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ORIGINAL PAPER

Treatment outcome of quality of life and clinical symptoms in patients with symptomatic lumbar degenerative disc diseases: which treatment modality is superior?

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Abstract

Objective This was to assess the quality of life and clinical symptoms before and after treatment of patients with symptomatic lumbar degenerative disc disease (LDDD). It was also to determine the superior treatment for well-selected patients: conservative versus surgical treatment.

Study Design Prospective interventional analytical study.

Methods We studied 160 adult symptomatic patients aged 31–60 years with diagnosis of LDDD who were enrolled between May 2016 and November 2017. Their pre- and post-treatment clinical symptoms and signs and quality of life were studied using the Oswestry disability index (ODI). The data was analysed using SPSS version 24.

Results One hundred fifty-three adult patients aged 31 to 60 years completed the study. The male-to-female ratio was 1:1.5 while the symptom duration ranged between one and 14 years. The treatment modalities were medical (46%), epidural steroid injection (26%) and operative treatment (28%). The responses to the treatment were worsened symptoms (10.5%), no improvement (13.1%), moderate/slight improvement (27.5%) and significant improvement (49%). There were statistically significant improvements (p value < 0.05) in clinical symptoms, sign and ODI at six months after treatment. Surgical treatment was superior to all other form of care.

Conclusion This study showed significant improvement in outcome among the participants in different treatment modalities with surgical treatment being the superior. We recommend surgical treatment for well-selected adult patients with symptomatic LDDD and assessment of quality of life and clinical symptoms before and after treatment.

Keywords Symptomatic lumbar degenerative disc disease · Quality of life and clinical symptoms

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Introduction

Lumbar degenerative disc disease (LDDD) is one of the commonest causes of acute and chronic low back pain (LBP) globally. It ranked as the top causes of years lived with disability and a leading cause of disability, morbidity as well as high socioeconomic burden [1–4]. These effects are major health concerns for the care providers, patients and their relations. The prevalence of LDDD depends on the patient's geographical region, races, age, sex, hereditary and some physically demanding occupations like heavy sport.

Lumbar DDD is a term used to describe degenerative anatomical changes of the inter-vertebral discs (IVDs) that consequently cause degeneration of the vertebral bodies, and their related joints (facet joints) with discogenic back pain and radiculopathy or mechanical/segmental instability [5–7]. Patients with LDDD usually present with low back pain which commonly radiates to one or both lower limbs, low back stiffness, altered sensation in the

lower limbs, neurogenic claudication and paraspinal muscle spasms. Even though there is high prevalence of LDDD in the population, the management approaches largely varied [5–7].

There are several assessment tools used in literature to prognosticate this disease condition and evaluate treatment intervention. The Oswestry disability index (ODI) is the commonest tool/questionnaire used for the assessment of disability and outcome measure of impact of treatment for low back pain in a hospital setting, and it has been validated in English and many languages [8–11]. It has ten items about pain level and its interference with physical activities, sleeping, self-care, sex life, social life and travelling. Each question offers six answers from which patients mark appropriate response [8–10]. Because of its clinical and functional details, ODI was used for this study (Table 1).

The purposes of this study were (1) to assess the quality of life before and after treatment of patients with symptomatic lumbar degenerative disc using ODI at presentation and six months after treatment, (2) to assess their clinical symptoms before and six months after treatment, and (3) to assess success of the treatment modalities used (medical, epidural steroid injection and operative treatment) (Fig. 1).

Patients and methods

One hundred sixty adult patients aged 31 to 60 years with LBP secondary to LDDD were studied in the Spine Unit of National Orthopaedic Hospital, Igbobi, Lagos, between May 2016 and November 2017. The exclusion criteria were patients with LBP from other causes, previous back trauma, operation and other back pathologies.

All the participants were counselled, gave informed consent for the study and recruited consecutively and followed up for six months. The diagnosis of LDDD was made by the tripods of details, clinical history, physical examination, magnetic resonance imaging (MRI) and lumbo-sacral radiograph investigations. Other applicable investigations were done to rule out differential pathologies.

Table 1 Pre-treatment and 6-month post-treatment Oswestry disability index

Oswestry disability index (ODI) (%)	Pre-treatment frequency	6-month post-treatment frequency	Total
Minimal disability (0–20)	10	45	55
Moderate disability (21–40)	33	84	117
Severe disability (41–60)	61	16	77
Crippled (61–80)	38	6	44
81–100	11	2	13

Significant improvement of ODI in all the groups from pre-treatment to 6-month post-treatment ODI. Chi square = 0.03

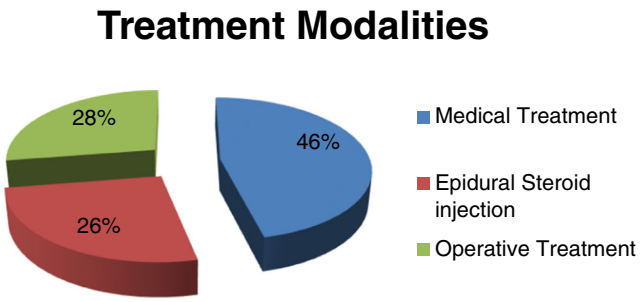

Fig. 1 Type of treatment modalities. Key: Majority of the patients had medical treatment

Patient's demographic data and pre-treatment and post-treatment symptoms were documented (Table 2). The pre-treatment and post-treatment functional status as well as the quality of life using ODI was obtained on questionnaires at presentation and six months after treatment intervention for each patient.

The treatment modalities were posterior lumbar spine fusion (with or without discectomy and decompressive laminectomy), epidural steroid injection and medical therapy (analgesics with or without neurovitamin and muscle relaxants) (Fig. 2). The participants were divided into these three groups based on the clinical symptomatology and informed decision of the patients as well as their response to initial conservative treatment (Fig. 3). All patients had initial non-operative treatment by medical and physical therapies with lifestyle modifications for a minimum of six to eight weeks. Based on the initial clinical response, a group of patients wished to continue on conservative care while another group of patients had epidural steroid injection in addition to conservative care. However, the last group of patients had posterior spinal fusion on account of persistent (unbearable) symptoms despite adequate initial conservative management, documented significant imaging findings matching the symptomatology, presentation with distal neurological deficit (acute or chronic) or associated features of mechanical instability and patient's with significant side effect of medical treatment like severe dyspeptic symptom or peptic ulcer disease (without satisfactory symptom improvement). The spinal fusion was through posterior approach with spinal nerve and or spinal cord decompression based on the patients' symptoms. Bone graft was harvested either locally from the laminae and/or from the posterior superior iliac crest depending on the quantity required. Instrumentation for stabilisation was done through pedicle screws and rods.

The clinical response and quality of life to these three different modalities of treatment were assessed prior to the treatments and six months later for each group of patients. However, patients who had no satisfactory improvement, responded poorly or developed worsening clinical symptoms following medical or epidural steroid injection, were accordingly further treated with steroid injection or operative care, respectively, as clinical status dictated.

The data generated was analysed using Statistical Package for Social Science (SPSS) version 24. The results obtained

were presented and analysed by descriptive statistics numerical variables while the categorical variables were expressed in frequency and percentages. A confidence interval was set at 95% and a statistical significance (p value < 0.05) was used.

Results

One hundred sixty patients with complaints of LBP from LDDD were studied. Seven (4.38%) of the patients were lost to follow-up. The remaining 153 patient were followed up for six months after treatment, and they were analysed. There were 61 males and 92 females, male-to-female ratio of 1:1.5. The ages of the participants were between 31 and 60 years with a mean of 45.50 ± 14.50 years. The duration of the symptom was from one to 14 years with mean symptom duration of 4.46 years. Eighty six of the patients presented to the clinic while the rest (14%) presented to the emergency department. The tribes who participated were Yoruba, Ibo, Hausa and others in distribution of 61.25%, 30.00%, 7.50% and 1.25%, respectively. Three patients (1.96%) had superficial surgical infection which was treated with antibiotics with satisfactory results.

Discussion

Lumbar degenerative disc disease is the commonest cause of low back pain globally in people age 40 and above and one of the leading causes of disability, morbidity and socioeconomic burdens among people in different race and regions [12, 13]. The male-to-female ratio of 1:1.5 indicated higher incidence in women. A similar male-to-female ratio of 1:1.4 was reported in Benin City, southern Nigeria [14]. This might be due to the fact that the two studies were conducted in tertiary hospital centre where many cases of LDDD were referred to for specialist care.

Our study showed statistical significant improvement in the quality of life in all the three groups when pre-treatment and nine month post-treatment ODI were compared (p value = 0.03). This noticed improvement might be as a result of improved symptoms following the treatment modalities. This is similar to the report by Leah et al. in a systemic review of 25 studies of operative versus non-operative treatment of LDDD, however, with greater ODI improvement in patient who had surgical treatment with fusion compare to lower ODI and poor improvement in patients who had nonsurgical (medical) form of treatment [15]. It might be possible that greater number of these patients with LDDD have at least occult mechanical instability in addition to spinal canal and foramina compromising the neural function which is usually addressed during surgical intervention that may translate to a better outcome when compared to non-operative treatment.

Findings from our study also revealed statistically significant improvement of all the clinical symptoms and signs at nine month post-treatments compare to at presentation of the participants (< 0.05) in almost all the symptom groups; however, the improvement noted in the group that had surgical intervention was superior to those noted in medical and epidural

Table 2 Clinical symptoms and signs at presentation and at 6-month post-treatments

Clinical symptoms and signs	At presentation	At 6-month post treatments
Altered sensation in lower limb	153	39
Decreased/absence of Achilles tendon reflex	65	21
Weakness/loss of toe extension	52	22
Weakness/loss of toe flexion	53	17
Weakness/loss of ankle plantar-flexion	43	16
Weakness/loss of ankle dorsi-flexion	38	15
Weakness/loss of knee extension	32	13
Weakness/loss of knee flexion	33	14
Weakness/loss of hip flexion	24	11
Weakness/loss of hip extension	29	12
Loss of sphincteric control	17	8
Worsened LBP at rest	68	15
Worsened pain with movement or the lumbar spine ROM	136	19
Sciatic stress test	107	22
Femoral nerve stress test	78	15
Patient with unilateral radiculopathy	18	5
Patient with bilateral radiculopathy	134	15

Significant improvement of all the clinical symptoms and signs at 6-month post-treatments compare to at presentation. Chi square is ≤ 0.04 in almost all the symptom groups

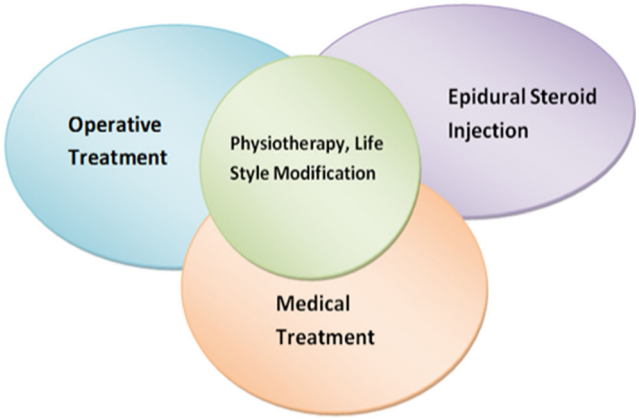

Fig. 2 How patients were treated. All patients had physiotherapy and/or lifestyle modification

steroid injection groups. In a randomised cohort or an observational cohort study, Weinstein et al. reported a study of patients from 13 centres in 11 US patients who had LDDD and treated surgically, showing substantially greater improvement in pain and function during a period of two years than patients treated non-surgically using ODI and medical outcomes study 36-Item Short-Form General Health Survey (SF-36) bodily pain and physical function scores [16]. Phillips et al. in their systematic review of 26 articles with six studies of surgery versus non-operative treatment and 12 studies of alternative surgical procedures using validated patient-reported clinical outcomes measures (including visual analogue scale, ODI, Short Form [36] Health Survey [SF-36] PCS and patient satisfaction) with minimum of 12-month follow-up after lumbar fusion surgery in adult patients with LDDD, all the results support fusion surgery as a viable treatment option for reducing pain and improving function in patients with LDDD refractory to non-surgical care [17].

Medical treatment has a varied outcome ranging from transient symptom relieve to a complete treatment failure that usually needs further interventions. Non-steroidal anti-inflammatory drugs (NSAIDs) and acetaminophen are the integral parts of treatment of LDDD with myriad of other drugs being used by most physicians which include other analgesics (peripheral or centrally acting), sedatives, muscle relaxants, some steroids, anticonvulsants, antidepressants, antihistamines and stimulants with varied outcome. In our study, the outcome of the medical treatment which included the use of different analgesics and adjuncts showed treatment failure in 26.8% of the patients who had medical option of the treatment.

Epidural steroid injection in our study showed clinical improvement of the symptoms among the patients; however, it has the worst outcome as 40% of the participants in this group had treatment failure. This clinical response in our study is similar to Buttermann's report on epidural steroid injection in the treatment of LDDD which showed improvement in symptoms and functions in about 50% of the participants [18]. Laxmaiah et al., in a systemic review of epidural injection for LDDD from 1966 to 2014 reported that fluoroscopically directed epidural injections provide long-term improvement in the treatment of LDDD; however, the percentage success rate and treatment failure were not clearly stated [19]. Kanayama et al. in Japan did a retrospective review of 641 cases of degenerative lumbar pathologies with their response to nerve root injection and reported an average obviation for surgery in 51.7% of the patients with spinal pathology while the rate of obviating surgery was 42.0% in disc herniation, 52.9% in degenerative spondylolisthesis, 67.4% in spinal stenosis, 54.5% in isthmic spondylolisthesis, 57.1% in foraminal stenosis, 61.1% in degenerative scoliosis and 54.1% in failed back surgery and with poor results in herniated disc with spinal stenosis, foraminal disc herniation, recurrent disc herniation and failed back surgery with instability [20].

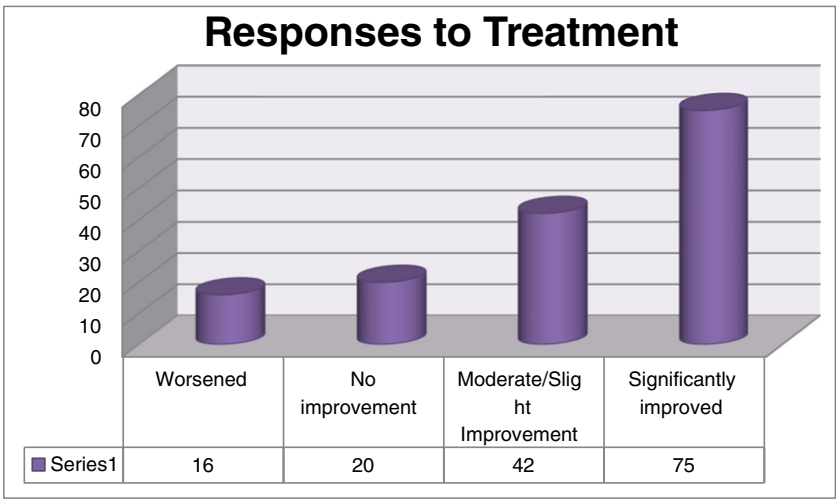

Fig. 3 Distribution of the treatment responses. Key: 76.5% of the 153 patients had improvement of their symptoms and 10.5% of the patients had worsening symptoms

These findings of Kanayama et al. are similar to the success rate (60%) noted in our study (Table 3) without significant gender or age influences on the findings.

However, different results were recorded from autologous bone marrow aspirate injections. Kenneth et al. studied 26 patients with degenerative disc disease and candidates for spinal fusion or total disc replacement surgery who were injected with 2-ml autologous bone marrow concentrate into the nucleus, and after 36 months follow up, only six patients progressed to surgery while 20 patients improved in ODI and visual analogue scale with none of them developed worsening radiographic features [21]. Also, a two year follow-up of 26 patients treated for discogenic back pain with autologous bone marrow concentrate injection by Pettine et al. in the USA showed that the treatment was safe with 92% and 81% of the participants avoided surgery through one and two years, respectively, while 21 of the patients had the average ODI and VAS scores of 18.3 and 22.9 at 24 months, respectively [22]. Five of the 26 patients opted for surgical intervention and had fusion or artificial disc replacement by the two years [22]. The high success rate from autologous bone marrow aspirate injection might be due to many factors which include biological factors in the aspirate and the minimally invasive method of the procedure which causes less injury to spinal structures.

The results of surgical intervention among the participants showed the best outcome of all the three treatment modalities (2.4% of the 42 patients who had surgical treatment had treatment failure). This good outcome similar to the clinical outcomes of lumbar degenerative disc disease treated surgically (posterior lumbar inter-body fusion) in a multicentre trial prospective study conducted by Arnold et al. in the USA using ODI reported 86% significant improvement in ODI [23]. Dickson in his study and Yu Chao et al. in Australia reported that current evidence showed the superiority of surgical treatment when compared to other form of treatments in carefully selected patients who had failed conservative treatment and who had no significant psychosocial disease [24, 25]. They also reported that fusion surgery with the correct grafting and stabilisation techniques has long-term results demonstrating successful clinical outcomes [24]. In another one year prospective clinical study among 50 patients by Ricarda at al. to evaluate the fusion rate and clinical outcome in anterior lumbar inter-body fusion with beta-tricalcium phosphate and bone marrow aspirate as a bone graft substitute showed significant radiographic fusion rate (X-ray = 85.48% and, CT for anterior and posterior intersegmental bone bridging in 77.78%) of treated levels with fusion rates of beta-tricalcium phosphate being similar to autologous bone [26]. The use of autologous bone grafting in our studies might have yielded similar high fusion rate resulting in the recorded success rate.

Results from less invasive surgical interventions from other studies in well-selected patients are also encouraging. The study of a new approach for percutaneous endoscopic lumbar discectomy of highly down-migrated lumbar disc herniation among seven patient by Du et al. in China showed significant improvement in VAS of 1.3 ± 0.8 (range, 0–3) and ODI of 8.4 (range, 0–14) [27]. Wang et al. in Nanjing, China, conducted a study among 207 patients with lumbar disc herniation who had undergone transforaminal endoscopic lumbar discectomy with the THESSYS system which showed significant improvement in mean pre-operative and post-operative VAS and ODI scores, hospital stay of about seven days and resumption to work in about ten days [28]. Nie et al. studied 260 patients with lumbar disc herniation for the therapeutic efficacy of radiofrequency target disc decompression compared with nucleoplasty for lumbar disc herniation with five year follow-up and reported that both treatment options reduce pain and improve quality of life [29]. However, the nucleoplasty group had shorter hospital stay and operation time than radiofrequency target disc decompression [29].

This clinical outcome recorded from the surgical intervention might be due to decompression of the spinal cord and nerve roots, stabilisation of the unstable motion segments and fusion depending on the clinical status of the patients. Also, surgical fusion treatment directly treats the LDDD at its affected sites (affected motion segments). We did not notice any additional risk of infection in the group

Table 3 Types of treatment and their outcome

		Post-treatment clinical signs and symptoms				Total
		Worsened	No improvement	Moderate/ slight improvement	Significantly improved	
Type of treatment	Medical treatment	10	9	22	30	71
	Epidural steroid injection	6	10	16	8	40
	Operative treatment	0	1	4	37	42
Total		16	20	42	75	

97.6% of the operated patients had improved outcome, 60% of the patients who had epidural steroid injection was improved, and majority of the participants (46.4%) had medical care with improvement in 73% of them

with previous epidural steroid injection when compared with those that had surgical intervention after initial medical care. However, a five year comparative study for risk of infection in the military health system after epidural steroid injection by Seavey et al. revealed the overall infection rates 1.18% in the injection group versus 0.76% in the control group [30].

Conclusions

Symptomatic lumbar degenerative disc (LDDD) is a common spine pathology affecting adult population worldwide. It poses functional challenges to the patients and affects their quality of life. Patient should be well selected for an appropriate treatment modality to yield the desired outcome. Pre- and post-treatment quality of life and clinical symptoms assessment and outcome of chosen treatment modality for patients with (LDDD) are recommended to evaluate and prognosticate management intervention. In our study, we found a significant improvement in post-treatment quality of life and clinical symptoms when compared with pre-operative findings. We also noticed that operative treatment yielded the best outcome when compared with other forms of treatments.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethics approval Approval to conduct the study from the Ethical Committee of NOHI was obtained before the study.

Informed consent Informed consent was obtained from all the participants in this study.

The researchers' level of the participation All the authors fully participated in all the stages of the study and manuscript writing.

Recommendation We recommend that all patients with symptomatic LDDD should have pre- and post-treatment functional and quality of life assessments.

Limitations of the study It is a uni-centred study done in referral orthopaedic hospital where a fraction of the people in the community presents to. A multi-centred study or community-based study with a larger sample size will be more statistically significant for the conclusion. A longer follow-up period of the patients after treatment will show long-term effects of the treatment types.

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