

# Diagnostic Accuracy of Magnetic Resonance Angiography in Prediction of Intracranial Aneurysms in Post-Coiling Patients Taking Digital Subtraction Angiography as Gold Standard

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## ABSTRACT

**Aim:** Diagnostic accuracy of magnetic resonance angiography in prediction of intracranial aneurysms in post coiling patients taking digital subtraction angiography as gold standard.

**Methodology:** It is a cross sectional study in department of Neuro-Radiology, Lahore General Hospital, Lahore from 21-01-18 to 21-06-18. 136 cases were enrolled. Patients with intracerebral coiling of brain aneurysms underwent MRA and findings were noted. Then these patients had four vessel cerebral DSA and findings were identified. Data was analyzed on SPSS version 20.

**Results:** The mean age was 41.03±11.98 years. M:F ratio was 2.1:1. The mean duration of coiling was 8.1±1.8 months. The sensitivity, specificity, PPV, NPV and diagnostic accuracy of ICA-MRA was 88.2%, 92.9%, 88.2%, 92.9% & 91.2% respectively.

**Conclusion:** MRA is very useful noninvasive procedure in follow up for post-coiling cerebral aneurysms in diagnosing recurrence of aneurysm.

**Keywords:** Coiling, Magnetic Resonance Angiography, Intracranial Aneurysms, Digital subtraction angiography

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## INTRODUCTION

Digital subtraction angiography (DSA) is used as gold standard for detection and characterization of ICAs with many disadvantages, like high skill levels, high cost and less availability of centers and it is an invasive procedure with neurological complications of 2.3%.<sup>1</sup>

Contrast Enhanced Magnetic resonance angiography (MRA) can be used for follow up aneurysm recanalization non-invasively.<sup>2</sup> One study reported that a total of 383 (short term <1 year and long term >1 year) follow up angiograms show that recurrence was found in 33.6% of treated aneurysms i.e. 129/383.<sup>3</sup>

MRA is a safe and accurate non-invasive imaging method and is used for evaluating coiling cerebral aneurysms. It has the same accuracy as of DSA. Three-dimensional time of flight (TOF) MRA clearly demonstrates residual/recurrent aneurysm neck and sac. MRA source images provide more information about, bleeding, cerebral infarction and atrophy.<sup>4</sup>

MRA is not only cost effective but also has equivalent health benefits as Intra cranial DSA. MRA should replace routine Intra-cranial DSA to follow-up patients with coiled aneurysms<sup>5</sup>

**Rationale:** Objective was to assess the diagnostic accuracy of MRA for follow up of post coiling intra cranial aneurysms taking DSA as gold standard. MRA is a non-invasive, relatively economical and easily accessible method for follow up of post-coiling ICAs. It can replace DSA, which is expensive, not easily available and needs high level of skill. Moreover, literature shows controversial results.

In order to confirm the reliability of MRA for prediction of post-coiling ICAs, study was conducted. This study will help for early and economical method for diagnosis of post-coiling ICAs instead of going for DSA. Moreover, no local evidence was found. So it will not only help us to get local evidence and we will be able to implement the use of MRA instead of DSA.

## METHODOLOGY

It is a cross sectional study conducted at department of neuro radiology, Lahore General Hospital, Lahore from 21-01-2018 to 21-06-2018. A sample size of 136 patients was calculated with 95% confidence level, taking prevalence of recurrence of aneurysm as 33.6%, sensitivity of 90.9% with 7% margin of error, specificity of 88.8% with 7% margin of error.

**Inclusion Criteria:** Patients 20-60 years of age with either gender who underwent coiling for subarachnoid hemorrhage due to ruptured aneurysms and now returned for six months with post coiling follow up.

**Exclusion Criteria:** Patients with medical record of traumatic subarachnoid hemorrhage, subjects having metallic clip, implanted hearing aids, eye metallic bodies, cardiac pacemaker, surgical clipping or endovascular coiling for their ICA before this procedure were excluded from study.

**Data Collection Procedure:** A total of 136 subjects fulfilling inclusion criteria were selected. Informed consent was taken. Demographic data e.g. name, age, gender, duration of IA) was identified. Then MRA was done and reported by a single senior radiologist having at least 4 years post residency experience. MRAs were performed using 1.5 T superconducting MR system. Then patients underwent DSA by a single senior interventional

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neuroradiologist. Reports were assessed and patients were confirmed as positive or negative. On MRA recurrence of aneurysm was labeled if there was any saccular or fusiform contrast containing new outpouching adjacent to the neck of previously coiled aneurysm. On DSA it was considered as recurrence if there was any newly formed contrast containing outpouching or saccular dilatation of vessels adjacent to previously coiled vessel with coil in situ. Specially designed performa was used to collect all information.

Data was entered and analyzed by SPSS-20. Quantitative data like age and duration after coiling was presented as mean ± sd. Qualitative data like gender was presented as frequency and percentage.

**RESULTS**

One hundred and thirty six patients were enrolled. The mean age was 41.03±11.98 years. Males were 92(67.7%) and 44(32.4%) patients were females. M:Fratio was 2.1:1. The mean duration of coiling of the patients was 8.1±1.8 months (Table 1). The sensitivity, specificity, PPV, NPV and diagnostic accuracy of intra cranial aneurysms MRA was 88.2%, 92.9%, 88.2%, 92.9% & 91.2% respectively taking DSA as gold standard (Table 2).

Table1: Baseline characteristics of patients

N	136
Age (years)	41.03±11.98
Sex (m / f)	92 (67.7%) / 44 (32.4%)
Duration of coiling (months)	8.1±1.8

Table2: Accuracy of MRA for ICA diagnosed against DSA

		ICA DSA		Total
		Positive	Negative	
ICA MRA	Positive	45	6	51
	Negative	6	79	85
Total		51	85	136

Sensitivity=88.2%, Specificity=92.9%, PPV =88.2%, NPV =92.9%, Diagnostic Accuracy=91.2%

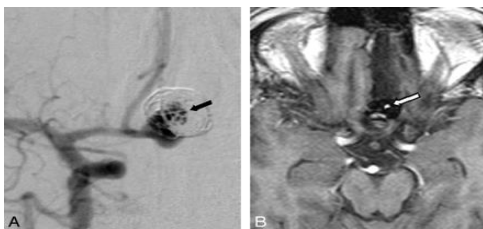


Fig1. A) DSA image shows coiled A Com aneurysm with a small collection of contrast (black arrow) suggesting regrowth in the neck region. B) MRA image returning a hyperintense signal (white arrow) representing collection of contrast in neck suggesting recurrence.

**ABC**



Fig 2. A) DSA of left ICA shows aneurysm of Ant Communicating artery (ACA). B) DSA of post Coiling follow up shows a small focal pocket of contrast inferiorly representing residual aneurysm. C) MRA image showing the same area.

MRA of Intracranial vessels of same patient show coils with focal collection of contrast inferiorly suggesting residual aneurysm.

**DISCUSSION**

In this study, the sensitivity, specificity, PPV, NPV and diagnostic accuracy of ICA MRA was 88.2%, 92.9%, 88.2%, 92.9% & 91.2% respectively taking DSA as gold standard.

The incidence of unruptured ICAs in global level is about 2–3%.<sup>6,7</sup>In past studies, the follow-up duration varied, the duration after which screening could be effective remains unknown.<sup>8</sup>

MRA provided equivalent health benefits as Intra-arterial-DSA and was cost-effective. MRA dominates and should replace routine Intra-arterial-DSA to follow-up patients with coiled aneurysms.<sup>5</sup>

A study by Sabry A.E et al<sup>4</sup> documented that MRA is safe and non-invasive follow-up imaging procedure for post coiling patients for evaluating cerebral aneurysms after the development of emboli with same accuracy as DSA. Three-dimensional time of flight MRA visualized neck and sac of residual/recurrent aneurysm.

In many studies, MRA is a non-invasive, common and accurate imaging of brain blood vessels for post coiling follow up and does not involve ionizing radiation exposure. The images obtained are slightly affected by coil-induced artifacts. Other studies proved statistically no significant difference in accuracy between MRA and DSA.<sup>9,10,11</sup>

The sensitivity and specificity intime of flight (TOF) MRA for follow up of coiled ICA were 40% and 90% respectively.<sup>12</sup>Basiratniaet al. has reported the sensitivity and specificity of MRA in detection of ICAs is 90.9% and 88.8% respectively.<sup>13</sup>

In a study by Van Amerongen MJ et al,<sup>14</sup> it is seen that the MRA is a safe and cheap method as compared to DSA in the follow-up of ICAs treated subjects with endovascular coil occlusion. The sensitivity and specificity in case of time of flight -MRA was 86% and 84% respectively for the detecting any recurrent aneurysm. For contrast-enhanced MRA, the sensitivity and specificity were 86% and 89% respectively. Both time of flight -MRA and contrast-enhanced MRA are significantly accurate for visualizing recanalization in ICAs treated with endovascular coil occlusion.

Bakker NA et al<sup>15</sup> showed that the MRA is a feasible primary follow-up modality after coiling of ICAs.

By stratifying by age with age ≤40 years, the sensitivity, specificity and diagnostic accuracy of MRA for diagnosing ICA was 88.9%, 92.5% & 91.1% respectively taking DSA as gold standard and patients with age >40 years, the sensitivity, specificity and diagnostic accuracy of MRA for diagnosing ICA was 87.5%, 93.3% & 91.3% respectively. Similarly stratifying by gender among male patients the sensitivity, specificity and diagnostic accuracy of MRA for diagnosing ICA was 84.9%, 93.2% & 90.2% respectively and among female patients the sensitivity, specificity and diagnostic accuracy of MRA for diagnosing ICA was 94.4%, 92.3% & 93.2% respectively.

## CONCLUSION

This study concluded that TOF and post contrast MRA is very useful, feasible and noninvasive procedure for follow up of post-coiling cerebral aneurysms for recurrence of aneurysm taking DSA as gold standard.

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