Research Article

Adjacent Segment degeneration following spinal surgery for degenerative disc disease

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Abstract

Introduction: Adjacent segment degeneration is a highly challenging entity faced by every spine surgeon. It is difficult to diagnose considering the fact that it has variable presentation in term of symptom it produces, its time frame and radiological changes. Also of challenge is to distinguish it from age-related degenerative process. **Aims and objective:** To study the adjacent segment degeneration following spinal fixation and determine if it significantly contribute to patient morbidity in follow up patients. **Materials and Method:** In the present study total 31 patients who had undergone spinal surgery either at cervical or lumbar level were included. Postoperative x ray and MRI were taken and studied for changes. Preoperative x ray and MRI were studied wherever available. However many a time preoperative X ray and MRI were not available. Clinical outcome were decided based on questionnaire given to the patients. This clinical outcome was matched with radiological outcome. X ray and MRI were reported by single person to avoid inter observer variation. The changes found were matched with clinical criteria to measure significance of the same. MRI criteria by Beattie *et al* were utilized. **Results:** It was observed that majority of the patients in the study were between the age group of 31to 50 years and majority of them were male. Out of the total cases, lumbar spine was involved in 80.65% cases whereas cervical spine was involved in 19.35% cases. Instrumentation was done in 45.16% cases. Multiple vertebras were involved in 38.71% cases. Fusion was done in 74.19% cases. It was seen that 4 out of 31 patient had x ray change in form of adjacent osteophyte. 11 out of 31 patients showed MRI changes of grade 1 disc prolapsed **Conclusion:** We conclude that adjacent segment degeneration is highly complex entity, which is difficult to predict. Multiple segment fusion is needed to treat degenerative spinal deformity; more care should be taken in deciding the extent of fusion and correction of the sagital balance to prevent possible ASD.

Keywords: Adjacent Segment degeneration, multiple segment fusion, MRI changes.

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INTRODUCTION

Adjacent segment degeneration is a highly challenging entity faced by every spine surgeon. It is difficult to diagnose considering the fact that it has variable presentation in term of symptom it produces, its time frame and radiological changes. Also of challenge is to distinguish it from age-related degenerative process. Our understanding of biomechanics of spine is increasing. Also, indications for spinal surgery are increasing. Many new instrumentation and technique are being marketed with a goal to halt progress of ASD or prevent it. So, it would be worth for every spine surgeon to be familiar with the topic and new instrumentation. The normal lumbar spine has 5 very mobile segments, so if a partial segmental fusion is done in this area, the load on the other lumbar vertebra will be increased and the momentum changed, increasing the stress and deformation forces acting on the adjacent segments and accelerating early degenerative changes. Adjacent segment degeneration includes accelerated disc degeneration, herniation of nucleus pulposus, acquired spondylolysis, segmental instability, spinal stenosis, arthritis of posterior facet joints, endplate sclerosis.[1-6] In recent years, to obtain successful fusion, various new fusion devices and methods have come up. High fusion rate is achieved with these devices and methods. However, in follow up patients accelerated degenerative changes have been found. Biomechanical studies of lumbosacral fusion have

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found increased intradiscal pressure and motion at the adjacent spinal levels and intradiscal pressure increases with the number of levels fused.[1,2]

AIMS AND OBJECTIVE

To study the adjacent segment degeneration following spinal fixation and determine if it significantly contribute to patient morbidity in follow up patients.

MATERIALS AND METHOD

The present study was conducted in the department of orthopedics of Lokmanya Tilak Medical College and Hospital.

Following inclusion and exclusion criteria was used to select the study subjects.

Inclusion Criteria

Patients aged between 20-80 years of either sex and operated for spinal surgery

Exclusion Criteria

- Patients with metallic device in body (except for Instrumentation)
- Pregnant woman
- Patient with cardiac pacemaker
- Patient with severe underlying medical condition

Thus total 31 patients who had undergone spinal surgery either at cervical or lumbar level were included in the present study. Postoperative x ray and MRI were taken and studied for changes. Preoperative x ray and MRI were studied wherever available. However many a time preoperative X ray and MRI were not available. Clinical outcome were decided based on questionnaire given to the patients. This clinical outcome was matched with radiological outcome. X ray and MRI were reported by single person to avoid inter observer variation. The changes found were matched with clinical criteria to measure significance of the same. MRI criteria by Beattie *et al*,[7] were utilized. They are as follow.

- **Grade 0(absent):** no visible disc material contacting or deforming thecal sac.
- **Grade 1(minimal):** disc material in contact with thecal sac.
- **Grade 2 (moderate):** disc material deforming thecal sac, antero-posterior distance of thecal sac ≥ 7 mm.
- **Grade 3 (severe):** disc material deforming thecal sac. Antero-posterior distance of thecal sac < 7 mm.

The collected data was entered in Microsoft excel and was analyzed and presented with appropriate tables and graphs.

RESULTS

Table 1: Age and sex distribution of cases

		No. of cases	Percentage
Age	21-30	4	12.9
	31-40	11	35.49
	41-50	8	25.8
	51-60	4	12.9
	61-70	3	9.68
	>70	1	3.23
Sex	Male	20	64.52
	Female	11	35.48

It was observed that majority of the patients in the study were between the age group of 31to 50 years and majority of them were male.

Table 2: Distribution of various factors in the study subjects

		No. of cases	Percentage
Level of Spine involved	CERVICAL	6	19.35
	LUMBAR	25	80.65
Instrumentation	NO	17	54.84
	YES	14	45.16
Single/ multiple	MULTIPLE	12	38.71
	SINGLE	19	61.29
Fusion	NO	8	25.81
	YES	23	74.19

Out of the total cases, lumbar spine was involved in 80.65% cases whereas cervical spine was involved in 19.35% cases. Instrumentation was done in 45.16% cases. Multiple vertebras were involved in 38.71% cases. Fusion was done in 74.19% cases.

Table 3: Distribution according to X ray and MRI changes

		Frequency	Percent
X Ray Change	ADJACENT OSTEOPHYTE	4	12.90
	NONE	27	87.10
MRI changes	GRADE 1 DISC	11	35.48
	NONE	20	64.52

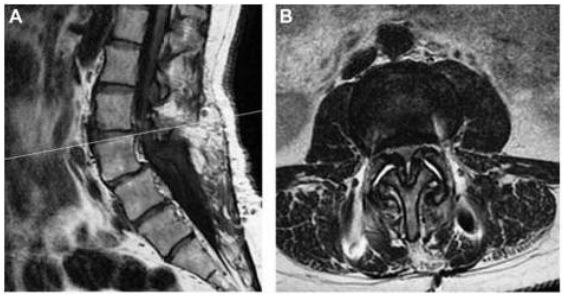

Figure shows that Operated c/o L3 TO L5 LUMBAR CANAL STENOSIS. 4Yr post op. Showing CANAL STENOSIS at higher l2 l3 level with qualification symptoms

Table 4: Association of MRI changes with age and duration since surgery

		Patient with MRI changes	No MRI changes	Clinical outcome		
				Excellent	Good	Fair
Age group	20-29	0	3	4	0	1
	30-39	7	4	6	4	1
	40-49	2	6	3	4	0
	50-59	1	3	2	2	0
	60-69	1	2	1	2	0
	70-79	0	1	0	1	0
Time since index surgery	1-3 year	7	9	5	10	1
	4-5 year	0	9	9	0	0
	6-10 year	3	2	2	2	1
	>10 year	1	0	0	0	1

Out of 31 patient 11 had MRI changes. Out of this 3 patient were in cervical spine group and rest in lumbar group. Most common disc found to be prolapsed was at L4-L5 level in 5 patients. In cervical group, most common disc to be prolapsed was C5-C6 level. This can be attributed to higher number of fusion occurring at L5-S1 level. Also, it is important to note that L4-L5 motion segment is most mobile out of all. Thus it is subjected to enhanced level of stress following lumbar spine fusion. In cervical group, 2 out of 3 disc found prolapsed was of lower disc space. In lumbar group, 5 out of 8 discs found to be prolapsed was of upper disc space. This can be attributed to the fact that cervical spine has relatively more mobility than lumbar spine. Thus, these changes were in accordance with other major studies done in this field.

DISCUSSION

The present study was conducted in the department of orthopedics in Lokmanya Tilak Medical College and Hospital. Total 31 cases were studied in the present study. The male to female ratio was 1.35. Out of 19 males, 6 had developed MRI changes as opposed to 5 out of 14 female developed MRI changes. Thus, there was no sex predilection for developing adjacent segment changes. Similar findings were also reported by Gore DR *et al*[8] and Hillibrand AS *et al*[9]. Total 5 patients had instrumentation at multiple levels. All five patients had developed MRI changes in form of grade 1 disc prolapse. This reinforces theory of increased stress at adjacent motion segment.[1-6] 4 patient had changes in form of adjacent osteophyte. Of them, 2 had been operated upon lumbar spine with multiple level fixations. The rest 2 were operated upon cervical spine with single level fixation. These changes are in accordance with fact that cervical spine is more mobile and cervical motion segment is more vulnerable to increased stress due to fixation.[8,10,11,12] However, 4 out 5 patient who had undergone multiple level fusion had reported to have good to excellent outcome emphasizing that fixation may not be only attribute associated with clinical outcome.[13] Another important factor observed was age group. Although 9 out of 23 patients in age group of 20-49 had MRI changes, 13 out of 23 patients had reported to have excellent outcome. 2 out of 8 patients had MRI changes in age group 50-79. But only 3 out of 8 patients had reported excellent outcome. Thus, instrumentation may bring changes of adjacent segment degeneration in younger age group earlier. But clinical implication of this changes and its relation to age group is

doubtful.[8,9,13,14] Time since index surgery was also an important factor seen in study was. Out of 25 patient only 7 patients had MRI changes in group of patient whose time since index surgery was 1-5 years. However 4 out of 6 patients had MRI changes in group of patient whose time since index surgery was more than 6 years. Also, 14 out of 25 patient reported excellent outcome with time since index surgery being 1-5 years. However, only 2 out of 6 patient had reported excellent outcome with time since index surgery being >6 years. Thus, with time changes or MRI may be more prudent and also clinical outcome deteriorates over the period of time. Thus, it implicates time since index surgery as one of the important factor in determining adjacent segment degeneration.[13,15,16] Adjacent segment degeneration is a concern to both patients and surgeon and is a potential cause of further spinal surgery. Although asd may be considered as a part of the normal aging process and degenerative change, it is influenced by changes in the stress acting on the adjacent segment after spinal fusion. To mitigate the problem of adjacent segment degeneration a number of changes in instrumentation have been developed in recent years.[17] The dynamic stabilization may be defined as system, which would favorably alter the movement and load transmission of spinal motion segment, without the intention of fusion of the segment. This needs to be carefully differentiated from semirigid fixation, where a fusion is intended. The postulated hypothesis behind dynamic stabilization is that control of abnormal motion and more physiological load transmission would relieve pain and prevent adjacent segment degeneration. A remote expectation is that, once normal motion and physiological load transmission is achieved, the damaged disc may repair itself. The various dynamic stabilization systems described in the literature are all posterior implant. They can be classified into four categories.[17]

CONCLUSION

We conclude that adjacent segment degeneration is highly complex entity, which is difficult to predict. Multiple segment fusion is needed to treat degenerative spinal deformity; more care should be taken in deciding the extent of fusion and correction of the sagittal balance to prevent possible ASD.

REFERENCES

1. Aota Y, Kumano K, Hirabayashi S. Post-fusion instability at the Adjacent segments after rigid pedicle screw fixation for Degenerative lumbar spinal disorders. J spinal disord 1995; 8:464-73.[PubMed]
2. Kumar MN, Baklanov A, Chopin D. Correlation between Sagittal plane changes and adjacent segment degeneration Following lumbar spine fusion. Eur spine j 2001; 10:314-319.[PMC Free Article] [PubMed]
3. Lehmann TR, Spratt KF,Tozzi JE, et al. Long term follow-up of Lower lumbar fusion patients. Spine 1987; 12:97-104.[PubMed]
4. Nagata H, Schendel MJ, Transfeldt EE, et al. The effects of immobilization of long segments of the spine on the distal and adjacent facet force and lumbosacral motion. Spine 1993; 18:2471-9.[PubMed]
5. Penta M, Sandhu A, Fraser RD. Magnetic resonance imaging Assessment of disc degeneration 10 years after anterior lumbar interbody fusion. Spine 1995; 20:743-747.[PubMed]
6. Rahm MD, Hall BB. Adjacent segment degeneration after lumbar fusion with instrumentation: a retrospective study.J spinal disord 1996; 9:392-400.[PubMed]
7. Beattie PF, Meyers SP, Stratford P et al. Association between patient report of symptom and anatomical impairment visible on lumbar mri. Spine 25; 819, 2000.[PubMed]
8. Gore DR, Gardner GM, Sepic SB, et al. Roentgenographic finding following anterior cervical fusion. Skeletal radiography. 1986: 15: 556-559. [PubMed] [CrossRef]
9. Hillibrand AS, Callson GD, Palumbo MA, et al. Radiculopathy and myelopathy at segments adjacent to the site of a previous anterior cervical arthrodesis. J bone joint surg. Am.1999; 81: 519-528.[PubMed]
10. Baba H, Furusawa N, Imura S. et al. Late radiographic findings after anterior cervical fusion for spondylotic myeloradiculopathy. Spine. 1993. 18; 2167-2173. [PubMed]
11. Lee CK, Weiss AB. Isolated congenital cervical block vertebrae below the axis with neurological symptoms Spine. 1981. 6; 118-124.[PubMed]
12. Whitehill R, Moran DT, Fechner RE et al. Cervical ligamentous instability in a canine in vivo model, Spine. 1987. 12; 959-963.[Spine]
13. The impact of adjacent segment degeneration on the Clinical outcome after lumbar spine fusion. Young yang et al. Spine 2008; 33(5) 503-508.[Spine]
14. Ghiselli G, Wang JC, Hsu WK, et al. L5-S1 segment survivorship and clinical Outcome analysis after L4-L5 isolated fusion. Spine 2003; 28:1275-80.[PubMed]
15. Moskowitz A, Moe JH, Winter RB, et al. Long term follow up of scoliosis fusion, j bone joint surg am 1980;62 364-76.[PubMed]
16. Etabar S, Cahilll DW. Risk factors for adjacent segment failure following lumbar fixation with rigid instrumentation for degenerative instability. Jour of Neurosurg 1999, 90;163-169.[PubMed]
17. D.K. Sengupta. Neurology india, December 2005, Vol 53, Issue 4:466-474. [Neurology INDIA]

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