

Fatal Intracranial Hemorrhage in a Patient with Possible Infective Endocarditis: A Case Report

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Abstract: *Infective endocarditis (IE) can have devastating and life-threatening neurologic complication. Intracranial hemorrhage occurs rarely in infective endocarditis, it is found in about 5% patients with IE. We present a case of young female patient who was admitted with abdominal pain complains, who developed severe intracranial hemorrhage. Abnormal cardiac finding and further investigation lead to Possible IE diagnosis on this patient.*

Keywords: intracranial hemorrhage, infective endocarditis, neurologic complication

1. Introduction

Infective Endocarditis (IE) can have devastating and life-threatening neurologic complication. Those include ischemic stroke, intracranial hemorrhage, mycotic aneurysm, and brain abscess. Intracranial hemorrhage can be found in about 5% patient with IE, Well-known cause of these hemorrhages includes ischemic stroke with hemorrhagic transformation, septic emboli, mycotic aneurysm and septic erosion of arterial wall [1]. We present a case of young female patient admitted for management of abdominal pain, who suddenly experienced decrease of consciousness on the fourth day, head CT scan revealed severe intracranial haemorrhage (ICH). Abnormal cardiac finding and further investigation lead to Possible Infective Endocarditis diagnosis on this patient.

2. Case Illustration

A 19-year old female without significant past medical history admitted to hospital complaining left abdominal pain accompanied by fever which was intermittent since the last 1 week. The abdominal pain was felt on left lower quadrant that radiated to flank area, there were no history of vomiting and problem in urination and defecation. The review of systems was negative for any recent sore throat, other symptoms of upper respiratory tract infection and symptoms suggestive of central nervous system involvement. There were no history of joint pain, palpitation, syncope, and dyspnoea in the past. Also, patient denied any history of smoking, iv drug abuse or alcohol abuse.

She was hemodynamically stable and did not appear to be in any apparent distress. On examination, tenderness on left lower abdominal quadrant and left costovertebral angle were found. On cardiovascular examination we revealed grade 3/6 holosystolic murmur on mitral valve area. The initial workup showed leukocytes 13,240/ μ l with normal differential, hemoglobin 9,5 mg/dl, turbidity on urinalysis with leukocyte esterase 75/ μ l, sediment: 4-8 red blood cells under high

power field, 8-10 leukocytes under high power field, pregnancy test result was negative. The patient then started on empiric antibiotic for urinary tract infection. The following day plain abdominal radiograph was taken showing no sign of abnormality, ultrasound examination revealed free fluid in Douglas pouch, but no abnormalities were found during gynecology examination. Peripheral blood smear examination suggested an anemia due to chronic disease.

On the fourth day, when patient was transferred to radiology department, she felt headache and suddenly after a chest radiograph she became acutely less responsive. During observation the patient was delirious with GCS of 10, vital signs at that time were within normal limit and no seizure was observed. Stat head CT scan was done showing no abnormality (**Figure 1**). The next day she went in soporous condition with GCS E1V2M3, bilateral unresponsive pinpoint pupil, with normal vital signs. Neurologic examination revealed lateralization to the left side with flexion response to painful stimulus in right extremities. A transthoracic echocardiography demonstrated a 5 mm x 4,8 mm vegetation on mitral valve (**Figure 2**) with moderate mitral regurgitation and mild pulmonary regurgitation with normal ejection fraction, diagnostic considerations during that time included mitral valve prolapse and infective endocarditis. Empirical treatment with ampicillin and gentamycin started for presumed infective endocarditis and the blood sample was sent for culture and sensitivity.

There was an episode of seizure on that night and the patient became febrile with body temperature of 39,5°C, oxygen saturation dropped to 88% with canule oxygenation. The next morning patient was semi-comatose, GCS E1V1M2, with a decerebrate posture, her pupils at that time were 3 mm unreactive on right and 1 mm unreactive on left, blood pressure 100/70 mmHg, heart rate 104 beats/min, respiratory rate 30 breaths/min, body temperature 37,6°C, oxygen saturation 98% with 10 L/min Non Rebreathing Mask (NRM) oxygenation. Repeat head CT showed subarachnoid hemorrhage (SAH) in right and left parietal lobe, intraventricular hemorrhage (IVH), acute ischemic lesion in

bilateral thalamus, and brain edema with hydrocephalus (Figure 3). Follow up laboratory findings showed, arterial blood gas analysis pH 7.44, PaCO₂ 36 mmHg, PaO₂ 56 mmHg, CHCO₃⁻ 24 mmol/L, SaO₂ 90%. The white blood cells had increased to 23,260/mm³, with hemoglobin 10.5 g/dL, platelets 476,000/mm³. Blood chemistry as follows: urea 20 mg/dL and creatinine 0.8 mg/dL. Elevated intracranial pressure and herniation syndrome were treated with Mannitol, she was also given nimodipine and tranexamic acid. Her condition continued to deteriorate, and the patient was declared dead the following day. Later on, we found out the result from blood culture was negative.

Diagnosis of Possible IE was made according to Modified Duke Criteria since there were endocardial involvement and vascular phenomenon (intracranial hemorrhage). Differential diagnoses on this case were rupture of cerebral aneurysm and rupture of arteriovenous malformation.

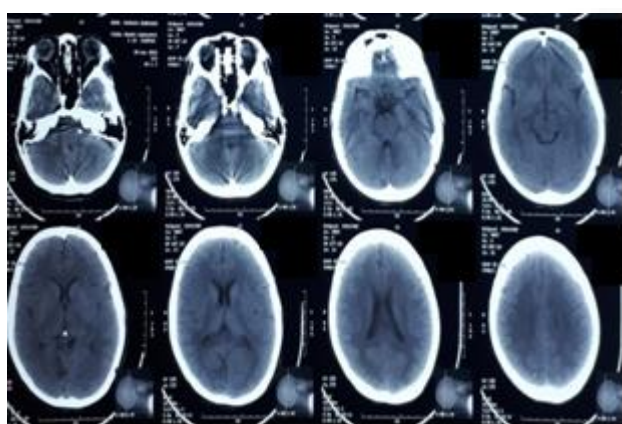


Figure 1: First Head CT scan was normal



Figure 2: Transthoracic Echocardiography revealed 5 mm x 4.8 mm vegetation on mitral valve

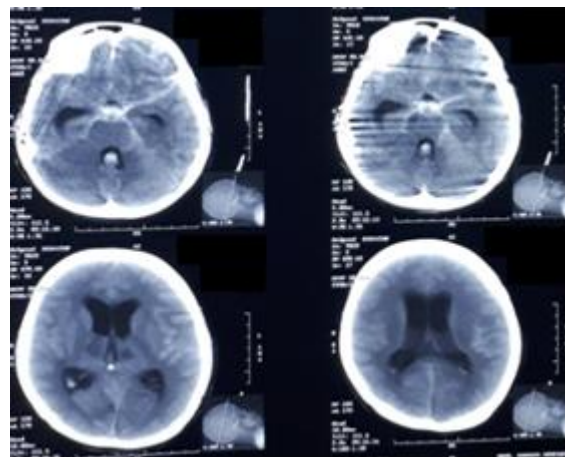


Figure 3: Repeat Head CT scan revealed SAH, IVH and hydrocephalus

3. Discussion

Intracranial hemorrhage may occur due to traumatic or non-traumatic processes. Non-traumatic intracranial hemorrhage most commonly results from hypertensive damage to blood vessel walls, but it also may be due to autoregulatory dysfunction with excessive cerebral blood flow, rupture of an aneurysm or arteriovenous malformation (AVM), arteriopathy, altered hemostasis, hemorrhagic necrosis, or venous outflow obstruction. In rare cases, intracranial hemorrhage manifests as a life threatening complication of infective endocarditis [1].

Neurologic sequelae are the most frequent extra cardiac complications of infective endocarditis, occurring in anywhere from 25%-70% cases [2,3]. These include ischemic and hemorrhagic stroke, infectious intracranial aneurysm (also known as mycotic aneurysm), brain abscess and/or meningitis. Mortality is higher in those with neurological complications than in those without [4]. Intracranial hemorrhage occurs in about 5% patients with infective endocarditis, they may be the result of several different mechanisms. Well known causes of these hemorrhages include cardioembolism with hemorrhagic transformation, septic emboli, mycotic aneurysms and septic erosion of arterial wall without a well-identified aneurysms [5].

Transformation of ischemic infarcts caused by septic emboli is involved in approximately one third of patients with cerebral bleeding, either at the early phase of emboli or later [6]. The offending infected emboli may escape clinical recognition by being small, incompletely obstructing flow, or by preventing infarction by collateral circulation. So that lack of antecedent clinical brain embolism does not eliminate the risk of ICH, as most hemorrhages occurred without recognized, antecedent embolism.

Brain emboli complicating infective endocarditis result in ICH by at least 3 different mechanisms: 1) sterile emboli can cause infarcts that is usually mild and asymptomatic in the

Major criteria

- Blood culture positive for IE

Typical microorganisms consistent with IE from 2 separate blood cultures: Viridans streptococci, *Streptococcus bovis*, HACEK group, *Staphylococcus aureus*; or community-acquired enterococci in the absence of a primary focus, or microorganisms consistent with IE from persistently positive blood cultures defined as follows: at least 2 positive cultures of blood samples drawn >12 h apart or all 3 or a majority of ≥ 4 separate cultures of blood (with first and last sample drawn at least 1 h apart)

- Single positive blood culture for *Coxiella burnetii* or anti-phase 1 IgG antibody titer $\geq 1:800$

- Evidence of endocardial involvement

Echocardiogram positive for IE (TEE recommended for patients with prosthetic valves, rated at least possible IE by clinical criteria, or complicated IE [paravalvular abscess]; TTE as first test in other patients defined as follows: oscillating intracardiac mass on valve or supportin structures, in the path of regurgitant jets, or on implanted material in th absence of an alternative anatomic explanation; abscess; or new partial dehiscence of prosthetic valve or new valvular regurgitation (worsening or changing or pre-existing murmur not sufficient)

Minor criteria

- Predisposition, predisposing heart condition, or IDU

- Fever, temperature $>38^{\circ}\text{C}$

- Vascular phenomena, major arterial emboli, septic pulmonary infarcts, mycotic aneurysm, intracranial hemorrhage, conjunctival hemorrhages, and Janeway lesions

- Immunological phenomena: glomerulonephritis, Osler nodes, Roth spots, and rheumatoid factor

- Microbiological evidence: positive blood culture but does not meet a major criterion as noted above (excludes single positive cultures for coagulase negative staphylococci and organisms that do not cause endocarditis) or serological evidence of active infection with organism consistent with IE

Table 1: Modified Duke Criteria [10]

absence of anti-coagulation therapy; 2) septic emboli during uncontrolled infection, can cause acute, erosive arteritis with rupture; and 3) septic emboli during effective antimicrobial therapy and/or associated with nonvirulent organisms can injure the arterial wall, leading to subacute development of aneurysms that are often aseptic at the time of rupture [7,8].

A smaller number of ICH in infective endocarditis are caused by infectious intracranial, also known as mycotic, aneurysms. Intracranial mycotic aneurysm (ICMA) are relatively rare, accounting for less than 10% of neurologic complications of IE. They usually result from septic embolization to the vasa vasorum or to the intraluminal space of the vessel itself. Septic emboli are responsible for an inflammatory lesion starting on adventice surface and ultimately destroying the intima. The diagnostic imaging of choice is a cerebral angiogram. Non-ruptured ICMA are responsible for fever, headache, seizures, and focal deficit. Patients with ruptured ICMA have sudden arachnoid or intracerebral bleeding, associating decreased level of consciousness, intracranial hypertension, and focal deficit [6].

Cerebral microhemorrhage is increasingly acknowledged as a silent complication of endocarditis and recently has been implicated in predicting overt hemorrhage. The proposed mechanism is that of infective vasculitis although this is speculative. Cerebral microhemorrhage has been detected in 57% of cases with IE, usually located cortically [3,9]. Modified Duke Criteria for the diagnosis of IE is listed in **Table 1**.

The definition of IE according to Modified Duke Criteria categorized as "Definite IE" if there is fulfillment of one or more pathologic criteria, or 2 major criteria, or 1 major and 3 minor criteria, or 5 minor criteria, "Possible IE" with fulfillment of 1 major criteria and 1 minor criteria, or 3 minor criteria, "Rejected IE" if there is firm alternative diagnosis explaining evidence of IE, or resolution of IE symptoms with antibiotics for less than or equal to 4 days, or no pathological

evidence of IE at surgery or autopsy, with antibiotic therapy < 4 days, or does not meet criteria of possible IE as above [10].

Our patient complained about left abdominal pain and intermittent fever for the last one week before hospitalization, however fever was absent during the first four days of stay in our hospital, besides, our patient received paracetamol during her hospital stay. Fever of $39,5^{\circ}\text{C}$ was noted one day after the patient started to loss in consciousness. Empiric antibiotic therapy was given from the first day of admission whereas the blood sample for culture was taken on fifth day, this may have contributed to the negative blood cultures seen on this patient. In addition, she did not have the usual sequelae of endocarditis, including Roth spots and Osler's nodes. Diagnosis of possible infective endocarditis was made with evidence of endocardial involvement from transthoracal echocardiography and vascular phenomena in the form of intracranial hemorrhage.

In terms of possible IE it is recommended to use clinical judgement to decide if the patient has IE. Ttrans-esophageal echocardiography should be considered if not done, it is important to identify candidates who need surgical treatment and examine the patient regularly to watch for major and minor signs of IE, moreover blood cultures should be drawn regularly if not positive earlier to look for microbiologic evidence [10]. Some factors that could impact on negative culture test include inadequate microbiological technique, highly fastidious bacteria or fungi, and previous use of antibiotics [11].

Further diagnostic imagings are needed to investigate the underlying mechanisms of ICH caused by IE as we mentioned above and to rule out other possible causes, which in our case could not be done due to limited hospital imaging facility. Differential diagnoses on this case were rupture of cerebral aneurysm and rupture of arteriovenous malformation (AVM). Aneurysmal subarachnoid hemorrhage (SAH) may

be detected in 90-95% of cases with head CT scan. MRI Fluid-attenuated inversion recovery (FLAIR) sequences are very sensitive for SAH, although the comparison of CT scan with MRI in detection of SAH is controversial. Noninvasive angiographic methods, such as computed tomographic angiography (CTA) and magnetic resonance angiography (MRA), allow for detection and characterization of aneurysms. However, minor aneurysmal hemorrhage may not be detected with noninvasive methods. Conventional angiography is the definitive procedure for the detection and characterization of cerebral aneurysms [12,13].

Diagnosis of cerebral AVM might be using several imaging studies: CT scanning easily identifies intracerebral hemorrhages, raising suspicion of AVM in a younger person or a patient without clear risk factors hemorrhage; however, this modality can identify only large AVMs [14]. Arteriovenous malformations in head CT might appear as an area with mixed densities associated with edema, mass effect and enhancement with contrast administration. Calcification appears in 25-30% of AVM cases. Further evaluation with MRI is required if the CT scan shows negative results and other symptoms lead to AVM. The malformations appear as irregular or globoid masses anywhere within the hemispheres or brainstem. Magnetic Resonance angiography (MRA) may identify AVMs greater than 1 cm in size, but is inadequate to delineate the morphology of feeding arteries and draining veins; small aneurysms can be missed easily. Cerebral angiography is required for hemodynamic assessment, which is essential for planning treatment.

Management of infective endocarditis consists of appropriate antibiotics therapy, cardiac surgery based on indication, and management of intracardiac and extracardiac complication. Neurologic complications may have impacts on the management of patients with IE. Their presence can help diagnosis because, as peripheral manifestations of IE, they are minor criteria in the Duke classification. Intracranial hemorrhage needs supportive treatment with or without surgical or neurointervention procedure, which depends on the type, location and severity of the hemorrhage. Until now timing for cardiac valve surgery still controversial for patient with IE and stroke. It is reasonable to delay valve surgery for at least 4 weeks in patient with intracranial hemorrhage. Moreover, discontinuation of all forms of anticoagulation in patients with mechanical valve IE who have experienced a CNS embolic event for at least 2 weeks is reasonable [10]. Specific approach, such as interventional neuroradiology is required to treat ICMA. A multidisciplinary collaborative approach is critical in order to optimize outcomes [6].

4. Conclusion

Clinician should be aware that intracranial hemorrhage could develop in patients with infective endocarditis. Cerebral hemorrhage may be the first manifestation of infective endocarditis and should be suspected in a febrile patient with sudden coma and/or neurologic deficit. It is essential to monitor mental status; if this change, conscientious efforts should be made to identify the cause.

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