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(CASE REPORT)

Pediatric Spontaneous Intracranial Hemorrhage (SICH) with unknown etiology in rural area

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Abstract

Background: Spontaneous intracranial haemorrhage (SICH) on paediatrics is a rare condition which usually doesn't present specific sign and symptoms. Therefore, quick diagnosis followed by appropriate initial treatment is necessary to reduce morbidity and mortality rate.

Case Presentation: An 11-year-old boy was admitted to the ER (emergency room) with sudden altered mental status 2 hours prior to admission. According to his parents, he complains headache after playing with friends previously. No history of trauma was found. Non contras CT scan shows intracerebral haemorrhage in the left and right lateral periventricular of the posterior horn (Vol 0.77 cc) and intraventricular haemorrhage in all the ventricles. EVD (External Ventricular Drain) placement surgery was performed. After two weeks of hospitalization, he was allowed to go home without any neurological deficits, and continued follow up in outpatient unit.

Summary: Spontaneous intracranial bleeding in children have high mortality and morbidity rates, but children do not always have specific signs and symptoms. Therefore, a quick diagnosis accompanied by appropriate initial treatment is very necessary to reduce morbidity and mortality rate, such as those to reduce intracranial pressure.

Keywords: Spontaneous intracranial haemorrhage; Paediatric; Non-contrast head CT scan; EVD

1. Introduction

The definition of hemorrhagic stroke included subarachnoid haemorrhage (SAH), intraventricular haemorrhage (IVH), and non-traumatic intracerebral haemorrhage (ICH, with or without intraventricular extension). Pediatric hemorrhagic stroke is defined as a hemorrhagic stroke in children aged >28 days to 18 years. This condition is a rare non-traumatic neurological case which might cause severe neurological morbidity and mortality in children [1–4].

In more specific conditions, spontaneous intracranial hemorrhage (SICH) is estimated to occur around 12-15/100,000 patients each year, where the incidence in children itself is around 1.1 – 4.5/100,000 patients and is associated with a mortality of more than 50%. To date, several underlying etiologies have been investigated, but in some cases SICH is idiopathic. Due to the high morbidity and mortality rates in SICH, prompt diagnosis and appropriate initial treatment are very important to emphasize. If possible, the underlying etiology should be studied in more depth so that definitive treatment can be carried out immediately [2,4,5].

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2. Case report

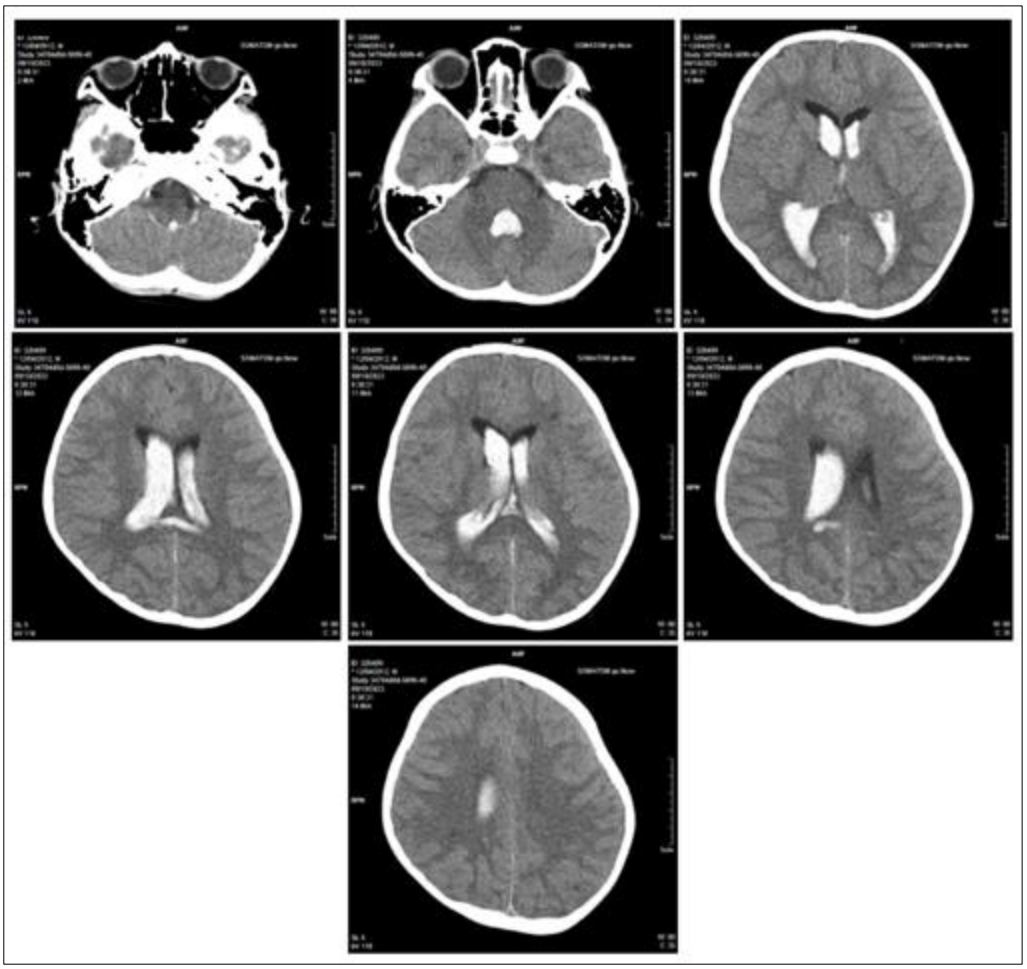
An 11-year-old boy was taken to the ER at Ngudi Waluyo Wlingi Hospital, Blitar, with altered mental status since 2 hours prior to the admission. Patient previously complained of a headache after playing with friends in the afternoon. Fever, nausea, vomiting, history of acute respiratory infection, and complaints of defecation and urination were denied by the parents. His parents stated that he had no history of major head trauma, seizures, stroke developmental delay, and spontaneous bruising or bleeding. Immunization history is complete according to age.

During pregnancy, his mother had routine antenatal care with a midwife. The pregnancy was normal without any history of bleeding, hypertension, diabetes mellitus, or infection. Patient was born pervaginam with no history of cyanosis or jaundice. His anthropometry measurements during the admission are shown on **Table 1** bellow:

Table 1 Anthropometry measurement

Parameter	**Anthropometry status**
Weight for age	30 kg (5^{th}-95^{th} percentile) Weight within normal range
Height for age	136 cm (5^{th}-95^{th} percentile) Height within normal range
Body Mass Index	5^{th} – 85^{th} BMI within normal range

Initial physical examination shows GCS of 211. Blood pressure was 112/73 mmHg, pulse rate 72 times per minute, respiratory rate 22 times per minute. He was also afebrile. SpO_2 is 99% and blood glucose 163 mg/dL. There are no signs of cyanosis, icterus, and dyspnea. On examination of the thorax, bilateral vesicular breath sounds were found, there were no rhonchi or wheezing. Heart sound are regular with neither murmurs nor gallops. On abdominal examination, abdomen was soft, abdominal sound is present normally, tenderness was difficult to evaluate because of the patient unconsciousness. Initially, patient's extremities were cold and capillary refill time was >2 seconds. On neurological examination there was no neck stiffness, pupils are 3 mm/3mm, sensory and motor function were difficult to evaluate.



CT scan shows ICH (0,77 cc) on right and left lateral periventricle along with IVH filling all ventricular system

Figure 1 Non contrast head CT scan on October 8th 2023

Thorax x-ray and non-contrast head CT scan were performed on the day of admission (October 8th 2023). On CXR, no abnormalities were found. However, CT scan reveals IVH filling the entire ventricular system and ICH in the left and right lateral periventricular of the posterior horn (estimated volume of ± 0.77 cc). Complete blood count, liver function test, kidney function test, and random blood sugar were also performed and are shown on **Table 2** bellow. Urine analysis was also performed, the urine colour was cloudy yellow, bacteria +1, pH 6.0, and urine density is 1.015. Urine reduction, urobilin, bilirubin, albumin, ketones, cylinders, crystals and erythrocytes were negative. Epithelium is 2-3/HPF and leukocytes is 1-2/HPF.

Patient is diagnosed with intracerebral and intraventricular haemorrhage. Patient is hospitalized and EVD was scheduled. During hospitalization, patient is sometimes restless and tends to sleep during the day. Patient initially rambled incoherent words. There was neither seizures nor vomiting. When nasogastric tube (NGT) was administered, a greenish brown liquid came out. The patient received IVFD therapy of 1000 cc/24 hours accompanied by IV Ceftriaxone 2x1 gr, Metronidazole 3x300 mg, Santagesic 2x300 mg, Omeprazole 1x30 mg and oral Sucralfat 40-80 mg/kg/24 hours. NGT diet is given 3 times per day, each 150 cc.

On October 10th, EVD was installed at 15 cm H_2O, then reduced to 10 cm H_2O and then maintained for 2 weeks. On the first day after installation, clinical improvement was visible, the patient's GCS increased to 356. During hospitalization, patient never complained of nausea, vomiting, seizures, or altered mental status. However, patient remains restless and complains about headache with a scale of 5-7 out of 10. EVD production is approximately 55 - 75 cc per 24 hours with a clear reddish color. A drip of Fentanyl 2.5 mg/hour is given when the patient complains severe headaches and the dose is reduced slowly when the pain decreases. On the 3rd day post-EVD, fever was observed, but was resolved with IV paracetamol, alternating with IV Metamizole 4x300 mg. The administration of antibiotics was stopped at the 2nd week. EVD was removed on the 15th day after installation. A week after discharge, he came to outpatient unit in good

condition, without any neurological deficits. Then he was referred to the nearest city with hospital equipped to perform DSA (Digital Subtraction Angiography) to identify possible underlying causes of his SICH.

Table 2 Complete blood count, liver function test, kidney function test and random blood sugar

Parameter	08/10/23	09/10/23	10/10/23	15/10/23	17/10/23	Unit	Normal Value
Complete Blood Count							
Hemoglobin	12.7		11.6	11.6	10.5	g/dL	12 – 17
Leukocyte	24.15		12.52	9.04	8.99	$X10^3$ µL	4,5 – 11
Hematocrit	37.0		34.2	33.4	31.2	%	38 – 51
Thrombocytet	411		335	343	351	$X10^3$ µL	150 – 450
Kidney Function Test							
Ur/Cr	22/0,96					mg/dL	17 – 45 / 0,5 – 1,5
Liver Function Test							
SGOT	80					U/L	L<37/ P<31
SGPT	33					U/L	L<41 / P<31
Hemostatic Function							
PT		13.4				Second	10” – 14”
APTT		27.8				Second	25” – 35”
Random Blood Glucose							
Blood glucose	163					mg/dL	70 – 120
Serum Electrolyte							
K+	3.18	4.16				mmol/L	3,4 – 5,3
Na+	137.6	135.1				mmol/L	135 – 150
Calcium ion	1.23	1.23				mmol/L	1,00 – 1,40
Chloride	103	99.2				mmol/L	98 – 107/ 96 – 114
Viral Marker							
HbsAg		Non-reactive					
Anti HCV		Non-reactive					
HIV Rapid 1		Non-reactive					

3. Discussion

An 11-year-old boy was presented with sudden altered mental status due to intracranial hemorrhage. Intracranial hemorrhage in pediatric cases are rare and quite challenging. Especially because children tend to have difficulties in communicating symptoms, and bleeding has non-specific clinical features such as somnolence, headache and irritability.

Patient in this case complained headaches before losing consciousness. This is in accordance with previous studies which stated that headache was found in approximately 60-80% of pediatric cases. Other symptoms that may appear are changes in mental status, neck pain, nausea and vomiting, seizures, and focal neurological deficits including hemiparesis, ataxia or aphasia, pupil disorders such as anisocoric or non-reactive pupils may also be present. Hydrocephalus can also occur either quickly or slowly due to IVH or compression of the ventricular system and can be indicated by a lump in the anterior fontanelle. Other less specific symptoms such as skin sores or shock during the hospitalization period have also been reported in one study. However, symptomatic symptoms may be nonspecific, especially in children less than 3 years of age [1,3,5].

In this case, patient was 11 years old. According to ACR (American College of Radiology), in children older than 6 months of age with a clinical presentation indicating an acute stroke not related to sickle-cell or a focal neurological defect that persists or worsens >24 hours since the last normal condition, it is appropriate to make a diagnosis using imaging. Initial diagnosis can be made with a non-contrast CT scan, non-contrast MRI, and non-contrast MRA. ICH imaging evolves through 5 phases: hyperacute (<12 hours), acute (12 hours – 2 days), early subacute (2 – 7 days), late subacute (8 days – 1 month), and chronic (>1 month). In the early subacute period, ICH is isodense compared to brain tissue, so if it is not observed carefully it might go undetected. However, multiplanar CT scan images can improve ICH detection in all phases. The image of early acute and subacute ICH shows hyperdensity as a result of progressive retraction of blood clots; in the late subacute phase, this will be gradually reduced by progressive lysis of red blood cells. Progressive blood resorption results in abnormalities in the hypodense brain that contains cerebrospinal fluid (CSF) during the chronic phase. Certain MRI sequences exhibit similar temporal signal fluctuations. The most sensitive sequences to identify blood products are T2TM, GRE, or SWI sequences, which should be assessed whenever ICH is suspected, particularly in an emergency situation [3,4].

Table 3 ICH Evolution on CT and MRI

Phase	**CT**	**T1-weighted MRI**	**T2-weighted MRI**
Hyperacute (<12 hours)	Isodense	T1-iso/ hypointense	T2-hyperintense
Acute (12 h – 2 days)	Increasing density	T1-iso/ hypointense	T2-hypointense
Early subacute (2 – 7 days)	Increasing density	T1-hypointense	T2-hypointense
Late subacute (8 days – 1 month)	Decreasing density	T1-hyperintense	T2-hyperintense
Chronic (>1 month)	Hypodense	T1-hypointense	T2-hyperintense (hypointense rim)

In addition to diagnosing ICH and its complications, neurological imaging should thoroughly investigate any potential primary causes of ICH. In the patient in this case, there was no history of previous diseases, such as arteriopathy or moya-moya, history or suspicion of cervicocranial artery dissection, or history or suspicion of central nervous system vasculitis. In patients with unknown etiology, the ACR recommends performing non-contrast MRA, CTA with contrast, cervicocerebral arteriography, or MRI of the head with and without contrast. However, in patients without vascular malformations, AVMs and tiny aneurysms, particularly those that are less than 2 mm in size, can be missed by CTA and MRA, thus CCA may also be performed [1,3,4].

In this case, the local healthcare facility did not have imaging modalities that would allow for further evaluation of the underlying etiology, therefore, after initial decompression was performed and the patient's condition was stable, the patient was then referred to a healthcare facility capable of performing angiography.

Examples of etiologies that may underlie ICH include vascular malformations (arteriovenous malformations or AVMs, aneurysms, cavernous malformations, or moya-moya), hematological disorders and brain tumors in children. Hematological disorders themselves can vary, ranging from coagulopathy (VKDB, congenital deficiency factors such as ITP, liver cholestasis, coagulopathy related to drug use) or thrombocytopenia (due to leukemia, aplastic anemia, thalassemia with hypersplenism). Other etiologies such as complications of meningitis have also been documented. A study reported that in children over 5 years of age, like the patient in the case, SICH usually occurs due to vascular malformations. Vascular malformations in children can have several risk factors, such as connective tissue disorders, fibromuscular dysplasia, and vasculitis due to infection or inflammation [1,5–8].

Other risk factors such as hypertension, which is one of the risk factors for hemorrhagic stroke in adults, are also one of the determinants of prognosis in children. However, this patient had normal blood pressure from the initial examination until the patient went home after being hospitalized for 2 weeks [1,5,6].

Initial treatment may include conservative therapy or surgery. Conservative therapy includes stabilizing the patient's vital signs (airway, breathing and circulation), controlling intracranial pressure, minimizing neurological deficits and preventing hematoma expansion, as well as administering anti-epileptics if indicated. Until now there is still no consensus explaining the role of surgery as definitive therapy. However, focal lesions with midline shift on imaging are recommended to be treated with surgery. The choice of surgical method must also be adjusted to the underlying etiology and clinical manifestations in the patient. Some procedures that can be performed include: hematoma evacuation with craniotomy, AVM node excision or AVM embolization, placing clips on aneurysms, and tumor excision. In some patients, ventricular drainage with EVD can be performed in patients with high intracranial pressure [5,9,10].

Patient reported in this case experienced extensive intraventricular extension filling the entire ventricular space, therefore evacuation of the hematoma was carried out with EVD placement. In patients, surgical treatment improves the patient's condition significantly.

The prognosis of SICH itself actually depends on several factors, studies on adult SICH have reported that the prognosis is better in patients with small bleeding, minimal neurodeficiency, and GCS >8. Recently, advances in diagnosis and earlier surgical intervention have improved the prognosis of SICH itself. In addition, the brain in pediatric has good tissue plasticity and ability to repair cerebrovascular lesions [5,7].

A study in 2018 formulated scoring components for ICH in pediatrics, the components of the predictor prognosis include herniation, changes in mental status, hydrocephalus, infratentorial hematoma location, extension of IVH, and ICH with a volume >2% TBV. Modified pediatric intracerebral hemorrhage (mPICH) scoring can be seen in **Table 4** below. An mPICH >4 is a predictor of moderate disability, mPICH >5 is associated with severe disability, while mPICH >6 carries a high risk of death or vegetative state. The patient did not find any herniation, but there was altered mental status and there was extension of the IVH only [11].

Table 4 mPICH score

Components	**Score**
Brain herniation	4
Altered mental status during admission	3
Hydrocephalus	2
Infratentorial intracerebral hemorrhage	2
Intraventricular hemorrhage	1
Intracerebral hemorrhage volume >2% of total brain volume	1

4. Conclusion

In this case, we report an 11-year-old boy with sudden altered mental status due to spontaneous intracranial hemorrhage. SICH in children has a high mortality and morbidity rate, but children do not always have specific signs and symptoms, therefore initial imaging such as a non-contrast head CT scan can be carried out, then additional supporting examinations to determine the underlying causes are also needed. Initial treatment includes controlling intracranial pressure either with medication or surgery.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of informed consent

Informed consent was obtained from individual included in this study.

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