Minimization of the Number of Pedicular Screws Placing in the Degenerative Lumbar Spine

Pinit Hirunyachote MD*,
Wallop Adukasem MD*

** Department of Orthopaedic Surgery, Nakhonpathom Hospital, Nakhonpathom*

Objective: *The present study was carried out to compare clinical results of spinal fusion in degenerative disease of lumbar between using pedicular screw instrumentation in every pedicle and partial placing the screws in some vertebra to provide immediate stabilization of the spine.*
Material and Method: *Fifty patients with degenerative diseases of their lumbar spines and needing spinal fusion between 2004 and 2007 were included in this study. They were divided into two groups by the order of their admissions. All underwent complete decompressive laminectomy and posterlateral fusion with autogenic bone grafting. In the first group, 25 patients received pedicular screw instrumentation at all pedicles that were in the fusion area. In the second group, 25 patients received pedicular screw instrumentation only in particular pedicles to minimize the operative time, blood loss and the cost of instrumentation. Japanese Orthopedic Association (JOA) Lumbar Scoring System was used to evaluate function outcome of the patients.*
Results: *There was no serious complication in both groups. Furthermore, there was no significant difference in terms of operative time, amount of blood loss, time to bone union, and JOA lumbar score at the one-year follow-up between the groups. However, the costs of instrumentation were significantly reduced in the second group.*
Conclusion: *Minimizing the numbers of pedicular screws instrumentation for spinal fusion of degenerative spine could be carried out to lessen the cost of treatment in particular patients.*

Keywords: *Pedicular screw, Degenerative lumbar spine, Spinal fusion*

J Med Assoc Thai 2008; 91 (6): 864-7
Full text. e-Journal: *http://www.medassocthai.org/journal*

The budgets of all government hospitals are under control by the capitation system of the National Health Security Office. The system supports the universal coverage project of the Thai Government that has significantly lessened the income of the hospitals. This system also affects the treatment expenses of most spinal surgery and instrumentation. The present study was done to minimize the cost of this spinal instrumentation and provide a suitable treatment to patients with unstable degenerative diseases of their lumbar spines.

Material and Method

Between 2004 and 2007, 50 patients who had unstable degenerative diseases of their lumbar spines were enrolled in the present study. Surgical treatment was applied in all patients including decompressive laminectomy, foraminotomy and posterolateral fusion with autogenic bone graft. The patients were then divided into two groups. The first group consisted of 25 patients and received conventional pedicular screw instrumentation in every pedicles of the lumbar spine that were included in the fusion levels, Fig. 1. Both pedicles were fixed at each vertebra. In the second group, also consisting of 25 patients, received pedicular screw instrumentation only in the particular pedicles that needed strong fixation. Pedicular screw instrumentation was not used in low stress vertebral level, usually only one pedicle was fixed with the screw and was cooperated in the instrumentation system, Fig. 2. However, bi-pedicular fixation was still used at the upper most and lower most vertebras to maintain

Correspondence to: Hirunyachote P, Department of Orthopaedic Surgery, Nakhonpathom Hospital, Nakhonpathom 73000, Thailand.

Fig. 1 The anteroposterior x-ray film of lumbar spine showed the treadtional pedicular screwing in both pedicles on each vertebra

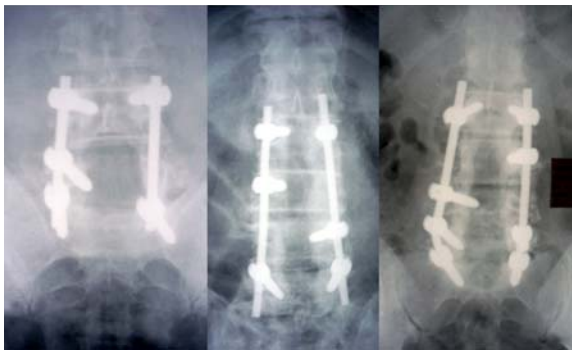

Fig. 2 The anteroposterior x-ray film of lumbar spine showed the partial pedicular screwing in interbetween vertebra of the fusion segment

the stability of the instrumentation system. After the operation, the patients in both groups were allowed to sit in the upright position on the 2nd day. On the 3rd and 4th day, all patients could ambulate with the use of lumbosacral supports. All patients were requested to use the supports for three months post operatively. The patients were asked to limit their vigorous work until the end of the 6th month. Radiograph of the spines of the patients was taken at the end of the 6th week, 3rd month, 6th month, and 1st year after the operation to evaluate the placing of the pedicular screw, the

Table 1. Clinical symptom score of the Japanese Orthopaedic Association (JOA) for a patient with lumbar disc herniation

Parameter	Finding	Points
Low back pain	None	3
	Occasional mild pain	2
	Frequent mild	1
	Occasional severe pain	1
	Frequent pain	0
	Continuous pain	0
Leg pain and/ or tingling	None	3
	Occasional slight symptom	2
	Frequent slight symptom	1
	Occasional severe symptom	1
	Frequent severe symptom	0
	Continuous severe symptom	0
Gait	Normal	3
	Able to walk > 500 meters although it results in pain tingling and/or muscle weakness	2
	Unable to walk > 500 meters owing to leg pain tingling and/or muscle weakness	1
	Unable to walk > 100 meters owing to leg pain tingling and/or muscle weakness	0
SLRT	Normal (> 70 degrees)	2
	30-70 degrees	1
	< 30 degrees	0
Sensory disturbance	None	2
	Slight disturbance (not subjective)	1
	Marked disturbance	0
Motor disturbance	Normal (grade 5)	2
	Slight weakness (grade 4)	1
	Marked weakness (grade 0-3)	0
Turn over while lying	No restriction	2
	Moderate restriction	1
	Severe restriction	0
Standing	No restriction	2
	Moderate restriction	1
	Severe restriction	0
Washing	No restriction	2
	Moderate restriction	1
	Severe restriction	0
Leaning forward	No restriction	2
	Moderate restriction	1
	Severe restriction	0
Sitting about 1 hour	No restriction	2
	Moderate restriction	1
	Severe restriction	0
Lifting or holding a heavy object	No restriction	2
	Moderate restriction	1
	Severe restriction	0
Walking	No restriction	2
	Moderate restriction	1
	Severe restriction	0
Urinary bladder function	Normal	0
	Mild dysuria	-3
	Severe dysuria	-6

instrumentation, and progression of bone union after spinal fusion. Japanese Orthopedic Association (JOA) Lumbar Scoring System[1] was used to evaluate function outcome of the patients before and after the operation at every visit. The continuous data were analyzed by Student-t-test and the discrete data were analyzed by Chi-square test or Fisher's exact test. A p-value of less than 0.05 was considered significant.

Results

Biographic data of the patients in both groups were comparable, Table 2. The JOA scores were also similar between the groups. All the patients had a complete follow up. There was no significant difference between the groups in terms of spinal instrumentation levels, operative time, blood loss, hospital stay, bone fusion time and JOA scores, Table 3. No patient had any serious complication.

Discussion

Decompressive laminectomy and spinal fusion are commonly used in the management of unstable degenerative spine. To promote spinal union in multi-level fusion and to allow the patient to have early ambulation, spinal instrumentation is used[2-9]. The instrumentation can improve stability of the spine so that the patients can have early ambulation, rapid pain relief, rapid fusion union, and early return to work. Among the spinal instrumentation, pedicular screw system is the most common system to be used. However, this system is costly and is a time consuming operation, especially when multilevel fusion has to be done. The cost of instrumentation can affect the budget of most government or public hospitals. Since the cabinet has launched the universal coverage project to provide health care to the population by granting very limited budget to all hospitals, the hospitals' budgets are further burdened. One of the most important factors influencing the cost of instrumentation is the number of pedicular screws to be used. Minimal screw number that can still provide optimum strength to the instrumentation system should be tried. Although stability of the lumbar spine may be loss at a particular level in degenerative process, the degenerated spine still has some stability from reactive or reparative processes such as osteophyte formation and calcification on particular spinal ligaments[10]. The reparative process can allow the surgeon to lessen the number of spinal pedicle screw placing without significantly reducing the stability of the system. The upper most and the lower most vertebras need strong fixation while the vertebras in between need less fixation strength. Minimizing the screw numbers in the system can lessen the cost of the operation significantly.

Reducing pedicular screw fixation in particular vertebras had no clinical effect on the outcome of our patients. There was no clinical difference between the

Table 2. Biographic data, pathology and JOA functional spinal score of the two groups before surgery

	Group 1	Group 2
Age range	52-65	54-62
Age average	58	57
2 level of fusion	8	8
3 level of fusion	10	12
4 level of fusion	7	5
Male	4	5
Female	21	20
JOA lumbar score (29)	8	8

Table 3. There was no significant difference between the groups in terms of operative time, bleeding, hospital day, fusion time, and JOA functional spinal score

	Group 1			Group 2		
	2 level	3 level	4 level	2 level	3 level	4 level
Operating time (hour)	1:25-2:30 (1:55)	2:15-3:20 (2:42)	2:45-3:15 (3:00)	1:05-2:00 (1:35)	2:00-2:45 (2:28)	2:20-2:50 (2:43)
Bleeding	200-350	250-350	400-1000	100-250	200-300	400-800
Fusion time by x-ray (month)		6			6	
Implant cost	37,500	50,000	62,500	31,250	37,500	43,500
JOA lumbar score at 6 week		20			20	
JOA lumbar score at 12 week		25			24	
Range of stay in hospital		4-12 (average 7)			3-11 (average 7)	
Complication		No			No	

groups in terms of spinal instrumentation levels, operative time, blood loss, hospital stay, bone fusion time, and JOA scores that could confirm the present hypothesis in reducing screw number to lessen the cost of operation.

Conclusion

Reducing the number of pedicular screw fixation can be done in the treatment of unstable degenerative diseases of the lumbar spine without influencing the clinical outcome.

References

1. Osawa T, Ogura T, Hayashida T, Mori M, Hase H. Evaluation of lumbosacral nerve root lesions using evoked potentials recorded by a surface electrode technique. Spine 2003; 28: 496-501.
2. Hirunyachote P, Adulkasem W. The results after surgical treatment of spinal stenosis. J Thai Orthop Surg 1999; 24: 49-52.
3. Bridwell KH, Sedgewick TA, O'Brien MF, Lenke LG, Baldus C. The role of fusion and instrumentation in the treatment of degenerative spondylolisthesis with spinal stenosis. J Spinal Disord 1993; 6: 461-72.
4. Mardjetko SM, Connolly PJ, Shott S. Degenerative lumbar spondylolisthesis. A meta-analysis of literature 1970-1993. Spine 1994;19:2256S-65S.
5. Sidhu KS, Herkowitz HN. Spinal instrumentation in the management of degenerative disorders of the lumbar spine. Clin Orthop Relat Res 1997: 39-53.
6. Roy-Camille R, Benazet JP, Desauge JP, Kuntz F. Lumbosacral fusion with pedicular screw plating instrumentation. A 10-year follow-up. Acta Orthop Scand Suppl 1993;251:100-4.
7. Yuan HA, Garfin SR, Dickman CA, Mardjetko SM. A historical cohort study of pedicle screw fixation in thoracic, lumbar, and sacral spinal fusions. Spine 1994; 19: 2279S-96S.
8. Zdeblick TA. A prospective, randomized study of lumbar fusion. Preliminary results. Spine 1993; 18: 983-91.
9. Booth KC, Bridwell KH, Eisenberg BA, Baldus CR, Lenke LG. Minimum 5-year results of degenerative spondylolisthesis treated with decompression and instrumented posterior fusion. Spine 1999; 24: 1721-7.
10. Williams KD, Park AL. Lower back pain and disorders of intervertebral disc. In: Canale ST, Beaty JH, editors. Campbell's operative orthopaedics. Vol. 2. 11th ed. Philadelphia: Mosby Elsevier; 2008: 2159-236.

ผลการผ่าตัดเชื่อมกระดูกสันหลังโดยลดจำนวน pedicle screw ในการยึดตรึง

พินิจ หิรัญโชติ, วัลลภ อดุลย์เกษม

ตั้งแต่สำนักงานประกันสุขภาพแห่งชาติ ได้ก่อตั้งขึ้น และประกาศใช้โครงการประกันสุขภาพถ้วนหน้า ทำให้งบประมาณที่โรงพยาบาลรัฐแต่ละแห่งได้รับมีจำนวนไม่เพียงพอในการรักษาผู้ป่วย โดยเฉพาะการรักษาที่มีค่าใช้จ่ายสูง การผ่าตัดเชื่อมกระดูกสันหลัง เป็นการรักษาหนึ่งที่มีค่าใช้จ่ายสูง คณะผู้ศึกษาจึงได้ทำการศึกษาเพื่อจะลดค่าใช้จ่ายการผ่าเชื่อมกระดูกสันหลังลง

ผู้ป่วยจำนวน 50 คนได้รับการแบ่งออกเป็น 2 กลุ่มโดยกลุ่มแรกได้รับการผ่าตัดตามแนวทางปกติ แต่ในกลุ่มที่ 2 ได้ลดจำนวนของสกรูที่ใช้ยึดตรึงกระดูกสันหลังลง และได้ติดตาม ระยะเวลาที่ใช้ในการผ่าตัด ปริมาณเลือดที่สูญเสีย ค่าโลหะดามกระดูกสันหลัง และผลของการผ่าตัด โดยติดตามเป็นระยะ 1 ปี

ผลการผ่าตัดพบว่าไม่มีความแตกต่างของผลการผ่าตัด ระยะเวลาของการผ่าตัด การสูญเสียเลือด ระยะเวลาที่ผู้ป่วยนอนโรงพยาบาล แต่ ค่าใช้จ่ายลดลง

การลดค่าใช้จ่ายในการผ่าตัดเชื่อมกระดูกสันหลังโดยการลดจำนวนสกรูที่ยึดตรึงลง ไม่มีผลแตกต่างของผลการรักษา สามารถใช้เป็นมาตรฐานได้