

EM Camporesi, MD, S Agazzi, MD, Anna Mizzi, MD, J Sullebarger, MD, Rita Patel, MD, D Mangar, MD  
University of South Florida, Tampa, Florida, United States

## Introduction

A wide range of cardiac abnormalities have been associated with aneurismal subarachnoid hemorrhage (SAH), but no study has provided a detailed analysis of the relative frequency of cardiac abnormality in SAH patients and associated outcome. We completed a retrospective review of the charts of all patients who were referred for cardiology consultation immediately after admission for SAH and described their outcome.

## Methods

During this IRB approved study period of 4.5 years, **617** patients were admitted with a diagnosis of non-traumatic SAH. Among these patients, **87** underwent evaluation by Cardiology due to new onset cardiac abnormalities. Demographic and clinical parameters were analyzed in addition to pertinent laboratory values (troponin I (TI) and CPKMB) and type of intervention for aneurysm treatment. Myocardial infarction (MI) was defined as a rise of TI levels over 0.3ng/ml, together with evidence of myocardial ischemia. The primary study endpoint was the effect of each cardiac event on patient outcome; the secondary endpoint was the association of different cardiac events with the location of the aneurysm. Multiple variable analysis was performed by logistic regression.

## Results and Discussion

The median age of the patients was 65 (range 27-89) years, with a female predominance (87.4%). More than 70% of the patients suffered from hypertension and 30% had a past cardiac medical history. On admission, 62 patients (71.3%) had a clinical grade of WFNS 1-3, 17 had WFNS grade 4, and 8 had WFNS grade 5. An aneurysm was demonstrated by cerebral angiography in 83 patients, while 4 had a negative angiogram. 14 patients underwent endovascular coiling and 63 had surgical clipping. The remaining 6 had no intervention as they remained as WFNS grade 5.

## Radiographic Data

Aneurysm location‡	
Anterior circulation, n (%)	26/83 (31.3%)
Posterior circulation, n (%)	20/83 (24.1%)
Multiple aneurysms, n (%)	22/83 (26.5%)
Intracerebral hemorrhage, n (%)	
Intracerebral hemorrhage, n (%)	6/87 (6.9%)
Intraventricular hemorrhage, n (%)	32/87 (36.8%)
Vasospasm, n (%)	16/87 (18.4%)
Treatment	
Coiling, n (%)	14/87 (16.1%)
Clipping, n (%)	63/87 (72.4%)
No treatment, n (%)	10/87 (11.5%)
External Ventricular Drainage, n (%)	
External Ventricular Drainage, n (%)	37/87 (42.5%)
Ventriculo-Peritoneal Shunt, n (%)	
Ventriculo-Peritoneal Shunt, n (%)	10/87 (11.5%)

\* World Federation of Neurological Surgeons

‡ In 4 patients no aneurysms were found at cerebral angiography, therefore the total number is 83

Cardiac events: **41 patients (47%) experienced an MI, 37 of which had a non-ST elevated MI (NSTEMI)**. 58.6% developed an arrhythmia and 31% CHF with pulmonary edema. New-onset atrial fibrillation and ventricular tachycardia were the most common arrhythmias. The most frequent EKG change was T wave inversion (17.2%). Cardiac TI levels were measured in 67 patients, and 48 (71.6%) were elevated. 6 patients underwent a coronary angiogram: 3 were negative, 1 had mild disease, while 2 had triple vessel disease. A cardiac ECHO was performed in 61 patients, among these, only 11.5% showed a severely depressed myocardial contractility (EF<40%), while 37.7% had an EF value between 51 and 60%, and 37.7% had an EF>61%. Most cardiac events were transient and the mortality rate in our cohort was 23% (20/87), which compares favorably to 24.4% reported by the national database.

## Conclusions

Our analysis demonstrated that in patients admitted for subarachnoid hemorrhage, MI with elevated troponin was significantly associated with a poor outcome (p=0.006), but higher WFNS score and age at presentation remained the only independent predictors of death.

Univariate Mortality Significant Risk Factors				
	Alive	Dead	p-value	OR for death
Age (median, range)	63, 27-89	71.5, 50-89	0.007	-----
Female (n=76)	58/76 (76.3%)	18/76 (23.7%)	-----	-----
WFNS (4-5) (n=25)	11/25 (44%)	14/25 (56%)	<0.001	<b>11.88 (3.75-37.68)</b>
WFNS (1-3) (n=62)	56/62 (90.3%)	6/62 (9.7%)	-----	-----
MI- Yes (n=41)	27/41 (65.9%)	14/41 (34.1%)	0.020	<b>3.46 (1.18- 10.12)</b>
Troponin peak: median, range	0.69, 0.03-24.6	1.3, 0.03-83.1	0.031	
Troponin >1.0 (n=34)	20/35 (57.1%)	15/35 (42.9%)	0.006	<b>5.25 (1.51- 18.20)</b>
Troponin <1.0 (n=33)	28/32 (87.5%)	4/32 (12.5%)	-----	-----
CPKMB peak	3.5, 0.7-39.8	6.0, 1.2-79.1	0.029	-----
OR: odds ratio				

