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Segmental arterial mediolysis: A clinical-pathologic review, its role in fibromuscular dysplasia and description and differential diagnosis of the masquerader-muscular artery cystic necrosis

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Author(s)
Richard E. Slavin

ABSTRACT
Segmental arterial mediolysis (SAM) is an uncommon non-inflammatory iatrogenic arteriopathy caused by alpha-1 adrenergic agonists or Beta-2 agonists able to release norepinephrine from the peripheral nervous system. Causative agents include adrenergic agonists used to control blood pressure, B-2 tocolytic agonists, and ractopamine used as a repartitioning agent in animal husbandry. The liberated norepinephrine both injures and stimulates a robust reparative response in the muscular arteries in the abdomen, brain base, and coronary arteries. This response may be augmented by endothelin-1 formed in the arterial adventitia. Three types of arterial lesions develop in the injurious stage: 1) apoptotic induced mediolysis, 2) separation of the outer media from the adventitia and 3) the formation of arterial gaps. The latter enlarge, particularly in elderly patients, to form gap-aneurysms complicated by dissections and dissecting an- eurysms that when ruptured cause the calamitous hemorrhages that clinically announce SAM. The other types of injury remain clinically silent but with repair develop sequelae and can metamorphose into fibromuscular dysplasia. The sequelae are mainly asymptomatic but may cause arterial stenosis and ischemic lesions. The definitive diagnosis of SAM re- quires histological conformation but misinterpreta- tion of smooth muscle vacuolar change has caused di-agnostic errors. Muscular artery cystic necrosis a newly named non-inflammatory muscular artery ar-teriopathy may be confused with SAM both clinically and pathologically. This arteriopathy represents the muscular artery equivalent of cystic media necrosis of the elastic arteries since it exhibits similar morphol- ogic features and can occur concomitantly with this entity. Adrenergic agents to counter hemorrhagic shock in SAM are contraindicated since they may intensify injury and create new lesions. The use of norepinehrine antagonists introduces a new, but as yet untested, treatment option for SAM.

KEYWORDS
Segmental Arterial Mediolysis; Norepinephrine; Adrenergic Agonists; Ractopamine; Arterial Apoptosis; Aneurysms; Dissecting Hematomas; Arterial Fibromuscular Dysplasia; Muscular Artery Cystic Necrosis

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References

[1] Kernohan, J.W. and Woltman, H.W. (1943) Postoperative, focal, nonseptic necrosis of vertebral and cerebellar arteries. JAMA, 122, 1173-1177. doi:10.1001/jama.1943.02840340021007

[2] Gruenwald, P. (1949) Necrosis in the coronary arteries of newborn infants. American Heart Journal, 38, 889-897. doi:10.1016/0002-8703(49)90889-3

[3] De Sa, D.J. (1979) Coronary arterial lesions and myocardial necrosis in stillbirths and infants. Archives of Disease in Childhood, 54, 918-930. doi:10.1136/adc.54.12.918

[4] Slavin, R.E. and Gonzales-Vitale, J.C. (1976) Segmental mediolytic arteritis: A clinical pathologic study.

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[5] Slavin, R.E., Cafferty, L. and Cartwright, J. (1989) Segmental mediolytic arteritis: A clinicopathologic and ultra-structural study of two cases. The American Journal of Surgical Pathology, 13, 558-568. doi:10.1097/00000478-198907000-00003

[6] Lie, J.T. (1992) Segmental arterial mediolysis. Not an arteritis but a variant of arterial fibromuscular dysplasia. Archives of Pathology & Laboratory Medicine, 116, 238- 241.

[7] Slavin, R.E., Sacki, K., Bhagavan, B. and Maas, A.E. (1995) Segmental arterial mediolysis: A precursor to fibromuscular dysplasia? Modern Pathology, 8, 287-294.

[8] Slavin, R.E. and Inada, K. (2007) Segmental arterial mediolysis with accompanying venous Angiopathy: A clinical pathologic review, report of 3 new cases, and comments on the role of endothelin-1 in its pathogenesis. International Journal of Surgical Pathology, 15, 121-134. doi:10.1177/1066896906297684

[9] Slavin, R.E. (2009) Segmental arterial mediolysis: Course, sequelae, prognosis, and pathologic-radiologic correlation. Cardiovascular Pathology, 18, 352-360. doi:10.1016/j.carpath.2008.09.001

[10] Slavin, R.E. and Yaeger, M. (2012) Segmental arterial mediolysis—An iatrogenic vascular disorder induced by ractopamine. Cardiovascular Pathology, 21, 334-338. doi:10.1016/j.carpath.2011.09.003

[11] Inayama, Y., Kitamura, H., Kitamura, H., Tobe, M. and Kanisawa, M. (1992) Segmental mediolytic arteritis clini- copathologic study and three-dimensional analysis. The Japanese Society of Pathology, 42, 201-209.

[12] Inada, K., Ikeda, K., Shimokawa, K. and Slavin, R.E. (2005) Venous lesions in segmental arterial mediolysis. Pathology and Clinical Medicine, 23, 1357-1362 (in Japanese with English abstract).

[13] Rosenberger, A., Adler, . and Lichtig, H. (1976) Angiographic appearance of the renal vein in a case of fibromuscular dysplasia of the artery. Radiology, 118, 579- 580.

[14] Hashimoto, T., Degachi, J., Endo, H. and Miyata, T. (2008) Successful treatment tailored to each splanchnic arterial lesion due to segmental arterial mediolysis. Journal of Vascular Surgery, 48, 1338-1344. doi:10.1016/j.jvs.2008.05.056

[15] Anson, A. (2009) The codex perspective on ractopamine. http://www.thebeefsite.com/articles/2082/the-codex-pers-pective-on-ractopamine

[16] Burniston, J.G., Tan, L.B. and Goldspink, D. (2006) Re- lative myotoxic and haemodynamic effects of the B-ago-nists fenoterol and clenbuterol measured in conscious unrestrained rats. Experimental Physiology, 91, 1041- 1049. doi:10.1113/expphysiol.2006.035014

[17] Yaeger, M.J., Mullin, K., Ensley, S., Slavin, R.E. and Ware, W.A. (2012) Myocardial toxicity in a group of greyhounds administered ractopamine. Veterinary Pa- thology, 49, 569-573. doi:10.1177/0300985811424752

[18] Green, D.R. and Kroemer, G. (2004) The pathophysiol- ogy of mitochondrial cell death. Science, 305, 626-629. doi:10.1126/science.1099320

[19] Hoffman, R.S., Kirrane, B.M. and Marcus, S.M. (2008) A descriptive study of an outbreak of clenbuterol-containing heroin. Annals of Emergency Medicine, 52, 548-553. doi:10.1016/j.annemergmed.2008.04.026

[20] Katz, V.L. and Seeds, J.W. (1989) Fetal and neonatal car- diovascular complications from B-sympathetic therapy for tocolysis. American Journal of Obstetrics & Gynecology, 16, 1-4.

[21] Armis, O.A. and Donovan, D.C. (1992) Segmental mediolytic arteritis involving hepatic arteries. Archives of Pathology & Laboratory Medicine, 16, 531-534.

[22] Huntley, T.E. and Kon, V. (2001) Update on endothelins-biology and clinical implications. Pediatric Nephrology, 16, 752-62. doi:10.1007/s004670100631

[23] Parris, R.J. and Webb, D.J. (1991) The endothelin system in cardiovascular physiology and pathophysiology. Vascular Medicine, 2, 31-43.

[24] Sakata, N., Takebayashi, S., Shimizu, K., Kojima, M., Masawa, N., Suzuki, K. and Takatama, M. (2002) A case of segmental mediolytic arteriopathy involving both in- tracranial and intraabdominal arteries. Pathology—Re- search and Practice, 203, 771-778.

[25] Ro, A., Kageyama, N., Takatsu, A. and Fukunaga T. (2010) Segmental arterial mediolysis of varying phases affecting both the intra-abdominal and intracranial vertebral arteries: An autopsy case report. Cardiovascular Pa- thology, 19, 248-251. doi:10.1016/j.carpath.2009.02.002

[26] Chao, C.P. (2009) Segmental arterial mediolysis. Seminars in Interventional Radiology, 26, 224-232. doi:10.1055/s-0029-1225666

[27] Inada, K., Maeda, M. and Ikeda, T. (2007) Segmental arterial mediolysis: Unrecognized cases culled from cases of ruptured aneurysm of abdominal visceral arteries reported in the Japanese literature. Pathology—Research and Practice, 203, 771-778. doi:10.1016/j.prp.2007.07.010

[28] Michael, M., Widmer, U., Wildermuth, S., Baghorn, A., Duewell, S. and Pfammatter, T. (2006) Segmental arterial mediolysis: CTA findings at presentation and follow-up. AJR—American Journal of Roentgenology, 187, 1463- 1469. doi:10.2214/AJR.05.0281

[29] Lie, J.T. and Berg, K.K. (1987) Isolated fibromuscular dysplasia of the coronary arteries with spontaneous dissection and myocardial infarction. Human Pathology, 18, 654-656. doi:10.1016/S0046-8177(87)80368-4

[30] Ohtoh, T., Ono, Y., Iwasaki, Y., Sakurai, Y., Nishino, A., Arai, H., Suzuki, H. and Namba, Y. (2003) Non-traumatic recurrent dissection and its spontaneous repair in the circle of Willis: Report of two autopsy cases. Neuropa- thology, 23, 195-198. doi:10.1046/j.1440-1789.2003.00502.x

[31] Leu, H.J. (1994) Cerebrovascular accidents resulting from segmental mediolytic arteriopathy of the cerebral arteries in young adults. Cardiovascular Surgery, 2, 350-353.

[32] Eskenasy-Cottier, A.C., Leu, H.J., Bassetti, C., Bogous-slavsky, J., Regli, F. and Janzer, R.C. (1994) A case of dissection of intracranial cerebral arteries with segmental mediolytic “arteritis”. Clinical Neuropathology, 13, 329-337.

[33] Fantaneanu, T., Veinot, J.P., Torres, C., Alhazzaa, M. and Stotts G. (2011) Cervical arterial dissections due to segmental mediolytic arteriopathy. Neurology, 77, 295-297. doi:10.1212/WNL.0b013e318225aad2

[34] Ungemach, F.R. (2004) Ractopamine (addendum). WHO Food Additives Series, 53.

[35] Wikipedia, the Free Encyclopedia (2012). http://enwikipedia.org/wiki/clenbuterol

[36] Vuong, P.N. and Berry, C. (2002) The pathology of ves- sels. Springer-Verlag, Paris.

[37] Levy, B.I. (2001) Artery changes with aging: degeneration or adoption. Dialogues in Cardiovascular Medicine, 6, 104-111.

[38] Schouwenberg, B.J., Rietjens, S.J., Smits, P. and de Galan, B.E. (2006) Effect of sex on the cardiovascular response to adrenaline in humans. Journal of Cardiovascular Pharmacology, 47, 155-157. doi:10.1097/01.fjc.0000198519.28674.cc

[39] Price, R.A. and Vawter, G.F. (1972) Arterial fibromuscular dysplasia in infancy and childhood. Archives of Pa- thology, 93, 419-421.

[40] Lie, J.T. (1996) Systemic cerebral and pulmonary segmental mediolytic arteriopathy; villainous masqueraders of vasculitis. Cardiovascular Pathology, 5, 305-331. doi:10.1016/S1054-8807(96)00071-3

[41] Yamada, M., Ohno, M., Itagaki, T., Takaba, T. and Matsuyama, T. (2004) Coexistence of cystic medial necrosis and segmental arterial mediolysis in a patient with aneurysms of the abdominal aorta and the iliac artery. Journal of Vascular Surgery, 39, 246-249. doi:10.1016/j.jvs.2003.07.022

[42] Basso, M.C., Flores, P.C., Marques, A., de Souza, G.L., Brescia, M.D.G., et al. (2005) Bilateral extensive cerebral infarction and mesenteric ischemia associated with segmental arterial mediolysis in two young women. Pathology International, 55, 632-638. doi:10.1111/j.1440-1827.2005.01881.x

[43] Davran, R., Cinar, C. and Parildar, M. (2010) Radiologic findings and endovascular management of three cases with segmental arterial mediolysis. CardioVascular and Intervenlional Radiology, 33, 601-606. doi:10.1007/s00270-009-9651-2