

Years-Experiences with a Neuromonitoring-System (Neurovision) in Lumbar Spine Surgery

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Summary of Background

Pedicle screws demonstrate even in case of meticulous technique wrong positions with the possibility of clinical relevance. Besides navigation there exists the possibility of neuromonitoring (Neurovision-system, Nuvasive, San Diego, USA) to minimize or avoid a screw-malposition.

Method and patients

Using Neurovision-system corresponding muscle groups are monitored by surface electrodes. The complex data are evaluated by a PC. Time to set on those systems is very short; after cleaning of the skin the electrodes are fixed and connected to the PC. Measurement is done using the pedicle finder, the canal of the pedicle into the vertebral body, the fixed screw and/or the nerve root. The reduction of mA to get a nerve-response < 9 mA demonstrates the possibility and < 4 mA a high probability of contact to the root and danger for function. EMG-control thorough the whole operation can also prevent problems to the root.

From 9/2006 to 3/2010 the results were evaluated in 185 patients (172 posterior lumbar instrumentations, 5 fusions via extreme lateral approach (XLIF), 4 AxiaLIF and 4 decompressions).

Results

In 987 pedicle screw applications using Neurovision-control 37 pedicle-canals were drilled for a second time, the position of 14 screws was changed and 2 screws were not implanted, all together 5,3 % of malposition could therefore be avoided. In 18 patients significant EMG-changes were seen. In 2 of these cases (pedicle-substraction-osteotomy) postoperative clinical state demonstrated a reversible paresis of quadriceps muscle.

32 screws were cemented after monitoring the pedicle-canal; only in 1 case a slight cement-extrusion laterally without clinical relevance occurred.

From the 37 new-drilled pedicles 3 patients demonstrated a reversible radicular pain and 1 temporary radicular hypaesthesia (9%); from the 14 changed screws 1 slight paresis and 2 radicular pains were regarded (21% symptoms).

Regarding the "pitfalls" we saw 1 moderate L5 paresis after L4/5 instrumentation without reaction of Neurovision and with correct screw position; further on 5 lateral mal positions occurred without reduction of mA (one with revision).

"Wrong-positive" signals were observed in 16 drilled screw canals; as we saw neither clinically nor in image intensifier a mal position of the marked canal the screws were placed and the measurement changed to correct values; we interpret those observations as consequence of micro lesions of the pedicle wall especially in osteoporotic patients; the screw can close this lesion.

In XLIF-approach nerve-monitoring is an important part of the procedure avoiding nerve-lesions within the m. psoas; of the 5 XLIF-operations we saw a reaction of Neurovision in 3 cases, requiring the change of the dilatator-position!

Discussion

The use of Neurovision-nerve monitoring system in lumbar spine surgery demonstrates increased safety to avoid root lesions. We see the quick and easy technique without preoperative CT-scan, the functional character, the possibility of demonstrating danger for the lower roots too, the EMG-monitoring during the whole procedure and the possibility of direct measurement of nerve roots as advantages over navigation control.

As disadvantage the obvious lower sensitivity for lateral displacement caused probably by the larger distance of superior root to the lateral pedicle wall and a small number of wrong-positive results because of bony micro lesions in osteoporosis must be accepted.