INTRODUCTION
Recently lumbar spinal stenosis has become one of the most serious problems in elderly patients. It is generally considered that the genesis of leg symptoms in lumbar spinal stenosis may be the result of both mechanical compression and ischemia of the spinal nerve roots. The pathogenesis of the symptoms in lumbar spinal stenosis, however, is still not well understood.

A number of experimental studies have been recently reported regarding the compression of the spinal nerve roots, as well as measuring either the epidural pressure or blood flow in the spinal nerve roots. However, there have so far been no reports on the local pressure in the vertebral foramen of the lumbar spine. We have measured the local pressure in the vertebral foramen of the lumbar spine during lumbar spine surgery and herein report our findings regarding the relationship between the local pressure in the vertebral foramen and various postures in patients demonstrating spinal nerve compression.

PATIENTS AND METHODS
The local pressure in the vertebral foramen was measured in nine patients (16 vertebral foramens) who underwent lumbar spine surgery, including 7 men and 2 women, ranging 23-73 years of age (mean, 51.1 y.o.). Five patients were diagnosed to have lumbar spinal stenosis while 4 had lumbar disc herniation. The 16 vertebral foramens consisted of 8 L5/S1 foramens, 6 L4/5 foramens and 2 L3/4 foramens.

All patients were classified as either having foraminal stenosis or not by measuring either the epidural pressure or blood flow in the spinal nerve roots. However, there have so far been no reports on the local pressure in the vertebral foramen during lumbar spine surgery and herein report our findings regarding the relationship between the local pressure in the vertebral foramen and various postures in patients demonstrating spinal nerve compression.

RESULTS
The local pressure in the vertebral foramen was 18.125±7.881mmHg in the lumbar flexion position, and 23.125±8.051mmHg in the lumbar neutral position, and 34.906±14.756mmHg in the lumbar extension position. The peak values of the pressure increase were also significantly different (Fig.1, p<0.05) between each posture position. In the lumbar flexion position, the local pressure of the L5/S1 foramens (n=8) was 20.375±9.516mmHg, L4/5 (n=6) was 15.250±5.520mmHg and L3/4 (n=2) was 17.750±7.425mmHg. In the lumbar neutral position, the local pressure was 25.562±9.734mmHg, 19.250±7.838mmHg and 25.000±7.071mmHg in each vertebral foramen. In the lumbar extension position, the local pressure was 38.500±16.490mmHg, 32.250±14.580mmHg and 28.500±8.485mmHg in each vertebral foramen. The L5/S1 foramens tended to show a high local pressure, however there were no significant differences between each vertebral foramen. In the foraminal stenosis group (n=11), the pressure was 19.000±9.041mmHg, 24.000±8.614mmHg and 34.727±13.411mmHg in each posture and 16.200±4.804mmHg, 21.200±7.129mmHg, and 35.300±19.146mmHg in the nonstenosis group (n=5). The flexion and neutral position tended to show high local pressure in stenosis group, however contrary to our expectation, no statistically significant differences were found between the stenosis and nonstenosis groups.

DISCUSSION
The most common and characteristic symptom in lumbar spinal stenosis is neurogenic intermittent claudication which may be induced by either walking or prolonged standing in the upright posture. In addition, these symptoms can be relieved by changing to a flexion posture of the lumbar sacral spine. The relationship between the epidural pressure and lumbar posture have been reported by Takahashi et al. They reported that the local pressure at the stenotic level was low in the lying and sitting postures, and high in the standing postures.

In degenerative lumbar spine disease the lesions which are known to cause nerve root static entrapment include lateral recess lesions and intervertebral foramens lesions consisting of front-back entrapment in the former and up-down/pinhole entrapment in the latter. The anatomic location of the dorsal root ganglia is one important factor for the induction of nerve root lesions caused by lateral lumbar stenosis. The ganglia demonstrates an extremely high mechanosensitivity while, at the same time, it is fragile both physiologically and morphologically. Our findings demonstrated that the local pressure in the vertebral foramen increased substantially during lumbar extension, while it decreased during forward flexion. The same condition as that observed in lumbar spinal stenosis also seems to occur regarding the size of the vertebral foramen space which significantly changes when the spine is either extended or loaded, thereby increasing the pressure to nerve root and also inducing radicular symptoms. The size of the vertebral foramens space tends to increase in the lower lumbar spine, however, there were no significant differences between each local pressure in the vertebral foramen.

There are still many unclear points regarding the damage to the spinal nerve root in the vertebral foramen related to foraminal stenosis. Therefore, based on the current pilot study, further investigations are needed to clarify the occurrence of radicular symptoms in lumbar spinal stenosis patients.

Measurement of the local pressure in vertebral foramen : 
The correlation of the local pressure in the vertebral foramen and the lumbar spine posture position 

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