## **Lumbrokinase – An Enzyme for More Than Just Circulatory Health!**

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## References

- 1. Mihara H, et al. A novel fibrinolytic enzyme extracted from the earthworm, *Lumbricus rubellus*. *Japanese Journal of Physiology*. 1991;41(3):461–472.
- 2. Ma EL, et al. Effects of Rongshuan No 1 (F-1) on the antithrombotic and antiplatelet aggregation. *Journal of Shenyang Pharmaceutical University*. 2001;18(5):370-372.
- 3. He ZZ, et al. Separation and purification of earthworm fibrinolytic enzyme and the study of anti-thrombosis activity. *Chinese Journal of Biochemical Pharmaceutics*. 2001;22(6):284-286.
- 4. Zhang J, et al. Experimental study on the effect of lumbrokinase on fibrinolysis in rats. *Chinese Journal of Pathophysiology*. 2004;20(5):891-892.
- 5. Jiang DS, et al. Inhibition of platelet aggregation in hamsters by lumbrokinase extracted from Eisenia fetida. *Journal of Capital Medical University*. 1994;15(4):291-294.
- 6. Zhao J, et al. *Eisenia fetida* Protease-III-1 Functions in Both Fibrinolysis and Fibrogenesis. *J Biomed Biotechnol*. 2007;2007(5):97654.
- 7. Yang M, et al. Eisenia fetida lumbrokinase research VI thrombolytic effect in rabbits and protective effects in experimental stroke model in hamsters. *Biotechnology*. 1995;5(3):9-11.
- 8. Li WY, et al. Observation of treating twenty-seven cases of ischemic stroke patients with lumbrokinase. *New Chinese Medicine*. 2003;34(4):63-64.
- 9. Zhang HY. Observation of treating acute ischemic stroke with lumbrokinase. Capital Medicine. 2000;7(3):45-46.
- 10. Zhang DJ, et al. Prevention of ischemic stroke recurrence using lumbrokinase. Capital Medicine. 2003;5(10):47-48.
- 11.Cao YJ, et al. Oral fibrinogen-depleting agent lumbrokinase for secondary ischemic stroke prevention: results from a multicenter, randomized, parallel-group and controlled clinical trial. *Chin Med J* (Engl). 2013 Nov;126(21):4060-5.
- 12. Sun MY, et al. Clinical Observations of Lumbrokinase Intervention in 60 Coronary Heart Disease Patients with Aspirin Resistance. *Chinese Journal of Gerontology*. 2009; 29: 760-761.
- 13.Liu HS. Clinical observation of treating 60 angina patients with lumbrokinase. Tianjin Pharmacy. 2002;14(2):45-46.
- 14. Yi XF, et al. Efficacy of treating unstable angina seniors with lumbrokinase. Capital Medicine. 2002;9(9):57-58.
- 15. Zhou HS, et al. Clinical observation of treating unstable angina seniors with lumbrokinase capsules. *Central Plains Medical Journal*. 2001;28(9):2-3.
- 16.Kasim M, et al. Improved myocardial perfusion in stable angina pectoris by oral lumbrokinase: a pilot study. *J Altern Complement Med.* 2009 May;15(5):539-44.
- 17. Song JS, et al. Clinical analysis of treating 17 cases of deep venous thrombosis with lumbrokinase. *Occupation and Health*. 2001;17(4):111-115.
- 18. Ye SZ, et al. Observation of treating 51 cases of essential hypertension with lumbrokinase. Clinical Medicine. 2007;27(9):59.
- 19. Gao Y, et al. Efficacy of combining lumbrokinase with nimodipine in the treatment of vascular dementia. *Journal of Liaoning University of Traditional Chinese Medicine*. 2008;10(11):5-7.
- 20.De Cicco M. The prothrombotic state in cancer: pathogenic mechanisms. Crit Rev Oncol Hematol. 2004 Jun;50(3):187-96.
- 21. Molnar S, et al. Procoagulant factors in patients with cancer. Hematology. 2007 Dec;12(6):555-9.
- 22. Falanga A, et al. Hypercoagulability and tissue factor gene upregulation in hematologic malignancies. *Semin Thromb Hemost*. 2008 Mar;34(2):204-10.
- 23. Francis JL, et al. Effect of antihemostatic agents on experimental tumor dissemination. *Thrombosis and Hemostasis*. 2002; 28: 29-38.
- 24. Caine GJ, et al. The hypercoagulable state of malignancy: pathogenesis and current debate. *Neoplasia*. 2002 Nov-Dec;4(6):465-73.
- 25. Clerk CP, et al. The effect of low molecular weight heparin on survival in patients with advanced malignancy. *J Clin Oncol*. 2005 Apr 1;23(10):2130-5.
- 26.Kakkar AK, et al. Low molecular weight heparin, therapy with dalteparin, and survival in advanced cancer: the fragmin advanced malignancy outcome study (FAMOUS). *J Clin Oncol*. 2004 May 15;22(10):1944-8.
- 27.DeFeo K, et al. Use of dabigatran etexilate to reduce breast cancer progression. Cancer Biol Ther. 2010 Nov

- 15;10(10):1001-8.
- 28.Li HY, et al. Antitumor activity of earthworm fibrinolytic enzyme. Chinese Pharmacological Bulletin. 2004;20(8):908-910.
- 29. Chen H, et al. Effect of earthworm fibrinolytic enzyme on the inhibition of invasion and metastasis in hepatocellular carcinoma cell. *Jiangsu Medical Journal*. 2008;34(4):383-385.
- 30. Chang CX, et al. Anti-metastatic activity of earthworm fibrinolytic enzyme on hepatoma cell in vivo. *Traditional Chinese Drug Research & Clinical Pharmacology*. 2009;20(6):520-524.
- 31.Levi M, et al. Infection and inflammation and the coagulation system. Cardiovasc Res. 2003 Oct 15;60(1):26-39.
- 32. Kitchens CS. Concept of hypercoagulability: a review of its development, clinical application, and recent progress. *Semin Thromb Hemost.* 1985 Jul;11(3):293-315.
- 33. Song WG, et al. Clinical observation of Boluoke with Lotensin, a new therapy for early stage diabetic nephropathy. *Jiangxi Medical Journal*. 2010 July; 45(7): 667-668.
- 34.Gu XL, et al. Observation of the effectiveness of treating diabetic peripheral neuropathy by lumbrokinase. *Chinese Journal of Primary Medicine and Pharmacy*. 2003 July; 10(7): 665.
- 35.Liao HE, et al. Cardio Protective Effects of Lumbrokinase and Dilong on Second-Hand Smoke-Induced Apoptotic Signaling in the Heart of a Rat Model. *Chin J Physiol.* 2015 Jun 30;58(3):188-96.
- 36.Fu YT, et al. Porous gelatin/tricalcium phosphate/genipin composites containing lumbrokinase for bone repair. *Bone*. 2015 Sep;78:15-22.
- 37.Fu YT, et al. Earthworm (Pheretima aspergillum) extract stimulates osteoblast activity and inhibits osteoclast differentiation. *BMC Complement Altern Med.* 2014 Nov 11;14:440.
- 38. Wang CL, et al. Progress in lumbrokinase. Progress in Veterinary Medicine. 2009;30(11):86-90.
- 39. Tang YJ, et al. Lumbrokinase: A review of domestic research literatures. Capital Medicine. 2011;18(6):39-42.
- 40. Serrapeptase Monograph, Natural Health Products Ingredients Database, Health Canada. 2014 February 7. http://webprod.hc-sc.gc.ca/nhpid-bdipsn/atReq.do?atid=serrapeptase&lang=eng
- 41. Weng YQ, et al. Nattokinase: An Oral Antithrombotic Agent for the Prevention of Cardiovascular Disease. *Int J Mol Sci.* 2017 Mar; 18(3): 523.
- 42. Wang KY, et al. Recombinant protein production of earthworm lumbrokinase for potential antithrombotic application. *Evid Based Complement Alternat Med.* 2013;2013:783971.