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Review Article

Infratentorial retroclival and tentorial subdural hematoma from posterior communicating artery aneurysm rupture: A case report and systematic review of literature

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ABSTRACT

Background: The objective of this systematic review is to evaluate the pathogenesis, clinical course, and prognosis of patients who suffer from aneurysm rupture, leading to subdural hematoma (SDH) of the infratentorial space without associated subarachnoid hemorrhage (SAH).

Methods: Following Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, a literature review was conducted in PubMed and Scopus electronic databases for relevant published cases of aneurysmal SDH (AnSDH) of the infratentorial compartment without associated SAH. The presentation, treatment, clinical course, and outcome of identified cases are compiled. In addition, a patient suffering from an infratentorial SDH following aneurysm rupture is presented with an illustrative case.

Results: Three articles were identified and met inclusion criteria. All cases occurred from ruptured posterior communicating artery aneurysms. All patients arrived with a Hunt and Hess classification of 2 or less. Only one case was managed with operative aneurysm clipping and hematoma evacuation while the other three cases were managed endovascularly. There were no reported postoperative complications, vasospasm, or seizures reported. All patients had a final Modified Rankin score of 3 or less at last reported follow-up.

Conclusion: Infratentorial AnSDH without associated SAH is an etiology rarely reported in the literature. Here, we present a case report and systematic review demonstrating a relatively benign clinical course and outcome compared to report aneurysm rupture associated with SAH or mixed SAH and SDH. Moreover, there appear to be lower rates of vasospasm and improved outcomes in patients with isolated AnSDH compared to the literature aneurysmal SAH rates.

Keywords: Aneurysm, Embolization, Infratentorial, Subdural hematoma

INTRODUCTION

Acute subdural hematoma (SDH) typically results from traumatic brain injury. However, spontaneous SDH in the absence of trauma may result from neurovascular pathology. An example of neurovascular pathology resulting in spontaneous SDH, in the absence of trauma,

is a ruptured intracranial aneurysm (RIA). While RIAs are commonly accompanied by subarachnoid hemorrhage (SAH), instances of aneurysms bleeding predominantly into the subdural space have been reported throughout the literature. These cases of aneurysmal SDH (AnSDH) involve a wide range of aneurysm locations across all major intracranial arterial distributions. Ruptured aneurysms of the posterior communicating segment of the internal carotid artery represent the most common etiology, leading to AnSDH. These commonly involve the supratentorial space and redistribute along the calvarial convexity and are accompanied by SAH. However, a pure acute SDH, without associated SAH, in the infratentorial compartment is very rare entity.[1,5,6] Given the rarity of this presentation, the clinical sequelae as well as the prognosis have not been well elucidated in the literature. We present a case of a ruptured posterior communicating artery (PcomA) aneurysm presenting with isolated and infratentorial AnSDH and provide a systematic review of to identify presentation, management, and outcomes of infratentorial AnSDH.

MATERIALS AND METHODS

The presentation, treatment, clinical course, and outcome of a patient suffering from an infratentorial SDH following aneurysm rupture are presented with an illustrative case. Informed consent was obtained and all patient information was anonymized. Ethics approval was not required for this case. A literature review was conducted in PubMed and Scopus electronic databases from their dates of inception to December 2021 using combinations of the following keywords: "AnSDH" OR "AnSDH" OR "aneurysmal subdural" OR "aneurysm SDH" OR "aneurysm SDH" OR "aneurysm subdural" AND "infratentorial" OR "retroclival" OR "tentorial." Only studies published in English or Spanish language were considered in this review. Our review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.[7] Only three studies were identified that met the inclusion criteria of having an aSDH involving the infratentorial fossa with no associated SAH [Figure 1].[1,5,6] The age, sex, race, comorbidities, hematoma location, radiographic data, clinical presentation, medical and surgical management, complications, and outcomes were analyzed and are presented in Table 1.

CASE REPORT

An 87-year-old female with a medical history of treated pancreatic cancer and on daily low-dose aspirin intake presented with sudden onset of severe, occipital headache with vertigo, and diaphoresis. She was awake and had mild right-sided sensorineural hearing loss. Computed tomography (CT) of the head without contrast demonstrated an acute SDH posterior to the clivus with extension into the upper cervical spine and along the tentorium bilaterally [Figure 2]. CT angiogram and catheter angiography revealed an irregular and bilobed 2.4 mm × 2.8 mm aneurysm arising from the posterior communicating segment of the right internal carotid artery, in relation to a prominent (fetal-like) PcomA. The relationship of the aneurysm dome to the clinoids, tentorial edge, clivus, and tentorial leaflets is shown in [Figure 3] and this was deemed to be the etiology of the peculiar SDH. The anterior-posterior (AP) and left anterior oblique (LAO) views demonstrate the anterior-inferior projection of the aneurysm [Figure 4]. The aneurysm was successfully secured with endovascular coil embolization [Figure 5]. Postoperative course was uncomplicated and the patient was discharged to acute rehab. The patient did not experience any seizures, delayed cerebral ischemia, or any new neurologic deficits other than her right-sided diminished hearing that improved throughout her hospital course. The patient returned to her neurologic baseline at her 1-month follow-up visit with a Modified Rankin score (MRS) of 0. Given the patient's age and comorbidities, it was decided to proceed with magnetic resonance angiography and MRI for evaluation of the patient's secured aneurysm, which demonstrated stable occlusion of the aneurysm as well as resolution of the SDH.

DISCUSSION

Isolated AnSDH with no evidence of SAH is an exceptionally rare presentation and the incidence is not clearly defined. There are better estimates regarding mixed AnSDH and SAH. A recent series analyzed data from over 10,000 patients in the United States and showed the incidence of acute SDH among patients with nontraumatic aneurysmal SAH (aSAH) to be 3.5%.[4] Others in the past have estimated the incidence of mixed AnSDH/SAH to be anywhere from 0.5% to 7.9%.[1] The incidence of isolated AnSDH is certainly much lower and only represented in the literature in case reports and small case series PcomA location is a recurrent theme among risk factors for developing SDH following aneurysmal rupture.[2]

Hypotheses for SDH formation

Multiple hypotheses have been proposed but the most common involves the formation of adhesions between the aneurysmal wall, arachnoid membrane, and dura.[2] AnSDH would presumably occur more readily when the aneurysm wall is in proximity to the outer arachnoid and dura, near dural folds, and invaginations such as the falx or tentorium. Such adhesions have been described frequently during microsurgical aneurysm clipping.[8] These adhesions are thought to originally arise from prior small and subclinical subarachnoid bleeds, leading to inflammatory scarring of the aneurysmal adventitia to the adjacent arachnoid membrane.[2] A second hypothesis suggests that a rupture

Table 1: Clinical and radiographical data of four reported cases of infratentorial AnSDH.

Citation	Age/ Sex	Location of aneurysm	Size (mm)	Projection of aneurysm	Presentation	HH	Location of SDH	Additional aneurysms on angiogram	Treatment modality	Major complication	Seizures Reported	Rebleed	Vasospasm reported?	MRS at last follow-up
Kim *et al.*[5]	83/F	PcoA	10	Two lobes. One lobe directed inferior-posterior, other lobe directed inferior-medial	Headache, dizziness	1	Clival	No	Stent-assisted coiling only	none	No	Not reported	No	0
Nowicki *et al.*[6]	82/F	PcoA	6	Posteroinferior	Headache, CNIII palsy	2	Clival	No	Balloon-assisted coiling initially. flow diversion stent 3 days later.	none	No	Not reported	No	3
Al-Abdulwahhab *et al.*[1]	34/F	PcoA	Not reported	Posterolateral	Headache, back pain	1	Tentorium and spine	No	Evacuation and clipping	none	No	Not reported	No	0
This case	87/F	PcoA	2.8	Anteroinferior	Headache, dizziness	1	Clival and tentorium	No	Coiling	None	No	No	No	0

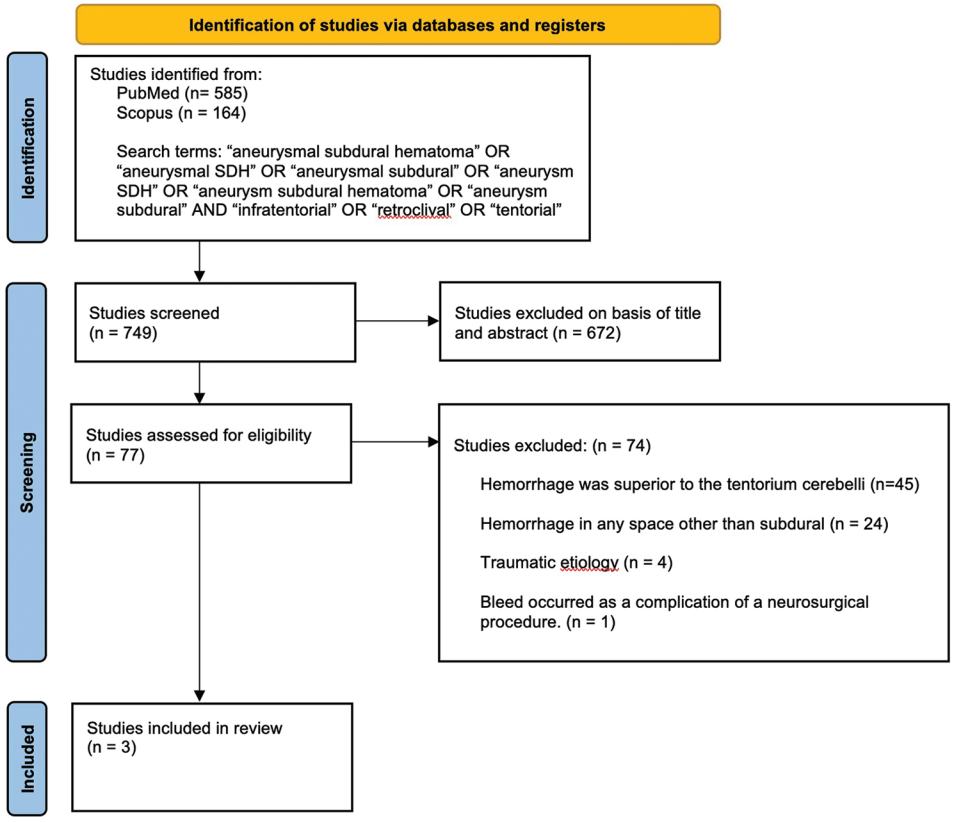

Figure 1: PRISMA flow diagram presenting the search for and selection of studies that include subjects with pure aSDH of the infratentorial compartment.

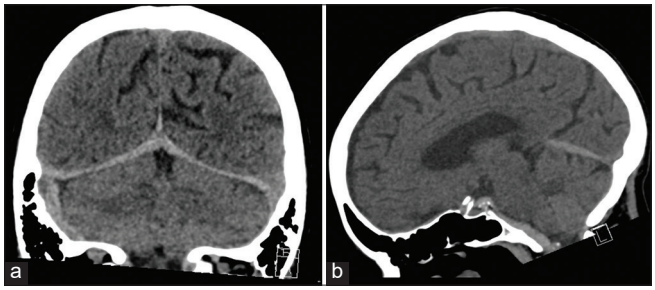

Figure 2: Computed tomography (CT) without contrast of the head at initial presentation. (a) Coronal image with bilateral subdural hematoma (SDH) inferior to the tentorium with more blood product being on the right side. (b) Sagittal image with SDH inferior to the tentorium and dorsal to the clivus with extension into the ventral cervical spine.

through smaller aneurysmal wall defects in the direction of the arachnoid membrane produces a high-velocity flow that could perforate into the subdural space.[3] This mechanism is theoretically more likely to result in concurrent SAH.

Anatomy of dural folds and formation of SDH

The intimate anatomy of aneurysms in the region of the ICA-Pcom to the posterior clinoid processes, dorsum sellae, interclinoid ligaments, petroclinoid ligaments, and adjacent tentorial edges presents the most plausible explanation for SDH formation [Figure 6].[9] Such an aneurysm buried in the dura in a strategic posteromedial and inferior direction can rupture to produce a SDH along the clivus and tentorium [Figure 2]. In our case, as well as in the Al-Abdulwahhab *et al.* in Table 1, the SDH had both tentorial and clival or spinal components.[1] possible rupture points could have been the petroclinoid ligaments and/or the tentorial edge. This contrasts with the other two infratentorial PcomA AnSDH cases shown in Table 1 which presented with purely clival SDHs. In these cases, it is likely that the aneurysms ruptured at a more medial/anteromedial location such as the posterior clinoid process and dorsum sellae. In the Kim *et al.* case, the PcomA aneurysm was noted to have an attachment to the dorsum sellae, supporting this hypothesis.[5] Therefore, the specific anatomical location and orientation of PcomA aneurysms likely play a significant role in determining presentation with SDHs in different locations.

Outcome data

There are no large studies analyzing outcomes of patients with isolated AnSDH, but few larger studies investigating the outcomes of patients with mixed AnSDH are present

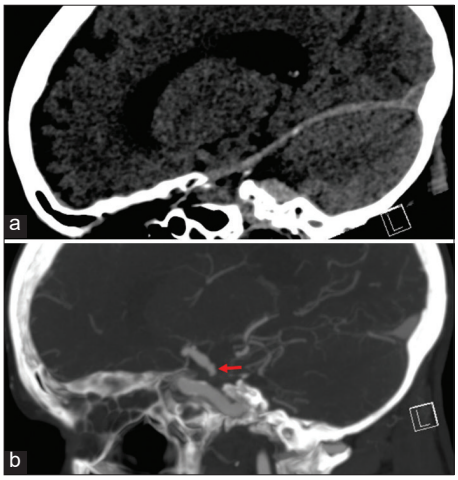

Figure 3: Sagittal CT head without contrast (a) and CT angiogram (b) demonstrating SDH inferior to the tentorium with an inferiorly projecting posterior communicating artery (PComA) aneurysm (red arrow). This figure highlights the anatomical orientation of this aneurysm and how its rupture can lead to a pure SDH in the infratentorial compartment.

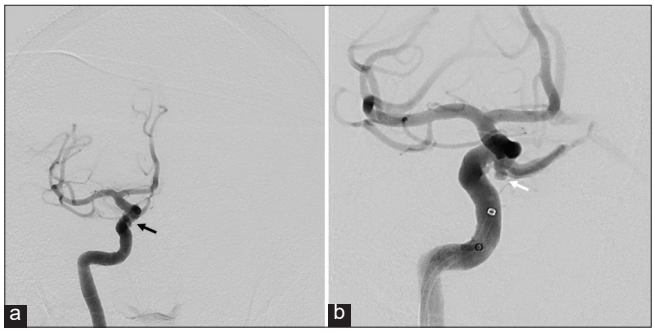

Figure 4: Digital subtraction angiogram demonstrating orientation of aneurysm. (a) Anterior-posterior (AP) view demonstrates the AP aneurysm projection as the aneurysm (black arrow) is projecting parallel to ICA. (b) LAO view demonstrates the anterior-inferior projection of the aneurysm (white arrow).

in the literature. Kaur *et al*.'s study reported that patients with aSAH and acute SDH had almost double the mortality when compared to patients with only aSAH (24% vs. 12%, respectively).[4] This study also showed that patients with mixed AnSDH that survived had worse outcomes and were significantly less likely to be discharged to their home, requiring more long-term care than those with aSAH alone. Kaur *et al*. and Schuss *et al*.'s studies reported that mixed AnSDH patients had poor outcomes in 59% and 66% of cases, respectively.[4,10] Again, there is a paucity of data regarding those patients who have only isolated AnSDH without SAH, and even more so for those that are exclusive to the infratentorial fossa. Despite not having the benefit of large volumes of case data, we speculate that outcomes are likely superior in patients with isolated

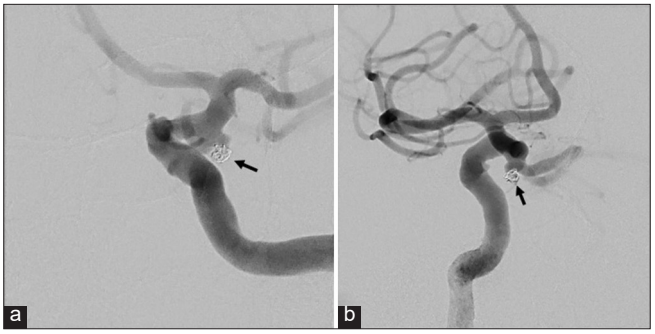

Figure 5: An AP (a) and LAO (b) digital subtraction angiogram demonstrating effective coil embolization of aneurysm (black arrow).

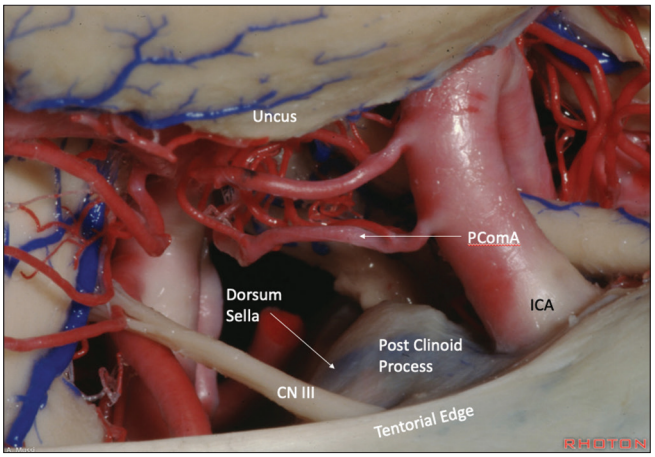

Figure 6: Cadaveric image from the Rhoton Collection demonstrating the anatomical proximity and relationship of the ICA-Pcom to the posterior clinoid processes, dorsum sellae, and adjacent tentorial edge. This provides for an anatomical understanding as to how a PComA rupture projecting inferiorly could lead to a SDH of the infratentorial compartment. Anatomical dissections performed by Antiono Mussi, MD, at Dr. Rhoton's laboratory. Reproduced with permission from the Rhoton Collection (http://rhoton.ineurodb.org), CC BY-NC-SA 4.0 (http://creativecommons.org/licenses/by-nc-sa/4.0).

AnSDH when compared with patients with both SAH and SDH. Theoretically, these patients should have lower rates of vasospasm-induced ischemia and seizure as the parenchyma and surrounding subarachnoid vessels would be isolated from the inflammatory extravascular blood products in the subdural space. The results of our review of the literature and summary of the four reported cases confirm this hypothesis as all patients arrived with a Hunt and Hess grade of 2 or less, had no major complication, no reported seizures, no reported vasospasm, and had a final MRS of 3 or less at last follow-up visit. In addition, only one patient required operative intervention for SDH evacuation following aneurysm clipping.

Given this current review and the present case, several points may be made. Primarily, the patients presenting

with aneurysm rupture with SDH formation in the absence of SAH in the infratentorial compartment may likely have a better outcome with a close return to function with the aneurysm adequately secured. Second, the presence of a spontaneous and acute infratentorial SDH without obvious traumatic etiology is rare, and an underlying cerebrovascular pathology such as an aneurysm must be ruled out. From our experience with this case and the subsequent review of literature, we recommend the use of CT angiogram in the work-up to rule out an aneurysmal etiology. We also recommend considering the use of digital subtraction angiography if the CT angiogram is found to be negative. Finally, this review provides support that vasospasm in this subset of aneurysm rupture may occur less frequently and thus not require aggressive monitoring and prophylaxis as compared to aSAH and mixed SAH with SDH.

CONCLUSION

Infratentorial AnSDH without associated SAH is an etiology rarely reported in the literature. Here, we present a case report and review of the literature demonstrating a relatively benign clinical course and outcome compared to reported aneurysm rupture associated with SAH or mixed SAH and SDD. Moreover, there appear to be lower rates of vasospasm and improved outcomes in patients with isolated AnSDH compared to the literature aSAH rates.

Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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