LOMBOK HEALTH and SCIENCE JOURNAL
No. ISSN 2964-5239
https://journal.unram.ac.id/index.php/lhsj/index

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

NATURAL HISTORY AND TREATMENT OF DEEP-SEATED BRAIN ARTERIOVENOUS MALFORMATIONS

Alifia Firdiansari[1], Rohadi Muhammad Rosyidi[2], Bambang Priyanto[2], Surahman Hadi[2], Januarman[2]

1. Medicine Faculty, Mataram University, Indonesia
2. Neurosurgery Departement, General Hospital Of West Nusa Tenggara Province

Email: firdiansarialifia@gmail.com/rha.ns2010@gmail.com

ABSTRAK

Background: Brain arteriovenous malformations (AVM) might be asymptomatic. The unruptured AVM was commonly found in patient with symptoms like persistent headaches and seizure. The ruptured AVM was 35.5% annually and usually involved deep and large structures. Spetzler-Martin grading system was commonly used to evaluate the outcome and treatment options of AVM.

Aim: this case report will provide information about Spetzler-Martin grade III AVM in a 26-year-old male patient with a history of throbbing headaches and a history of VP shunt procedure.

Case: A 26-year-old man with the main complaint of a headache that felt like it was throbbing and continuous. Nausea and vomiting were present. History of similar complaints in 2015. History of VP shunt in 2015 due to hydrocephalus. In the head CT scan we found an iso-hyperdense lesion of ill-defined density involving the left thalamus, left basal ganglia. After adding contrast, a serpiginous tubular lesion was seen forming a nidus size ±AP 2.77 x LL 1.96 x CC 3.72 cm with draining veins in the vein of Galen, a hyperdense lesion appears filling the left lateral ventricle and third ventricle, a VP shunt is installed through the right frontal region with the distal end in the left lateral ventricle.

Discussion: Our patient was diagnosed with Spetzler-Martin grade III which has to be treated multimodally such as pre-surgical endovascular embolization followed by microsurgery or radiosurgery. Endovascular embolization may reduce the risk of bleeding in the following surgery

Conclusion: Bleeding is commonly found in AVM, consisting of half of the total cases. The risk of bleeding increase in deep and large structure of AVM in the brain, usually found in Spetzler-Martin grade III.

Keyword: AVM, Spetzler-Martin Grading System, Deep

LOMBOK HEALTH and SCIENCE JOURNAL
No. ISSN 2964-5239
https://journal.unram.ac.id/index.php/lhsj/index

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

INTRODUCTION

AVMs, or arteriovenous malformations, are unnatural fistulas that occur between veins and arteries without the presence of a capillary bed in between. High blood flow straight into vein structures can damage the vein walls and potentially result in life-threatening bleeding. The most frequent way to diagnose intracranial AVMs is during the work-up for an acute intracerebral hemorrhage, however, they are also frequently discovered by accident when treating disorders like seizures and persistent headaches. The Spetzler-Martin grading scale is the most often used categorization system to characterize them.[1]

Abecassis et al. performed a systematic literature analysis and discovered that the frequency of cerebral arteriovenous malformations (AVMs) varied between 1.12 and 1.42 cases per 100,000 person/year. Bleeding is the first case present in 36 and 38 percent of new patients.[2] In a meta-analysis, Gross and Du estimated an annual rupture risk of 3.0% for AVMs overall, with a rate of 2.2% of cases per year for the unruptured category and 4.5% per year for the ruptured subset.[3]

A yearly rupture rate as high as 35.5% was observed in the study by Stapf and colleagues when deep location, deep venous drainage, and previous bleeding are present.[4] Higher feeding artery pressure may make smaller AVMs more prone to rupture than larger AVMs, though not all research supports this theory.[3,5] There is a 2.2% yearly risk of bleeding for unruptured cerebral AVMs, according to the Randomized experiment of Unruptured Brain AVMs (ARUBA) experiment.[6] An increased chance of AVM rupture is linked to risk factors such as deep AVM placement, primarily deep venous drainage, history of bleeding, and concomitant aneurysms.[3] This presented case is about

LOMBOK HEALTH and SCIENCE JOURNAL
No. ISSN 2964-5239
https://journal.unram.ac.id/index.php/lhsj/index

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

deep AVM in a 26-year old male with prior

VP shunt procedure for hydrocephalus.

LOMBOK HEALTH and SCIENCE JOURNAL
No. ISSN 2964-5239
https://journal.unram.ac.id/index.php/lhsj/index

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

CASE

A 26 year old man with the main complaint of headache felt like it was throbbing and continuous. Nausea to vomiting. History of similar complaints in 2015. History of VP shunt in 2015 due to hydrocephalus. Vital sign examination is within normal limits, neurological examination is within normal limits. Complete laboratories are normal, Anti-HIV is non-reactive and HBsAg is non-reactive. A CT-Scan of the head with contrast and Digital Subtraction Angiography was carried out. (Figure 1)

In head CT scan we found an iso-hyperdense lesion of ill-defined density involving the left thalamus, left basal ganglia. After adding contrast, a serpiginous tubular lesion was seen forming a nidus size ±AP 2.77 x LL 1.96 x CC 3.72 cm with draining veins in the vein of Galen, a hyperdense lesion appears filling the left lateral ventricle and third ventricle, a VP shunt is installed through the right frontal region with the distal end in the left lateral ventricle; Sulci, fissura sylvii and gyri are normal; Blurred white and gray matter differentiation around the lesion; Normal ventricular and cisternal systems; There is no visible shift in the center line; Infratentorial: pons, mesencephalon, CPA and cerebellum are normal; Right and left mastoid orbits and air cells are normal. The patient was treated symptomatically with strong analgetic like a fentanyl patch to help reduce the pain intensity. Thenceforth, the patient underwent endovascular

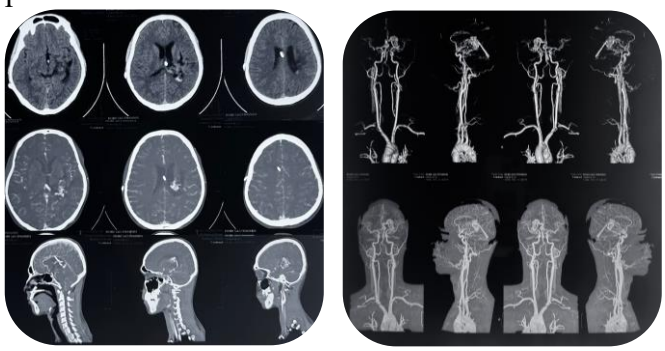

Figure 1 Spetzler Martin score 3 (diameter nidus 0-3 cm = 1, eloquent area = 1 (thalamus-basal ganglia), deep draining vein = 1(vein of galen).

DISCUSSION

One of the most prevalent congenital vascular brain malformations, brain arteriovenous malformations (AVM)

LOMBOK HEALTH and SCIENCE JOURNAL
No. ISSN 2964-5239
https://journal.unram.ac.id/index.php/lhsj/index

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

usually appear in early childhood.[7] AVMs may not cause any symptoms, but when they do, patients may experience headaches, seizures, intracranial hemorrhage (ICH), and neurological impairments.[8,9] ICH is the most common presenting symptom in 50% of cases.[9] Although subarachnoid locations are less prevalent, brain arteriovenous malformations (AVMs) account for 9% of subarachnoid hemorrhages and are the primary source of ICH in young adults.[9,10] Most hemorrhages occur intraparenchymally. According to reports, the overall yearly rupture risk was 2.3-2% for unruptured cases, 1.3–2.2% for ruptured cases, and 4.5–4.8% for both.[9] Individuals who have previously experienced an AVM rupture are more vulnerable to bleeding than those who have not. Between 11 and 33 percent of cases had seizures.[11]

Treatment options include conservative therapy, neurosurgical elimination, radiosurgery, endovascular techniques, and combinations of these options. Treatment recommendations, the mortality and morbidity of surgical resection were estimated using the Spetzler-Martin arteriovenous malformation (AVM) grading system. It assigns points based on size, elegant location, and venous drainage, among other characteristics of intracranial AVM (Table 1).[12]

Table 1 Spetzler-Martin grading System

Characteristics	Point
Size of Nidus	
Small (<3 cm)	1
Medium (3-6 cm)	2
Large (>6 jam)	3
Eloquence of Adjacent Brain	
Noneloquent (frontal and temporal lobe, cerebellar hemispheres)	0
Eloquent (sensorimotor, language, visual cortex, hypothalamus, thalamus, brain stem, cerebellar nuclei, or	1

LOMBOK HEALTH and SCIENCE JOURNAL
No. ISSN 2964-5239
https://journal.unram.ac.id/index.php/lhsj/index

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

regions directly adjacent to these structures)	
Venous Drainage	
Superficial only	0
Deep	1

Low grade (grade I-II) AVM based on Spetzler-Martin grading system is usually treated with surgical resection as the primary curative strategy. This option was preferred because it has a high cure rate and low complications.[13] The Expert Consensus on the Management of Brain Arteriovenous Malformations recommended high grade (IV-V) is preferably conservative. Grade III has to be treated with a multimodal approach based on case specific. Radiosurgery was mostly preferred for grade III with unruptured AVM.[14] Microsurgical resection could be another option for grade III, performed with pre-surgical endovascular embolization might improve the neurological outcome.[15]

In our case, the patient was Spetzler-Martin grade III, treated with the endovascular embolization. Embolization is usually performed as pre-procedural microsurgery or radiosurgery. Presurgical embolization aids in decreasing the nidus's size and lowers the possibility of bleeding after surgery. By embolization, those arterial feeders that would be challenging to reach during the initial phases of surgery should be removed. As a result, it aids in the nidus volume or flow reduction that enables safer surgical removal. High-risk angiographic characteristics, such as feeding artery and intranidal aneurysms, are also treated by embolization. After endovascular embolization, microsurgical excision may be carried out to lower the risk of bleeding during surgery and to enable a thorough and straightforward removal.[16] Prior to surgical resection, endovascular embolization serves as an additional therapeutic intervention for volume reduction. It is a

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

transient technique that needs to be followed by radiosurgery or surgery.[17]

CONCLUSION

AVM may be asymptomatic but the devastating effect of AVM is intracranial bleeding, which is seen in 50% of the total cases. Most patients develop symptoms at an early age, such as headache, seizure, and

treatment option is based on grading. The Spatzler-Martin grading system is one of the early grading systems that has been used for decades. Grade III AVM is usually treated with multimodal but the most preferred option was radiosurgical.

REFERENCES

1. Zyck S, Davidson CL, Sampath R. Arteriovenous Malformations. [Updated 2022 Aug 15]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK531479/
2. Abecassis IJ, Xu DS, Batjer HH, Bendok BR. Natural history of brain arteriovenous malformations: a systematic review. Neurosurg Focus. 2014 Sep;37(3):E7.
3. Gross BA, Du R. Natural history of cerebral arteriovenous malformations: a meta-analysis. J Neurosurg. 2013 Feb;118(2):437-43.
4. Stapf C, Mast H, Sciacca RR, Choi JH, Khaw AV, Connolly ES, Pile-Spellman J, Mohr JP. Predictors of hemorrhage in patients with untreated brain arteriovenous malformation. Neurology. 2006 May 09;66(9):1350-5
5. Norris JS, Valiante TA, Wallace MC, Willinsky RA, Montanera WJ, terBrugge KG, Tymianski M. A simple relationship between radiological arteriovenous

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

malformation hemodynamics and clinical presentation: a prospective, blinded analysis of 31 cases. J Neurosurg. 1999 Apr;90(4):673-9.

6. Mohr JP, Parides MK, Stapf C, Moquete E, Moy CS, Overbey JR, Al-Shahi Salman R, Vicaut E, Young WL, Houdart E, Cordonnier C, Stefani MA, Hartmann A, von Kummer R, Biondi A, Berkefeld J, Klijn CJ, Harkness K, Libman R, Barreau X, Moskowitz AJ., international ARUBA investigators. Medical management with or without interventional therapy for unruptured brain arteriovenous malformations (ARUBA): a multicentre, non-blinded, randomised trial. Lancet. 2014 Feb 15;383(9917):614-21
7. Tong X, Wu J, Lin F, Cao Y, Zhao Y, Ning B, Zhao B, Wang L, Zhang S, Wang S, Zhao J. The effect of age, sex, and lesion location on initial presentation in patients with brain arteriovenous malformations. World Neurosurg, 2016 87:598–606
8. Brown RD Jr, Wiebers DO, Torner JC, O'Fallon WM. Frequency of intracranial hemorrhage as a presenting symptom and subtype analysis: a population-based study of intracranial vascular malformations in Olmsted Country, Minnesota. J Neurosurg. 1996; 85(1):29–32
9. Kim H, Al-Shahi Salman R, McCulloch CE, Stapf C, Young WL, MARS Coinvestigators. Untreated brain arteriovenous malformation: patient-level meta-analysis of hemorrhage predicors. Neurology 83. 2014; (7):590–597
10. Al-Shahi R, Warlow C. A systematic review of the frequency and prognosis of arteriovenous malformations of the brain in adults. Brain. 2001; 124(Pt 10):1900–1926

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

11. Garcin B, Houdart E, Porcher R, Manchon E, Saint-Maurice JP, Bresson D, Stapf C. Epileptic seizures at initial presentation in patients with brain arteriovenous malformation. Neurology. 2012; 78(9):626–631
12. Spetzler RF, Martin NA. A proposed grading system for arteriovenous malformations. Journal of neurosurgery. 1986 Oct 1;65(4):476-83.
13. Baharvahdat H, Blanc R, Fahed R, Smajda S, Ciccio G, Desilles JP, Redjem H, Escalard S, Mazighi M, Chauvet D, Robert T. Endovascular treatment for low-grade (Spetzler-Martin I–II) brain arteriovenous malformations. American Journal of Neuroradiology. 2019 Apr 1;40(4):668-72.
14. Kato Y, Dong V, Chaddad F, Takizawa K, Izumo T, Fukuda H, Hara T, Kikuta K, Nakai Y, Endo T, Kurita H. Expert consensus on the management of brain arteriovenous malformations. Asian Journal of Neurosurgery. 2019 Dec;14(04):1074-81.
15. Catapano JS, Frisoli FA, Nguyen CL, Wilkinson DA, Majmundar N, Cole TS, Baranoski JF, Whiting AC, Kim H, Ducruet AF, Albuquerque FC. Spetzler-Martin grade III arteriovenous malformations: a multicenter propensity-adjusted analysis of the effects of preoperative embolization. Neurosurgery. 2021 May 1;88(5):996-1002.
16. Derdeyn CP, Zipfel GJ, Albuquerque FC, Cooke DL, Feldmann E, Sheehan JP, et al. Management of brain arteriovenous malformations: A scientific statement for healthcare professionals from the American Heart Association/American Stroke

LOMBOK HEALTH and SCIENCE JOURNAL
No. ISSN 2964-5239
https://journal.unram.ac.id/index.php/lhsj/index

Published in July 2024, included in Vol.1 (2024) : LHSJ July 2024 (1-9)

Association. Stroke. 2017;48:e200–e224.

17. Nerva JD, Kim LJ, Barber J, Rockhill JK, Hallam DK, Ghodke BV, et al. Outcomes of multimodality therapy in pediatric patients with ruptured and unruptured brain arteriovenous malformations. Neurosurgery. 2016;78:695–707.