

SUPPLEMENTAL CONTENT 3

MOOSE Assessment

The criteria can be answered Yes (Y), No (N) or Unclear (U).

The criteria are:

1. Clear definition of study population?
2. Clear definition of outcomes and outcome assessment?
3. Independent assessment of outcome parameters?
4. Sufficient duration of follow-up?
5. No selective loss during follow-up?
6. Important confounders and prognostic factors identified?

The results for each study are displayed below.

Study	Criteria					
	1	2	3	4	5	6
Adrianto et al ¹	Y	Y	N	Y	Y	Y
Andres et al ³	Y	Y	U	Y	Y	Y
Cenzato et al ⁶	Y	Y	U	Y	Y	Y
Chibbaro et al ⁸	Y	Y	U	U	Y	Y
Cho et al ¹⁰	Y	Y	U	Y	Y	Y
Clark et al ¹¹	Y	Y	U	Y	Y	Y
Durnford et al ¹⁴	Y	Y	N	Y	Y	Y
Gemmete et al ¹⁶	Y	Y	U	U	Y	Y
Gokhale et al ¹⁷	Y	Y	N	Y	Y	N
Gross et al ¹⁸	Y	Y	U	Y	Y	Y
Hessler et al ²¹	Y	Y	U	Y	Y	N
Inagawa et al ²²	Y	Y	N	Y	Y	Y
Jellema et al	Y	Y	U	Y	Y	Y
Kaufmann et al ²⁴	Y	Y	Y	U	Y	Y
Kirsch et al ²⁶	Y	Y	U	Y	Y	U

Koch et al ²⁷	Y	Y	U	N	Y	Y
Lee et al ²⁸	Y	Y	U	Y	Y	Y
Ma et al ²⁹	Y	Y	U	Y	Y	Y
Narvid et al ³²	Y	Y	N	Y	Y	Y
Ozkan et al ³³	Y	Y	U	Y	Y	Y
Park et al ³⁴	Y	Y	N	Y	Y	Y
Qi et al ³⁶	Y	Y	U	U	Y	U
Rashad et al ³⁷	Y	Y	U	Y	Y	N
Ruiz- Juretschke et al ³⁹	Y	Y	U	Y	Y	N
Sasamori et al ⁴²	Y	Y	U	Y	Y	Y
Sherif et al ⁴⁵	Y	Y	U	Y	Y	Y
Shin et al ⁴⁶	Y	Y	U	Y	Y	Y
Shinoyama et al ⁴⁷	Y	Y	U	Y	Y	Y
Sri et al ⁴⁸	Y	Y	U	N	Y	Y
Takai et al ⁵¹	Y	Y	U	Y	Y	Y
Yen et al ⁵⁵	Y	Y	U	N	Y	Y
Zogopoulos et al ⁵⁶	Y	Y	N	Y	Y	Y
Blackburn et al ⁴	Y	Y	U	N	Y	Y
Chiu et al ⁹	Y	Y	N	U	Y	Y
Guillevin et al ¹⁹	Y	Y	U	Y	Y	N
Su et al ⁴⁹	Y	Y	U	Y	Y	U
Suh et al ⁵⁰	Y	Y	U	Y	Y	Y
Tsuruta et al ⁵²	Y	Y	U	N	Y	Y

Aghakhani et al ²	Y	Y	U	N	Y	N
Kim et al ²⁵	Y	Y	U	Y	Y	U
Cecchi et al ⁵	Y	Y	N	Y	Y	Y
Chen et al ⁷	Y	Y	Y	Y	Y	Y
Della et al ¹²	Y	Y	U	Y	Y	Y
Dhandapani et al ¹³	Y	Y	U	N	Y	U
Hanel et al ²⁰	Y	Y	U	Y	Y	N
Fox et al ¹⁵	Y	Y	U	Y	Y	N
Jablawi et al ²³	Y	Y	U	Y	Y	Y
Marquardt et al ³⁰	Y	Y	U	Y	Y	Y
Nagata et al ³¹	Y	Y	U	Y	Y	Y
Patel et al ³⁵	Y	Y	U	Y	Y	Y
Ropper et al ³⁸	Y	Y	U	Y	Y	Y
Safaei et al ⁴⁰	Y	Y	Y	Y	Y	Y
Saladino et al ⁴¹	Y	Y	U	Y	Y	Y
Schuetz et al ⁴³	Y	Y	U	U	Y	U
Schuss et al ⁴⁴	Y	Y	U	Y	Y	Y
Wang et al ⁵³	Y	Y	U	U	Y	Y
Wojciechowski et al ⁵⁴	Y	Y	U	Y	Y	Y

REFERENCES

1. Adrianto Y, Yang KH, Koo H-W, Park W, Jung SC, Park JE, et al: Concomitant origin of the anterior or posterior spinal artery with the feeder of a spinal dural arteriovenous fistula (SDAVF). *Journal of Neurointerventional Surgery* 9:405-410, 2017

2. Aghakhani N, Parker F, David P, Lasjaunias P, Tadie M: Curable cause of paraplegia: spinal dural arteriovenous fistulae. **Stroke** **39**:2756-2759, 2008
3. Andres RH, Barth A, Guzman R, Remonda L, El-Koussy M, Seiler RW, et al: Endovascular and surgical treatment of spinal dural arteriovenous fistulas. **Neuroradiology** **50**:869-876, 2008
4. Blackburn SL, Kadkhodayan Y, Ray WZ, Zipfel GJ, Cross DT, 3rd, Moran CJ, et al: Onyx is associated with poor venous penetration in the treatment of spinal dural arteriovenous fistulas. **Journal of Neurointerventional Surgery** **6**:536-540, 2014
5. Cecchi PC, Musumeci A, Faccioli F, Bricolo A: Surgical treatment of spinal dural arteriovenous fistulae: long-term results and analysis of prognostic factors. **Acta Neurochirurgica** **150**:563-570, 2008
6. Cenzato M, Debernardi A, Stefani R, D'Aliberti G, Piparo M, Talamonti G, et al: Spinal dural arteriovenous fistulas: outcome and prognostic factors. **Neurosurgical Focus** **32**:E11, 2012
7. Chen S, Ma Y, Liang P, Wang X, Peng C, Bian L, et al: Hyperbaric oxygen therapy for postoperative spinal dural arterio-venous fistula patients: An observational cohort study. **Medicine** **95**:e4555, 2016
8. Chibbaro S, Gory B, Marsella M, Tigan L, Herbrecht A, Orabi M, et al: Surgical management of spinal dural arteriovenous fistulas. **Journal of Clinical Neuroscience** **22**:180-183, 2015
9. Chiu AHY, Aw G, Wenderoth JD: Double-lumen arterial balloon catheter technique for Onyx embolization of dural arteriovenous fistulas: Initial experience. **Journal of NeuroInterventional Surgery** **6**:400-403, 2014
10. Cho WS, Kim KJ, Kwon OK, Kim CH, Kim J, Han MH, et al: Clinical features and treatment outcomes of the spinal arteriovenous fistulas and malformations: Clinical article. **Journal of Neurosurgery: Spine** **19**:207-216, 2013
11. Clark S, Powell G, Kandasamy J, Lee M, Nahser H, Pigott T: Spinal dural arteriovenous fistulas--presentation, management and outcome in a single neurosurgical institution. **British Journal of Neurosurgery** **27**:465-470, 2013
12. Della Puppa A, Rustemi O, Scienza R: Intraoperative Flow Measurement by Microflow Probe during Spinal Dural Arteriovenous Fistula Surgery. **World Neurosurgery** **89**:413-419, 2016
13. Dhandapani S, Gupta A, Singh J, Sharma BS, Mahapatra AK, Mehta VS: Spinal dural arterio-venous fistula: clinico-radiological profile and outcome following surgical occlusion in an Indian neurosurgical center. **Neurology India** **61**:406-410, 2013
14. Durnford AJ, Hempenstall J, Sadek AR, Duffill J, Mathad N, Millar J, et al: Degree and Duration of Functional Improvement on Long-Term Follow-Up of Spinal Dural Arteriovenous Fistulae Occluded by Endovascular and Surgical Treatment. **World Neurosurgery** **107**:488-494, 2017
15. Fox S, Hnenny L, Ahmed U, Meguro K, Kelly ME: Spinal dural arteriovenous fistula: a case series and review of imaging findings. **Spinal Cord Series and Cases** **3**:17024, 2017
16. Gemmete JJ, Chaudhary N, Elias AE, Toma AK, Pandey AS, Parker RA, et al: Spinal dural arteriovenous fistulas: clinical experience with endovascular treatment as a primary

- therapy at 2 academic referral centers. **Ajnr: American Journal of Neuroradiology** **34**:1974-1979, 2013
17. Gokhale S, Khan SA, McDonagh DL, Britz G: Comparison of surgical and endovascular approach in management of spinal dural arteriovenous fistulas: A single center experience of 27 patients. **Surgical neurology international** **5**:7, 2014
 18. Gross BA, Albuquerque FC, Moon K, McDougall CG: Validation of an 'endovascular-first' approach to spinal dural arteriovenous fistulas: an intention-to-treat analysis. **Journal of Neurointerventional Surgery** **9**:102-105, 2017
 19. Guillevin R, Vallee JN, Cormier E, Lo D, Dormont D, Chiras J: N-butyl 2-cyanoacrylate embolization of spinal dural arteriovenous fistulae: CT evaluation, technical features, and outcome prognosis in 26 cases. **Ajnr: American Journal of Neuroradiology** **26**:929-935, 2005
 20. Hanel RA, Nakaji P, Spetzler RF: Use of microscope-integrated near-infrared indocyanine green videoangiography in the surgical treatment of spinal dural arteriovenous fistulae. **Neurosurgery** **66**:978-984; discussion 984-975, 2010
 21. Hessler C, Regelsberger J, Grzyska U, Illies T, Zeumer H, Westphal M: Therapeutic clues in spinal dural arteriovenous fistulas - a 30 year experience of 156 cases. **Central European neurosurgery** **71**:8-12, 2010
 22. Inagawa S, Yamashita S, Hiramatsu H, Kamiya M, Tanaka T, Sakahara H, et al: Clinical results after the multidisciplinary treatment of spinal arteriovenous fistulas. **Japanese Journal of Radiology** **31**:455-464, 2013
 23. Jablawi F, Schubert GA, Hans F-J, Mull M: Anticoagulation Therapy After Surgical Treatment of Spinal Dural Arteriovenous Fistula. Effectiveness and Long-Term Outcome Analysis. **World Neurosurgery** **114**:e698-e705, 2018
 24. Kaufmann TJ, Morris JM, Saladino A, Mandrekar JN, Lanzino G: Magnetic resonance imaging findings in treated spinal dural arteriovenous fistulas: lack of correlation with clinical outcomes. **Journal of Neurosurgery Spine** **14**:548-554, 2011
 25. Kim DJ, Willinsky R, Geibprasert S, Krings T, Wallace C, Gentili F, et al: Angiographic characteristics and treatment of cervical spinal dural arteriovenous shunts. **American Journal of Neuroradiology** **31**:1512-1515, 2010
 26. Kirsch M, Berg-Dammer E, Musahl C, Bazner H, Kuhne D, Henkes H: Endovascular management of spinal dural arteriovenous fistulas in 78 patients. **Neuroradiology** **55**:337-343, 2013
 27. Koch MJ, Stapleton CJ, Agarwalla PK, Torok C, Shin JH, Coumans J-V, et al: Open and endovascular treatment of spinal dural arteriovenous fistulas: a 10-year experience. **Journal of Neurosurgery Spine** **26**:519-523, 2017
 28. Lee J, Lim Y-M, Suh DC, Rhim SC, Kim SJ, Kim K-K: Clinical presentation, imaging findings, and prognosis of spinal dural arteriovenous fistula. **Journal of Clinical Neuroscience** **26**:105-109, 2016
 29. Ma Y, Chen S, Peng C, Wang C, Li G, He C, et al: Clinical outcomes and prognostic factors in patients with spinal dural arteriovenous fistulas : a prospective cohort study in two Chinese centres. **BMJ Open** **8**:e019800, 2018

30. Marquardt G, Berkefeld J, Seifert V, Gerlach R: Preoperative coil marking to facilitate intraoperative localization of spinal dural arteriovenous fistulas. **Eur Spine J** **18**:1117-1120, 2009
31. Nagata S, Morioka T, Natori Y, Matsukado K, Sasaki T, Yamada T: Factors that affect the surgical outcomes of spinal dural arteriovenous fistulas. **Surgical Neurology** **65**:563-568, 2006
32. Narvid J, Hetts SW, Larsen D, Neuhaus J, Singh TP, McSwain H, et al: Spinal dural arteriovenous fistulae: clinical features and long-term results. **Neurosurgery** **62**:159-166; discussion 166-157, 2008
33. Ozkan N, Kreitschmann-Andermahr I, Goerike SL, Wrede KH, Kleist B, Stein K-P, et al: Single center experience with treatment of spinal dural arteriovenous fistulas. **Neurosurgical Review** **38**:683-692, 2015
34. Park SB, Han MH, Jahng T-A, Kwon BJ, Chung CK: Spinal dural arteriovenous fistulas: clinical experience with endovascular treatment as a primary therapeutic modality. **Journal of Korean Neurosurgical Society** **44**:364-369, 2008
35. Patel NP, Birch BD, Lyons MK, DeMent SE, Elbert GA: Minimally invasive intradural spinal dural arteriovenous fistula ligation. **World Neurosurgery** **80**:e267-270, 2013
36. Qi X, Lv L, Han K, Xu Z, Mei Q, Chen H, et al: Analysis of the embolization spinal dural arteriovenous fistula and surgical treatments on 52 cases of the patients. **International journal of clinical and experimental medicine** **7**:3062-3071, 2014
37. Rashad S, Abdel-Bary M, Aziz W, Hassan T: Management of spinal dural arterio-venous fistulas. Report of 12 cases and review of literature. **Clinical Neurology & Neurosurgery** **125**:81-86, 2014
38. Ropper AE, Gross BA, Du R: Surgical treatment of Type I spinal dural arteriovenous fistulas. **Neurosurgical Focus** **32**:E3, 2012
39. Ruiz-Juretschke F, Perez-Calvo JM, Castro E, Garcia-Leal R, Mateo-Sierra O, Fortea F, et al: A single-center, long-term study of spinal dural arteriovenous fistulas with multidisciplinary treatment. **Journal of Clinical Neuroscience** **18**:1662-1666, 2011
40. Safaee MM, Clark AJ, Burkhardt J-K, Winkler EA, Lawton MT: Timing, severity of deficits, and clinical improvement after surgery for spinal dural arteriovenous fistulas. **Journal of Neurosurgery Spine** **29**:85-91, 2018
41. Saladino A, Atkinson JLD, Rabinstein AA, Piepgras DG, Marsh WR, Krauss WE, et al: Surgical treatment of spinal dural arteriovenous fistulae: a consecutive series of 154 patients. **Neurosurgery** **67**:1350-1357; discussion 1357-1358, 2010
42. Sasamori T, Hida K, Yano S, Asano T, Seki T, Houkin K: Long-term outcomes after surgical and endovascular treatment of spinal dural arteriovenous fistulae. **European Spine Journal** **25**:748-754, 2016
43. Schuette AJ, Cawley CM, Barrow DL: Indocyanine green videoangiography in the management of dural arteriovenous fistulae. **Neurosurgery** **67**:658-662, 2010
44. Schuss P, Daher FH, Greschus S, Vatter H, Guresir E: Surgical Treatment of Spinal Dural Arteriovenous Fistula: Management and Long-Term Outcome in a Single-Center Series. **World Neurosurgery** **83**:1002-1005, 2015

45. Sherif C, Gruber A, Bavinzski G, Standhardt H, Widhalm G, Gibson D, et al: Long-term outcome of a multidisciplinary concept of spinal dural arteriovenous fistulae treatment. **Neuroradiology** **50**:67-74, 2008
46. Shin DA, Park KY, Ji GY, Yi S, Ha Y, Park SW, et al: The use of magnetic resonance imaging in predicting the clinical outcome of spinal arteriovenous fistula. **Yonsei Medical Journal** **56**:397-402, 2015
47. Shinoyama M, Endo T, Takahashi T, Shimizu H, Takahashi A, Suzuki M, et al: Long-term outcome of cervical and thoracolumbar dural arteriovenous fistulas with emphasis on sensory disturbance and neuropathic pain. **World Neurosurgery** **73**:401-408, 2010
48. Sri D, Higgins N, Laing R: Combined radiological and surgical management of spinal dural fistulas. **British Journal of Neurosurgery** **29**:505-507, 2015
49. Su IC, terBrugge KG, Willinsky RA, Krings T: Factors determining the success of endovascular treatments among patients with spinal dural arteriovenous fistulas. **Neuroradiology** **55**:1389-1395, 2013
50. Suh DC, Cho SH, Park JE, Liu H, Jung SC: Induced-Wedge Technique to Improve Liquid Embolic Agent Penetration into Spinal Dural Arteriovenous Fistula. **World Neurosurgery** **96**:309-315, 2016
51. Takai K, Kin T, Oyama H, Shojima M, Saito N: Three-dimensional angioarchitecture of spinal dural arteriovenous fistulas, with special reference to the intradural retrograde venous drainage system: Clinical article. **Journal of Neurosurgery: Spine** **18**:398-408, 2013
52. Tsuruta W, Matsumaru Y, Miyachi S, Sakai N: Endovascular Treatment of Spinal Vascular Lesion in Japan: Japanese Registry of Neuroendovascular Therapy (JR-NET) and JR-NET2.[Reprint of *Neurol Med Chir (Tokyo)*. 2014;54(1):72-8; PMID: 24305018]. **Neurologia Medico-Chirurgica** **54 Suppl 2**:72-78, 2014
53. Wang G, Ma G, Ma J, Hao S, Li D, Han L, et al: Surgical treatment of spinal vascular malformations performed using intraoperative indocyanine green videoangiography. **Journal of Clinical Neuroscience** **20**:831-836, 2013
54. Wojciechowski J, Kunert P, Nowak A, Dziedzic T, Czernicki T, Wojtowicz K, et al: Surgical treatment for spinal dural arteriovenous fistulas: Outcome, complications and prognostic factors. **Neurologia i Neurochirurgia Polska** **51**:446-453, 2017
55. Yen PPW, Ritchie KC, Shankar JJS: Spinal dural arteriovenous fistula: correlation between radiological and clinical findings. **Journal of Neurosurgery Spine** **21**:837-842, 2014
56. Zogopoulos P, Nakamura H, Ozaki T, Asai K, Ima H, Kidani T, et al: Endovascular and Surgical Treatment of Spinal Dural Arteriovenous Fistulas: Assessment of Post-treatment Clinical Outcome. **Neurologia Medico-Chirurgica** **56**:27-32, 2016