THE MODIFIED WILTSE APPROACH FOR TREATMENT OF EXTRAFORAMINAL DISC HERNIATION IN THE LUMBAR SPINE

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Objective. To evaluate the effectiveness of a modified Wiltse approach to the lumbar spine for extraforaminal disk herniation.
Material and Methods. A total of 1020 patients with herniated lumbar intervertebral disc were operated on, out of them 30 (2.9 %) patients were diagnosed as having extraforaminal disc herniations most often observed at the L4—L5 (53.3 %) and L5—S1 (40.0 %) levels. Clinical manifestations included back pain in 20 patients (66.6 %) and radicular syndrome — in all patients, which was accompanied by movement disorders in 15 (50.0 %) cases and by sensitivity disorders in 9 (30 %). Evaluation of surgical results was performed in the early postoperative period and at 3 and 6 months after surgery. Clinical outcomes were assessed using modified MacNab criteria.
Results. Based on MacNab criteria, an excellent outcome was observed in 45 %, good — in 42 %, and satisfactory — in 13 % of cases at 6 months after surgery. The volume of intraoperative blood loss was on average 52.8 ± 30 mL, the average length of hospital stay was 2.6 days.
Conclusion. The modified Wiltse approach is an effective surgery to remove extraforaminal herniation in the lumbar spine, which allows achieving excellent and good results of treatment in 87 % of cases.
Key Words: lumbar spine, radiculopathy, extraforaminal disc herniation.

Please cite this paper as: *Klimov VS, Evsyukov AV, Kosimshoev MA. The modified Wiltse approach for treatment of extraforaminal disc herniation in the lumbar spine. Hir. Pozvonoc. 2016;13(2):62—67. In Russian.*
DOI: http://dx.doi.org/10.14531/ss2016.2.62-67.

Compression of spinal nerve roots by the extraforaminal herniation is a complex clinical case, which is difficult to diagnose using only neurological examination. In 1971, MacNab described 2 cases of L5 spinal nerve root compression by L5—S1 extraforaminal disc herniation after unsuccessful L4–L5 intervention [12]. In 1974, Abdullah et al. [3] first reported the syndrome of far lateral disc herniation. According to Hood [11], extraforaminal disc herniations amount to 2.8–10.0 % of all spinal disc herniations.

Subtotal or total resection of functionally important elements of the weight-bearing portion of the spine is often required to ensure an appropriate microsurgical decompression of a nerve root in extraforaminal discectomy via median approach [4, 14 and 19]. In such cases, the operation takes longer time and is often accompanied by a serious blood loss. The facetectomy may lead to the development of instability in the operated spinal motion segment, which requires further stabilization [13, 14]. One of the approaches used to reach the extraforaminal portion of the intervertebral disc is the modified Wiltse approach that allows performing complete dissection of the extraforaminal segment of a disc [5, 6, 8, 10, 16, 19].

The objective of the study is to analyze the efficacy of the modified Wiltse approach in patients with lumbar extraforaminal disc herniation.

Material and Methods

A total of 1020 patients with herniated lumbar intervertebral disc were operated on in the spinal department of the Federal Center of Neurosurgery (Novosibirsk) during the period of September 2013 – December 2015. Out of them, 30 (2.9 %) patients were diagnosed as having extraforaminal disc herniations. The group included 13 (43.3 %) males and 17 (56.7 %) females. The age of patients varied between 27 and 69 years (mean, 50.2 years).

In 53.3 % of cases, extraforaminal disc herniations were observed at L4–L5 level. Less frequently herniations were registered at L5-S1 (40.0 %) and L3–L4 (6.7 %) levels .

Mandatory diagnostic protocol of preoperative examination included patient's history taking; common clinical, neurological, and X-ray examinations, survey, and lumbar spine MRI. The intensity of leg pain was evaluated using visual analogue scale (VAS) at 3 and 6 months after surgery. Motor disorders were assessed using the Weiss Functional

Impairment Rating Scale (WFIRS), and the quality of life - using the Oswestry questionnaire [7]. The clinical outcomes were estimated at 6 months after surgery using the modified MacNab criteria [12].

The lumbar spine MRI was performed in the preoperative and the early postoperative periods, and 6 months after surgery. The lumbar spine condition was also controlled using radiography with functional tests in the preoperative period and at 3 and 6 months after surgery. The instability was assessed according to criteria suggested by White and Panjabi [18].

Results

The preoperative low back pain was revealed in 20 (66.6 %) patients, all of them reported spinal nerve root-related pain; lower paresis from 3 to 4 points was diagnosed in 9 (30.0 %) patients, sensitivity disorders – in 15 (50.0 %). In all cases, the preoperative conservative treatment was performed during 8 weeks (from 2 weeks to 12 months) and proven to be ineffective. The duration of first radiculopathy symptoms ranged from 3 weeks to 6 months (3 months on average). According to the VAS, preoperative pain intensity was 5.8 ± 2.0 points in the lumbar spine and 7.8 ± 2.5 points in the legs.

The results of preoperative radiography control with functional tests demonstrated no instability in patients. The assessment with White and Panjabi's criteria yielded 3 ± 1 points.

In all patients, the modified Wiltse approach was used. In 2 (6.7 %) patients, the approach was performed at the L3–L4 level, in 16 (53.3 %) – at L4–L5 level, and in 12 (40.0 %) – at L5–S1 level. The average duration of surgery comprised 60.3 ± 10.0 minutes. The blood loss varied from 20 to 100 ml (mean, 52.8 ± 30.0 ml).

The early postoperative period proceeded without complications in all cases. The average hospital stay was 2.6 days.

During the early postoperative period, the pain syndrome became less intense and comprised 4.4 ± 1.6 points in the lumbar spine and 2.9 ± 1.7 points in the legs. According to patients' estimates, the average intensity of lumbar pain after 3 months decreased to 2.7 ± 1.3 points. After 6 months, this value descended to 1.7±1.3 points. At 3 and 6 months, no patients reported the spinal nerve root-related pain.

After 6 months following the surgery, the return of sensitivity was observed in 6 (40.0 %) out of 15 patients who had demonstrated sensitivity disorders before the operation. The paresis regression from grade 3 to grade 5 was diagnosed in 5 cases, which comprised 55.5 % of all patients presented with movement disorders in the preoperative period.

According to functional state evaluation performed with the Oswestry questionnaire after the surgery, the quality of life improved in all patients compared to the preoperative period. In the early postoperative period, the average ODI score decreased from 45.9 ± 4.0 to 30.5 ± 2.0 points; after 3 months it comprised 20.2 ± 2.0 points, whereas after 6 months – 12.2 ± 1.5.

The control MRI study in the early postoperative period and at 6 months after surgery revealed no relapse at the operated levels. The X-ray examination performed with functional tests at 3 and 6 months after surgery demonstrated no instability in the operated segment either. The instability assessment using White and Panjabi's criteria after 3 and 6 months yielded 2 ± 1 points.

According to the evaluation of clinical outcomes of the surgery carried out after 6 months using the modified MacNab criteria, 45 % of cases were classified as excellent, 42 % – as good, and 13 % – as satisfactory.

Clinical case. Patient A., 65 years old, was admitted with complaints of pain in the lumbar spine (VAS score 7) irradiating along the anterior surface of the left thigh and the inner surface of the lower leg (VAS score 8). Conservative treatment for 4 months did not provide significant relief. Visual examination revealed tension in the lumbar muscles and weakness in the right lower leg extensors (3 points out of 6 according to the M. Weiss scale). Hypoesthesia in the innervation zone of the left L4 root was observed. Evaluation of the functional state by the Oswestry questionnaire yielded 45 points.

MRI study of the lumbar spine revealed the right-sided extraforaminal disc herniation at the L4–L5 level (Fig. 1). The X-ray examination with functional tests before the operation demonstrated no instability. The assessment performed according to the White and Panjabi criteria yielded 4 points.

In the operating room, the patient under endotracheal anesthesia was

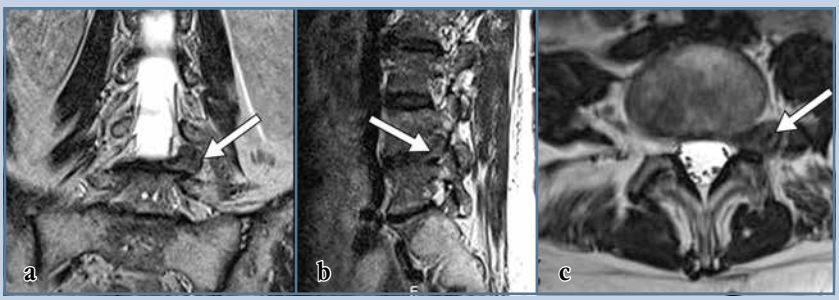

Fig 1
MRI of the patient A., 65 years old: the fragment of disc herniation is visible at L4–L5 level; the extraforaminal segment of disc is obstructing the left radicular foramen; an arrow points at extraforaminal disc herniation that caused the compression of spinal nerve root; on opposite side, the root runs free: **a** – coronal section; **b** – sagittal section; **c** – axial section

positioned prone on the Wilson frame. The X-ray marking of the intertransverse space at the affected level was performed before the section. A 2.5 cm skin incision was made 2.5 cm lateral to the midline in the projection of the intertransverse space at the L4–L5 level on the left (Fig 2a). After that, the subcutaneous fat and the broadest thoracolumbar fascia were dissected. The muscle fibers of *m. multifidus* and *m. longissimus* were moved apart using the tubular retractor and fixed with a frame retractor. Further, bone markers were identified: the upper edge of the transverse process of the subjacent vertebra and the lateral surface of the L5 diapophysis (Fig 2b). Having performed the approach, the surgeon repeated X-ray control that allows one to check the damage level. Operating microscope was adjusted. The intertransverse ligament resection was made with the Kerrison forceps. Resection of the lateral surface of L5 diapophysis was performed using the high-speed drill. The root displaced laterally due to the herniation became visible (Fig 2c). To detect the protruding part of the fibrous ring, visual means and the olive-shaped probe were used. The identified protruding part was dissected with the knife, and then disc fragments were removed using conchotomes. The decompression adequacy was tested with the olive-shaped probe (Fig 2d).

The postoperative period proceeded well, the regression of the radicular pain syndrome was observed immediately after the operation. According to VAS, the pain intensity was 4 points in the spine and 3 points in the legs. The control lumbar spine MRI performed in the early postoperative period did not reveal extraforaminal disc herniation (Fig. 3). At 3 and 6 months after surgery, the patient reported the regression of low back pain to the VAS score 2; pain in the leg was not presented. The Oswestry index during follow-up decreased from 45 to 13 points. According to the White and Panjabi criteria, the instability assessment performed using the radiographic examination of the lumbar spine with functional tests yielded 2 points. Based on the MacNab criteria, the clinical

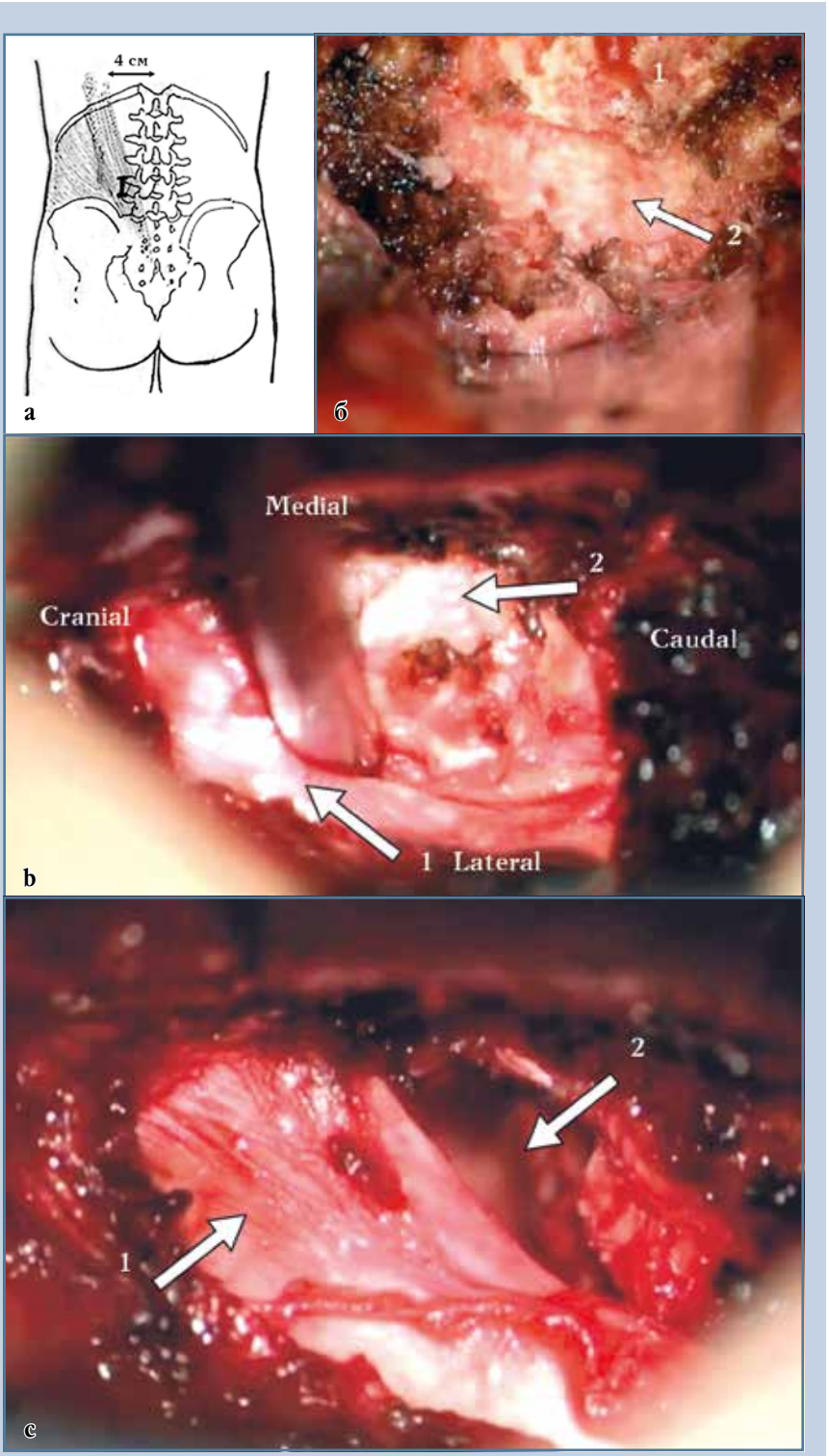

Fig 2
The surgery technique in patient A., 65 years old: **a** – section line; **b** – bone markers: 1 – facet joint, 2 – intertransverse ligament; **c** – root (1) and disc herniation (2) are visible; **d** – roots (1) and disc space (2) after excision of disc herniation

outcome for this patient was evaluated after 6 months as excellent.

Discussion

The extraforaminal disc herniation is localized in the extraforaminal part of the intervertebral foramen [8]. The extraforaminal part of the intervertebral foramen is limited to the pedicle of the superjacent vertebra's arch from above, the upper edge of the transverse processes of the subjacent vertebra from below, the lateral surface of the facet joint from inside, and the massive muscle bulk of the spine from the outside [17].

Due to the lack of volume and the limited character of the extraforaminal part of the spinal root, insignificant extraforaminal disc herniation leads to more serious symptoms [6, 8].

The principal method to diagnose the extraforaminal disc herniation is MRI, which should be performed in three dimensions: sagittal, axial and frontal. It is necessary to visualize not only the central part of the spine but intervertebral foramina up to the spinal nerves exit points in order to diagnose the extraforaminal compression of the roots in T1- and T2-weighted images of the sagittal sections [2, 9, 20]. In the frontal sections, it is necessary to visualize the points of digression of the spinal nerves from the dura mater down to their exit points under the vertebral pedicle [15, 20]. Axial sections should be presented as T2-weighted images, which allow one to differentiate easily between of the dark tissue of discs and ligaments and the light areas corresponding to the spinal cord canal. One should study sections containing the superjacent vertebra (5–10 mm from the lower edge), the entire disc, and the subjacent vertebra (5–10 mm from the upper edge). This requirement is stipulated by the fact that the foraminal and the extraforaminal herniations are not visible in the section made through the central parts of the disc [2, 15, 20]. T1-weighted image is essential in a contrast-enhanced study to ensure the differential diagnosis of the spinal nerve root's tumor or the spinal cord tumor [2, 9, 15].

According to many authors, the most optimal approach to the extraforaminal disc herniation is the modified Wiltse approach. Parasagittal approach to the lumbar spine for the spondylolisthesis treatment was reported for the first time in 1968 by Wiltse et al. [19]. The authors suggested to make a skin incision 4–7 cm to the midline and to move apart the lumbosacral muscles by blunt dissection without incising, as the fibers of muscles have different directions at this level. The authors also pointed out that this technique allows one to avoid bleeding while performing the approach and to shorten rehabilitation time after surgery. In 2006, Vialle et al. [17] thoroughly described the anatomical features and topographic markers of the parasagittal approach to the lumbar spine. The authors' suggestion was to make a skin incision 2–2.5 cm to the midline and to move muscle fibers apart at the level between *m. multifidus* and *m. longissimus*, which allows for keeping the structure of the lumbosacral muscles intact. In 2008, Anand et al. [4] first used the term "modified Wiltse approach".

Numerous authors are positive about the fact that the modified Wiltse approach ensures direct visualization of the discoradicular conflict area, that allows one to avoid traction of the compressed spinal root and to reduce further neurologic impairment risks [4, 13]. In our patients, no augmentation of the sensitivity and the motor disorders was observed. Direct visualization of the compressing factor provides the possibility of proper decompression of spinal nerve root and keeping the spinal motion segment anatomically intact [4]. In all our 30 patients, radicular pain syndrome completely regressed after the surgery. Moreover, after 6 months, return of sensitivity was reported by 40.0 % of patients with initial sensitivity disorders, whereas the paraplegia regression – by 55.5 % of patients with movement deficiency presented in the preoperative period.

The minimal trauma of muscle and ligament system allows for faster postoperative recovery [4, 13]. Due to the fact that there is neither a necessity in skeletization of the spine, nor a necessity of resection of functional elements of the weight-bearing portion of the spine, the risk of damage to blood vessels at surgical site is significantly lower [10, 15, 16]. According to functional state evaluation performed with the Oswestry questionnaire after the surgery, the quality of life improved in all patients compared to the preoperative period.

Direct visualization of the discoradicular conflict area during the modified Wiltse approach does not require significant resection of functional elements of weight-bearing portion of

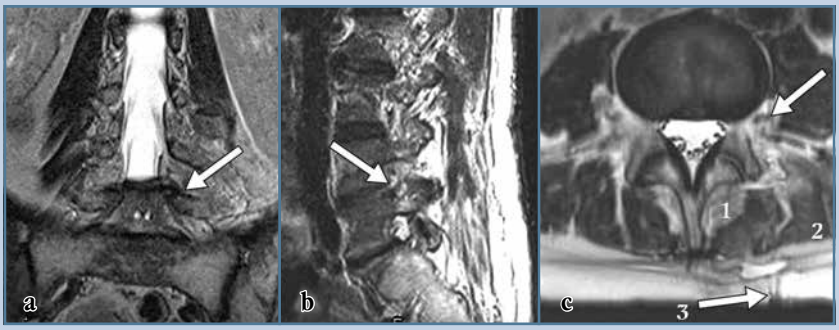

Fig. 3
Postoperative lumbar spine MRI of the patient A, 65 years old: extraforaminal disc herniation is not detected: **a** – coronal section; **b** – sagittal section; **c** – axial section; 1 – *m. multifidus*, 2 – *m. longissimus*, 3 – area of surgical approach

spine, which allows to preserve stability at the level of intervention. In our patients, no cases of instability in the operated segment were observed in the follow-up.

In 2005, Porchet et al. [14] reported outcomes of 83 patients with extraforaminal lumbar disc herniations. Excellent results comprised 38 % of cases, good results – 42 %, and satisfactory – 20 %. In our study, we obtained similar results.

The modified Wiltse approach for surgical treatment of extraforaminal disc herniations complies with the principles of anatomical accessibility, physiological relevance and surgical possibilities defined by the pioneer of the Russian neurosurgery, N.N. Burdenko [1].

Conclusion

The modified Wiltse approach is an effective surgery to remove extraforaminal herniation in the lumbar spine, that allows one to achieve excellent and good treatment outcomes in 87 % of cases along with microsurgical techniques.

References

1. **Kagan II, Chemezov SV.** Topographic Anatomy and Operative Surgery. Moscow, 2011:41–51. In Russian.
2. **Krylov VV, Grin AA.** On intervertebral disc hernias and the results of treatment of patients with this disease. Consilium medicum. 2009;11(9):5–10. In Russian.
3. **Abdullah AF, Ditto EW 3rd, Byrd EB, Williams R.** Extreme-lateral lumbar disc herniations. Clinical syndrome and special problems of diagnosis. J Neurosurg. 1974; 41:229–234.
4. **Anand N, Baron EM, Bray RS Jr.** Modified muscle-sparing paraspinal approach for stabilization and interlaminar decompression: a minimally invasive technique for pedicle screw-based posterior nonfusion stabilization. SAS J. 2008;2:40–42. DOI: 10.1016/SASJ-2007-0120-MIS.
5. **Brock M, Kunkel P, Papavero L.** Lumbar microdiscectomy: subperiosteal versus transmuscular approach and influence on the early postoperative analgesic consumption. Eur Spine J. 2008;17:518–522. DOI: 10.1007/s00586-008-0604-2.
6. **Eicker SO, Rhee S, Steiger HJ, Herdmann J, Floeth FW.** Transtubular microsurgical approach to treating extraforaminal lumbar disc herniations. Neurosurg Focus. 2013; 35: E1. DOI: 10.3171/2013.4.FOCUS13126.
7. **Fairbank JC, Pynsent PB.** The Oswestry Disability Index. Spine. 2000; 25: 2940–2952.
8. **Fankhauser N, De Tribolet N.** Extraforaminal approach for extreme lateral lumbar disc herniation. In: Torrens MJ, Dickson RA eds, Operative Spinal Surgery. Edinburgh, Churchill Livingstone, 1991: 145–160.
9. **Fardon DF, Milette PC.** Nomenclature and classification of lumbar disc pathology. Recommendations of the Combined task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology. Spine. 2001; 26: E93–E113.
10. **Fariborz S, Gholamreza B, Mohammad RE, Hamed K.** Intraforaminal and extraforaminal far lateral lumbar disc herniation. Med J Islam Repub Iran. 2008; 22: 63–67.
11. **Hood RS.** Far lateral lumbar disc herniations. Neurosurg Clin N Am. 1993; 4: 117–124.
12. **MacNab I.** Negative disc exploration. An analysis of the causes of nerve-root involvement in sixty-eight patients. J Bone Joint Surg Am. 1971; 53: 891–903.
13. **O'Brien MF, Peterson D, Crockard HA.** A posterolateral microsurgical approach to extreme-lateral lumbar disc herniation. J Neurosurg. 1995; 83: 636–640.
14. **Porchet F, Chollet-Bornand A, de Tribolet N.** Long-term follow up of patients surgically treated by the far-lateral approach for foraminal and extraforaminal lumbar disc herniations. J Neurosurg. 1999;90(1 Suppl):59–66. DOI: 10.3171/spi.1999.90.1.0059.
15. **Takeuchi M, Wakao N, Kamiya M, Hirasawa A, Osuka K, Joko M, Kawanami K, Takayasu M.** Lumbar extraforaminal entrapment: performance characteristics of detecting the foraminal spinal angle using oblique coronal MRI. A multicenter study. Spine J. 2015; 15: 895–900. DOI: 10.1016/j.spinee.2015.02.011.
16. **Tessitore E, de Tribolet N.** Far-lateral lumbar disc herniation: the microsurgical transmuscular approach. Neurosurgery. 2004; 54: 939–942.
17. **Vialle R, Wicart P, Drain O, Dubousset J, Court C.** The Wiltse paraspinal approach to the lumbar spine revisited: an anatomic study. Clin Orthop Relat Res. 2006; 445: 175–180. DOI: 10.1097/01.blo.0000203466.20314.2a.
18. **White AA, Panjabi MM.** Clinical Biomechanics of the Spine. Philadelphia: JB Lippincott, 1978.
19. **Wiltse LL, Bateman JG, Hutchinson RH, Nelson WE.** The paraspinal sacrospinalis-splitting approach to the lumbar spine. J Bone Joint Surg Am. 1968; 50: 919–926.
20. **Wu H, Fu C, Jiang R, Yu WD.** Multilevel magnetic resonance imaging analysis of multifidus-longissimus cleavage planes in the lumbar spine and clinical application to the Wiltse approach. Pak J Med Sci. 2012; 28: 839–841.

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Received 02.02.2016

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