

Technical Arrangement of the Williams-Isu Method for Anterior Cervical Discectomy and Fusion

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Anterior cervical fixation with autologous bone transplantation—without the need for harvesting bone from other sites, such as the ilium—was developed by Williams and modified by Isu et al. In recent intervertebral fusion procedures, after harvesting the cuboid bone from vertebral bodies, a hydroxyapatite block is placed between two harvested vertebral bones in the same way as in the sandwich method for intervertebral fixation. According to previous studies, this procedure has the following disadvantages: (i) as the corrective force for cervical kyphosis is insufficient, it could not be adapted for patients with preoperative kyphosis; (ii) special devices, including a microsurgical saw, are required for harvesting vertebral bones. In our modified method, we used a conventional high-speed drill instead of a microsurgical saw. Nevertheless, the results show that the operated spine can be stabilized to a greater extent by decreasing the height of the grafted bone, and this might help in reducing postoperative kyphosis.

(J Nippon Med Sch 2015; 82: 50–53)

Key words: anterior cervical fusion and discectomy, Williams-Isu method, sandwich method, technical arrangement

Introduction

Williams et al.¹ developed an anterior procedure for degenerative cervical spondylosis in 1992. A modification of this technique—the Williams-Isu method—was developed by Isu et al.^{2–4}, and has been used for cervical anterior decompression and fixation with autologous bone grafting, without the need for harvesting bone from the ilium. The advantages of this method are as follows: (i) as compared with the Cloward method, it enables safer and more reliable spinal decompression owing to a much larger operating field; (ii) harvesting bone from the ilium is unnecessary with this method. However, it requires special equipment, such as a microsurgical saw, which is not available in all institutions. In addition, it has been reported that the degree of cervical kyphosis tends to increase postoperatively in some patients who develop

kyphosis before surgery⁵. To overcome these disadvantages, we developed a modified technique that does not require the use of a microsurgical saw for harvesting bones and can reduce the size of the grafted bone.

Materials and Methods

Isu Method and Our Modification

In the original Williams-Isu method, both the upper and lower vertebral bodies adjacent to the affected intervertebral disc are cut into a cuboid form with a microsurgical saw. After spinal decompression, a ceramic block is placed between the two harvested bone grafts in the same way as in the sandwich method for bone grafting (Fig. 1a, b).

We made two major modifications to this procedure, as follows:

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Journal Website (<http://www.nms.ac.jp/jnms/>)

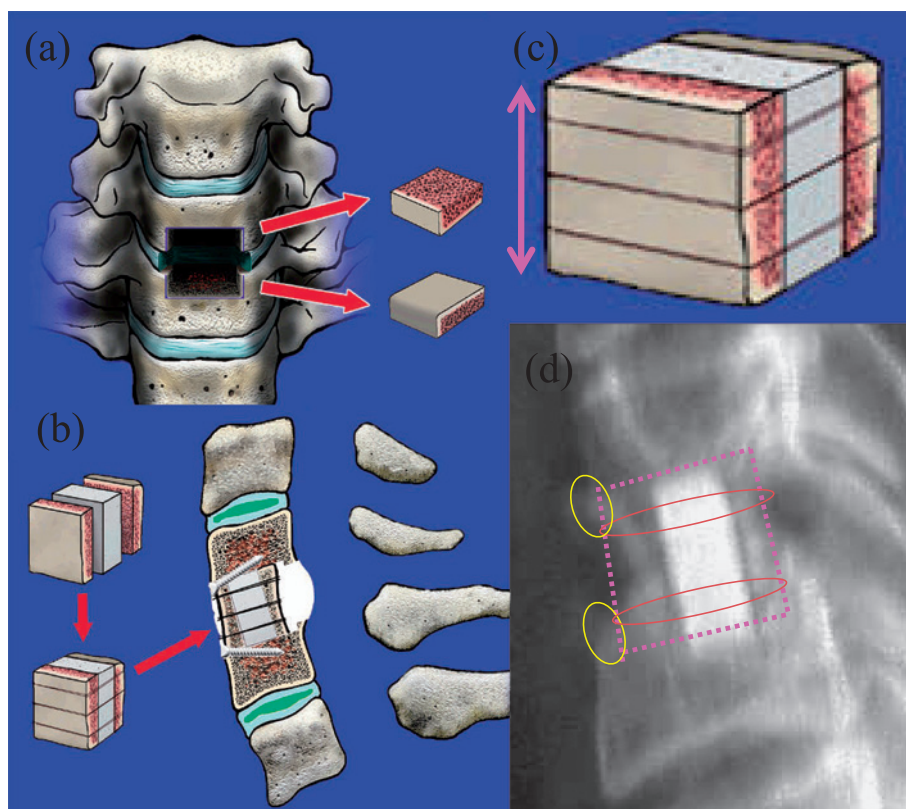


Fig. 1 The Williams-Isu method for anterior cervical fusion with a wide working space (a). Schematic diagrams of the frontal and (b) lateral views (quoted from reference no.6). Improved and shorter graft bone height (c). Radiograph, lateral view (d). The improved method resulted in larger remaining normal vertebrae and stable fusion.

Table 1 Five patients with radiological kyphosis and fusions after 3 years through the improved Williams-Isu method. Solid fusion means perfect ossification of operative vertebrae without displacement by spinous processes

Case	Age (Y)	Sex	Site	History	Radiological flexion preoperation	Kyphosis postoperation	Fusion at 3 years
1	74	M	C45	HT	-	-	solid
2	75	M	C56	DM	+	-	solid
3	41	M	C56	-	+	+	solid
4	39	F	C45	-	+	+	solid
5	60	M	C67	HT, DM	+	-	solid

HT: hypertension, DM: diabetes, AP: receiving anti-platelet therapy for cerebral infarction or heart disease

1. Instead of the special equipment (microsurgical saw) for resecting the cuboid bone from the vertebral body, we used a high-speed drill (with a 1-mm diamond bar attachment) that is commonly available in most neurosurgical institutions.

2. The size of the resected vertebral body in the original method was approximately 13-15×5×13-15 mm (width×height×depth). In our modified technique, the cutting size was 13×3×13 mm and the height of grafted

bone was reduced to <3 mm. With the reduction of the size of the bone to be harvested, the height of the bone graft was also reduced and its shape became more stable (Fig. 1c, d). Five patients were operated on with this modified procedure and were followed for >3 years.

Results

After 3 years of follow-up, cervical kyphosis had improved in two of four patients (Table 1). This procedure

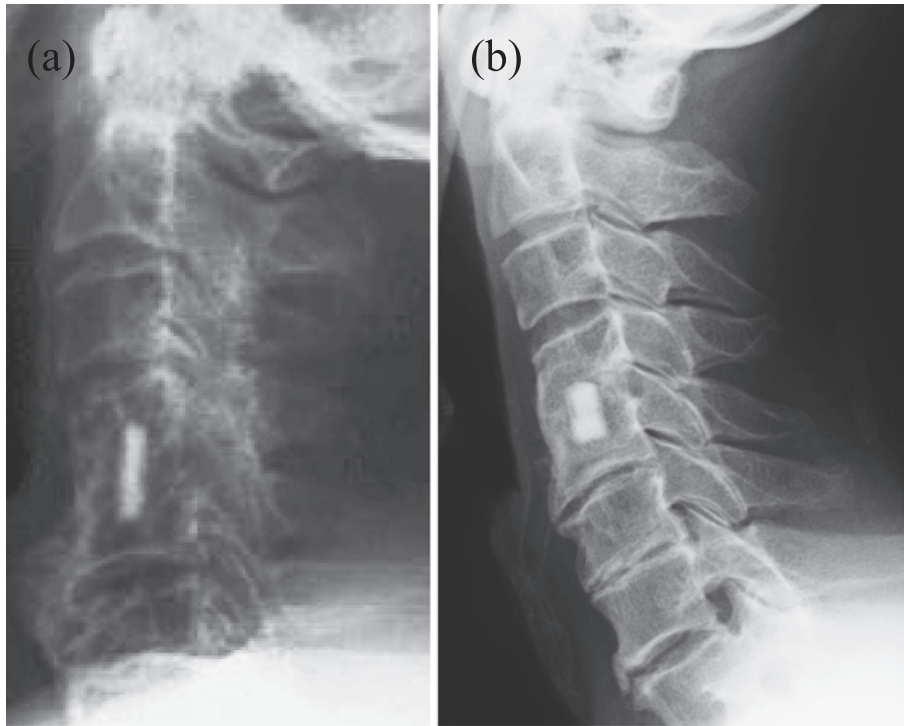


Fig. 2 Postoperative fusion after the Williams-Isu method for anterior cervical fusion. (a) The original method. (b) The improved method (case 1); cutting by less than 3 mm via verterectomy and using lower-height graft bones that sandwiched the hydroxyapatite.

was recommended in patients who exhibited some flexion kyphosis preoperatively. With either of the surgical methods for cervical discectomy with fusion, bony fusion usually occurs at 12–18 months after surgery, after which solid fusion is achieved. All five patients showed solid fusion at 3 years after surgery (Fig. 2).

Discussion

The Williams-Isu method was first described by Isu et al.¹ in 2002, and the original method was reviewed by Kim et al.⁶ in 2012. This surgical method provides a wider working space for spinal decompression as compared with the conventional method for intervertebral fusion. Moreover, with this method, autologous bone transplantation can be performed from the same cervical region without the need for harvesting bone from the ilium. In addition, solid fusion can be achieved in most cases, thus indicating its potential usefulness as a method for anterior cervical decompression and fusion (Fig. 1). In particular, this procedure is recommended for patients with segmental ossification of the posterior longitudinal ligament, vascular disorders, or tumors at the anterior region of the spinal canal⁷. It is a less complicated method than vertebral body fixation with a titanium mesh cage and plate, which might cause serious problems in cases of

non-union. Since 2007, in our institution, we have employed the anterior cervical approach when performing the William-Isu method for cases that required wide bone fenestration, including cases with ossification of the posterior longitudinal ligament. However, this procedure has some limitations, as follows: (i) it requires a microsurgical saw, which is not available in most institutions in Japan, and (ii) it might not be recommended for patients with preoperative cervical kyphosis, as pointed out by Kim et al.⁵. With the original method, excessive excision may cause the development of cervical kyphosis in the midterm or long term. Since 2010, we have harvested bone grafts from the vertebral body by reducing the height of the vertebral body to <3 mm. Moreover, instead of a microsurgical saw, we use a high-speed drill that is commonly available in most neurosurgical institutions. With this revised method, a considerably wide working space can be obtained as compared with that obtained with the original method. In addition, by reducing the height of the grafted bone and by preserving the vertebral body as much as possible, the operated spine can be stabilized to a greater extent and solid fusion can be achieved, thus reducing the possibility of postoperative kyphosis. In this study, we concluded that our procedure can be conducted relatively easily because a high-speed

drill and a diamond bar are used for exceeding bone from vertebral body graft excision instead of a microsurgical saw, and that an adequately large operating field can be obtained by reducing the size of the resected vertebral bone. However, special care is required when performing this procedure because slipping out of the grafted bone could cause serious problems.

Short-term follow-up of (1–2 years) and radiographic evaluations showed that two of the four patients with preoperative cervical kyphosis were free of kyphosis postoperatively, and that all patients had achieved solid fusion. Therefore, we think this modified surgical method is useful.

Conclusion

We report the use of a modified Williams-Isu method that is helpful for patients with a cervical pathology that requires a wide vertebral body dissection. This modification could reduce the risk of postoperative cervical kyphosis and facilitate the achievement of solid spinal fusion.

Conflict of Interest: The authors declare no conflict of interest.

References

1. Williams RC: Anterior cervical fusion utilizing autogenous bone graft from the cervical vertebrae. *Neurosurgery* 1992; 11: 339–342.
2. Isu T: Surgical selection for cervical spondylosis and cervical disc hernia. *Jpn J Neurosurg* 2002; 11: 453–460.
3. Suzuki S, Uenohara H, Arai H, Nishino A, Sakurai Y: Anterior cervical fusion using autogenous cervical vertebral grafts with sandwiched hydroxyapatite plate. *Spinal Surg* 1997; 11 (Suppl 1): 52.
4. Takayasu M, Hara M, Suzuki Y, Yoshida J: Anterior cervical decompression and fusion for cervical spondylosis using vertebral grafts obtained from the fusion site. Technical advantages and follow-up results. *Acta Neurochir (Wien)* 1998; 140: 1249–1255.
5. Kim K, Isu T, Sugawara A, et al.: Radiological study of the sandwich method in cervical anterior fusion using autologous vertebral bone grafts. *J Clin Neurosci* 2010; 17: 450–454.
6. Kim K, Isu T, Morimoto D, Sugawara A, Kobayashi S, Teramoto A: Cervical anterior fusion with the Williams-Isu method: clinical review. *J Nippon Med Sch* 2012; 79: 37–45. Review. PMID: 22398789 [PubMed—indexed for MEDLINE].
7. Kim K, Isu T, Sugawara A, et al.: Treatment of cervical OPLL by cervical anterior fusion using autologous vertebral bone grafts. *Acta Neurochir (Wien)* 2009; 151: 1549–1555.

(Received, November 14, 2014)

(Accepted, February 16, 2015)