Effect of Prostaglandin E1 on Injured Nerve Root in Lumbar Canal Stenosis.

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Introduction: Neurogenic intermittent claudication (NIC) in patients with lumbar canal stenosis (LCS) is said to have a close association with ischemia and/or congestion of the cauda equina due to circulatory disturbance. Prostaglandin E1 (PGE1) is a potent vasodilator as well as an inhibitor of platelet aggregation and has therefore attracted interest as a therapeutic drug for LCS. Many reports about the response of NIC to PGE1 have appeared in the literature, but little is known about the mechanism of action or efficacy. However, investigations in the clinical setting have shown that lipo-PGE1 is effective in some patients but not in others, although the reason for this is unclear. This study is to investigate the effect of lipo-PGE1 in injured nerve root induced by mechanical compression using in vivo model. Then, we treated LCS patients with PGE1 and compared their response with the magnetic resonance (MR) imaging.

Methods: Experimental study. Ten adult dogs were used in nerve root compression models. Under general anesthesia, the 7th lumbar nerve root was exposed and compressed using a clip with a pressure of 7.5 gram force. The wound was closed and the animals were maintained for 3 weeks. The clip was removed, a needle-type blood flow sensor was inserted into the root at the compressed site, and changes in intraradicular blood flow to 1 hour after intravenous injection of lipo-PGE1 were measured using a laser-Doppler blood flow meter. As the control group, the 7th lumbar nerve root of another 5 animals was exposed, and intraradicular blood flow was immediately measured before and after intravenous injection of lipo-PGE1. Lipo-PGE1 was injected at a dose of 0.15 µg/kg. The nerve root in which blood flow was measured was then removed and examined histologically.

Clinical study: The subjects were 50 LCS patients with NIC (walking distance ≤ 300 m) and MR imaging evidence of central canal stenosis. They comprised 38 men and 12 women aged 75-95 years (mean: 81 years). Each patient received PGE1 intravenously at 10µg/day for 14 days. After completing treatment, the MRI findings of 25 patients achieving relief from intermittent claudication (group A) and 25 patients without relief (group B) were retrospectively compared. In all patients, T1- and T2-weighted images were obtained. On T1-weighted images, the transverse area of the dural tube at the site of maximal canal stenosis, but were not seen in group A. Intraradicular edema was observed in 14 (56%) of the 25 patients from group B, being located proximal to the site of maximal stenosis, but were only seen in 2 (8%) patients from group A.

Discussion: The results of many studies have suggested that PGE1 is likely to be useful for lumbar canal stenosis, but its position has not been firmly established among the treatments available. Lipo-PGE1 is not rapidly inactivated in vivo and therefore accumulates in lesions. After experimental investigating the changes of nerve root blood flow caused by bolus intravenous injection of Lipo-PGE1, Murakami et al. (1) reported a 37.8% increase of blood flow at a dose of 0.15 µg/kg, and Toribatake et al. (2) reported a 59% increase at a dose of 0.1 µg/kg. These studies of the effect of lipo-PGE1 on blood flow in normal nerve roots using experimental methods have reported an increase in flow, but none have examined the effect of lipo-PGE1 on compressed sections of nerve roots. In the present study, intravenous injection of lipo-PGE1 also significantly increased intraradicular blood flow in the control group in which the nerve root was not compressed, but the increase in blood flow observed in the compressed section of the nerve root exhibiting Wallerian degeneration was transient and was not sustained. Our clinical studies indicate that patients who have a transverse dural area ≤60 mm² and redundant nerve roots (suggesting wallerian degeneration) may achieve little relief of NIC with PGE1 therapy. It is therefore concluded that lipo-PGE1 has less effect on markedly degenerated nerve roots than it does on those that are normal.