spontaneous subarachnoid hemorrhage (SAH). 1,2 ICH occurs when a blood vessel in the brain rupture, causing blood to collect in the brain parenchyma and harming the brain. Subarachnoid hemorrhage (SAH) is a condition in which a blood vessel ruptures in the subarachnoid space. Hypertension is the main contributor to hemorrhagic stroke (Owen et al., 2021).

According to the WHO country risk profile, stroke was the leading cause of death in 2012, with global prevalence of 21%. Based on the stroke age category of 65-74 years, the incidence of stroke Indonesian population is 200 per 100,000, or 2.7 per 1,000. 7 Known poor prognostic factors of ICH include large hematoma volume, hematoma expansion, IVH, infra-tentorial location, old age, contrast extravasation on CT scan (spot sign) and the use of anticoagulation. 8 Out of all types of ICH, intraventricular hemorrhage (IVH) is associated with a higher mortality rate (Elmegiri et al., 2020).

Almost 12-45% of cases of ICH are IVH. IVH patients tend to have significantly higher mortality than non-IVH patients. SAH may also expand and cause IVH. Risk factors include existence of premorbid conditions (hypertension, diabetes mellitus), low GCS on first admission, hypertensive during admission, and posterior circulation aneurysmal rupture. Most common sign of IVH is altered sensorium, followed by nausea/vomiting, headache, coma, and seizure. Other manifestations include meningeal irritation, cranial nerve deficit, and hemiparesis (Mishra et al., 2021).

Brain aneurysms are abnormal enlargements of the arterial walls of the cerebral vessels that typically form in a vascular segment with an underlying structural defect, most frequently close to a bifurcation point. The tunica media is thin or absent, and the internal elastic lamina in the vessel wall is frequently absent or fragmented. There is the tunica adventitia, perhaps with fibrous material beneath. Saccular or berry aneurysms make up about 90% of all aneurysms. Other forms include microaneurysms, dissecting, mycotic, traumatic, fusiform (involving a longer artery segment), and mycotic (associated to an underlying infectious condition) (usually seen on small perforator vessels due to chronic hypertension). One of the risk factors of developing aneurysm iare atherosclerosis and uncontrolled hypertension. 11 Up to 85% of atraumatic SAH cases are brought on by aneurysm rupture. Aneurysms come in two different varieties: saccular aneurysms and fusiform aneurysms. 6 It is recommended that SAH patients should undergo computed tomography angiography (CTA) or digital subtraction angiography (DSA) whenever possible to detect aneurysms (Rajashekar & Liang, 2022). Following this evidence, the patient in this case had undergone CTA and the imaging revealed a large saccular aneurysm on the right PCA and fusiform aneurysm on the right MCA. IT is then concluded that SAH in our patient was due to ruptured aneurysm.

Management of IVH includes anti-hypertensive agents (calcium channel blocker, beta-blocker, etc), intracranial pressure lowering agents (mannitol), and extraventricular drainage (EVD) placement with fibrinolytics administration. Chronic hypertension is the main risk factor for the development of spontaneous ICH, which makes blood pressure (BP) lowering physiologically intuitive as a strategy to prevent hematoma expansion (Masotti et al., 2021). The patient in our case was given nimodipine. Afterwards, BP was lowered gradually to normal values (Iyer et al., 2023).

In our patient, phenytoin was given due to the presence of seizures. Seizures are possible with SAH. A thick subarachnoid clot, intracerebral hemorrhage, delayed infarction, and aneurysms in the middle cerebral artery are all recognized risk factors. Although seizures are linked to rebleeding and poor neurological outcomes, there isn't universal agreement on how to manage prophylactic anticonvulsant medication following SAH. The advantages for both abortive and preventative therapy of seizures, however, appear likely to outweigh the risks of antiseizure drug medications, given the low risk of antiseizure drugs itself. Therefore, American Heart Association (AHA) recommends to administer antiseizure medications in patients with impaired consciousness and active seizures (Hostettler et al., 2019).

EVD can aid as a diagnostic procedure for intracranial pressure (ICP) monitoring, and can also aid in ICP lowering. Early attempts to treat IVH focused on ICP elevation as the critical abnormality. This focus was reasonable, because severe ICP elevations are associated

with herniation and ischemia -2 common sequelae in IVH. The patient's head should be placed in 30 degree elevation (Vinas Rios et al., 2018).

The presence of blood in the ventricles can interrupt the normal cerebrospinal fluid (CSF) flow. Additionally, the hemorrhage may also clot and cause obstructive (noncommunicating) hydrocephalus and increased ICP. IVH and hydrocephalus in the setting of ICH have been traditionally associated with worse ICH outcomes in multiple cohort studies (Satyanarayana et al., 2019). Placement of an EVD to drain CSF and monitor ICP should therefore be considered in patients with acute hydrocephalus/IVH and GCS ≤ 8 or with signs of transtentorial herniation (Toossi & Moheet, 2019). The prognosis of IVH depends on the amount of ventricular blood, degree of hypertension, admission neurological status, and progression of symptoms (van Solinge et al., 2020). The patient in our case was already in comatose state early during admission, had a significant amount of bleeding, and also very hypertensive. Using this clinical grounds, poor prognosis could be suspected. The patient in our case also had hydrocephalus.

During admission, the patient a diminished pupillary reflex and fixed pupils at 2mm/2mm. It was a concerning finding but the patient improved afterwards. This finding was also found in a study by Stretz et al, where the previously deteriorating post-EVD patient in their study improved significantly in 72 hours. The study concludes that even with relatively conservative care, patients with ICH and IVH can have significant improvements. It is therefore advised to delay early prognostications for patients with ICH and/or IVH for at least 72 hours until a clearer understanding of the patient's clinical trajectory over time (Heinonen et al., 2022).

CONCLUSION

This case report focused on a 67-year-old man who was diagnosed with IVH and hydrocephalus with possible poor prognosis. The patient is currently on ventilator and treated conservatively. A few tests will be needed to assess the brainstem function.

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