

# Acute Subdural Hematoma and Subarachnoid Hemorrhage Caused by Ruptured Cortical Artery Aneurysm: Case Report and Review of Literature

## Abstract

The present report describes an acute subdural hematoma (ASDH) associated with subarachnoid hemorrhage (SAH), due to ruptured cortical aneurysm. To our knowledge, extremely rare cases of this sort have been reported so far. A 23-year-old male patient without previous trauma presented with severe headache and rapidly decreasing level of consciousness to decerebrate status. Computed tomography (CT) scan has demonstrated an ASDH together with SAH. Hematoma has immediately been evacuated without any evaluation by angiography. After evacuation of the thick subdural clot, a 10-mm aneurysm was revealed on a precentral artery of frontal cortex, which was ligated. However, after 35 days the patient discharged with left side hemiparesis and dysphasia, and just after several months of admission he got symptom free. Ruptured cortical aneurysm should be considered as one of the causes of spontaneous ASDH. Vascular anomaly investigations are suggested for these cases, thus CT angiography or digital subtraction angiography has to be considered if clinical condition allows.

**Keywords:** *Acute subdural hematoma, cortical cerebral aneurysm, spontaneous*

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## Introduction

Spontaneous or nontraumatic acute subdural hematoma (ASDH) is very rare. Aneurysmal rupture, rupture of perisylvian arteries and tumors has been considered as the main causes. Ruptured aneurysms is usually associated with either subarachnoid hemorrhage (SAH) or intracranial hemorrhage (ICH).

Spontaneous ASDH accompanied by SAH due to ruptured cortical artery is extremely rare.<sup>[1-4]</sup>

The report involves a case of extremely rare presence of spontaneous ASDH associated with SAH caused by a ruptured cortical artery aneurysm. The awareness of such a case is crucial due to the vital urgent diagnostic procedures and therapeutic strategies that have to be taken. Ruptured aneurysms are usually associated with either SAH or ICH. ASDH due to ruptured intracranial aneurysm is very rare.<sup>[4]</sup> Knowledge of this uncommon presentation is crucial because it requires immediate diagnostic procedures and treatment.

We report a case of spontaneous ASDH and SAH caused by a ruptured cortical artery aneurysm.

## Case Report

A 23-year-old man presented with sudden onset severe headache to a peripheral hospital followed by reduction of the level of consciousness. There was no history of trauma. His history indicated a minor psychological problem that was under medical treatment. Because of progressive reduction of the level of consciousness, he has been referred to our hospital for further investigation and treatment. When he reached our emergency ward, he was in a deep coma (decerebrate rigidity). The right pupil was dilated, and the left one was myotic. The patient had central neurogenic hyperventilation. He underwent brain computed tomography (CT) scan that disclose a high density hemispheric subdural hematoma (SDH) on the right side with SAH [Figure 1].

There was a filling defect between hematoma and cortex in the center of hematoma. There was marked mass effect with displacement of ventricular structures to the left side. The laboratory data including coagulopathy screen were normal. Because of the patient's critical situation, we decided on emergency

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craniotomy and removal of hematoma without performing angiography or CT angiography. In the operating room a large right side craniotomy has been performed. The dura was tense. After opening the dura, a thick subdural clot was removed. After hematoma removal, at the center of the field, there was a thick SAH and a vascular lesion at the center of SAH. By dissecting the arachnoid, the lesion was an aneurysm connecting to precentral artery by a neck [Figure 2]. Aneurysm was pulsatile with thin membrane and a small clot adherent to it indicating of recent hemorrhage. The neck has been ligated and aneurysm coagulated and removed. Dura has been closed with a pericranial patch. The bone removed because of the brain edema. Postoperative CT scan has shown reduction of mass effect without additional bleeding [Figure 3]. Postoperative CT angiography of cerebral vessels showed no vascular abnormality [Figure 4].

After 35 days of operation, the patient discharged with mild left side hemiparesis and dysphasia. Then he just has mild hemiparesis several months after admission.

### Discussion and Review of Literature

The occurrence of spontaneous ASDH is rare. Since the first report by Munro in 1934,<sup>[5]</sup> many cases of spontaneous

ASDH have been reported. In review of the literature there were total of 178 cases. The main causes involve aneurysmal rupture,<sup>[3,6-44]</sup> rupture of perisylvian cortical arteries<sup>[45-55]</sup> and tumors and neoplastic diseases.<sup>[56-67]</sup> Some other rare causes include moyamoya disease,<sup>[68,69]</sup> arachnoid cyst,<sup>[70]</sup> dural cavernous angioma,<sup>[71]</sup> dural arteriovenous fistula,<sup>[72]</sup> myelodysplastic/myeloproliferative disorder<sup>[73]</sup> and polycythemia vera.<sup>[74]</sup> The most common cause of spontaneous ASDH was aneurysmal rupture (135 cases about 75.8% of cases). About 5 cases of aneurysmal rupture were cortical artery aneurysms in the territory of middle cerebral artery branches<sup>[1-4]</sup> (3.7% of all aneurysms that caused ASDH). Other locations of aneurysms that cause ASDH and their incidence described at Table 1. The incidence of SAH associated with an ASDH due to rupture of intracranial aneurysms varies from 0.5% to 7.9%;<sup>[44]</sup> however a pure SDH without SAH is extremely rare.<sup>[37]</sup> Several mechanisms have been proposed to explain the occurrence of ASDH after aneurysmal rupture. Previous hemorrhage may fix an aneurysm to local arachnoid adhesion, resulting direct bleeding to the subdural space. Other causes may be due to hemorrhage under high pressure, leading to both pia mater and arachnoid rupture and extravasation of blood directly to subdural space.<sup>[2]</sup>

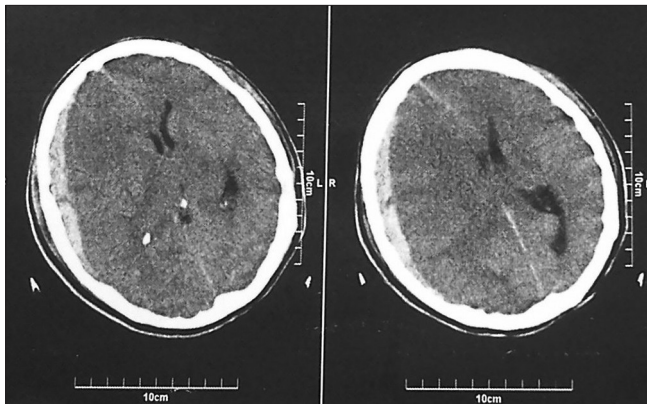


Figure 1: Brain computed tomography scan on admission demonstrates a high density hemispheric subdural hematoma on the right side with subarachnoid hemorrhage

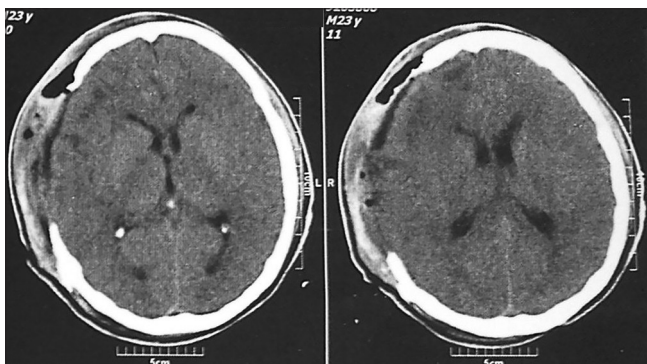


Figure 3: Postoperative computed tomography scan shows reduction of mass effect without additional bleeding

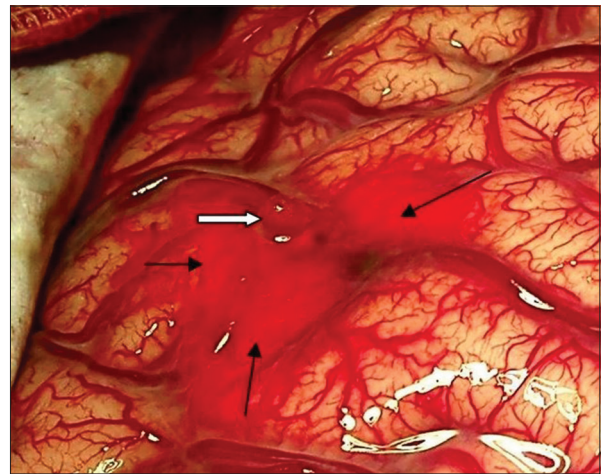


Figure 2: Operative view shows a thick subarachnoid hemorrhage (SAH) (block arrows) and a vascular lesion at the center of SAH (white arrow)

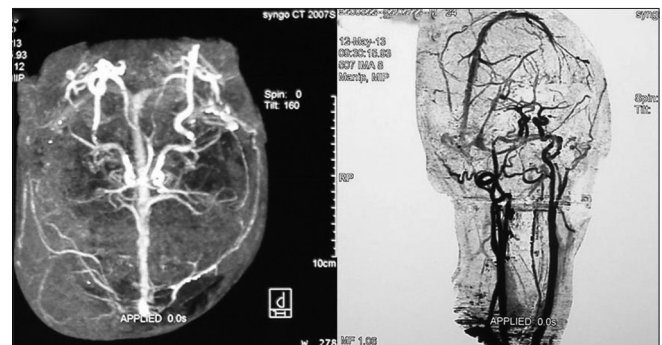


Figure 4: Postoperative computed tomography angiography of cerebral vessels showed no vascular abnormality

**Table 1: Locations of the aneurysms that cause ASDH and their incidences**

Location of aneurysms	Incidence (%)
PCoA	29.6
MCA	26.6
ACoA	13.3
Distal ACA	11.1
Not detected/Other rare locations	8.3
ICA	7.4
Cortical aneurysms	3.7

ACA: Anterior cerebral artery, ACoA: Anterior communicating artery, ICA: Internal carotid artery, MCA: Middle cerebral artery, PCoA: Posterior communicating artery

The other common cause for spontaneous ASDH was bleeding from perisylvian branches of middle cerebral artery<sup>[45-55]</sup> (29 cases about 16.2% of all cases). In this group of patients treatment with anticoagulant drugs as fondaparinux<sup>[46]</sup> and coagulopathy,<sup>[47]</sup> cocaine use,<sup>[49]</sup> hemophilia,<sup>[50]</sup> systemic hypertension<sup>[51,52]</sup> were predisposing factors. Several authors have explained this mechanism of spontaneous ASDH. Vance found in his autopsies that small twinges connecting to the dura matter were identified that branched perpendicularly from the cortical arteries. As these twinges are torn by the shearing force, bleeding occurs and ASDH forms.<sup>[53]</sup> According to Drake's report there were adhesions between dura matter and cortical arteries. Laceration of the adhesive arterial wall was caused even by trivial trauma resulting in bleeding.<sup>[54]</sup> The points of rupture were always located at the branches in the territory of middle cerebral artery. Tallala and Mc Kiscock reported that the causative mechanism of rupture of arteries was based on connections between the dura matter and arteries.<sup>[75]</sup>

Finally there were 14 cases (about 7.8% of all cases) of spontaneous ASDH due to tumors and neoplastic diseases.<sup>[56-72]</sup> Intracranial and metastatic extracranial tumors with involvement of dura matter can cause ASDH. These cases include metastatic seminoma,<sup>[56]</sup> meningioma,<sup>[57,58]</sup> metastatic lung cancer,<sup>[59,60]</sup> anaplastic astrocytoma of brain,<sup>[61]</sup> choriocarcinoma,<sup>[62]</sup> metastatic adenocarcinoma of prostate,<sup>[63]</sup> chronic myeloblastic leukemia,<sup>[64]</sup> malignant pleural mesothelioma,<sup>[65]</sup> metastatic dural carcinomatosis<sup>[66]</sup> and paranasal sinus cancer.<sup>[67]</sup>

All of the metastatic tumors had involved dura matter and the origin of bleeding was venous.

The choice of initial neuroradiological investigation in patients with spontaneous ASDH should be based on the neurological status of the patient. If the patient presented with stable neurological condition, angiography or CT angiography should be performed prior to surgery to dictate the best strategy. When an aneurysm presents, the patient should undergo emergency surgery to evacuate

the hematoma and obliterate or extirpate the lesion. If the angiography or CT angiography does not demonstrate the source of bleeding, the patient can be managed conservatively or surgically according to the subsequent evaluation of the neurological status, if necessary, additional investigations with MRI can be performed to rule out tumors.

In cases presenting with rapidly neurological deterioration, immediate decompressive surgery should be done before angiography or CT angiography. In the absence of intraoperative identification of cortical arterial rupture or other source of bleeding, complementary postoperative angiography or CT angiography is required.

## Conclusion

Ruptured cortical aneurysm should be considered as a cause of nontraumatic spontaneous ASDH. Angiography or CT angiography has to be carried out if the patient's clinical condition permits. Spontaneous ASDH and poor neurological condition dictates an emergent evacuation of hematoma and ligation of aneurysm. Follow up complementary investigations have to be done to examine any existing vascular anomalies.

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## Conflicts of interest

There are no conflicts of interest.

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