# INTRACRANIAL ANEURYSMS CLIPPING IN RWANDA, CAN IT BE DONE? WHAT ARE THE CHALLENGES?

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***List of abbreviations***

**AHA/ASA:** American Heart Association/American Stroke Association
**AComA:** Anterior Communicating Artery
**A&E:** Accident and Emergency
**aSAH:** aneurysmal Subarachnoid Haemorrhage
**CHUK:** Centre Hospitalier Universitaire de Kigali
**CN:** Cranial Nerve
**CT:** Computed Tomography
**EDH:** Epidural Haematoma
**EVD:** External Ventricular Drain
**ETV:** Endoscopic Third Ventriculostomy
**GCS:** Glasgow Coma Score
**HDU:** High Dependence Unit
**HTN:** hypertension
**IADSA:** Intra-Arterial Digital Subtraction Angiography
**ICA:** Internal Carotid Artery
**ICU:** Intensive Care Unit
**ISUIA:** International Study of Unruptured Intracranial Aneurysms
**KFH, K:** King Faisal Hospital, Kigali
**MCA:** Middle Cerebral Artery
**MRA:** Magnetic Resonance Angiography
**PComA:** Posterior communicating Artery
**SAH:** Sub-Arachnoid Haemorrhage
**WFNS:** World Federation of Neurosugical Societies

## ABSTRACT

**Background:** Intracranial aneurysms are vascular abnormalities that cause outpouching of the arterial wall [1]. Although they are not uncommon, there is scanty information regarding intracranial aneurysms in Africa [2]. Intracranial aneurysms are often asymptomatic until they cause symptoms and signs resulting from mass compression and/ or spillage of blood products into the arachnoid space. Currently available diagnostic tools are computed tomography (CT) angiography, magnetic resonance angiography (MRA) and intra-arterial digital subtraction angiography (IADSA) [1]. In our setting we continue to diagnose and achieve clipping of intracranial aneurysms amongst the currently available choices of managing intracranial aneurysms.

**Objectives:** To establish the feasibility and reflect on the challenges of clipping intracranial aneurysms in our settings. To raise awareness among health professionals and the general population

**Methods:** This is a retrospective case series of 5 patients diagnosed with intracranial aneurysms at King Faisal Hospital and Kigali University Teaching Hospital from October 2014 to October 2015. Available diagnostic methods used are the computed tomography (CT) angiography and/ or magnetic resonance angiography (MRA). We have excluded cases that were diagnosed with intracranial aneurysm at autopsy.

**Results:** Five patients met inclusion criteria for our study. We describe case by case, the choices of therapeutic measures, the challenges encountered during their management and their outcome.

**Conclusion:** Despite the challenges, intracranial aneurysms are treatable in Rwanda with good outcome. However, there is still lack of awareness about this pathology.

**Keywords:** Aneurysm; Clipping; Subarachnoid; Hemorrhage; Vasospasm; Rwanda

## INTRODUCTION

Intracranial aneurysms are acquired vascular abnormalities that cause outpouching of the arterial wall. They are often located at the bifurcation of the arteries in the anterior circulation of the Circle of Willis [1].

There has not been any screening among the general population to investigate the extent of this condition worldwide. Therefore, there is a huge variation in the epidemiology of the intracranial aneurysms. The European stroke organization guideline reports an incidence of aneurysmal SAH of 9.1/100000 per person-year in general population with higher incidence in Finland and Japan [3]. There is scanty information about intracranial aneurysms in Sub-Saharan countries. However, Julius A. Ogeng'o in his report of 56 cases of intracranial aneurysms from 1998 to 2007 at Kenyatta National Hospital, he identified that the anatomic, age and gender distribution were different from those described in the literature [2].

Patients who have ruptured intracranial aneurysms will manifest with some or all of the following: a sudden onset thunderclap headache, nausea, vomiting, loss of consciousness, neck stiffness and seizures as there is blood accumulation into the subarachnoid space with subsequent decreased CSF absorption and breakdown of blood products.

The formation of intracranial aneurysms is an incompletely understood process. Even if they are considered as acquired conditions, many modifiable and non modifiable risk factors have been identified to influence their formation, growth and rupture [3].

The IADSA, the computed tomography angiography (CTA) and magnetic resonance angiography (MRA) are known to be the diagnostic tools for intracranial aneurysms. They appear on fluoroscopy as radio opaque, smooth margined, out-pouching of the cerebral vasculature. Although the IADSA is the gold standard for diagnosis of intracranial aneurysms, it is invasive and associated with transient to permanent neurologic complications in 2-4 % and 0.5% of cases respectively [4].

Since the advent of new surgical and anaesthesia techniques and instrumentations, there has been a great progress in the management of intracranial aneurysms but there remain many controversies on the management of intracranial aneurysms.

Considering the problem burden of intracranial aneurysms worldwide and scanty information in our country, detailed data are needed regarding the management aspects of intracranial aneurysms in our settings.

## PATIENTS PRESENTATION, MANAGEMENT AND OUTCOME

In this case series, we have identified five patients who were diagnosed with intracranial aneurysms at King Faisal Hospital, Kigali and University Teaching Hospital of Kigali by means of CTA and MRA from October 2014 to October 2015.

Hypertension as risk factor was identified in 3 patients, hypercholesterolemia in 1 patient and no risk factor was found in two patients. All patients presented symptoms and signs classical of aneurysmal SAH.

In our settings where IADSA is not yet available, CTA was used as the sole diagnostic tool in one patient and MRA for the rest of the four patients. One aneurysm was located at the ICA bifurcation, two were found at AComA, one was located at MCA bifurcation and another one at PComA (Table 1).

**Table 1 summary of clinical, imaging and outcome data**

| Case | Age & Sex | Clinical presentation | | | Radiology presentation | | Localization& Morphology | Treatment | | Outcome |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Consult | Risk factor | WFNS grade | Fisher grade | Other | | Type | Approach | |
| 1 | 44 M | 4 hours | HTN | 3 | 4 | | Right MCA bifurcation saccular aneurysm | Clipping | Pterional | Good |
| 2 | 38 F | within 24 hours | HTN | 2 | 4 | | Right ICA bifurcation saccular aneurysm | Clipping | Pterional | Good |
| 3 | 24 F | 5 days | HTN | 1 | 2 | Hydrocephalus | AComA saccular aneurysms | Clipping | Pterional | Good |
| 4 | 35 M | 4 days | Nil Known | 2 | 2 | | Right PComA saccular aneurysms | Medical treatment | | Death |
| 5 | 60 F | 5 days | Nil Known | 1 | 2 | | Left AComA saccular aneurysm | Medical treatment | | Death |

***Patient 1***

*Mr. M, 44*-years old male, with a long history of hypertension not compliant to treatment. He was brought by his wife six hours post sudden onset of severe headaches followed by altered mental status and left sided weakness. On arrival at A&E, he presented with high blood pressure (220/120 mmHg). His neurological examination showed GCS of 14/15, left hemiparesis with a pronator drift. The WFNS grade was evaluated at III (Hunt and Hess grade 3).

At A&E, CT scan was obtained and showed a SAH with an epicenter in the right sylvian fissure associated with intraparenchymal hematoma. MRA was done the same morning of admission and revealed a right MCA bifurcation aneurysm **(Image 1. A to E).**

He was admitted to ICU for close monitoring and continuation of resuscitation. The following morning, microsurgical aneurysm clipping was done through a right pterional approach.

The patient recovered full neurological function after surgery and medical care in ICU, but on day 8, he had a seizure. CT scan was requested and showed EDH which was surgically evacuated. He was discharged on day 26 with full neurological function on antihypertensive, anti-epileptic drugs, and analgesics. Currently, he has resumed his daily activities as a businessman.

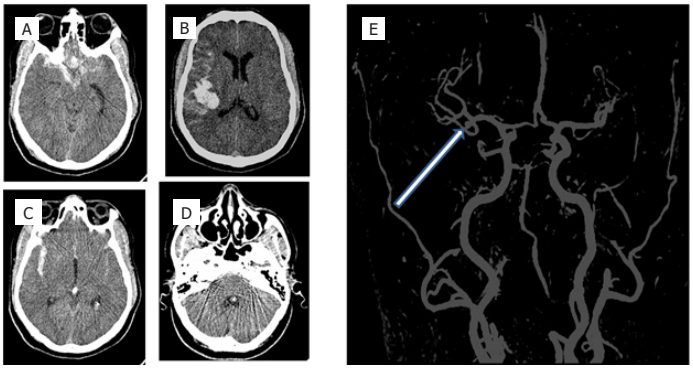



**Image 1:** the image 1.A and 1.C : Axial CT brain shows subarachnoid hemorhage in the basal cistern and sylvian fissures, mostly in the right sylvian fissure considered to be the epicentre of the hemorhage. Image 1.B shows right parietal intracerebral hemorhage. Image 1. E : MR angiography shows MCA aneurysm (see white arrow).

***Patient 2***

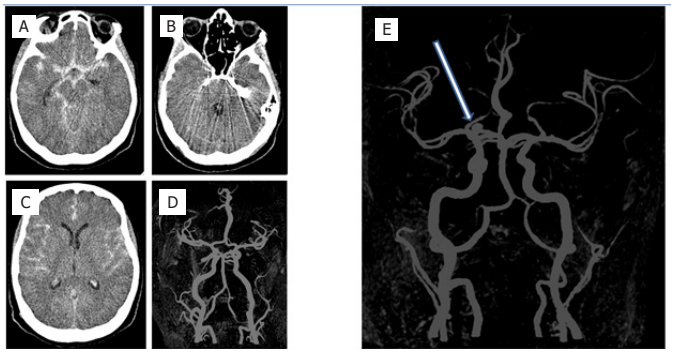
*Ms. J,* 38 years old, female patient was found by her housemate in the shower room with confusion, severe headache and dizziness. She presented to us with GCS of 15/15 and a left cranial nerve (CN)VI palsy. The CT scan of brain done at A&E showed a SAH while the MRA didn't show any aneurysm. She was treated for SAH and discharged on antihypertensive medication and she was given a left eye patch for her diplopia.

Four months later, during regular follow up session, she presented with new onset of severe headaches, blurred

vision and left hand paresthesias progressing for around 1 month. Examination revealed blood pressure of 168/105 mmHg; it was noted that the patient was poorly compliant on antihypertensive medication. She had cushingoid appearance and a normal neurological examination. At this time MRA done showed a right ICA bifurcation aneurysm (Image 2. A to E).

She was hospitalized for stabilization and clipping of the aneurysm. Three days later, right ICA aneurysm clipping was done through a pterional approach .The aneurysm was identified at the ICA bifurcation oriented posteromedially. The aneurysm neck was clipped using application of a right angled permanent clip. She recovered well and the following day the paresthesias subsided. As complications during hospitalization, she had transient confusion and hypokalemia which were treated successfully.

She was discharged on the thirteenth day post surgery on antihypertensive, analgesics and proton pump inhibitor. She has returned to her job as an accountant.




**Images 2:** A through C: axial cuts CT brain show diffuse subarachnoid hemorhage in the basal cisterns, sylvian fissures and interhemispheric and peripheral subarachnoid space. Image E : MR angiography show carotid bifurcation aneurysm (see white arrow).

***Patient 3***

Ms L, 24 years old overweight woman who had recently been diagnosed with hypertension was found in her house with decreased level of consciousness, headache, left eye blurred vision, vomiting and impaired speech. She was taken to a local district hospital where she was admitted. Five days later, she was referred to CHUK where she presented with a GCS of 14/15 and diplopia. Brain CT scan done showed SAH associated with obstructive hydrocephalus that was treated with Endoscopic Third Ventriculostomy (ETV) before she was referred to KFH, K for further management.

On presentation at KFH, K she was in fair general condition with a normal neurological examination. The brain MRA done revealed an ACom A aneurysm (Image 3. A to E).
On day 21 post aneurysmal rupture, she underwent aneurysm clipping through pterional craniotomy. During surgery, the brain was relaxed and she recovered well post surgery. She was discharged 5 days after surgery. She regularly attends outpatient department for her hypertension and she has returned to university to continue studies and works as an accountant.

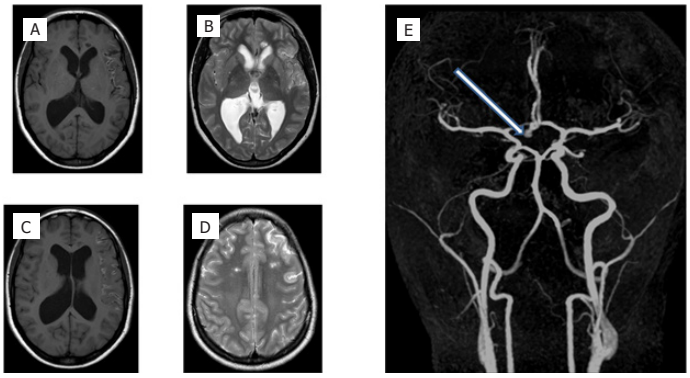



**Image 3:** A through C : axial view MR images show communicating hydrocephalus. Image 3 E : MR angiogram shows anterior communicating artery aneurysm (white arrow).

***Patient 4***

*Mr. H,* 35 years old male, presented to our A&E with history of thunderclap headache that interrupted his sleep, transient episode of confusion and right drooping eyelid which he had had for 4 days. Clinical examination showed a GCS of 15/15 and right oculomotor nerve palsy.

A CTA showed a PCom A berry aneurysms, the patient was admitted to ICU and treatment for aSAH was started.

On the 11th day post admission, the ICU staff decided to shift the patient to HDU as there was shortage of beds and his clinical condition was considered better compared to the rest of patients in ICU. Upon admission to HDU, he kept complaining of headaches and he died later while he was receiving his morning bed bath.

***Patient 5***

Ms A, 60 years old, female patient presented to us on 5th day of headaches and vomiting. Neurological examination done on admission was normal. She came with MRA done at a private clinic showing left AComA aneurysm and CT scan was showing SAH **(Image 5 A to D).**

She was admitted to ICU for aneurysmal SAH management, according to protocol. She started worsening on day 13 post aSAH. She developed hydrocephalus on day 15 post SAH which required EVD. She died suddenly on day 22 post aneurysm rupture after emotional upset.

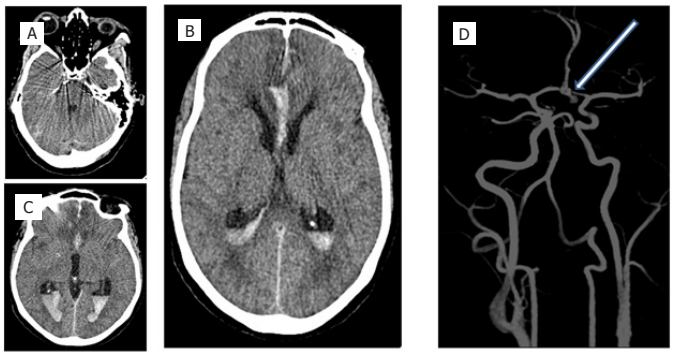



**Image 3:** A through C: axial CT brain images show interhemispheric subarachnoid hemorhage with intraventricular extension. Image 5 D: MR Angiography show anterior communication artery aneurism (see white arrow)

## DISCUSSION

Intracranial aneurysms are considered to be acquired cerebrovascular conditions but it is known also that modifiable risks and non modifiable risks may influence aneurysms formation, growth and rupture. Mortality rate is 30%, 60% and 100% after the initial, the second and the third hemorrhage respectively [5]. Most of the patients treated for ruptured intracranial aneurysms came late in the vasospasm period due to delays in seeking medical care or delays in transfers / for diagnosis. Hence, the awareness of the medical personnel and general population about this condition is needed to decrease the morbidity and mortality.

Aggressive management of ruptured intracranial aneurysms improves the prognosis: notably glycemia control, temperature control, blood pressure control and triple H therapy (which consist of hypervolemia, hemodilution and hypertension) [7]. Ipso facto, medical therapy of ruptured intracranial aneurysms in our conditions is a pitfall for prevention of complications related to intracranial aneurysms and to decrease the morbidity and mortality.

Current surgical practice favors early surgery (before 72 hours) to prevent deadly rebleeding and vasospasm and improve outcome but it is associated with increased intraoperative complications [5,6]. However, delayed surgery (10 - 14 days post aneurysms rupture) is favored for large aneurysms (10 mm), aneurysms in difficult locations or in patients with a poor health condition (Hunt and Hess class 4-5). But delayed surgery is associated with poor outcome. Postponing treatment in patients who are eligible for treatment between days 5 to 10 after aSAH is not recommended [5].

Surgery of ruptured intracranial aneurysm is intriguing in terms of timing, selection of patients, operative choices and anaesthesia management. Furthermore, there is several conflicting data regarding management of unruptured intracranial aneurysms.

Hence, management of unruptured intracranial aneurysms remains a decision on individual case basis.

## CONCLUSION AND RECOMMENDATIONS

Despite the challenges, intracranial aneurysms are treatable in Rwanda with good outcome.

The main challenges are the delay in transfer because of the referral system and limited access to intensive care unit.

Delay in transfer can be overcome by giving referring doctors the powers to transfer anerysmal patients without having to go through the tedious referral process because of the risk of bleeding and vasospasm. This also will answer the problem of limited access to intensive care unit.

We recommend continuous medical education on spontaneous subarachnoid hemorrhage management for medical personnel and educating the public about the signs and symptoms of the disease and availability of treatment within the country.

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