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Case Report

A Rare Case Report of Multiple Intracranial Aneurysms with Factor VII Deficiency

Abstract

Pathogenesis of intracranial aneurysms is multi-factorial. Origin of aneurysm may be acquired or genetic, and there may be more than one aneurysm simultaneously, or there may be the formation of a new aneurysm after treatment of previous one. Collagen vascular disorders, neurofibromatosis, polycystic kidney disease, and so many other disorders are associated with multiple intracranial aneurysms. As Factor VII deficiency is also genetic in origin, there might be a correlation between deficiency of the same with multiple intracranial aneurysms. Only one such case is reported in the literature and we are reporting such a rare case having a similar association.

Keywords: *Factor VII, intracranial aneurysms, subarachnoid hemorrhage*

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Introduction

Intracranial aneurysms are devastating vascular lesions. They are nightmare for neurovascular surgeons as they require constant neuromonitoring as well as the dedicated team who can either operate or perform the endovascular procedure at any hour of the day. The anterior communicating artery is the most common site for aneurysm formation, followed by the posterior communicating artery. In the previous studies, the detection of multiple aneurysms was rare, but due to recent technological advances in neurovascular imaging, the rate of detection of multiple aneurysms is increased. Most of the recent studies demonstrate that among all the aneurysm patients, the incidence of multiple intracranial aneurysm is around 15%–35%.[1,2] The exact pathogenesis of multiple intracranial aneurysms is not well elucidate, but there is few pathological conditions such as collagen vascular disorders, atrial myxoma, cerebral vascular malformations, and IgE syndrome are associated with multiple intracranial aneurysm. We searched PubMed for case reports of multiple intracranial aneurysm with Factor VII deficiency, and we were able to found only one such case report. We are reporting such a rare case of multiple intracranial aneurysms in a patient with Factor VII deficiency.

Case Report

A 55-year-old postmenopausal female admitted in neurosurgery department with sudden onset of headache followed by vomiting and loss of consciousness. The patient was nonsmoker and nonalcoholic. She did not have any history of cardiac disease, antihypertensive medication nor there was any history of substance abuse.

On examination, the patient was unconscious. She did not have eye opening on pain, no verbal response and localizing on painful stimulus (Glasgow coma scale [GCS] $E_1V_1M_5$). Her pupils were 4 mm, round, regular and reacting to the light bilaterally and equally. Her pulse rate was 60 per min and blood pressure was 160/90. Patients urgently intubated and taken for the computed tomography (CT) scan of the brain [Figure 1] that showed subarachnoid hemorrhage (Fisher Grade 4) in bilateral sylvian fissure and suprasellar cistern with intraventricular extension. CT Angiography of the brain [Figure 2] showed multiple aneurysms, and to our surprise, there were ten aneurysms including basilar top, both posterior communicating artery, anterior communicating artery, both middle cerebral artery (MCA) bifurcation, bilateral distal anterior cerebral artery, and bilateral distal MCA aneurysm. On hematological examination, her hemoglobin was 13 g%, white blood cell count 6000, and platelet count 200,000. Serum

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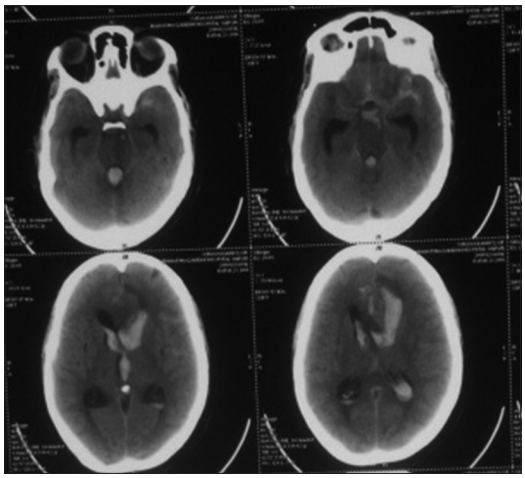

Figure 1: Plane computed tomography scan of brain showing subarachnoid hemorrhage in bilateral sylvian fissure, interhemispheric fissure with intraventricular extension without any evidence of infract

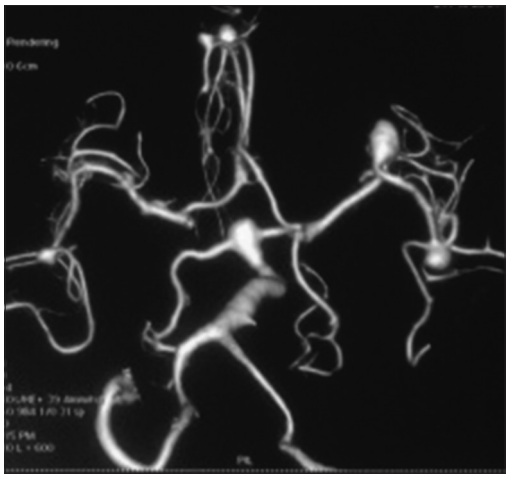

Figure 2: Computed tomography angiography volume rendering image showing multiple aneurysms

electrolyte, liver, and renal function test were within normal range. Coagulation profile revealed prolonged prothrombin time with normal activated partial thromboplastin time. Blood serum level of Factor VII was 18%. Ultrasonography of abdomen did not reveal any abnormality in kidneys and architecture of the liver was well preserved. Patient treated with ventilator with antiepileptics, intravenous nimodipine, and mannitol. Transfusion of recombinant Factor VII done. Repeat CT scan does not show any evidence of hydrocephalus. Patient advised for coiling of aneurysms but before we could perform definitive treatment patient re-bleed and her GCS response become $E_1V_1M_1$. Repeat CT scan of the brain showed multiple infract in the brain with hydrocephalus for that external ventricular drain insert. In spite of all the efforts patient could not save and died on 3 days after admission.

Discussion

Etiology of cerebral aneurysm is multifactorial.[3] There are certain diseases such as Marfan syndrome, von Recklinghausen neurofibromatosis type 1, Ehlers-Danlos syndrome type IV, Autosomal dominant polycystic kidney disease, and aortic coarctation – are in part the expression of genetic abnormalities with a higher incidence of multiple cerebral aneurysm due to the associated congenital weakness of vessel wall.[4] Hemodynamic stress on native vascular wall also helps in the formation of the aneurysm, but there are certain locations like MCA bifurcation, posterior inferior cerebellar artery origin that having less hemodynamic stress hence the formation of aneurysm on these sites cannot be explained by this theory only.[5] In the present case if hemodynamic factors were sole responsible for the aneurysm formation than the presence of mirror image aneurysm cannot be explained by this theory; hence, there might be some other contributing factors also responsible for the same. There are only a few studies available which are based on congenital metameric principles to explain mirror image aneurysms.[6]

The present case had isolated Factor VII deficiency. Factor VII is also called proconvertin. It is Vitamin K-dependent serine protease glycoprotein that synthesized by the liver. Tissue factor is an intrinsic membrane glycoprotein that is normally not exposed on the surface of intact blood vessels. When the vascular lumen is damaged, tissue factor is exposed and then binds to the small amounts of circulating Factors VIIa and VII. This facilitates the conversion of Factor VII to Factor VIIa. Factor VIIa bound to tissue factor in the presence of calcium and phospholipids facilitates further coagulation cascade. The inheritance of Factor VII deficiency is autosomal recessive with homozygous and heterozygous forms. Factor VII deficiency is less pronounced in heterozygous form as compared to homozygous form. There are few studies correlating matrix metalloproteinase overexpression in patients of Factor VII deficiency with increased risk of multiple intracranial aneurysm.

There is increase tendency of intracranial bleeding in patients of deficient Factor VII, but the pathogenesis of multiple aneurysms formation in the same patient's group is not very clear.[7] One possible explanation is direct hemodynamic and rheological influence on vessel wall[8] or these factors may have a direct effect on vessel integrity.

Endovascular and open neurosurgical procedures are two main treatment arms for multiple cerebral aneurysms in patients with Factor VII deficiency. International Subarachnoid Aneurysm Trial study first compared both treatment options and found endovascular treatment having less morbidity and mortality than open neurosurgical procedures.[9] After this study, there are so many case series in the literature using both treatment options in patients with multiple cerebral aneurysms.

However, there are recent trends toward endovascular approach as this is more convenient, having less morbidity and mortality.[10] The risk of recurrent bleeding after 1 year of treatment is rare in both treatment groups. After coiling, there is still increase the chance of re-bleeding in initial couple of days with a high incidence of vasospasm, and there are few case reports in which there is the formation of a new aneurysm after coiling or clipping in patients with Factor VII deficiency. In our case, we were not able to performed CT angiography or Digital substraction angiography of the brain after the second episode of bleed; hence, we cannot comment on formation of a new aneurysm at some other site. After securing the aneurysm Triple H therapy, that is, hemodilution, hypertension, and hypervolemia along with intravenous nimodipine is used postoperatively to prevent cerebral vasospasm.

Conclusion

This case is unique and illustrates several important points. There is a definite relation of genetic disorders and multiple aneurysms. This fact can also fit logically for hereditary Factor VII deficiency; although, further study is needed to prove this assumption. Second, clotting disorders are associated with increased risk of intracranial bleeding with poorer outcome. Our case also emphasized that in patients of multiple intracranial aneurysms, one should search for Factor VII deficiency apart from other genetic disorders and these patients are at increased risk for formation of a new aneurysm at remote site after treatment of the first aneurysm.

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Conflicts of interest

There are no conflicts of interest.

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