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Evaluation of the Therapeutic Effect of Calibrated Cervical Traction on Cervical Osteoarthritis

MeyaKiala Georges[1] , Nsitwayiwatadi Bertin[1] , NkakuduluBikuku H[1] ,Miangindula Betty[1], MbuyiMuamba Jean Mari[2] .
1 University of Kinshasa, Department of Physical and Rehabilitation Medicine, osteo-articular unit and musculoskeletal system.
2 University of Kinshasa, Department of internal Medicine, service of Rhumatology .
Corresponding Author: MeyaKiala Georges, Phd student on Physical and Rehabilitation Medicine; Head of Physiotherapyservice, University Hospital of Kinshasa. Mont Amba

Abstract:-
Background:- Cervicarthrosis is almost inevitable pathology with age. Men and women are affected. Calibrated cervical traction relieves pain and functional discomfort in cervicarthrosis patients. Objective: Contribute to the improvement of the rehabilitative management of cervicarthrosis patients and provide practitioners with a management protocol based on calibrated cervical traction.Methods and device: a descriptive and prospective study was conducted from January 2014 to March 2018. After the patient's examination, an inflammatory assessment and a radiological examination (radiography, CT scan or MRI) were necessary to diagnose cervicarthrosis and exclude inflammation. A rehabilitation session (massage) was performed to prepare patients for C.C.T. An appointment within 3 months was set after the series of therapeutic sessions for a second evaluation. Results: 44 patients (54%) , men and 37 (46%) women. The mean age was 56 ± 12.34 years; 29 patients (29.6%) were self-employed, 23 patients (28.4%) were doing clerical work. 79 patients (97.5%) had an X-ray and 68 patients (84%) had an inflammatory assessment before treatment. According to BMI, 36 patients (44%) were overweight. At the end of treatment, 78 patients (96.3%) no longer had pain. Conclusion: Calibrated cervical traction, in the management of common cervicarthrosis effectively relieves patients. The calibration of cervical traction devices is a way for effective and safe cervical traction, especially in developing countries, where electronic equipment fails sometimes. We recommend the use of references table of payloads for cervical traction, its use is easy and the protocol offers is feasible in all conditions everywhere.

Keywords:- *Calibrated, Cervical Osteoarthritis, University Hospital Of Kinshasa.*

I. INTRODUCTION

In its function of supporting and orientation of the head in space, the cervical spine is very rich in proprioceptive sensors, whose role is very important in the regulation of muscle tone and postural reflections. The radiographic abnormalities of this region are not always consistent with the clinic and more than 50% of patients with images of degenerative cervical lesions do not present with neck pain [(1).]

In China, cervicarthrosis is a common and common condition in middle-aged and advanced people. In recent years, more and more young people are affected by this pathology [(2)].The frequency of degenerative involvement of the cervical spine varies according to the level: C2 / C3: 25%, C3 / C4: 14%, C4 / C5: 25%, C5 / C6: 56%, C6 / C7: 44% (4%), [(3,4)]. Approximately eighteen percent of the general population suffers of joint neck pain (cervicalgia due to degenerative, deterioration or functional disorder of anatomical structures of the cervical region) [(6,7).]Cervicarthrosis myelopathy accounts for 55% of cervical myelopathies in adults. The condition is observed especially after 50 years, more often in men than in women, its frequency increases with age; it is one of the first causes of functional disability in the elderly [(8,9)].

Osteoarthritis is the most common form of arthritis and a leading cause of disability worldwide, largely due to pain, the primary symptom of the disease[(5)]. And that it has an economic impact both on productivity and on the cost of health. Its overwhelming frequency makes it a public health problem. Although it is one of the most frequent locations of spinal osteoarthritis, cervicarthrosis is still poorly understood: its causes, its natural history before and after treatment are mysterious. Increasing our knowledge of these three elements would allow us to better treat cervicarthrosis .

Some causes such as senescence are known, but have little interest in terms of public health. However, overweight, decreased estrogen, vertebral malformations, increased cervical lordosis, macrotrauma and repeated microtrauma are suspected as etiologic factors for cervicarthrosis[(5).]

➢ *Theoretical framework of the study:*

Cervical traction has been one of the rehabilitation techniques that relieve pain and functional discomfort in cervicarthrosis patients. On the other hand, in our environment, the lack of mastery of the technique and the insufficiency of the knowledge on the methods of calibration of the devices of cervical traction, the ratio weight and maximum load useful to realize the neuro-vertebral decompression expose the cervicarthrosis patients to consequences adverse effects that may aggravate the course of the disease. In addition, the ten percent of total weight considered as the maximum tensile load, showed its limitations.

Since the advent of a publication (Meya et al) [6] on the standardization of calibration methods for cervical traction devices, and the adaptation of a calibrated cervical traction device model to University Clinics of Kinshasa; a considerable improvement in the management of cervicarthrosis patients was observed.

Physiologic and side effects: Cervical traction is increasing space between the vertebrae. The theorized value of intervertebral separation is for normalizing morphology more specifically the disc's position and increasing the dimensions of the intervertebral foramen containing the spinal nerve root. Although generally safe, cervical traction may be accompanied by certain transient side-effects, including increased blood pressure, which may lead to vertigo. [15, 16]

The calibrated cervical traction device: are devices which, during cervical traction, offer the possibility of visualizing the mobilized forces in order to adapt them to the weight of the patient and according to his position at the start of the traction, horizontal in supine or vertical sitting position.

More, considering the high cost of traction equipment, it would be beneficial for patients and our entire community of establish in our sanitary structures the model of calibrated traction easy to adapt and less expensive.

II. PATIENTS AND METHODS

2.1. Type of Study

This descriptive and prospective clinical study is a therapeutic intervention by cervical traction with a calibrated cervical traction devise, on cervicarthrosis patients. It covers the period from January 2014 to March 2018 at the University hospital of Kinshasa, Department of Physical and Rehabilitation Medicine ; Osteo articular and musculoskeletal system Unit .

2.2. Inclusion criteria

Agree to participate to the study;
To be examined during the study period,
Have performed at least one imaging test (standard X-ray, computed tomography, MRI)
To be diagnosed with cervical osteoarthritis

2.3. Exclusion criteria

Patients who presented other cervical pathologies (tumor, traumatic, infectious) and those who refused to participate in the study.
Visual analog scale (VAS) was used to assess pain at the start and the end of the study.

2.4. Parameters of interest

Evolution of clinical manifestations, para clinical examination, radiological diagnosis, duration of traction, number of session.

2.5. Cervical traction parameters

Maximum load: This is adapted to the weight of the patient, its maximum equivalent to 10% of the body weight plus the weight of the head (6)
Minimum load:equivalent to twice the weight of the head.
The payload: that tolerated by the patient, it varies between the two extremes, maximum and minimum load.

2.6. Statistical analysis

Data were entered using a microcomputer with its Microsoft Windows and Excel 2013 software for counting. Excel and SPSS version 20.0 for Windows were used to process data. Absolute and relative values were represented by the tables and figures .The chi-square statistical test, at 0.05 significance level, was used to establish potential links between some quantitative and qualitative variables.

III. RESULTS

3.1. Clinical Signs and Para clinical assessments

All study patients (100%), had presented neck pain as a complaint. During the first evaluation: 52 patients (64.2%) had moderate pain , analog visual scale (VAS) : 4 to 6 and 29 patients (35, 8%) had severe pain (VAS : 7-10). The average VAS was 6 ± 1.2 with 4 and 8 as extreme; upper limb paresthesia and neck stiffness at 67.9%; the irradiation of the shoulder pains was the third cause of consultation with 49.4 % (table1). 97.5%, of patients had performed a standard x-ray, 84% achieved an inflammatory test. As diagnosis, 87.7% of patients had a vertebral pinch, 86.4% a osteophytes, and 74.1% a rectitude of cervical spine. The average load used during the application of the calibrated cervical traction was 13 ± 2.0 kg, with 8.0 and 18.0 kg as extremes (table 1,2,3).These inflammatory and imaging assessments were essential because any other etiologies were excluded apart from degenerative cervicarthrosis.

➢ *Paraclinical examinations*

Table 1 : Paraclinicalexaminations

Variables (n=81)	Effective	%
Inflammatoryassessment	68	84,0
Standard x-ray	79	97,5
Scanner	8	10
MRI	2	2,5

The majority of patients had performed a standard radiographic examination, ie 97.5%, followed by those who had performed an inflammatory assessment at 84%.

➢ *Imaging diagnosis*

Table 2 : Distribution of patients by imaging diagnosis

Variables (n= 81)	Effective	%
Osteophytes	70	86,4
Cervicarthrosismyelopathy	4	4,9
Disc pinching	71	87,7
Narrow cervical canal	20	24,7
Straightness cervical spine	60	74,1

The majority of patients 87.7% had vertebral pinching, followed by those with osteophytes at 86.4% and straightness of the cervical spine at 74.1%.

➢ *Clinical signs*

Table 3 Clinical evolution of all complaints.

Variables (n=81)	Evaluation 1 N(%)	Evaluation 2 N(%)	Khi-deux
Cervical pain	81(100,0)	3(3,7)	p=0,000
Paresthesia	55(67,9)	4(4,9)	p=0,000
Headache and dizziness	21(25,9)	2(2,5)	p=0,000
Stif nec	55(67,9)	5(6,2)	p=0,000
Hand tremulation	5(6,2)	0(0,0)	p=0,023
Iradiated pain	40(49,4)	2(2,5)	p=0,000
heaviness	23(28,4)	3(3,7)	p=0,000
Motorfailure	17(21,0)	3(3,7)	p=0,001
Tinnitus	1(1,2)	1(1,2)	p=1,000

There is a statistically significant relationship between the calibrated cervical traction and the clinical course of all patient complaints. Regarding .Only one patient (1.2%) who had presented the sign of tinnitus during the first evaluation.

3.2 Number of session, duration and useful load of cervical traction

The average number of sessions applied was 13 ± 6.1; with 1 and 27 as extremes, for an average duration of 14.6 ± 1.9 minutes, with 3 and 17 minutes as extremes. 5 patients (6.2%) discontinued traction due to headache during the session and 3 (3.7%) for discomfort. The traction load applied was moderate for 54.3% of patients (Tables 2A,2B).

➢ *Parameters of cervical traction*

Table 4A : Distribution of patients according number of session, duration and useful load of cervical traction.

N°	Weight	Head Weight	Minimum load In Kg	Useful load In Kg	maximum load In Kg	Number of session	Duration of cervical traction (in minutes)
1	55	4,5	8,9	10	11	18	15
2	70	5,7	11,3	13	15	21	15
3	70	5,7	11,3	13	14	20	15
4	79	6,4	12,8	14	15	20	15
5	104	8,4	16,8	17	19	5	10
6	70	5,7	11,3	12	13	10	15
7	65	5,3	10,5	10	12	10	15
8	80	6,5	13,0	13	14,5	19	15
9	78	6,3	12,6	14	14	12	16
10	87	7,0	14,1	15	16	10	15
11	60	4,9	9,7	12	11	17	15
12	60	4,9	9,7	10	11	5	15
13	80	6,5	13,0	13	14,5	21	15
14	70	5,7	11,3	12,5	13	1	10
15	85	6,9	13,8	14	15,4	19	15
16	63	5,1	10,2	11	11,4	3	15
17	70	5,7	11,3	12	13	12	15
18	72	5,8	11,7	12	13	19	16
19	65	5,3	10,5	12	12	19	15
20	70	5,7	11,3	12	13	18	15
21	65	5,3	10,5	10	12	20	15
22	94	7,6	15,2	16	17	6	15
23	70	5,7	11,3	12	13	2	10
24	49	4,0	7,9	8	9	27	15
25	50	4,1	8,1	8	9,1	4	15
26	80	6,5	13,0	12	14,5	3	10
27	65	5,3	10,5	12	12	20	15
28	87	7,0	14,1	15	16	4	15
29	111	9,0	18,0	18	20,1	12	15
30	70	5,7	11,3	12	13	8	15
31	76	6,2	12,3	12	14	18	15
32	91	7,4	14,7	14	16,5	5	15
33	70	5,7	11,3	13	13	19	15
34	66	5,3	10,7	11	12	7	17
35	90	7,3	14,6	15	16,3	1	10
36	70	5,7	11,3	12	13	2	3
37	70	5,7	11,3	13	13	17	15
38	60	4,9	9,7	10	11	14	15

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Table 4B : **Distribution of patients according number of session, duration and useful load of cervical traction.**

N°	**Body Weight**	**headweight**	**Minimum load**	**Usefullload**	**maximum load**	**number of sessions**	**duration (minutes)**
39	70	5,7	11,3	12	13	14	15
40	65	5,3	10,5	11	12	18	15
41	79	6,4	12,8	13	14,3	7	15
42	70	5,7	11,3	13	13	18	15
43	76	6,2	12,3	13	14	8	15
44	66	5,3	10,7	11	12	4	15
45	80	6,5	13,0	14	14,5	3	15
46	75	6,1	12,2	13	14	20	17
47	60	4,9	9,7	10	11	19	16
48	75	6,1	12,2	13	14	10	15
49	80	6,5	13,0	12	14,5	20	15
50	80	6,5	13,0	14	14,5	13	15
51	70	5,7	11,3	13	13	15	16
52	66	5,3	10,7	10	11	5	15
53	70	5,7	11,3	12	13	6	15
54	85	6,9	13,8	15	15,4	20	15
55	70	5,7	11,3	12	13	7	15
56	70	5,7	11,3	13	13	10	15
57	70	5,7	11,3	14	13	20	16
58	91	7,4	14,7	15	16,5	20	15
59	70	5,7	11,3	12	13	12	15
60	85	6,9	13,8	14	15,4	15	15
61	60	4,9	9,7	11	11	10	15
62	104	8,4	16,8	18	19	15	15
63	57	4,6	9,2	10	10,3	10	15
64	90	7,3	14,6	15	16,3	5	10
65	85	6,9	13,8	14	15,4	15	15
66	64	5,2	10,4	11	12	10	15
67	80	6,5	13,0	14	14,5	10	15
68	100	8,1	16,2	17	18,1	15	15
69	83	6,7	13,4	15	15	15	15
70	65	5,3	10,5	11	12	15	15
71	58	4,7	9,4	10	11	20	16
72	95	7,7	15,4	16,5	17,2	10	15
73	96	7,8	15,6	16	17,4	15	15
74	70	5,7	11,3	12	13	12	15
75	90	7,3	14,6	15	16,3	10	15
76	57	4,6	9,2	10	10,3	10	15
77	80	6,5	13,0	13,5	14,5	10	15
78	85	6,9	13,8	15	15,4	15	17
79	71	5,8	11,5	12	13	12	15
80	80	6,5	13,0	14	14,5	15	15
81	79	6,4	12,8	14	14,3	15	15

The average load used for cervical traction was 13 ± 2.0 kg with 8.0 and 18.0 kg as extreme loads. Overall, the average number of sessions was 13 ± 6.1; with 1 and 27 as extremes. The average time during the performance of each traction session was 14.6 ± 1.9 minutes; with 3 and 17 minutes as extremes.

3.3Evolution of pain

Of the 55 patients (67.9%) who had paresthesia at first assessment , only 4 patients (4.9%) still had paresthesia, calculated (X_2 = 0.000, P0.05). Cervical headache and dizziness in 21 patients (25.9%) , and to only 2 patients (2.5%) after. Calculated $X^2 = 0.000$, P<0.05. Heaviness of the upper limbs was present in 23 patients (28.4%) , for 3 patients after (3.7%) . Calculated $X^2 = 0.000$, P<0.05. The mean VAS after treatment was 0.9 ± 0.45 with 0 and 3 as extremes (tables 3,4).

Table 5: Distribution of patient by evolution of pain (visual analogical scale)

Variables(EVA) n=81	First evaluation		Second evaluation		Khi-deux
	Effectif	%	Effectif	%	
No pain	0	0,0	78	96,3	
Low pain (1to 3)	0	0,0	3	3,7	
Moderate pain (4 to 6)	52	64,2	0	0,0	
severe pain (7to10)	29	35,8	0	0,0	
Total	**81**	**100,0**	**81**	**100,0**	p=0,000

78 patients (or 96.3%) no longer had pain and were considered relieved. versus 3 patients (3.7%) who presented with mild pain. The mean Visual Analogical Scal after treatment was 0.9 ± 0.45 with 0 and 3 as extremes.

IV. DISCUSSION

In developing countries because of lacking electronic devices for cervical traction, the use of this technique requires a great deal of attention, with a view to preventing sometimes harmful consequences that result when inadequate loads have been used. The use of a reference chart of cervical traction loads is one way to prevent these complications. The present study allowed us to produce this table, easy to use, including the weight of the patient, and the play load limits. This research, based on the evaluation of the therapeutic effect of calibrated cervical traction, finally had a favorable outcome. The major findings are as follows:

4.1.Evolution of pain

As for the evolution of pain (table 5), the statistical significance threshold was estimated at 0.05; the value of X^2 calculated = 0.000 was significant. This reflects a statistically significant link between the application of calibrated cervical traction and the reduction of pain. In fact, at our first evaluation, 52 patients (64.2%) had moderate pain and 29 in-between (35.8%) had experienced severe pain. After the treatment, the trends were reversed: 78 patients (or 96.3%) no longer had pain, were considered to have found relief against 3 patients (or 3.7%) who had presented mild pain (table4). This result proves that the tensile force used was sufficient to release the compression at the base of the irritation which caused the pain. This gradually adjusted force is visualized by means of a dynamometer incorporated in the circuit and allows remaining within the limits of tolerated forces and efficient (Fig 1).

About the biomechanics of cervical traction, Viel, recommended following a long series of radiographic examinations of their subjects, a position at 35 ° from the horizontal as being that which provides the greatest possibility of elongation of the posterior portion of the intervertebral disc [(10)]. Another team, that of (Deets, Hands and Hopp,) obtained the best results with traction applied at an angle of 45 ° to the horizontal; they also indicate that the average intervertebral separation increases when the subject is lying on his back, and decreases when the subject is placed in a sitting position. This 45 ° angle was chosen because it becomes obvious in the light of worksuccessive radiographs, that the more the position in anteflection is increased, the better we can separate the vertebral bodies [(10).]

Bagheripour B et al (2016) found a significant decrease in pain intensity and disability after the application of cervical traction, with an average VAS of 6 ± 1.49 for the first group and 4 ± 1.83 for the second group [(15)].For our study only the two extreme positions were used, either vertical or horizontal depending on patient tolerance and the force used was displayed on the dynamometer, (Figue 1). We can therefore deduce that between the position of the patient and the load used the parameter which counts more is the force mobilized during the traction.As shown in the figure below

Figure 1: Calibrated cervical traction with dynamometer

In the study by CongcongCai and al, on the application of mechanical cervical traction, 47 patients out of 103 responded positively with significant reduction of pain [17] . The results observed in our study can be justified by the effectiveness of the traction force used, 15 kg on average, taking into account our protocol sufficiently adapted to the weight of the patients.

4.2 Clinical evolution of others complaints

Headache of cervical origin, dizziness ,neck stiffness, trembling in one or two members, radiation of shoulder, motor deficit in the hupper limbs,had statistically well evolved at the second evaluation at the end of treatment (table 3). In a study on the standardization of cervical traction devices in Kinshasa (2015), Meya et al claimed that the standardized cervical traction device was effective in relieving patients with cervical arthritis [6]. This is confirmed by Angela in her publication on the beneficial effects of cervical traction [18]

4.3Parameters of calibrated cervical traction

The maximum traction load was calculated according to the formula below:

Maximum tensile load Head Weight (8.1% of Total Body Weight) + 10% of Total Body Weight.

The payload: it is that which is adapted to the weight of the patient and tolerated during a session of cervical traction. This load is gradually increased and reaches its maximum equivalent to 10% of the body weight plus the weight of the head (load of head+10% of body weight). For example: in a patient weighing 80 kg, his head weighs is (80 × 8.1 / 100 = 6.48kg) and the 10% of his body weight = (80kg .10 / 100 = 8kg) . The payload will then be: 6.48kg + 8kg = 14.48kg (6)

The results of the present study allowed us to develop a protocol below (table 6), as additional information to this study.

Table 6: Reference table of calibrated cervical traction loads, depending on patient body weight, ranging from 30 to 100 kg, the payload varying between two extremes, depending on the patient's tolerance.

Patients weight	Head weight	Minimum payload	Maximum payload	Patients weight	Head weight	Minimumpaylopad	Maximum payload
30	2,43	5,43	6	66	5,346	11,946	13,2
31	2,511	5,611	6,2	67	5,427	12,127	13,4
32	2,592	5,792	6,4	68	5,508	12,308	13,6
33	2,673	5,973	6,6	69	5,589	12,489	13,8
34	2,754	6,154	6,8	70	5,67	12,67	14
35	2,835	6,335	7	71	5,751	12,851	14,2
36	2,916	6,516	7,2	72	5,832	13,032	14,4
37	2,997	6,697	7,4	73	5,913	13,213	14,6
38	3,078	6,878	7,6	74	5,994	13,394	14,8
39	3,159	7,059	7,8	75	6,075	13,575	15
40	3,24	7,24	8	76	6,156	13,756	15,2
41	3,321	7,421	8,2	77	6,237	13,937	15,4
42	3,402	7,602	8,4	78	6,318	14,118	15,6
43	3,483	7,783	8,6	79	6,399	14,299	15,8
44	3,564	7,964	8,8	80	6,48	14,48	16
45	3,645	8,145	9	81	6,561	14,661	16,2
46	3,726	8,326	9,2	82	6,642	14,842	16,4
47	3,807	8,507	9,4	83	6,723	15,023	16,6
48	3,888	8,688	9,6	84	6,804	15,204	16,8
49	3,969	8,869	9,8	85	6,885	15,385	17
50	4,05	9,05	10	86	6,966	15,566	17,2
51	4,131	9,231	10,2	87	7,047	15,747	17,4
52	4,212	9,412	10,4	88	7,128	15,928	17,6
53	4,293	9,593	10,6	89	7,209	16,109	17,8
54	4,374	9,774	10,8	90	7,29	16,29	18
55	4,455	9,955	11	91	7,371	16,471	18,2
56	4,536	10,136	11,2	92	7,452	16,652	18,4
57	4,617	10,317	11,4	93	7,533	16,833	18,6
58	4,698	10,498	11,6	94	7,614	17,014	18,8

59	4,779	10,679	11,8	95	7,695	17,195	19
60	4,86	10,86	12	96	7,776	17,376	19,2
61	4,941	11,041	12,2	97	7,857	17,557	19,4
62	5,022	11,222	12,4	98	7,938	17,738	19,6
63	5,103	11,403	12,6	99	8,019	17,919	19,8
64	5,184	11,584	12,8	100	8,1	18,1	20
65	5,265	11,765	13				

V. STUDY LIMITATIONS

Indeed our study has some limitations; the most important is the absence of a comparative study proving the superiority of our method. But this weakness does not reduce the effectiveness of our study, because the rate of relief observed is largely significant.

VI. CONCLUSIONS

The calibration of cervical traction devices is a way for effective and safe cervical traction, especially in developing countries, where electronic equipment fails sometimes. We recommend the use of references table of payloads for cervical traction, its use is easy and the protocol offers is feasible in all conditions everywhere.

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