



Morphometric Study of the Endplates and Intersomatic Spaces in Cervical Spine. Valencia Polyclinic Center - Venezuela. March - August 2013

Alexis Antequera G^{1*}, Francisco García², Marvin Alvarado³,
Guillermo Valenzuela⁴, Sergio Sacchettoni⁵, Zaymis Mejia⁶,
Gabriela Mora⁷ and Nayrent Chaffardett M⁸

¹Neurosurgeon, Valencia Polyclinic Center, University of Carabobo, Venezuela, South America

²General Surgeon, CHET University of Carabobo, Venezuela, South America

³General Surgeon, Valencia Polyclinic Center, Venezuela, South America

⁴General Practitioner, University of West, Venezuela, South America

⁵Neurosurgeon, Vargas Hospital Central University of Venezuela, Venezuela, South America

⁶General Practitioner, Santo Domingo - Dominican Republic, Venezuela, South America

⁷General Practitioner, CHET University of Carabobo, Venezuela, South America

⁸Pediatrician in Ciudad Hospitalaria Dr. Enrique Tejera, Valencia

*Corresponding Author: Alexis Antequera G, Neurosurgeon, Valencia Polyclinic Center, University of Carabobo, Venezuela, South America.

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Abstract

The disc lesions, has led to a boom in cervical spine surgery, appearing in a wide variety of approach techniques, which involve the use of implants (protheses -maintaining the mobility of segments, and cages -fusion of segments-) conceiving limitations in the surgical act, to predefine if they adapt to the dimensions required of the patient. The most of implants invented to treat the degenerative cervical spine are based in Caucasian or Asian populations leaving out Hispanic population.

General Objective: To establish the dimensions of the cervical endplate and the intersomatic space in a sample of Venezuelan adults.

Materials and Methods: A descriptive retrospective, cross-sectional study was carried out, with an intentional non-probabilistic sample, consisting of 121 subjects between 30 and 65 years old, who went to two centers of imagenology, in the north of Valencia, Venezuela.

Results: AP diameter was C2 to C6 15.07 mm, C7-T1 16.05 mm, related in 83.5% and 90.9% respectively to the reference parameters. Height of the intersomatic space 5.60 mm.

Conclusions: this study showed that there are no important morphometric differences with respect to other studies, but it was found that the values of the cages are greater than the data in this study. Likewise, the dimensions of the protheses, although they have a standard average in their transverse diameter, are greater in height and depth. Therefore, the use of X-rays and MRI is necessary in the surgical planning and selection of the appropriate size of the instruments to be used to reduce the incidence of postoperative complications associated with the use of implants.

Keywords: Spinal Column; Disc Disease; Arthroplasty; Radiography; Magnetic Resonance Imaging

Introduction

In the degenerative cervical spine there are many options to approach this problem; the arthroplasty and cervical fusion are the most common ways to treat this condition.

The incidence of spinal injuries worldwide has been increasing for multifactorial reasons. The most frequent location is at the C6 - C7 level (60%) followed by C5 - C6 (20%) and C4 - C5 [1]. The spine is alternately made up of bone vertebrae and fibrocartilaginous discs interspersed between each vertebra, intimately connected

by strong ligaments and supported by musculotendinous masses (tension bands). There are 33 vertebrae (seven cervical, twelve thoracic, five lumbar, five sacral and four coccygeal); A typical vertebra is formed by an anterior body, more or less cylindrical, and a posterior arch composed of two pedicles, two articular facets on each side and two laminae joined later, to form a spinous process. The intervertebral discs act as elastic shock absorbers, to absorb the multiple mechanical effects that the spine supports and constitute the distraction band. The atlas and the axis, first and second cervical vertebra (C1 and C2), are atypical. They are attached to each other, to the skull and the other cervical vertebrae by cranio-cervical ligaments, stratified. The other five (from C3 to C7) show the general characteristics of any vertebra [2].

The cervical vertebrae are easily distinguished by the presence of holes in their transverse processes, for the passage of the vertebral arteries, which in 90% enters C6 and 10% in C5, C7 or even C4 or C3 [3]. The size of the discs it increases, as it descends through the column, until it reaches about 45 mm in the anteroposterior direction, 64 mm in the lateral direction and 11 mm in height in the lumbar region [4].

There are frequent lesions in the cervical spine, mainly caused by wear and tear, its incidence being greater in the fourth and fifth decade of life, covering approximately 45% of the population [1].

Advances in non-fusion technology for the treatment of vertebral pathologies, such as degenerated or damaged intervertebral disc, have introduced a new era to spinal surgery, commonly referred to as spinal arthroplasty or dynamic stabilization. This differs from traditional fusion methods, because its objective is to replace the injured disc, preserving the mobility and height of the disc and the cervical space, maintaining the height of the disc space, making a spinal decompression effect; while in theory, it reduces the probability of accelerated degeneration of adjacent discs, through the preservation of disc movement at the affected level [5].

Several investigations have evaluated the anthropometric dimensions of the cervical vertebrae in the population; Evangelopoulos et. cols. in a study with 72 human cervical vertebrae on the three-dimensional quantitative anatomy of the cervical vertebrae, determined coordinates of marked points on the surfaces of the vertebrae (linear, angular dimensions, surface areas, cross sections and intervertebral joints), from C2 - C7 and compared with the

currently known measures; The results showed two broad transition regions throughout the cervical vertebral segment: one towards the spine of the C7 vertebra, but narrower in terms of the spinal canal, and another towards the upper cervical region of the pedicle and spinal processes of C2 [6].

Know, et. cols, performed the morphometric analysis of the cervical spine, through computed tomography, obtaining accurate measurements of the cervical canal, which could serve as a useful guide for the determination of cervical canal stenosis, replacing the old x-ray technique. In addition, it shows measurements of the diameters of the transverse hole, arguing that they can provide important information for spinal surgeons, depending on the cervical level, which facilitates preoperative planning, avoiding possible trauma to the vertebral arteries, over distraction and neural injury on contiguous levels [7].

In relation to the treatment of cervical disc lesions there are devices that consist of a modular disc, used to restore the height of the intervertebral space and physiological mobility in the cervical spine (for example the Prodisc-C® prosthesis). It consists of two upper and lower prosthetic plates, made of cobalt, chromium and molybdenum alloy; a rough surface coating, made of pure titanium, that favors the integration into the bone tissue in a matter of a few months [8]. Also, intersomatic spacers or anterior cervical cages (example: Fidji cage, PCB cage-cervical plate), designed to maintain the interdiscal space and generate fusion between adjacent vertebrae [9].

Lesions of the cervical disc involve the use of implants (prostheses and intersomatic cage), therefore at the time of surgical planning, it is necessary to predefine whether or not they adapt to the dimensions of the patient. Some surgeons resort to imaging techniques, such as X-rays and Magnetic Resonance Imaging, to study the biometrics of the patient in search of improvements in the use of prostheses and / or cervical cages, while others postpone this decision until the time of surgery [7].

Due to numerous inconveniences, which are usually presented to the spine surgeon in their practice, with respect to the selection of prostheses or cages to be used, to solve the cervical desmopathy of the patient; There are controversies with the parameters established in the international manufacture of prostheses and / or cages, based on the biotype of this population, which leads to errors

in the choice of the device to be implanted. In Venezuela there are no known morphometric data published in relation to the cervical spine, therefore, the objective of this study was to determine the dimensions of the saucer and the cervical intersomatic space in a sample of adults. Therefore, if these diameters were compared, through imaging studies, with the diameters of the implants used, would this favor your correct choice in surgical practice?

Materials and Methods

A descriptive, retrospective, cross-sectional study was carried out, with an intentional non-probabilistic sample, made up of all subjects with ages ranging from 30 to 65 years of age, male and female, who attended two imaging centers, in the North zone of Valencia, Venezuela during the months of March-August, 2012. At the end of the study, the sample consisted of 121 patients (87 women and 34 men), who met the following inclusion criteria: Radiography (X-ray) and / or Magnetic resonance imaging (MRI) of the cervical spine, which did not present with degenerative or tumor bone pathology, without a history of fracture and / or cervical spine surgery, and without signs of instability due to cervical spine injury, according to White's criteria. Panjabi 10: 1- destruction or dysfunction of previous elements. 2- destruction or dysfunction of later elements. 3- positive stretching test. 4- spinal damage. 5- root damage. 6- abnormal decrease in interspace. 7- congenital rickets. 8- radiographic criteria: radiographs in neutral position with displacement of the sagittal plane (> 3.5mm or 20%), relative angulation of the sagittal plane (> 11 °) or flexo-extension radiographs with translation of the sagittal plane (> 3.5mm or 20%) and rotation of the sagittal plane (> 20).

Authorization was previously requested from the imaging centers, in order to obtain patient identification data and cervical vertebrae values; calculated through X-ray and MRI studies. The consent for the review of the databases was approved, following the Bioethics and Biosafety Standards for research with living organisms and the environment, the Code of Ethics for Life, the Ministry of Popular Power for Science, Technology and Intermediate Industries eleven.

For the data collection an observation guide was used, in which the measures of the cervical endplate and the intersomatic space of the sample studied were compiled.

The values of the dimensions of the endplate and intersomatic space were obtained, through X-rays and MRI of the cervical spine.

Regarding the X-ray of the cervical spine, the anterior-posterior (AP) projections were performed to study the transverse diameter of the vertebral plate and the height of the intersomatic and lateral space to study the AP diameter and height of the intersomatic space, according to the criteria for adequate radiological imaging of the cervical spine [12].

Regarding the MRI, the views were performed: sagittal to study the AP diameter of the vertebral endplates and height of the intersomatic space, and axial to study the AP and transverse diameters of the vertebral endplates. For the purposes of this study, only values obtained from the AP diameter were used in their lateral projection (X-rays) and in AP diameter in their sagittal view (MRI) In both techniques, the reference parameter for the projections was taken: upper and lower anteroposterior diameter C2-C6: 17mm; C7-T1: 20mm; for the dimensions of the intersomatic space (C2 – T1), the height of the intersomatic space (C2 - C7) was used as a reference, which has an average value of 5-7mm [13,14].

Subsequently, the values obtained were compared with cervical intersomatic implants, most commonly used in surgical practice according to references: Fidji® [9], PCB® [15], ProdisC-Nova® [8], PrestigeST® [16], MobiC® [17].

In the column radiographs, an Afgar Health Care CR30-X brand digitizer was used, while, for Magnetic Resonance, an MR-Signa EX-CITE HD (General Electric) system was used.

Statistic analysis

The statistical program SPSS version 16.0 was used. Descriptive statistics of central tendency (averages and standard deviation), minimum and maximum range and Spearman's correlation were made; a level of statistical significance $p < 0.05$ was considered. The Kolmogorof-Smirnov test was used to verify the distribution of the variables. For the purposes of the study, the data were analyzed according to sex and imaging technique.

Results

The research consisted of a sample of 121 patients who underwent imaging studies of the cervical spine of C2-T1; 97 of them cor-

respond to patients studied with MRI and 24 studied with X-rays. The average age of the sample studied was 45.8 years with a standard deviation of 9.98.

Table 1 shows the average values, minimum and maximum range and standard deviation of the upper and lower AP diameter, of X-rays in its lateral projection, according to sex.

Sex		n	Minimum (mm)	Maximum (mm)	Average (mm)	Stand. Deviat
Male	LATINC2	4	14,37	22,50	19,59	3,62
	LATSUC3	4	14,65	23,60	20,44	4,06
	LATINC3	4	14,72	22,10	19,75	3,44
	LATSUC4	4	14,77	21,70	19,24	3,25
	LATINC4	4	14,93	22,50	20,03	3,51
	LATSUC5	4	15,09	24,80	21,32	4,29
	LATINC5	4	15,21	23,90	20,95	4,07
	LATSUC6	4	15,43	26,60	22,78	5,13
	LATINC6	4	15,80	25,20	21,65	4,35
	LATSUC7	4	15,81	26,40	22,80	4,80
Female	LATINC7	3	15,95	25,90	22,05	5,34
	LATSUT1	2	16,22	22,80	19,51	4,65
	LATINC2	20	12,36	23,70	17,02	3,62
	LATSUC3	20	12,51	21,60	17,07	4,06
	LATINC3	20	13,08	23,10	17,71	3,44
	LATSUC4	20	13,10	22,30	17,58	3,25
	LATINC4	20	13,10	22,50	17,71	3,51
	LATSUC5	20	13,46	23,50	17,73	4,29
	LATINC5	20	13,58	23,90	18,58	4,07
	LATSUC6	20	13,81	23,30	18,47	5,13
Female	LATINC6	20	13,82	25,80	19,29	4,35
	LATSUC7	20	13,94	24,70	19,37	4,80
	LATINC7	19	14,02	24,70	19,39	5,34
	LATSUT1	15	14,27	25,90	18,82	4,65

Table 1: Average values, minimum and maximum range and standard deviation of the upper and lower AP diameter, of X-rays in its lateral projection, according to sex.

LATINC: Lateral projection of the lower edge of the cervical vertebra, LATSU: Lateral projection of the upper edge of the cervical vertebra; Values expressed in averages and standard deviation.

Source: Database taken from the thesis "Study of the dimensions of cervical interbody and cyst spaces and patients in the city of Valencia during March - August 2012".

It is evident that the average of the values obtained by X-rays in the male sex is 20.84 mm and a standard deviation of 4.20; observed in C6 and C7 maximum values; while in women, the average was 18.22 mm and a standard deviation of 4.20.

According to Spearman's correlation, the type of image was significantly correlated with the height of the intersomatic space, with the depth, the vertebrae C2-C6 and C7-T1; as well as, sex was correlated with depth, the vertebrae C2-C6 and C7-T1. Age was not correlated with any of the variables studied.

With the use of MRI, male patients, it was evident, for the upper and lower AP diameter, a range of 12.14 mm to 20.61 mm from C2 to T1, the average value being 15.4 mm and a deviation 1.76standard. As for women, the range goes from 11.91 mm to 24.7 mm, with an average value of 14.34 mm and a standard deviation of 1.06

Sex		n	Minimum (mm)	Maximum (mm)	Average (mm)	Stand. Deviat.
Male	LATINC2	30	10,74	17,40	14,35	1,41
	LATSUC3	30	10,74	18,20	14,65	1,65
	LATINC3	30	10,81	19,57	14,85	1,68
	LATSUC4	30	10,87	20,61	15,05	1,78
	LATINC4	30	10,96	20,61	15,40	1,90
	LATSUC5	30	11,15	19,50	15,43	1,78
	LATINC5	30	11,18	19,57	15,64	1,79
	LATSUC6	30	11,21	20,01	15,72	1,78
	LATINC6	30	11,27	19,27	15,90	1,71
	LATSUC7	30	11,32	19,47	15,85	1,74
	LATINC7	29	11,36	19,57	15,97	1,64
	LATSUT1	30	12,14	20,13	16,06	2,34
	Female	LATINC2	67	11,91	23,70	13,40
LATSUC3		67	12,00	16,38	13,52	,958
LATINC3		67	12,10	23,10	13,81	,940
LATSUC4		67	12,10	16,38	13,79	,904
LATINC4		67	12,20	22,50	14,12	1,00
LATSUC5		67	12,30	16,93	14,01	,992
LATINC5		67	12,30	23,90	14,36	1,21
LATSUC6		67	12,40	17,74	14,45	1,21
LATINC6		67	12,40	25,80	14,82	1,29
LATSUC7		67	12,60	17,54	14,81	1,12
LATINC7		67	12,60	24,70	14,95	1,12
LATSUT1		66	13,20	17,68	15,19	1,09

Table 2: Average values, minimum and maximum range and standard deviation of the upper and lower AP diameter, of MRI in its sagittal view, according to sex.

LATINC: Lateral projection of the lower edge of the cervical vertebra, LATSU: Lateral projection of the upper edge of the cervical vertebra; Values expressed in averages and standard deviation. **Source:** Database taken from the thesis "Study of the dimensions of cervical interbody and cyst spaces and patients in the city of Valencia during March - August 2012."

Table 3 shows the average values of the height, minimum and maximum range and standard deviation of the height of the intersomatic space (C2 - T1), in lateral projection according to technique and sex. It is observed that the average value in men through X-rays is 6.31 mm and a standard deviation of 0.90; while the women had an average of 5.87 mm and a standard deviation of 1.03. However, the MRI showed values slightly below, being in the male sex 5.78 mm and a standard deviation of 1.13 and for the female 5.41 mm with a standard deviation of 0.93. Higher than average values are evident in intersomatic spaces, specifically: C5-6, C6-7, C7-T1.

Sex	Study of imagen	n	Minimum (mm)	Maximum (mm)	Average (mm)	Stand. Devt.	
Male	X-rays	ESP. INTER 2-3	4	5,02	6,80	5,80	,74
		ESP. INTER 3-4	4	5,18	6,90	6,19	,73
		ESP. INTER 4-5	4	5,23	7,10	6,41	,81
		ESP. INTER 5-6	4	5,29	7,20	6,27	,82
		ESP. INTER 6-7	4	5,35	8,60	6,74	1,36
		ESP. INTER 7-1	3	5,40	7,20	6,50	,96
		MRI	ESP. INTER 2-3	30	3,50	7,57	5,47
	ESP. INTER 3-4		30	3,76	8,17	5,72	1,19
	ESP. INTER 4-5		30	3,81	7,93	5,67	1,18
	ESP. INTER 5-6		30	4,01	8,20	5,87	1,08
	ESP. INTER 6-7		30	4,01	8,16	5,96	1,18
	ESP. INTER 7-1		30	4,07	8,20	5,99	1,09

F e - male	X-rays	ESP. INTER 2-3	19	3,00	6,30	5,08	,90
		ESP. INTER 3-4	20	3,98	8,40	5,67	1,12
		ESP. INTER 4-5	20	4,07	8,80	5,98	1,09
		ESP. INTER 5-6	20	4,13	8,10	6,02	,96
		ESP. INTER 6-7	20	4,27	8,90	6,19	1,06
		ESP. INTER 7-1	15	4,59	8,60	6,29	1,08
	MRI	ESP. INTER 2-3	67	3,00	7,95	5,17	1,00
		ESP. INTER 3-4	67	3,80	8,00	5,39	1,00
		ESP. INTER 4-5	67	3,64	7,74	5,33	,88
		ESP. INTER 5-6	66	3,93	7,77	5,32	,89
		ESP. INTER 6-7	66	3,98	7,75	5,61	,86
		ESP. INTER 7-1	67	2,18	7,74	5,64	1,00

Table 3: Average values, minimum and maximum range and standard deviation of the height of the intersomatic space (C2 - T1) in lateral projection according to technique and sex.

ESP.INTER: Intersomatic Space.

Source: Database taken from the thesis "Study of the dimensions of cervical interbody and cyst spaces and patients in the city of Valencia during March - August 2012".

Table 4 reports the frequency distribution of the sample studied according to reference values of the AP diameter (C2-C6) 14 in lateral projection by technique and sex. Through the X-rays, it is observed that a high percentage of men and women are far from the reference values of the AP diameter of C2-C6 established. In MRI, it was obtained that 86.7% men and all women were within the reference values established as normal.

Study of Imagem	Sex		n	%
X-rays	Male	Normal	1	25,0
		Non normal	3	75,0
		Total	4	100,0
	Female	Normal	7	35,0
		Non normal	13	65,0
		Total	20	100,0
MRI	Male	Normal	26	86,7
		Non normal	4	13,3
		Total	30	100,0
	Female	Normal	67	100,0

Table 4: Frequency distribution of the sample studied according to reference values of the AP diameter (C2-C6) in lateral projection by technique and sex.

Rx: (n: 24); RM: (n: 97); reference values C2-C6: ≤ 17 mm;

Source: Database taken from the thesis “Study of the dimensions of cervical interbody and cyst spaces and patients in the city of Valencia during March - August 2012.”

With the X-rays, it is evident that 50% of the male sex are not in the normal reference values 14; as well as 40% of the female sex. Regarding MRI, it was reported that both men and women correspond to the reference values (Table 5).

Study of Image	Sex		n	%
X-rays	Male	Normal	1	25,0
		no normal	2	50,0
		Total	3	75,0
	Female	Normal	12	60,0
		no normal	8	40,0
		Total	20	100,0
MRI	Male	Normal	30	100,0
	Female	Normal	67	100,0

Table 5: Frequency distribution of the sample studied according to reference values of the AP diameter (C7-T1) lateral projection by technique and sex.

X-rays (n: 23); MRI (n: 97); Reference values C7-T1: ≤ 20 mm;

Source: Database taken from the thesis “Study of the dimensions of cervical interbody and cyst spaces and patients in the city of Valencia during March - August 2012.”

It can be seen in table 6 that all male patients studied with X-rays were within the normal reference values 15; as well as more than 50% of women in both techniques and men according to MRI.

Study of Image	Sex		n	%
X-rays	Male	Normal	4	(100)
		Non normal	---	-----
	Female	Normal	13	(65)
		Non normal	7	(35)
		Total	20	(100)
	MRI	Male	Normal	17
Non normal			13	(43,3)
Total		30	(100)	
Female		Normal	42	(62,7)
		No normal	25	(37,3)
Total	67	(100)		

Table 6: Frequency distribution of the sample studied according to reference values of intersomatic space height (C2-T1) in lateral projection by technique and sex.

X-rays (n: 24); MRI (n: 97); Reference values C2-T1: 5-7 mm;

Source: Database taken from the thesis “Study of the dimensions of cervical interbody and cyst spaces and patients in the city of Valencia during March - August 2012.”

Table 7 shows average values, minimum and maximum range and standard deviation of the total sample in its lateral projection obtained by both techniques. The average AP diameter of C2 - C6 is 15.07 mm, of C7 - T1 is 16.05, with a standard deviation of 2.46 and 2.65 respectively. The intersomatic space reported an average of 5.60; standard deviation of 1.02.

Discussion

The study of cervical vertebrae is a benefit that is vitally important at the time of surgical planning. Predefining whether or not the implant adapts to the dimensions required by the patient, helps to avoid inconveniences that are usually presented to the spine surgeon in surgical practice.

Regarding cervical disc injuries, Ramírez, *et al.* [1], reported that the incidence of people suffering from them throughout life is 26% of the population, frequently in the 4th and 5th decade [19],

	n	Mini- mum (mm)	Maxi- mum (mm)	Average	Stand. Deviat.
LATSUC3	121	10,74	23,60	14,62	2,43
LATSUC4	121	10,87	22,30	14,90	2,32
LATSUC5	121	11,15	24,80	15,22	2,47
LATSUC6	121	11,21	26,60	15,70	2,71
LATSUC7	121	11,32	26,40	16,08	2,82
LATSUT1	113	7,14	25,90	15,98	2,32
LAPINC2	121	10,74	23,70	14,43	2,38
LAPINC3	121	10,81	23,10	14,90	2,42
LAPINC4	121	10,96	22,50	15,23	2,37
LAPINC5	121	11,18	23,90	15,59	2,61
LAPINC6	121	11,27	25,80	16,05	2,81
LAPINC7	118	11,36	25,90	16,09	2,68
ESP.INTER 2-3	120	3,00	7,95	5,25	1,01
ESP.INTER 3-4	121	3,76	8,40	5,54	1,06
ESP.INTER 4-5	121	3,64	8,80	5,55	1,02
ESP.INTER 5-6	120	3,93	8,20	5,60	,99
ESP.INTER 6-7	121	3,98	8,90	5,83	1,02
ESP.INTER 7-1	115	2,18	8,60	5,84	1,05

Table 7: Average values, minimum and maximum range and standard deviation of the variables studied of the total sample in its lateral projection.

LATINC: Lateral projection of the lower edge of the cervical vertebra, LATSU: Lateral projection of the upper edge of the cervical vertebra, ESP.INTER: Intersomatic Space. ;

Source: Database taken from the thesis "Study of the dimensions of cervical interbody and cyst spaces and patients in the city of Valencia during March - August 2012."

said that the average age of the patients undergoing fusion was 51 years, 48% being men and 52% women. Unlike these authors, the sample of this research could not be matched, nor compared by sex and technique, due to the few patients with Rx; In addition, there were more women than men, members of it.

Kwon [7], evidenced a variety of anatomical parameters, through measurements of the transverse diameter of the vertebral body and the anteroposterior diameter (AP) in sagittal view; obtained as results of the diameter AP, in men 17 - 18 mm, with a

smaller one of 13 mm, and in women 15-16 mm, being the lowest, of 10 mm. Through different views, similar average figures were obtained in this research, both in women and men, highlighting that the lower average values are reflected in the lateral projection and are below those referred to above, similar to that shown by Hashimoto., *et al* [20].

Busscher., *et al.* [21], compared the anatomical dimensions of the spine in human and porcine corpses; these results are related to those obtained in this investigation; suggesting the specificity of the imagenology techniques already described.

The average value of the height of the intersomatic space in the sample studied is 5.60 mm, representing 62.8% according to the reference values used, coinciding with that indicated by Netter [14], when supporting that the size of the discs increases, as it goes down the spine, obtaining cervical values similar to those studied.

Regarding imaging techniques, it was shown that both studies provide data similar to the actual dimensions of the cervical spine. It is important to highlight the accuracy and quality of the image provided by MRI [7], but also the X-rays turns out to be a fast, economical and dynamic technique [22], these characteristics making them the gold standard for preoperative planning.

The surgical treatment of disc disease has been divided into two guidelines: arthroplasty, and cervical fusion [23], Cervical arthroplasty is based on the use of disc prostheses. For the purpose of this investigation, ProdisC-Nova®, PrestigeST®, MobiC® [8-16-17] were used as examples. The biomaterials used in its elaboration, are key to the viability of any disc implant 24 and in terms of its design, there is a standard average in its transverse diameter; However, according to their height and depth, these devices are greater than the values obtained in this study.

Ushold., *et al.* [25] established the prevalence of fusion technique over arthroplasty; since when placing an inadequate prosthesis there is an over-distraction of the intervertebral space, resulting in phase pain of the lateral joint masses, similar to the pain of its capsule; In addition, decrease in conjunction holes with tightness and involvement of nerve roots and axial pain.

In the fusion, intersomatic spacers known as cages are used, referring in this work to: PCB®, Fidji® although there are no impor-

tant morphometric differences with respect to other studies, it was found that the values of the boxes are greater than the data of this study. The dimensions of the prosthesis, although they have a standard average in their transverse diameter, are greater in height and depth. Additionally, the importance of the use of conventional X-rays and Magnetic Resonance Image in each patient is emphasized for the surgical planning and selection of the appropriate size of the instruments to be used and thus decrease the incidence of postoperative complications, associated with the use of implants.

Recommendations

It is urged, to continue conducting studies focused on determining the dimensions of the spine in general, in a representative sample of the country, in order to provide more reliable reference values; with the purpose of developing implants that adapt to the anatomical dimensions, improving the surgical and post-operative act. Similarly, it is recommended that research be carried out on cervical arthroplasty, which will guide its use as a surgical treatment of first choice in disco-articular diseases.

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