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Short-Term Outcome Of The Lignocaine-Based Pain-Gated Injections In Nigeria

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Abstract
Study design*: Prospective study*
Objective*: The study is to determine the short-term outcome of the use of the Lignocaine-based pain-gated injections for the management of pain in patients with lumbar radiculopathy in Nigeria.*
Background*: There are few studies on the use of lignocaine-based pain-gated injections globally, with none from Nigeria. The need to explore other pain alleviating techniques with high safety margin resulting in good outcome in a resource challenged country provides the template for this study. This study was conducted as a multi-center study involving the National Orthopaedic Hospital Dala Kano, Muhammadu Buhari Specialist Hospital Giginyu Kano, Spinecare Hospital Gwagwalada FCT, all in Nigeria from 2019-2021.*
Method*: Three hundred and twenty-six patients who had back pain with lumbar radiculopathy that consented to this conservative treatment were prospectively studied. All the patients had lignocaine-based pain-gated injections at different anatomical point designated as the gated channels (Gates C and G). The outcome parameters studied were pre and post injection VAS score and patient satisfaction score (PSQ 18). Follow-up was for an average of 6 months. The results were analyzed using SPSS 19.0.*
Result*: There was a slight female preponderance (57.9%) in this study. The duration of back pain and lumbar radiculopathy was 9.6±2.4 months. The parameters (pre- and post-injections VAS scores, and PSQ18) studied shows good outcome in the short-term evaluation.*
Conclusion*: Lignocaine-based pain-gated injections provide good pain control in patients with back pain with lumbar radiculopathy. This treatment is readily acceptable by patients, and free from serious complications associated with steroid use in other procedure. It is ideal in a resource challenged country like Nigeria; since it is done without the need for elaborate theatre setup, or radiological guidance. This also means that training to perform it is easier.*
Keywords: *Lignocaine, back pain, lumbar radiculopathy, channel blocker, Nigeria*

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I. Introduction

Low back pain is a highly prevalent condition globally, representing a major cause of disability.[1-15] Its multifactorial etiology necessitates careful clinical correlation to determine whether imaging findings corresponds to a patient's symptom.[1-4,6] Some of these factors are based on epidemiological studies, while others are based on clinical findings and physiological tests.[5-6]

Treatment strategies for low back pain emphasize target intervention based on underlying cause and this ranges from conservative to surgical management. Conservative management includes medication, physical therapy (e.g McKenzie regimen[12]), facet joint infiltration[13-17], and epidural injections[18-20]. A novel procedure discussed by Hammodi[21] that has emerged as a new tool in setting with limited healthcare infrastructure.

Hammodi[21] introduced a technique termed "anatomical gate" injections utilizing diluted lignocaine injected into specific anatomic region without radiographic guidance, nerve stimulators or operating theatre. The endpoint is patient-reported numbness in corresponding dermatomes.[21] The lignocaine-based pain-gated procedure is reported to be low-cost, easy to administer, and without any complications- a notable contrast to potential risks associated with lumbar epidural steroid injections.[22]

In resource-constrained environments, where a large proportion of the population lives below the poverty line and surgical access is limited, such a low-cost alternative is critically needed. This prospective study evaluates the short-term outcome of the use of Lignocaine-based pain-gated injections in patients with lumbar radiculopathy secondary to disc diseases and demonstrates its feasibility within our specific healthcare context.

II. Materials And Methods

Patient Selection

Demographic data relevant to this study were prospectively collected. These included age, sex, duration of symptoms, method of injection, repeat injection, pre and post-injection VAS scores, and patient satisfaction scores using PSQ18. Subsequent patients with back pain with lumbar radiculopathy were included. The patients were selected from consented patients managed at National Orthopaedic Hospital Dala Kano, Muhammadu Buhari Specialist Hospital Giginyu Kano, Spinecare Hospital Gwagwalada and Trust Charitos Hospital Jabi, Abuja Nigeria from year 2019 to 2021.

The exclusion criteria were:

1. All patients who has had previous lumbar spinal surgery
2. Patients who had previous epidural injections
3. Patient lost to follow-up at 6 months
4. Patients who did not complete the treatment
5. Patients who refused the treatment.

Procedure

There are 2 methods employed in this procedure for LBP using 3mls of 2% Lignocaine diluted by 7mls of water for injection. These methods are referred to as Gate C and Gate G.

Gate C injection method is done by identifying a point just posterior to the medial malleolus. Here sub-facial injection of the drug mixture above is slowly deposited. A universally available 10 ml syringe with 19G needle was utilized. The success of this procedure is confirmed by numbness of the heel after 1minute.

Gate G injection method is done by identifying the 4-quadrant of the buttock. The upper lateral quadrant is chosen. Spinal needle size 22G is pushed in till the pelvic bone is felt and the drug mixture described above is slowly deposited. The success of this procedure is also confirmed by numbness of the heel after 3minutes. When a patient re-presents within the first 3month of initial injection it is referred to as a repeat injection.

Patient assessment/ Outcome

Duration of symptom is graded as early-presenter and late-presenter. It is early-presenter when symptom is less than or equal to 3months and it is late-presenter if greater than 3 months. Pain was assessed using VAS score before injections, and at 30 minutes after the procedure. Further assessments of VAS score was done at 6 month follow-up. Patient Satisfaction Scores (PSQ-18) were used to evaluate subjectively the outcome of the Lignocaine-based pain-gated injections procedure at this time also.

Statistical methods

Fisher's exact test was performed for categorical variables, and two independent sample *t*-test was done for continuous variable for both patient groups. P-value less than 0.05 is considered significant. Statistical Package for Social Science (SPSS) 19.0 software was used for all analyses.

III. Result

This prospective study has a sample population of 326 patients. This demographic characteristic of the study population is demonstrated in Table 1. The male to female ratio was 1: 1.4. The average duration of symptom was 9.6±2.4 months. Majority (88.6%) of patients presented late. Single site injection was used in 134(41.1%) patients and double site injection (Gate C and G) was used in 192(58.9%) patients. Among the patients (134) who had a single site injection, 85(26.1%) patients had Gate C and 49(15.0%) had Gate G. Also 30(9.2%) patients in the single injection group re-presented for a repeat injection. Out of 192 patients who had double site injection, 14(4.2%) patients represented for repeat injection because of reoccurrence of symptoms.

Clinical characteristics of the study population are summarized in Table 2; stratified by injection type. The double injection and single injection had similar mean age, gender distribution, duration of presentation, patient satisfaction and pre-injection VAS score.

The double injection group has a lower number of subjects re-presenting for a repeat injection compared to the single injection but this is not statistically significant. The patient satisfaction score in double injection subjects is higher but not statistically significant than the single injection subjects. The double injection had a lower but statistically significant VAS Score immediately after the injection than the single injection. This is even more so at 6months post-injection.

IV. Discussion

Hammodi[21] proposed the use of lignocaine-based pain gated channels for pain relief due to cervical and lumbar disc disease. When there is nerve injury; there is hyperexcitability and spontaneous firing at the site of injury and in the dorsal root ganglion cell bodies.[21] Early studies[23-25] demonstrated that, after injury to their axons, neurons can display changes in excitability, suggesting increased sodium channel expression, and, in fact, abnormal sodium channel accumulation has been observed at the tips of injured axons. Lignocaine has been proposed to block this sodium channel to reduce pain and enhance function.[21]

Lignocaine is an established sodium channel blocker.[21,23-25] It is also a highly lipid soluble substance. The myelin sheath has a high lipid content (70-85%).[26] It is this lipid content that provide lignocaine access to the damage site and modulate the activity of the sodium channel. Hammodi[21] postulated that lignocaine will diffuse through different nerve segment causing a rest of the disturbances of the sodium channels causing pain relief. By identifying specific region recently named as gates, lignocaine in 6% concentration (3mls of lignocaine to 7mls of water for injection) has been effectively used to block pain. Gates C and G has been identified to manage back pain with lumbar radiculopathy.[21,27] These gates are based on surface anatomy and neither required X-ray guidance, ultrasound, nor theatre set-up.

Gate C injection method is done by identifying a point just posterior to the medial malleolus. Here sub-facial injection of the drug mixture above is slowly deposited. Here a universally available 10 ml syringe with 19G needle is utilized. The success of this procedure is confirmed by numbness of the heel after 1 minute.

Gate G injection method is done by identifying the 4-quadrant of the buttock. The upper lateral quadrant is chosen. Spinal needle size 22G is pushed in till the pelvic bone is felt and the drug mixture described above is slowly deposited. The success of this procedure is also confirmed by numbness of the heel after 3minutes.

In the present study, both injection methods were employed. Our findings corroborated that of Hammodi[21]. The use of this procedure improved the quality of lives of patients and there was no side effect recorded during the procedure. Repeat injections showed a better pain relieve and short-term patient satisfaction compare to single dose. Further studies on this phenomenon will help highlight areas for improvement.

V. Conclusion

Lignocaine-based pain-gated injections provides good pain control in patient with back pain and lumbar radiculopathy. This is readily acceptable by patients, and free from serious complications. It is ideal in a resource challenged country like Nigeria; because it requires less training and is easier to perform. There is neither need for X-ray and ultrasound guidance, nor theatre set-up.

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Table 1: Demographic representation

	Male	Female	Total
Number of Patients	137 (42.1%)	189 (57.9%)	326
Mean age (years)	56.4±9.7	61.8±9.8	58.5±10.5
Mean duration of symptoms (Month)	8.1±2.9	10.4±1.7	9.6±2.4
Single Injection site	48^{11}	86^{19}	134^{30}
Double injection site	89^{6}	103^{8}	192^{14}
Gate C injection Only	31^{5}	54^{11}	85^{16}
Gate G injection Only	17^{6}	32^{8}	49^{14}
Gate C+G Injections	89^{6}	103^{8}	192^{14}

Superscript numbers represent those who had a repeat dose within the first 3 month of the first injection.

Table 2: Baseline Patient Characteristics

Variables		Injection Technique		
		Double Injection (n=192)	Single Injection (n=134)	P-value
Mean Age		58.9 ±10.3	60.5 ±11.7	<0.001
Gender	n (%)			
Female		103(65.5%)	86(64.1%)	0.001
Male		89(34.5%)	48(35.9%)	0.001
Repeat injection.	n (%)	14(7.3%)	30(22.4%)	0.37
Patient satisfaction.	n (%)	186(96.9%)	124(92.5%)	0.001
VAS Score				
Pre-injection		7.4±2.1	7.8±1.7	
Post-injection after 30min		3.2±1.9	4.4±2.3	0.001
Post injection at 6month		4.1±1.6	5.3±2.7	0.001