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ORIGINAL PAPER

Modic Changes in Ecuadorian Mestizo Patients: Epidemiology, Clinical Significance, and Role in Chronic Low Back Pain

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Abstract

Modic changes (MC) are bone marrow lesions seen within a vertebral body on MRI, possibly associated with low back pain (LBP). Though the causes and mechanisms responsible for the formation of MC are still poorly understood, progress is being made in linking his spinal phenotype with disc degeneration and LBP. This paper analyzes the epidemiology, clinical signs, lesions type, and treatment of vertebral discopathy associated with MC in Ecuadorian mestizo patients, comparing MC type I-II changes versus MC type III differences. We performed an epidemiological, observational, cross-sectional study with two cohorts of Mestizo patients collected at "Hospital de los Valles" in Quito, Ecuador, between January 2017 and December 2020; 288 patients diagnosed with degenerative lumbar disc disease plus MC was taken who underwent surgery; 144 with MC type I-II (cohort 1) and 144 with MC type III changes (cohort 2). Cohort 1 was characterized by 68.8% of men with a mean age of 45 years who perform minimal or moderate exercise in 82% of cases. They showed only one level lesion in 88.9% of patients with a pain intensity of 7 or more on the visual analog scale, with three or more months of evolution, in 78.5% of cases of degenerative etiology, mainly between the L5-S1 lesion of the left side. Cohort 2 was 53.5% of women with a mean age of 62. In 81.4% of cases, they perform minimal or moderate exercise. They showed two-level lesions in 45.8% of patients with a pain intensity of 7 or more on the visual analog scale, with three or more months of evolution, in 97.9% of cases of degenerative etiology, mostly between L4-L5 lesions of the left side. In both groups, most patients showed a protruded and lateral hernia. There is a greater predisposition to require surgery for lumbar disc herniation in young men and older women. In addition, surgery at an older age has a higher risk of complications, especially infection.

Keywords Intervertebral disc degeneration · Therapeutics surgery · Low back pain/low back pain/etiology · Failed back surgery syndrome · Intervertebral disc · Spinal diseases/complications · Spinal diseases/surgery

Abbreviations

BMI Body mass index
DDD Degenerative disc disease
LBP Low back pain
MC Modic changes
MRI Magnetic resonance imaging
VAS Visual analog scale of pain

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Introduction

Degenerative disc disease (DDD) is an inevitable part of aging and contributes meaningly to low back pain [1]. Disc degeneration is an abnormal structural failure due to a cell-mediated response to multifactorial contributions, such as genetics, micro/macro trauma, accelerated age-related changes, inflammation, local nutritional deficiency, and vascular factors, leading to excess catabolic over anabolic response. Risk factors include obesity and increased body mass index (BMI), which is closely related to DDD [2].

Indeed, there are differences regarding sex, age, and biotype; sex due to hormonal characteristics reflecting a specific protective effect in premenopausal women given by

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estrogens. Age, young men have a higher incidence of DDD than women. Still, the result differs in the elderly population, where women are more inclined to develop this pathology [3]. And biotype, the endomorphic biotype has a greater predisposition for this pathology. Smoking history is a significant risk factor because smoking decreases blood flow to the vertebral body, alters fibrinolysis, increases intra-abdominal pressure due to coughing, and reduces bone mineral content that can directly and indirectly affect the degeneration of the intervertebral disc [4].

The most common clinical presentation is pain. These patients used to have axial pain and radicular pain. The intensity of pain is perceived differently depending on the sex; women have a lower pain threshold and tolerance to noxious stimuli in experimental studies than men. Similarly, the response and efficacy to analgesic treatment differ in men and women. Although there is evidence that acute pain occurs at the same rates in all age groups, chronic pain may be more common in older individuals [5]. Older patients also have higher pain levels due to previous musculoskeletal conditions [6]. The evolution time is related and shows differences between axial or radicular pain, significantly longer in axial type pain [7].

However, the number of affected levels is related to age either. Some authors showed in magnetic resonance imaging (MRI) of the lumbar spine that in patients aged 60 years or more, the findings were abnormal in 57% of cases. In addition, 36% of the subjects had a herniated nucleus pulposus, and 21% had spinal stenosis; abnormal findings were minor [4]. In general, the more mobile levels have a greater risk of being affected, and the structural changes in the degenerative disc, such as the loss of the volume of the nucleus pulposus and fissures in the fibrous annulus, limit the movement function of the segment. Consequently, it tends to suffer more significant changes in the segments of greater movement [8].

Modic changes (MC) are bone marrow lesions seen within a vertebral body on MRI, possibly associated with low back pain (LBP). Though the causes and mechanisms responsible for the formation of MC are still poorly understood, progress is being made in linking his spinal phenotype with disc degeneration and LBP. In MC type 1, there is vascular development in the vertebral body, with inflammation and edema findings but no trabecular damage or marrow changes. In type 2, there are changes in bone marrow, with fatty replacement of formerly red cellular marrow normally seen there. In type 2 changes, the marrow is substituted by visceral fat. Type 3 is less common, with trabecular bone fractures and trabecular shortening and widening [8].

Surgery is the gold standard for pain management for DDD. However, over time, there is an annual cumulative risk of requiring reintervention. The cumulative incidents reported are 4% per year, 6% in 2 years, 8% in 3 years, 11% in 5 years, and 16% in 10 years [9]. Surgery for radiculopathy due to a herniated disc and spinal stenosis has shown significant improvements at three months but slight modifications for pain and disability at five years of follow-up. It is possible to require new surgery with time [10, 11]. DDD is the leading cause of low back pain and disability. Physical activity affects the paraspinal muscle strength and helps reduce pain and disability during conservative treatment and post-surgical management [12]. It is also associated with alteration of the vertebral plate; therefore, the pathology is mainly anterior [13].

Regarding complications, surgical site infection rates in surgery for lumbar pathology are estimated to be between 0.7 and 16% [14]. There is a higher risk of infection in open surgery compared to minimally invasive surgery and a lower risk of infection in decompression surgery alone vs. instrumentation [15]. In other studies, the proportion of recurrent low back pain after discectomy ranged from 3 to 34% [16]. Some authors observed cerebrospinal fluid fistula in 3.2% of thoracolumbar spine procedures [17].

This paper analyzes the epidemiology, clinical signs, lesions type, and treatment of vertebral discopathy associated with MC in Ecuadorian mestizo patients, comparing MC type I-II changes versus MC type III differences.

Methods

Study Design

It is an epidemiological, observational, and cross-sectional study.

Settings

The study was conducted in Hospital de los Valles in Quito, Ecuador, between January 2017 and December 2020; 288 patients diagnosed with degenerative lumbar disc disease, plus MC were taken who underwent surgery.

Participants

Inclusion criteria were Ecuadorian patients with a DDD diagnosis with MC, between 18 and 99 years of age, both sexes, from any ethnic group. All patients with lumbar disc disease plus MC underwent surgical treatment. We included 288 patients with lumbar disc disease, 144 with MC I-II (cohort 1), and 144 with MC type III changes (cohort 2). MC were determined by presurgical MRI studies of the patients included in this research. All patients included were operated on during the research until the necessary sample was reached.

Variables

Demographic characteristics included age, ethnicity, occupation, profession, physical activity, weight, body mass index, morphological biotype, height, abdominal circumference, smoking history, trauma, classification of Modic-type changes by MRI, lesion level, number of lesion level, laterality of the lesion, type, and position of the herniated disc, primary symptoms, clinical duration time, etiology, presurgical treatment received, surgery indication, anesthesia type, surgical time, type of surgical treatment performed, and surgical complications.

Data Sources

We extracted the data included in this research from the medical records and patients. We anonymize and de-identify individual data before analysis.

Measurements

The classification of MC was done utilizing an MRI study of the lumbar spine, using a Philips 1.5-T model Achieva® resonator from the imaging service and evaluated by the same neuroimaging specialist.

Control of Bias

The same person always collected the information. We use a standardized data collection sheet. For example, the same neuroimaging physician classified MC, and every professional has more than 30 years of experience. The patients were assessed and operated on by the same spinal neurosurgeon.

Study Size

The present study includes 288 patients diagnosed with lumbar disc disease, 144 with MC I-II, and 144 with MC-III.

Quantitative Variables

The quantitative variables included age, weight, BMI, height, abdominal circumference, classification of MC by MRI, lesion level, number of lesions, clinical duration, and surgical time.

Statistical Methods

We analyzed the data with SPSS© software version 22.0 (SPSS Inc., Chicago, IL, USA). We used descriptive and inferential statistics to compare the differences between variables. Chi-square was analyzed, and statistical significance and a p value less than 0.05 were accepted. A multivariate analysis was also performed.

Ethical Aspects

All patients provided the information voluntarily and signed informed consent. The data obtained is confidential, and all individual data was anonymous. Our research group keeps the data. We received the Ethics Committee's approval in Research with Human Beings of the Universidad San Francisco de Quito (CEISH-USFQ), with the approval No.080 2021-CA.P20.027TPG-CEISG-USFQ, on May 19, 2021.

Results

Table 1 shows that the mean age for cohort 1 is 45 years, with a standard deviation of 16 years. For cohort 2, the mean age was 62, with a standard deviation of 12 years. Thus, cohort 2 has a mean age older than cohort 1 with statistical significance. The weight did not differ between groups, with a mean of 73.6 kg for cohort 1 and 73.4 kg for cohort 2. Male sex predominates in cohort 1 with 68.8% ($n = 99$) and cohort 2 with 46.5%. The body mass index (BMI) that predominates in both groups is overweight (BMI between 25 and 29.9), with 50% for cohort 1 and 45% for cohort 2; no statistically significant difference. The endomorphic biotype predominates in both groups, with 61.1% for cohort 1 and 52.8% for cohort 2, without statistically significant differences. The smoking history is higher in cohort 1, with 38.5%, than in cohort 2, with 24.3%. The history of previous trauma is 16% for cohort 1 and 8.3% for cohort 2. Physical activity is the same in both groups, with 83.3%. The highest degree of physical activity for cohort 1 is moderate, with 63.9%, and for cohort 2, mild, with 76.2%. The physical activity for cohort 1 is exercise at 46.5%, and for cohort 2, mild activity at 67.4% is statistically significant.

Table 2 shows that the number of levels affected in cohort 1 was more frequent in a single level at 88.9% and cohort 2 at two levels at 45.8%, with a statistically significant difference. The symptoms of important onset for cohort 1 are radicular pain at 48.6%, and for cohort 2, lumbar pain at 52.1% without statistical significance. The most frequent type of pain for cohort 1 is sciatic pain, with 53.5%, and for cohort 2, axial pain, with 54.2%. According to the visual analog scale (VAS), the most frequent pain intensity is VAS 7 > points for both groups. Cohort 2 is more significant, with 41.1%, and cohort 1, with 33.4%, is statistically significant. The evolution time until the most frequent surgery in both groups is more remarkable than three months. Cohort 2 is greater with 50.7%, and cohort 1 with 29.9% statistical significance. The most frequent etiology of the hernia in both groups is degenerative etiology, being almost exclusive for cohort 2 with 97.9%. Cohort 1 represents 78.5%, with a statistically significant difference between groups. The most frequent level of injury in both groups is the L5-S1 level,

Table 1 Distribution of the quantitative characteristics of the study groups, Modic I-II changes vs. Modic III changes

Variable	Modic I-II $n = 144$		Modic III $n = 144$		p value
	Mean	SD	Mean	SD	
Age	45.0	16.0	62.0	12.0	< 0.0001
Weight, Kg	73.6	8.9	73.4	10.8	0.88
BMI, Kg/m^2	25.6	3.0	25.7	3.7	0.87
Height, cm	169.6	2.8	169.2	3.7	0.29
Abdominal perimeter, cm	100.8	9.0	100.5	11.9	0.83
Male sex (n, %)	99	68.8	67	46.5	< 0.001
BMI category (kg/m^2)					
Low < 18.5	3	2.1	6	4.2	0.42
Normal 18.5–24.99	57	39.6	53	36.8	
Overweight 25.0–29.9	72	50.0	66	45.8	
Obesity > 30					
Biotype (n, %)					
Endomorphic	40	61.1	49	52.8	0.36
Mesomorphic	88	27.8	76	34.0	
Ectomorphic	16	11.1	19	13.2	
Tabaquism (n, %)	55	38.5	35	24.3	0.014
Previous trauma (n, %)	23	16.0	12	8.3	0.07
Physical activity (n, %)	120	83.3	120	83.3	1.0
Physical activity intensity					
Mild	51	35,4	109	76.2	0.04
Moderate	92	63.9	34	23.8	
Intense	1	0.7			
Physical activity type (n, %)					
Minimal Activity	51	35.4	97	67.4	< 0.001
Exercise	67	46.5	23	16.0	
Competitive sport	2	1.4			

Source: research data

Elaboration: authors

Table 2 Distribution of injuries at various levels of the lumbar spine according to the Modic changes classification

Variable	Modic I-II $n = 144$		Modic III $n = 144$		p value
	$n =$	%	$n =$	%	
Levels number					
One	128	88.9	62	43.1	< 0.0001
Two	14	9.7	66	45.8	
Three or more	2	1.4	16	11.1	
Clinical finding					
Lumbar pain	64	44.4	75	52.1	0.24
Radicular pain	70	48.6	51	35.4	0.03
Motor deficit	9	6.2	16	11.1	0.21
Pain type					
Axial	70	48.6	78	54.2	0.41
Sciatic	77	53.5	67	46.5	0.29
Pain intensity, visual analog scale (VAS)					
1-3	2	0.7	1	0.3	< 0.01
4-6	45	15.7	25	8.7	
7 >	96	33.4	118	41.1	
Evolution time					
One week	33	22.9	...	...	
1–4 weeks	31	21.5	25	17.4	< 0.0001
1 to 3 months	37	25.7	46	31.9	
More than 3 months	43	29.9	73	50.7	
Etiology					
Traumatic	30	20.8	2	1.4	< 0.0001
Degenerative	113	78.5	141	97.9	
Neoplastic	...	...	1	0.7	
Other	1	0.7	..	…	
Spine level					
L1-L2	2	1.4	4	2.8	0.68
L2-L3	2	1.4	9	6.2	0.07
L3-L4	15	10.4	27	18.8	0.07
L4-L5	65	45.1	100	69.4	< 0.0001
L5-S1	78	54.2	110	76.4	0.0001
Lesion site					
Right	52	36.1	53	36.8	0.04
Left	82	56.9	68	47.2	
Bilateral	10	6.9	23	16.0	
Hernia type					
Protruded	116	80.6	102	70.8	0.07
Extruded	28	19.4	42	29.2	
Hernia position					
Central	38	26.4	35	24.3	0.18
Lateral	74	51.4	88	61.1	
Foraminal	27	18.8	20	13.9	
Extraforaminal	5	3.5	1	0.7	

Source: research data

Elaboration: authors

higher in cohort 2 at 76.4% and cohort 1 at 54.2%, with statistical significance between groups. The most frequent injury site is the left in both groups, with 56.9% for cohort 1 and 47.2% for cohort 2. There is also a significant difference between right and left, whether unilateral or bilateral. The protruding type of hernia predominated in both groups, reaching 80.6% for cohort 1 and 70.8% for cohort 2 without statistically significant differences. The position of the greater hernia is the lateral one for both groups, slightly more important for cohort 2 with 61.1% and cohort 1 with 51.4%, without statistically significant difference.

Table 3 shows the characteristics of the treatment. The history of previous surgery was higher for cohort 2, with 21.5%, and cohort 1, with 4.2%, with a statistically significant difference. The most frequent surgical indication in both groups is pain, being more significant in cohort 1 with 83.9%, while for cohort 2, it was 72.9%, with a statistically

Table 3 Distribution of the treatment and management characteristics of the study groups Modic changes I-II vs. Modic III changes

Variable	Modic I-II $n = 144$		Modic III $n = 144$		p value
	$n =$	%	$n =$	%	
Surgical history	6	4.2	31	21.5	< 0.0001
Surgical indication					
Pain	120	83.9	105	72.9	0.02
Neurological deficit	22	15.4	39	27.1	
Other	1	0.7			
Type of anesthesia used					
General	90	62.9	141	97.9	< 0.0001
Peridural	50	35.0	3	2.1	
Spinal	3	2.1			
Post-surgical therapeutic					
Simple pain relievers	104	72.2	67	39.6	< 0.0001
Major painkillers	30	20.8	26	18.1	0.66
Neuromodulators	16	11.1	57	46.5	< 0.0001
Surgical procedure					
Microdiscectomy	74	52.1	6	4.2	< 0.0001
Discectomy + decompression	52	36.6	26	18.1	
Discectomy + decompression + posterior arthrodesis	16	11.3	35	24.3	
Discectomy + decompression + anterior and posterior arthrodesis			77	53.5	

Source: research data

Elaboration: authors

significant difference between groups. The most frequent type of anesthesia in both groups is general anesthesia, being almost exclusive in cohort 2 with 97.9%, while for cohort 1, it is 62.9%, with statistical significance between groups. The most frequent post-surgical treatment for cohort 1 was simple analgesics at 72.2%, while cohort 2 was neuromodulators at 46.5% with statistical significance. Finally, the most frequent surgical procedure for cohort 1 is microdiscectomy, with 52.1%. In comparison, for cohort 2, the most frequent method was discectomy plus posterior decompression plus anterior and posterior arthrodesis, with 53.5% with statistical significance between groups.

Table 4 shows the distribution of complications; the overall complication rate was 18.2% of 288 patients. In cohort 1, 13.9% were present, and in cohort 2, 23.1% (n144). Pain persistence was the most frequent complication in cohort 1, with 6.2%, while the infection was the most frequent in cohort 2, with 11.2%. The infection rate for cohort 1 is 3.5%, while for cohort 2, it represents 11.2%. The cerebrospinal fluid fistula rate for cohort 1 is 2.1%, while for cohort 2, it is 2.8%.

Table 4 Distribution of complications reported in the study group, in general, and by a group of changes Modic I-II and Modic III

	In all cases, $n = 288$		Modic I-II, $n = 144$		Modic III, $n = 144$	
	$n =$	%	$n =$	%	$n =$	%
Infection	21	7.2	5	3.5	16	11.2
Post-surgical hematoma	1	0.3	...	...	1	0.7
CSF fistula	7	2.4	3	2.1	4	2.8
Neurological deficit	5	1.7	3	2.1	2	1.4
Persistence of pain	16	5.6	9	6.2	7	4.9
Other	3	1.0	...	...	3	2.1
Total	53	18.2	20	13.9	33	23.1

Difference between Modic I-II groups vs. Modic III, $p < 0.0001$; Pearson's $\chi 2$ test

Source: research data

Elaboration: authors

Discussion

The mean age in cohort 2 was 17 years older than in cohort 1 because the older the age, the greater the risk of having more significant MC. This issue is because DDD is an inevitable part of aging and has contributed to LBP [18]. Furthermore, DDD is an abnormal structural failure due to the cell-mediated response to multifactorial contributions, such as genetics, micro or macro trauma, accelerated age-related changes, inflammation, local nutritional deficiency, and vascular factors, leading to an excess of catabolic over anabolic response [19]. The mean weight of the patients was the same in both groups. This lack of difference is related to the means of weight in our local population. We did not find any study that relates this variable as a risk factor for having a higher risk of DDD with more significant MC. The BMI that predominated in both groups was between 25 and 29.9, qualifying as overweight; there was no difference between groups, as did weight alone. In addition, obesity or being overweight is closely related to disc degeneration. Although there is a higher risk relationship, no study directly relates BMI to MC, so further studies are recommended. Male sex was more frequent for cohort 1, with 68.8%, unlike cohort 2, where it only represented 46.5% due to the age of involvement of these groups, which is lower in cohort 1 and higher in cohort 2. Indeed, a hormonal factor has a protective effect given by estrogens. This situation is attributed to young, middle-aged men having a higher incidence of DDD than women. Still, the result differs in the elderly population, where women are more inclined to develop this pathology [20].

The morphological biotype that predominated in both groups was the endomorphic biotype. This biotype predisposes to develop obesity, as evidenced in our study. This issue explains the greater risk of DDD in patients with this somatotype. No studies were found relating the morphological biotype directly with MC, for which more studies are also recommended. The smoking history was higher in cohort 1, with 38.5%, because the population was younger, mainly men. It is also attributed that smoking decreases blood flow to the vertebral body, alters fibrinolysis, increases intra-abdominal pressure due to coughing, and reduces bone mineral content that can directly and indirectly affect intervertebral disc degeneration. However, more studies are needed to determine how smoking increases the risk of DDD. The history of trauma was higher for cohort 1 with 16%, twice that of cohort 2. In cohort 1, a younger population, consequently more active, physically and occupationally, has a higher risk of trauma. The most frequent physical activity for cohort 1 was moderate activity, with 63.9%. For cohort 2, mild activity with 76.2%. We observed being overweight because mild physical activity is associated with a higher BMI. This finding is due to three reasons: sedentary life due to chronic pain, a vicious cycle, which causes overweight and increases BMI. Added to this are inadequate lifestyle habits and the lack of guided physical activity programs for older adults.

The number of affected spine levels for cohort 1 predominated only one level in 88.9%. However, in cohort 2, two spine levels prevailed due to the predominant ages in each group; this is attributed to the degenerative process. The older cohort 2 is at greater risk of affecting more than one level. In addition, some studies relate older age with a greater risk of degenerative changes of intervertebral discs. Some authors evidenced in MRI that in patients aged 60 years or more, the findings were abnormal in 57% of the scans. In addition, 36% of the subjects had a herniated nucleus pulposus, and 21% had spinal stenosis [21].

The most common clinical presentation was pain, divided into lumbar and radicular pain. In cohort 2, radicular pain was more frequent, with sciatic pain, and for cohort 2, lumbar pain with axial type pain because the patients of cohort 2 were older and had a higher degree of degeneration, not only of the intervertebral disc but also of other vertebral structures, as well as a higher frequency of facet disease, which makes axial lumbar pain more frequent in this group.

Pain intensity was more significant than 7 in both groups. However, there was a significant difference between groups, with intense pain being more frequent in cohort 2, where it appeared in 41.1%, instead of cohort 1 with 33.4%. This difference is because, in cohort 2, the female and older population predominated, translating into more pain sensitivity, mainly by age. Another explanation could be that women may have a lower pain threshold and tolerance to *noxious stimuli* in experimental studies than men. Similarly, the response and efficacy to analgesic treatment differ in men and women [22, 23]. Furthermore, other authors measured higher pain levels in older adults due to various musculoskeletal conditions. And finally, although acute pain has been reported to occur at the same rates in all age groups, chronic pain may be more common in older people.

The duration time was more than 3 months. However, there was a statistical difference between groups, being more significant in cohort 2 with 50.7%, due to the prevalence of axial type pain in this group and not being better tolerated than radicular pain. The most frequent etiology was DDD in both groups, which was more significant in cohort 2, with 97.9% due to degenerative changes [24].

The most frequent herniated disc injury in both groups was the L5-S1 level, followed by L4-L5. These are the levels with the highest demand and movement stress and the highest risk of being affected. This is attributed to structural changes in the degenerative disc, such as the loss of volume of the nucleus pulposus and fissures in the annulus fibrosus, limiting the segment's movement function. Consequently, the segments with greater movement tend to undergo more significant changes [25]. The most frequent injury site was left in both groups, more significant in cohort 1 with 56.9% and cohort 2 with 47.25. Protruding hernia predominated in both groups in equivalent percentages. The most frequent hernia position was lateral in both groups, slightly higher in cohort 2 with 61.1%. These data correspond to the international statistics reported.

The previous surgery history was 4.2% for cohort 1 and 21.5 for cohort 2. This issue is attributed to the fact that cohort 2 has a higher mean age and a higher degree of degeneration. Therefore, the older the patient, the greater probability of requiring more than one surgery. In addition, surgery for radiculopathy due to a herniated disc and spinal stenosis has shown significant improvements at three months of follow-up and slight to moderate improvements for pain and disability at 5 years of follow-up. Therefore, it is possible to require a new surgery. Although, over time, there is an annual cumulative risk of needing reintervention. The cumulative incidences reported are 4% in the first year, 6% in 2 years, 8% in 3 years, 11% in 5 years, and 16% in 10 years [26].

The main surgery indication in both groups was 83.9% for cohort 1 and 72.9% for cohort 2. This indication was DDD, the leading cause of low back pain and disability. However, it is also possible that there is no difference between groups because the perception of acute pain can occur at the same rates in all age groups. Chronic pain, which seems to be more frequent in older people, is a health-related factor that decreases life quality in a dependent manner with age.

The anesthesia type used most frequently was general anesthesia in both groups, with statistically significant differences between groups, and it is almost exclusive in cohort 2: the greater the MC, the greater degree of the degenerative lesion. Therefore, there is a greater risk of requiring a more complex surgery with a longer surgical time. Unfortunately, we did not find any study comparing the different anesthesia types in DDD surgery, which is why more studies are recommended.

Both groups' treatment for postoperative pain differed, with cohort 1 favoring simple analgesics at 72.2% and neuromodulators for cohort 2 at 46.5%. This difference is due first to the older age of cohort 2, which translates into a high risk of greater MC and, therefore, a greater degree of degeneration. On the other hand, in cohort 2, the female and older populations predominated. Similarly, the response and efficacy to analgesic treatment differ in men and women. The persistent pain in the elderly may be due to lack of exercise, since physical activity affects the paraspinal muscle strength and helps reduce pain and disability.

The primary surgical procedure in cohort 1 was microdiscectomy; in cohort 2, discectomy plus posterior decompression plus anterior and posterior arthrodesis was present. The main reasons were older age and longer duration time. Therefore, greater MC and more significant degenerative changes are shown in cohort 2. Also, in cohort 2, DDD is associated with alteration of the vertebral plate, mainly anterior [27].

The most frequent complication was an infection, with an overall rate of 7.2%, higher in cohort 2. This is possible due to complex surgical procedures and longer surgical time. The infection rates are related to those found in medical literature, where surgical site infection rates in surgery for lumbar pathology are estimated to be between 0.7 and 16%. On the other hand, there seems to be a greater risk of infection in open surgery than in minimally invasive surgery and a lower risk of infection in decompression surgery alone vs. instrumentation [15].

Pain persistence was 6.2% for cohort 1 and 4.9% for cohort 2. There were no significant statistical changes. Our findings are similar to those reported in the medical literature. A systemic review found that the proportion of recurrent low back pain after discectomy ranged from 3 to 34% [28]. However, no studies were found about the risk of postoperative pain related to MC; also, more studies are suggested. Cerebrospinal fluid fistula had an overall rate of 2.4%. For cohort 1, the prevalence was 2.1%, and for cohort 2, 2.8%, without statistically significant differences. Certain authors observed a cerebrospinal fluid fistula in the thoracolumbar spine procedure in 3.2% of cases [29].

This study has three significant limitations that could be addressed in future research: previous studies on the subject. Although there are numerous studies relating to the MC, they are no studies related to the population involved in these groups. Therefore, more studies are recommended in that sense. Second, the negative effect of the SARS-COV-2 pandemic could be affected some study variables. Third, the population of the present study belongs to a single center of the city of Quito in Ecuador, and we know that some centers nationwide perform lumbar spine surgery. Future studies should be carried including most of those healthcare centers.

The results obtained in this study can be taken as a local statistical reference of lumbar discopathy with MC since it includes a greater population sample. However, these data cannot be generalized because the study population was taken only from a spinal surgery center in Quito.

Conclusion

The patient profile analyzed was MC I-II individuals (cohort 1) with a mean age of 45 years, mostly men, with a single-level affectation, an onset of radicular pain, and sciatic pain. The second cohort was MC-III individuals with a mean age of 62 years, primarily women, with two levels of affectation, an onset of lumbar pain and axial pain. Both cohorts showed overweight, mild physical activity, degenerative and protruding hernia, and injury level at L5-S1, mainly in the lateral and left sides. Both cohorts were under surgery by uncontrol pain with general anesthesia. The most frequent post-surgical treatment was analgesics and neuromodulators. The most frequent surgical procedure was microdiscectomy in cohort 1 and discectomy plus posterior decompression plus anterior and posterior arthrodesis in cohort 1. Pain persistence was the most frequent complication in cohort 1 and infection in cohort 2. There is a greater predisposition to require surgery for lumbar disc herniation in young men and older women. In addition, surgery at an older age has a higher risk of complications, especially infection.

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Author Contribution KES, JE, and FG-A carried out the research protocol and its design, data collection, statistical analysis, evaluation, interpretation of the data, critical analysis, discussion, writing, and final manuscript approval.

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Data Availability All data are available upon request to the corresponding author.

Code Availability No kind of specific software or computer application was used in this investigation.

Declarations

Ethics Approval We received the Ethics Committee's approval in Research with Human Beings of the Universidad San Francisco de Quito (CEISH-USFQ), with the approval No. 080 2021-CA. P20.027TPG-CEISG-USFQ, on May 19, 2021. All methods were carried out following the relevant Helsinki Declaration, developed by the World Medical Association, outlining the minimum ethical standards for research on human participants. Also, we follow other guidelines and national regulations.

Consent to Participate All patients signed the informed consent. Informed consent was obtained from all adult subjects. No children were studied.

Consent for Publication All patients gave their consent for publication, included in the informed consent.

Conflict of Interest The authors declare no conflict of interest.

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