



MANAGEMENT OF LUMBAR BLACK DISC BY TRANSPEDICULAR SCREW FIXATION

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ABSTRACT

Introduction: Black disc disease is a degenerative processes of intervertebral disc dehydration match with radiological imaging changes. **Aim of work:** Normalization of disc height with preservation of spinal stability. **Patients and methods:** A total 300 patients were operated at one or two lumbar levels, fusion by screws and roods without cage. **Results:** Excellent outcome was detected in 239 patient (79.7%), good outcome was detected in 26 patient (8.7%), fair outcome was in 9 patients (3.0%), while poor outcome was in 7 patient (2.3%) of spinal metastasis. **Conclusion:** Normalization of disc height in degenerative disc, normalization of nerve root foramina and maintain spinal stability.

Keywords: black; disc; fixation

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Introduction

Black disc disease refers to a degenerative processes of inter vertebral disc resulting in disc dehydration which appear on MRI (Magnetic resonance imaging) a black nucleus on. This degenerative process of disc dehydration affects disc spaces of all vertebral bodies and represent the early sign of normal aging (osteoarthritis of the spine). It may be symptomatic or asymptomatic. Symptomatic "black disc" can produce joint pain without compression of the traversing spinal nerve roots or spinal cord (discogenic back pain). (Frank S et al 2015). Our aim is to normalize the inter vertebral disc height with preservation of spinal stability

Patients and method

Lumbar black disc on MRI single or double level and rupture disc fragment are included in this study and we exclude migrating disc up or down, dorsal and cervical spine. An informed written consent was taken from all patients. All patients of this study were submitted for Clinical Evaluation (Full history was taken searching for any associated disease), imaging Evaluation (Plain x ray and CT scan spine for stability

assessment, MRI spine done preoperative for assessment of degenerative disc, posterior disc height, foraminal height, facet joint, assessment of bone disease like paget disease of bone and assessment of metastasis in suspected patients and for follow up, PET scan done for suspected metastasis) and Laboratory evaluation (full lab investigation in addition thyroid profiles done for hypothyroidism, serum glucose level and HbA1c for diabetic patients).

We include in our study lumbar black disc in MRI and we exclude rupture disc, Migrating disc up or down, Dorsal and cervical spine.

All patients (n=300) were operated at one or two lumbar levels. Fusion by screws and roods without cage and without discectomy in most of cases (195 patients). Discectomy of ruptured disc fragments done in (105 patient), long term follow up of our patients postoperative(one year – two years) , our study was done at Al-zahraa University hospital, Al-Azhar University from January 2017 to July 2020.

Illustrative cases



Figure 1: MRI lumbosacral spine sagittal and axial view show lumbar 2,3,4 disc degeneration, absorption of water content , decrease disc height, decrease foraminal height and nerve root entrapment

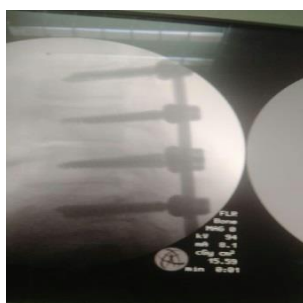


Figure 2: Intraoperative photo taken by C Arm apparatus showing site of trans pedicular screw fixation of lumbar 2,3,4,5 : mid pedicular, renormalization of disc height and foraminal height.

Statistical analysis:

The margin of error accepted was set to 5%. So, the p-value was considered significant at the level of < 0.05 .

Result:

Table (1): Clinical characterization of our study Lumbar black disc degeneration was studied in

Table (4): Radiological finding of our study: Pre and postoperative MRI LSS for our patients was studied , foraminal height was ranging from 7-8mm preoperative in(n=210)(70.0%) while postoperative foraminal height ranging from 15-17mm in (n=210)(70.0%)with p value , posterior disc height was ranging from 2.4-3.8 in all patients (n=300)(100.0%), while postoperative it was ranging from 4-5mm in all patients (n=300)(100.0%), p value(< 0.05), rupture disc fragment was radiologically detected preoperative in (n=105)(35.0%), postoperative MRI shows successful removal of rupture disc fragments.

Table (5): Recovery and follow up of our study: Immediate improvement of clinical presentation was observed within 72 hour in (n=233)(77.7%)of patients, early improvement was observed within 2-6 week in (n=20)(6.7%)of patients, late improvement was observed more

300 patient, 176(58.7%) male and 124(41.3%) female.

Table (2): mean age range from 18-70 year.

Table (3): Sciatica (n=210)(70.0%) represent the most common presentation of our study, gluteal pain was observed in (n=210)(72.3%)patient, while transverse low back pain was the least presentation(n=100)(33.3%).

than 6 weeks in (n=8)(2.7%), while recurrence of symptoms was found in 39 patient (13.0%).

Table (6): Excellent outcome was detected in 239 patient (79.7%), good outcome was detected in 26 patient (8.7%), fair outcome was in 9 patients (3.0%), while poor outcome was in 7 patient (2.3%) of spinal metastasis

Table (7): Recurrence of sciatica at the same level was observed in 35 patient (11.7%), Mexodema was detected as risk factor for recurrence in N=10 (28.6%) recurrence was occurred within 5 years, Facet arthropathy was detected in N=12(34.3%) and recurrence was within 2-3y, Paget disease was found in N=4(11.4%), recurrence within 8-16 month while Multiple Myeloma was found in N=2(5.7%) recurrence within one year while spinal metastasis responsible for recurrence of symptoms in (N=7) (20.0%) of patients within 4-8 month.

Table (8): Recurrence of sciatica in adjacent upper and lower levels was found in (n= 4)(1.3%), Over distraction represent (0.3%) while back trauma represent (1.0%) of recurrence.

Gender	No.casse	Percentage
Male	176	(58.7%)
Female	124	(41.3%)
Total	300	(100.0%)

Table (1): gender of study group

Range of age	18-70
Mean age	45.32±8.61

Table (2): range of age of study group

Clinical presentation	N0.cases	Percentage
Sciatica	210	(70.0%)
Transverse low back pain	100	(33.3%)
Gluteal pain	217	(72.3%)

Table (3): clinical presentation of study group

Radio-logical	Preoperative			Postoperative			P value
	Range	Mean±SD	No. cases	Range	Mean±SD	No. cases	
Range of foraminal height (mm)	7-8	7.73±0.70	210 (70.0%)	15-17	16.48±0.99	210 (70.0%)	<0.001*
Range of posterior disc height (mm)	2.4-3.8	3.19±0.29	300 (100.0%)	4-5	4.64±0.28	300 (100.0%)	<0.001*
Rupture disc fragment	105 (35.0%)			0 (00.0%)			<0.001*

Table (4): radiological finding

Immediate improvement (72 h)	Early improvement (2-6w)	Late improvement (>6w)	Recurrence
N = 233	N= 20	N=8	N=39
77.7%	6.7%	2.7%	13.0%

Table (5): Outcome and follow up

Risk factor	Excellent (n=239) (79.7%)	Good (n=26) (8.7%)	Fair (n=9) (3.0%)	Poor (n=7) (2.3%)	P value
Diabetes	N=82(34.3%)	N=4(15.4%)	N=3(33.3%)	N=0(00.0%)	0.066
Mexodema	N=2(0.83%)	N=10(38.5%)	N=0(0.00%)	N=0(00.0%)	<0.001**
Facet arthropathy	N=221(92.6%)	N=9(34.6%)	N=3(33.3%)	N=0(00.0%)	<0.001**
Pajet disease	N=0(0.00%)	N=3(11.5%)	N=1(11.1%)	N=0(00.0%)	<0.001**
Myeloma	N=0(0.00%)	N=0(0.00%)	N=2(22.2%)	N=0(00.0%)	<0.001**
Metastasis	N=0(0.00%)	N=0(0.00%)	N=0(00.0%)	N=7(100.0%)	<0.001**

Table (6): Outcome regards to risk factor

Risk factor	No. cases (n= 35)(11.7%)	Time
Mexodema	N=10 (28.6%)	5 years
Facet arthropathy	N=12(34.3%)	2-3y
Paget disease	N=4(11.4%)	8-16 month
Multiple Myeloma	N=2(5.7%)	1 y
Metastasis	N=7(20.0%)	4-8 month

Table (7): Recurrence in the same level with associated foraminal stenosis

	Adjacent upper levels (n= 2)(0.6%)	Adjacent lower levels (n=2) (0.6%)
Over distraction	N=1(0.3%)	N=0(00.0%)
Trauma	N=1(0.3%)	N=2(0.7%)
Total	N = 4(1.3%)	

Table (8): Recurrence in nearby levels

Discussion

Low back pain manifested as axial lumbar back pain radiating to the buttock region. [Oikawa Y et al 2012] Pain radiating to groin and or thigh usually from the lower lumbar discs. Central or foraminal stenosis manifested as radicular pain (Laplante BL et al 2012)

Black disc degeneration was studied in 300 patient all of them were in lumbar region, 176(58.7%) male and 124(41.3%) female, with age range from 18-70 year mean age 45.32±8.61. Sciatica (n=210)(70.0%) represent the most common presentation of our study, gluteal pain was observed in (n=210)(72.3%)patient, while transverse low back pain was the least presentation(n=100)(33.3%), (table 1,2,3)

Modic et al. suggested a classification system that describe the degenerative changes occurs in vertebral end plate and subchondral marrow on MRI. This system describe three types of changes: (1) First type of changes appears hypo intense T1-weighted imaging (T1) and hyper intense T2-weighted imaging (T2) representing marrow edema and inflammation; (2) second type of changes appears hyperintense T1 and iso intense T2 as normal red marrow is replaced by yellow fatty marrow due to marrow ischemia; and (3) third type of changes appears hypointense T1 and T2 representing subchondral sclerosis. Modic changes are frequently seen in patients with Lumbar disc degenerative disease [Jensen TS, et al 2008].

In our study there was statistical highly significance difference between Pre and postoperative MRI LSS for our patients denoting adequate neural decompression. Foraminal height was ranging from 7-8mm preoperative in(n=210)(70.0%) (Mean±SD 7.73±0.70) while postoperative foraminal height ranging from 15-

17mm in (n=210)(70.0%) (Mean±SD 16.48±0.99)(P value <0.001**), posterior disc height was ranging from 2.4-3.8 in all patients (n=300)(100.0%) (Mean±SD 3.19±0.29), while postoperative it was ranging from 4-5mm in all patients (n=300)(100.0%) (Mean±SD 4.64±0.28)(P value <0.001**), rupture disc fragment was radiologically detected preoperative in (n=105)(35.0%), postoperative MRI shows successful removal of rupture disc fragment(00.0%)(P value <0.001**) (table 4)

Fritzell P studied surgical over non-surgical treatments of degenerative disc disease, and he found that, superior outcomes noticed in surgical group (submitted to fusion of degenerative disc disease) compared to non-surgical treatments. using the Oswestry disability index (ODI)

In his study he found a reduction in back pain score in 33% of cases and a 25% decrease in disability in the operative group using the Oswestry disability index (ODI) while the non-operative group had 7% and 3% reductions in pain, respectively. also he reported a lower total economic cost in the operative group when compared to long-term non-operative care.

Also Palepu found in his study that, Fusion of degenerative disc disease (DDD) was practiced since the 20th century and was the gold standard in treating DDD and. Fusion without instrumentation frequently complicated by pseudoarthrosis (nonunion of bone).

In our study, immediate improvement of clinical presentation was observed within 72 hour in (n=233)(77.7%)of patients, early improvement was observed within 2-6 week in (n=20)(6.7%)of patients, late improvement was observed more than 6 weeks in (n=8)(2.7%), while recurrence of symptoms was found in 39 patient (13.0%). So

we agree with Fritzell P that surgical fusion of degenerative disc disease provide superior outcome over nonsurgical and decrease length of hospital stay.

In our study all patients were fused using posterior screws and rods without using inter body fusion cage, this was supported by a study done by Peter Endler, he compared the outcome of three different fusion techniques: non instrumented posterolateral fusion (PLF), instrumented posterolateral fusion (IPLF), and interbody fusion (IBF) and he concluded that their was no advantage in outcome in addition of interbody fusion to posterolateral fusion had also this addition was associated with a higher risk for further surgery.

The outcome of management in a study done by Yu Chao Lee depends on type of fusion was used, Yu Chao Lee used both open and minimally invasive fusion techniques and he concluded that minimally invasive fusion improving outcome through minimizing soft-tissue damage also successful clinical outcomes currently exists in carefully selected patients undergoing open fusions and employing correct grafting and stabilization techniques. But in our study outcome of management was depending on risk factors observed in our patients. Excellent outcome was detected in 239 patients (79.7%), good outcome was detected in 26 patient (8.7%), fair outcome was in 9 patients (3.0%).

Thyroid hormones produce multiple effects on neural development and function; hypothyroidism is associated with significant alterations in brain and neuromuscular system functions. Neurological manifestations of clinical hypothyroidism in adults produce fluid retention which leads to tissues swollen that compress peripheral nerves causing peripheral neuropathy and entrapment neuropathy. In previous study, it was found that after 1 year of therapy 33% of hypothyroid patients still had residual symptoms and signs. [Raj Bahadur Singh et al 2015]

In our study mexodema was detected in 12 patient, 2 of them had excellent prognosis after back surgery and 10 patients had good prognosis, mexodema was considered as risk factor for recurrence in N=10 (28.6%) recurrence. Recurrence occurred within 5 years.

Paget disease is a metabolic disorder diagnosed by presence of focal areas of bone resorption due to hyper activity of osteoclast cells accompanied by secondary increase in osteoblastic bone formation involving the

skeletal system [Roodman GD and Windle JJ, 2005].

Vishnu Senthil and Satish Balaji reported a case study of single vertebral involvement with central compression of body and lysis of lumbar spine, they concluded that Monostotic Paget disease of the lumbar vertebrae is less frequently noticed and can mimic various pathological conditions such as myeloma, metastasis, vertebral osteomyelitis, or osteoporotic compression that occurs in an old age man.

In our study Paget disease was found in N=4(11.4%) 3 of them had good prognosis after lumbar back surgery and one patient had fair prognosis, the four patients was develop recurrence of back pain and sciatica within 8-16 month after surgery.

Multiple myeloma (MM) defined as neoplastic proliferation of plasma cells which affects multiple organ systems. (Arian Lasocki et al 2017)

Bird JM et al said that back pain is usually seen in patients with MM, caused by development of a new lesion and/or a pathological fracture. Also Neurological manifestation resulted from meningeal involvement due to focal bone lesions or haematogenous dissemination (Arian Lasocki et al 2017). In our study Multiple Myeloma was found in N=2(5.7%) patient they had fair prognosis after back surgery, those two patient develop recurrence of sciatica within one year after lumbar back surgery and it was due to development of new lesion compressing the neural foramina.

Facet arthropathy is a degenerative disease that develop due to aging process, repetitive overuse, overweight, poor body mechanics, repeated micro trauma. Multiple studies found that lumbar disk degeneration occurs before facet joint arthrosis. (Steven J. Mann and Paramvir Singh 2019) because of disk degeneration leads to increased mechanical loading changes in the facet joints. Other studies showed increased facet joint degeneration with sagittal orientation of the facet joint. [Kalichman L et al 2007].

Studies have shown that hypertrophy of posterior capsule of the degenerative joint that developed over time, with fibrocartilage proliferation and synovial cyst formation. Osteophytes are developed at the attachment sites where the fibrocartilage extends beyond the original joint space. Facet mediated pain occurs due to these arthritic changes, as the entire joint

complex is innervated. [Boszczyk BM et al 2003]

In our study Facet joint arthropathy was detected in 233 patient, 221 of them had excellent prognosis after back surgery while 12 patient of them (34.3%) had recurrence of back pain and sciatica within 2-3y after surgery.

The most common site of bone metastasis is the spine. Which can presented with pain, instability and neurological deficits. Dissemination through Batson venous system is the principal process of spinal metastasis, also disseminate through arterial, lymphatic system and or by contiguity. Once cancer cells invade the spine, they stimulate production of growth factors that stimulate osteoblastic or osteolytic activity resulting in bone remodeling also stimulate release of other growth factors that lead to a vicious cycle of bone destruction and growth of the affected spine. (Giulio Maccauro et al 2011)

In our study spinal metastasis was found in 7 patient (2.3%), they had poor prognosis after back surgery and recurrence of symptoms in was within 4-8 month after surgery.

We achieve in our study Excellent outcome in (n = 239) (79.7%) Good(n=26)(8.7%), Fair(n=9)(3.0%) Poor (n=7)(2.3%), while Studying risk factors affecting outcome we found that their was no significant difference in Diabetes affect outcome excellent N=82(34.3%), Good N=4(15.4%), Fair N=3(33.3%), Poor N=0(00.0%) (P value 0.066), while highly significance difference were found in the following factors: Mexodema show Excellent N=2(0.83%), Good N=10(38.5%), Fair N=0(0.00%), Poor N=0(00.0%) P value <0.001**, Facet arthropathy show Excellent N=221(92.6%), Good N=9(34.6%), Fair N=3(33.3%) P value <0.001**, Pajet disease show Excellent N=0(0.00%), Good N=3(11.5%), Fair N=1(11.1%), Poor N=0(00.0%) P value <0.001**, Myloma show Good N=0(0.00%), Fair N=2(22.2%), P value <0.001**, Metastasis show poor outcome in N=7(100.0%) P value <0.001**

Rohlmann et al. studied the intersegmental rotations and intradiscal pressures (IDP) in a degenerated disc after implanting the posterior dynamic implant in a FE-based study. He found that the motion was decreased at the fused level, and slightly increased at the adjacent level also the intra discal pressure was also decreased at the fused level. But their is no much effect on IDP at the adjacent level.

Cakir B et al in his study found that, adjacent segment degeneration is the main complication associated with fusion. The reason for this has not yet been clear and become the point of debate. Some argument here is that the degeneration at adjacent level is part of aging process or fusion leads to reduce motion, hyper mobility of adjacent level accelerate degeneration, also increased disc or facet joint pressure, and alteration in histological features of ligaments at adjacent level to the implanted level all these factors play role in adjacent level degeneration.

In our study Recurrence of sciatica at the same level was observed in 35 patient (11.7%) also recurrence of sciatica in adjacent upper and lower levels was found in (n= 4)(1.3%), Over distraction represent (0.3%) while back trauma represent (1.0%) of recurrence. Table 7,8.

Conclusion

Trans pedicular screw fixatin of lumbar black disc helps in normalization of disc height in degenerative disc, normalization of nerve root foramina, maintain spinal stability, high success rate, early improvement, short hospital stay also decrease incidence of discitis.

References

- 1) Palepu, M. Kodigudla, and V. K. Goel : Biomechanics of Disc Degeneration, orthoped. J.2012: 726210.
- 2) Rohlmann A, Burra NK, Zander T, Bergmann G. Comparison of the effects of bilateral posterior dynamic and rigid fixation devices on the loads in the lumbar spine: a finite element analysis. *European Spine Journal*. 2007;16(8):1223–1231.
- 3) Cakir B, Carazzo C, Schmidt R, Mattes T, Reichel H, Käfer W. Adjacent segment mobility after rigid and semirigid instrumentation of the lumbar spine. *Spine*. 2009;34(12):1287–1291.
- 4) Bird JM, Owen RG, D'Sa S, et al. Guidelines for the diagnosis and management of multiple myeloma 2011. *Br J Haematol* 2011; 154: 32–75.
- 5) Arian Lasocki,^{1,2} Frank Gaillard,^{3,4} and Simon J Harrison : Multiple myeloma of the spine, *Neuroradiol J*. 2017 Jun; 30(3): 259–268.
- 6) Kalichman L, Hunter DJ. Lumbar facet joint osteoarthritis: a review. *Semin. Arthritis Rheum*. 2007 Oct;37(2):69–80. [PubMed]

- 7) Boszczyk BM, Boszczyk AA, Korge A, Grillhösl A, Boos WD, Putz R, Milz S, Benjamin M. Immunohistochemical analysis of the extracellular matrix in the posterior capsule of the zygapophysial joints in patients with degenerative L4-5 motion segment instability. *J. Neurosurg.* 2003 Jul;99(1 Suppl):27-33.
- 8) Steven J. Mann; Paramvir Singh: Lumbar Facet Arthropathy, 2019.
- 9) Giulio Maccauro,¹ * Maria Silvia Spinelli,¹ Sigismondo Mauro,² Carlo Perisano,¹ Calogero Graci,¹ and Michele Attilio Rosa : Physiopathology of Spine Metastasis, *Int J Surg*
- 10) Vishnu Senthil and Satish Balaji: Monostotic Paget Disease of the Lumbar Vertebrae: A Pathological Mimicker: *Neurospine.* 2018 Jun; 15(2): 182–186.
- 11) Roodman GD, Windle JJ. Paget disease of bone. *J Clin Invest.* 2005;115:200–8.
- 12) Raj Bahadur Singh, Arindam Sarkar, Mohd Meesam Rizvi, Mohmmad A Rasheed : A case of peripheral neuropathy due to hypothyroidism misdiagnosed as lumbar radiculopathy: A case report, 2015 | Volume : 29 | Issue : 3 | Page : 181-184.
- 13) 1. Fritzell P, Hagg O, Wessberg P, Nordwall A Swedish Lumbar Spine Study Group. 2001 Volvo Award Winner in Clinical Studies: Lumbar fusion versus nonsurgical treatment for chronic low back pain: a multicenter randomized controlled trial from the Swedish Lumbar Spine Study Group. *Spine (Phila Pa 1976)* 2001;26:2521–2532. [PubMed] [Google Scholar]
- 14) 2. Fritzell P, Hagg O, Jonsson D, Nordwall A Swedish Lumbar Spine Study Group. Cost-effectiveness of lumbar fusion and nonsurgical treatment for chronic low back pain in the Swedish Lumbar Spine Study: a multicenter, randomized, controlled trial from the Swedish Lumbar Spine Study Group. *Spine (Phila Pa 1976)* 2004;29:421–434.
- 15) Yu Chao Lee,¹ Mario Giuseppe Tedesco Zotti,¹ and Orso Lorenzo Osti²: Operative Management of Lumbar Degenerative Disc Disease: *Asian Spine J.* 2016 Aug; 10(4): 801–819.
- 16) Oikawa Y, Ohtori S, Koshi T, et al. Lumbar disc degeneration induces persistent groin pain. *Spine (Phila Pa 1976)* 2012;37:114–118. [PubMed] [Google Scholar]
- 17) Laplante BL, Ketchum JM, Saullo TR, DePalma MJ. Multivariable analysis of the relationship between pain referral patterns and the source of chronic low back pain. *Pain Physician.* 2012;15:171–178.
- 18) Modic MT, Steinberg PM, Ross JS, Masaryk TJ, Carter JR. Degenerative disk disease: assessment of changes in vertebral body marrow with MR imaging. *Radiology.* 1988;166(1 Pt 1):193–199. [PubMed] [Google Scholar]
- 19) Jensen TS, Karppinen J, Sorensen JS, Niinimäki J, Leboeuf-Yde C. Vertebral endplate signal changes (Modic change): a systematic literature review of prevalence and association with non-specific low back pain. *Eur Spine J.* 2008;17:1407–1422.
- 20) Peter Endler, Per Ekman, Ivan Berglund, Hans Möller, Paul Gerdhem: Long-term outcome of fusion for degenerative disc disease in the lumbar spine, *The Bone & Joint Journal* Vol. 101-B, No. 12 Spine, 2019.
- 21) Frank S. Bishop, Kenneth S. Yonemura, Hansen A. Yuan: *Black Disc: Diagnosis and Treatment of Discogenic Back Pain*, Chapter 59, *Spine Surgery 2-Vol Set Techniques* 2015.