Original Article

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Impact of chronic pain and depressive symptoms on the quality of life of adults with Chiari Malformation type I: A comparative study

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SUMMARY Chiari Malformation type I (CM-I) is a neurological disorder characterized by cerebellar tonsillar herniation. Chronic pain, particularly headaches, is a prevalent symptom in CM-I patients, significantly impacting their quality of life. The objective of this study was to evaluate the perceived quality of life in adults with CM-I and examine the influence of chronic pain and comorbid symptoms on their well-being. 26 CM-I patients (8 with decompressive surgery) and 26 matched healthy controls were recruited. Participants completed the following questionnaires: WHOQOL-BREF, HDI, NDI, OLBPDQ and HADS. CM-I patients exhibited significantly lower scores across all domains of quality of life when compared to healthy controls. Chronic pain, including headache, neck pain, and low back pain, was more pronounced among CM-I patients and demonstrated a significant correlation with depressive symptoms. Notably, after controlling for chronic pain, the differences in quality of life between CM-I patients and controls diminished. The results suggest that chronic pain, especially headaches, and comorbid depressive symptoms exert a substantial impact on the quality of life of CM-I patients. Surgical intervention alone may not fully address these issues, highlighting the importance of considering psychological interventions as part of the comprehensive treatment. Further research with larger samples and pre-post-surgery assessments is needed to validate these findings and explore the potential benefits of psychological therapies in enhancing the quality of life for CM-I patients.

Keywords Chiari Malformation type I, chronic pain, quality of life, psychological symptoms

1. Introduction

Chiari Malformation type I (CM-I) is a rare neurological disorder characterized by a downward herniation of the cerebellar tonsils (> 3-5mm) through the foramen magnum into the spinal canal (*1*). The current prevalence rate is uncertain due to the lack of appropriate data as well as the wide disparity of analysis and results among different studies (*2*). Tonsillar ectopia is the most characteristic sign of CM-I, which leads to posterior cranial fossa crowdedness (*3,4*). The hindbrain compression may explain the majority of signs and symptoms, among which headache and neck pain are the most frequently reported by CM-I patients (*5,6*). However, there is a remarkable heterogeneity in the clinical expression of the disease, from asymptomatic patients to cases with a variety of systems affected, including auditory, vestibular, visual, oropharyngeal, gastrointestinal and sleep disorders (*6*).

Meeker *et al.* (*7*) analyzed the impact that CM had on daily activities, suggesting high rates of vulnerability even when minimal symptoms were reported. Although pain is the most frequent complaint, CM-I can also present neurocognitive (*8*) and psychological symptoms (*9*). Considering cognitive deficits, attention, executive functioning and visuospatial abilities appeared to be the most affected domains (*10*). Regarding psychiatric morbidity, anxiety and depression were the most outstanding disorders reported by CM-I patients (*11,12*).

The adverse impact which the set of symptoms has on CM-I patients leads to a lower quality of life and a significant decrease in their general well-being (*9,7,13*).

Mestres *et al.* (*14*) analyzed the perceived quality of life in a cohort of 67 CM-I patients noting that the impact of this malformation was mild in the 53.7%, moderate in 25.4%, severe in 11.9% and the 9% of participants indicated no effect on their lives. Moreover, these authors reported high rates of anxiety (86.6%) and depressive symptoms (25.4%). These figures reveal the importance of considering together the physical, psycho-emotional and social consequences of CM-I. Although there is scarce literature that assesses globally these aspects, the vast majority analyzed the effect of surgical procedures on the quality of life, suggesting a positive outcome for patients who underwent surgery (*15,16*). Considering the effect of pre-surgical conditions, Mueller and Oro' (*15*) recruited 112 patients and stated that having syringomyelia and the level of tonsillar descent did not correlate with self-perceived quality of life, which was assessed using the Sickness Impact Profile (SIP). In a more recent study, Almotairi *et al.* (*17*) reported similar conclusions. These authors also found a significant improvement after decompressive surgery in 11 patients when EQ-ED-5L measurements were compared, while the Life Satisfaction (LiSat-11) questionnaire did not report any differences before and after surgery (*17*). Overall, the existing literature that compares pre and post-surgical status suggests a positive outcome for CM-I patients on their quality of life, however, generalizability is limited due to the variability in the procedures and assessments.

According to previous works, chronic pain is the most limiting symptom reported by CM-I patients, which contributes greatly to a decrease in their quality of life. A recent study conducted by Garcia (*18*) provided preliminary evidence supporting the Acceptance and Commitment Therapy (ACT) as a valid intervention to treat this clinical symptomatology. To our knowledge, after an extensive literature search through databases (PubMed, Scopus and Web of Science) using different combinations between CM-I and psychological therapy keywords, this is the only study that addresses this symptomatology with psychological interventions for CM-I patients, although it did not demonstrate sufficient effectiveness for all target symptoms.

There is a remarkable lack of scientific research focused on chronic pain and its effect on quality of life in CM-I patients. The aim of this study is to analyze the perceived quality of life in a sample of CM-I adult patients and the impact of pain and comorbid symptoms. Further efforts are necessary to identify key symptoms in order to find and develop effective treatments.

2. Patients and Methods

2.1. Participants

Twenty-six patients diagnosed with CM-I were recruited from the Neurology Service of the Marqués de Valdecilla University Hospital and the Chiari and Syringomyelia Association of the Principality of Asturias. Twenty-six gender-, age- and education-matched healthy controls participated in the study. The inclusion criteria were as follows: *i*) available diagnosis of CM-I, *ii*) at least 12 months after surgery (if applicable), *iii*) age ≥ 18, *iv*) Spanish as the primary language (only *iii* and *iv* were applied to the control group). Exclusion criteria included: *i*) any other neurological, psychological or psychiatric diagnosis not secondary to CM-I, *ii*) illiteracy, *iii*) non-compensated sensory deficits. Sociodemographic data and clinical features are presented in Table 1.

2.2. Instruments

Sociodemographic and clinical data were collected through a brief interview with each participant. After collecting them, the following questionnaires were administered to assess physical and psychosocial status using the adapted version for Spanish population.

WHOQOL-BREF (*19*): this questionnaire is the World Health Organization's quality of life short version scale. It consists of 24 items that evaluate four domains including: physical, psychological, social relationships and environmental, in addition to two more items that measure the individual's overall perception of quality of life and their health.

Hospital Anxiety and Depression Scale (HADS) (*20*): this instrument is used to evaluate anxious-depressive symptomatology in clinical populations. It contains 14 items, divided into two subscales, evaluating anxiety and depression respectively.

Headache Disability Inventory (HDI) (*21*): this questionnaire measures the individual's perception of the impact of headache on daily living. It consists of 25 items.

Neck Disability Index (NDI) (*22*): this scale consists of 10 items. It is used to evaluate self-perception of the effect that cervical pain has on daily activities.

Oswestry Low Back Pain Disability Questionnaire (OLBPDQ) (*23*): this questionnaire evaluates the individual's perception of the impact that lumbar pain has on daily activities.

2.3. Procedure

CM-I patients were recruited from the Neurology Service at the Marqués de Valdecilla University Hospital and the Chiari and Syringomyelia Association of the Principality of Asturias. Healthy controls were recruited among adult volunteers. Those who met the inclusion criteria were called to be assessed. All participants completed the informed consent document before their enrolment. Each session was individual and lasted around 45 minutes. Both clinical group and control group were administered the test protocol similarly by a trained researcher.

The study was approved by the Ethics Committee of the University of Deusto (ETK-20/17-18) and it was conducted according to the guidelines of the Declaration of Helsinki.

2.4. Data analyses

Statistical analyses were run with the Statistical Package for Social Sciences (SPSS) 28.0. Means and frequencies were obtained for sociodemographic data and clinical features. For comparisons between clinical and control group, raw scores were converted into *z* scores. To analyze differences between clinical and control group, *Chi*-square and Mann-Whitney *U* tests were used. For multiple comparisons, Kruskal-Wallis test was used together with the Bonferroni test as *post hoc* analysis. Multivariate analysis of covariance (MANCOVA) was used to control for the effect of chronic pain on psychosocial variables. Effect sizes were calculated based on Kramer's *V* or eta squared (η^2), as appropiate. Correlations were performed using Spearman's *Rho* statistic. Statistical level of significance was established at $p < 0.05$.

3. Results

CM-I patients and healthy controls were gender-, age-, and education-matched ($p > 0.05$). Sociodemographic information and clinical features of clinical group are shown in Table 1. It should be noted the high comorbidity with other diagnosis, especially with syringomyelia and scoliosis, along with the age of onset, which is around the third decade, similar to what literature reports. Likewise, it is worrying the average delay to get the diagnosis, which is around five years.

3.1. Effect of underlying symptomatology

The comparison between decompressed and non-decompressed CM-I patients about their clinical symptomatology is presented in Figure 1. Participants were asked about the occurrence of symptoms and their frequency (low or high). As it can be observed, a general overview revealed higher percentages of symptomatology in patients who had undergone posterior fossa decompression (PFD), except for headache, dizziness and visual disturbances. However, statistically significant differences were only found for upper limbs pain ($\chi^2 = 7.22$, $p = 0.007$, $V = 0.527$), lower limbs pain ($\chi^2 = 3.87$, $p = 0.049$, $V = 0.386$), instability ($\chi^2 = 7.22$, $p = 0.007$, $V = 0.527$), auditory disturbances ($\chi^2 = 4.26$, $p = 0.039$, $V = 0.405$), and oropharyngeal difficulties ($\chi^2 = 3.97$, $p = 0.046$, $V = 0.391$), where non-decompressed patients indicated lower occurrence. No differences

Table 1. Sociodemographic and clinical features of the sample

Variables	CM-I patients		Control group	$\chi2/U$	*p*
	PFD	Non-PFD			
	n (%) / M (SD)		*n* (%) / M (SD)		
SOCIODEMOGRAPHIC DATA					
N	8 (30.8%)	18 (69.2%)	26 (100%)		
Gender				0	1
Female	7 (87.5%)	15 (83.3%)	22 (84.6%)		
Male	1 (12.5%)	3 (16.7%)	4 (15.4%)		
Age	54.38 (9.74)	43.94 (15.47)	46.42 (13.53)	317.5	0.707
Years of education	13.88 (2.1)	13.33 (3.1)	14.62 (2.73)	247.0	0.090
CLINICAL FEATURES					
Age at diagnosis (y)	41.88 (13.54)	34.22 (12.65)			
Age of onset (y)	36.13 (14.44)	29.22 (14.72)			
Diagnosis delay (y)	5.75 (11.73)	5.0 (6.28)			
Disease duration (y)	12.50 (8.14)	10.06 (8.34)			
Tonsillar ectopia (mm)	7.13 (1.55)	7.94 (4.52)			
Time elapsed from surgery (mo)	88.13 (56.80)	-			
COMORBIDITY					
Syringomyelia	6 (75%)	1 (5.6%)			
Hydrocephalus	-	2 (11.1%)			
Basilar impression	-	1 (5.6%)			
Platybasia	-	1 (5.6%)			
Scoliosis	5 (62.5%)	9 (50%)			
Other cranial malformations	-	1 (5.6%)			

PFD: posterior fossa decompression. *Note:* The information shown in this table has been reported by Chiari patients.

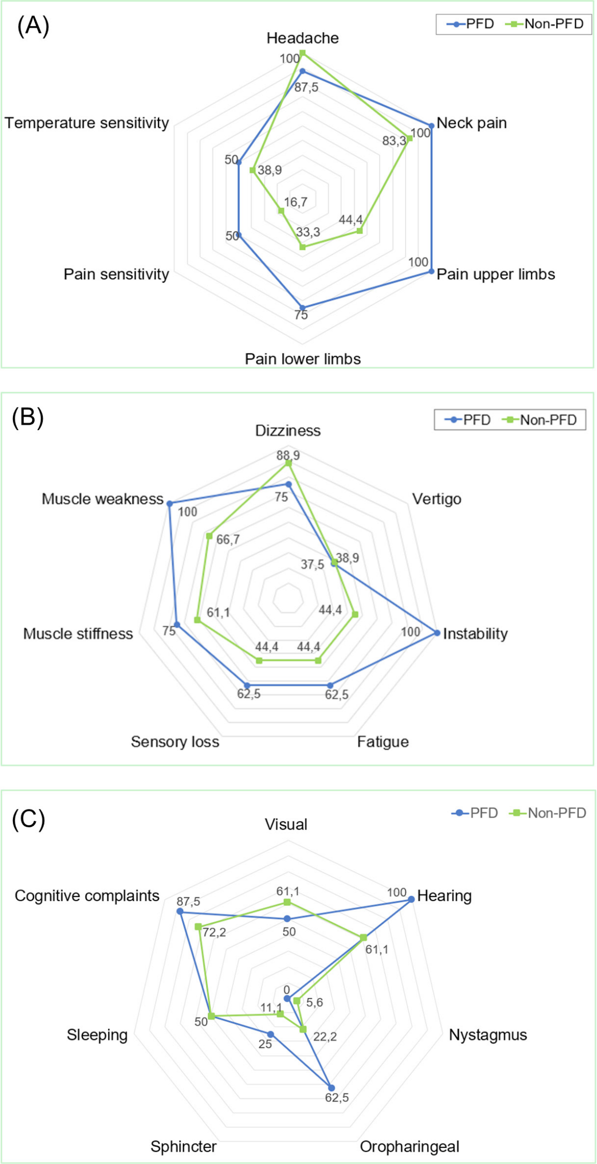

Figure 1. Clinical features of CM-I patients. (A), Pain and sensitivity. **(B)**, Muscie and vestibular symptoms. **(C)**, Other systems.

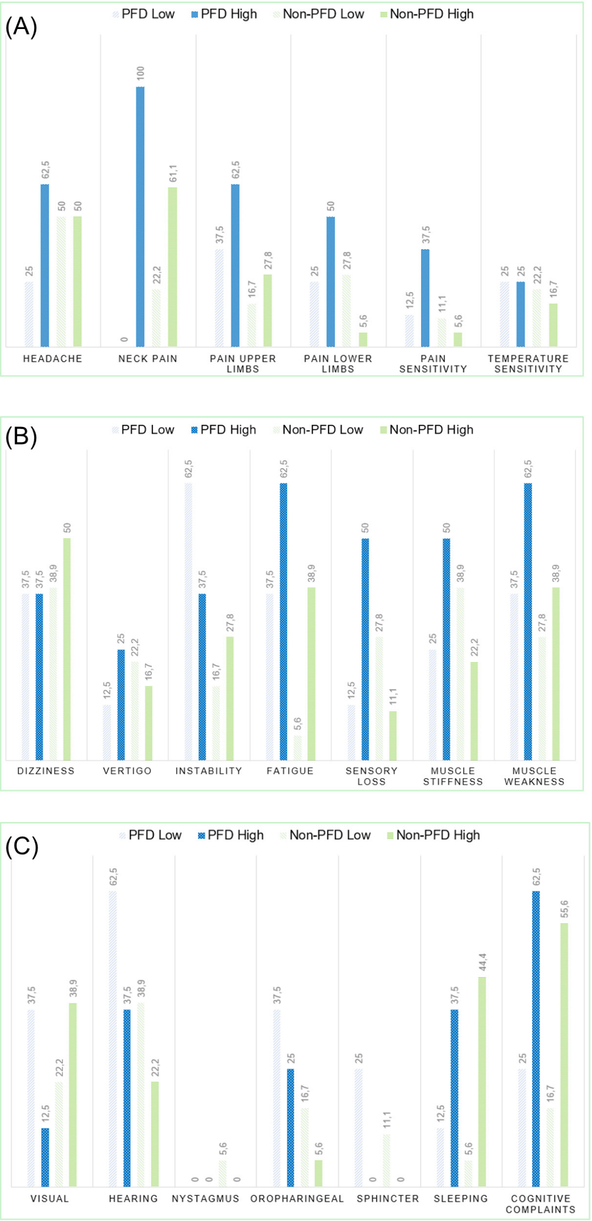

Figure 2. Frequency of clinical symptoms in CM-I patients. (A), Pain and sensitivity. **(B)**, Muscular and vestibular. **(C)**, Other systems.

were found when frequency of appearance was analyzed between both groups ($p > 0.05$) (Figure 2).

3.2. Effect of chronic pain

To analyze differences between clinical and control group in their physical and psychosocial status, Kruskal-Wallis statistic was run. Results are detailed in Table 2. CM-I patients showed statistically significant worse scores in quality of life than healthy controls in physical, psychological, social relationships and environmental domain, as well as in anxious-depressive symptomatology ($p < 0.01$). When chronic pain-related tests were analyzed, CM-I patients also showed statistically significant worse status compared to control group ($p < 0.001$). Moreover, the effect sizes were high ($\eta^2 > 0.14$). The *post hoc* analysis revealed results for multiple comparisons (Table 3). When clinical group was compared to healthy controls, undergoing patients showed poorer perceived quality of life and worse psychopathological status except for psychological domain and anxious symptomatology, respectively. Non-operated patients did not differ from controls in social relationships domain ($p = 0.341$), individual's overall perception of quality of life ($p = 0.064$) and depressive symptomatology ($p = 0.060$). Comparison between decompressed and non-decompressed CM-I patients showed no differences in quality of life nor pain-related measures ($p > 0.05$). According to these results, it can be observed that chronic pain has a significant impact

Table 2. Physical and psycho-emotional status of the sample

Status	CM-I patients		Control group	H	p	Effect size $\eta 2$
	PFD	Non-PFD				
	M (SD) [a]		M (SD)			
Quality of life (WHOQOL-BREF)						
Physical domain	43.75 (12.63)	52.78 (16.37)	78.43 (13.03)	26.50	< 0.001	0.51
Psychological domain	54.69 (17.46)	51.16 (16.47)	68.59 (16.17)	12.19	0.002	0.23
Social relationships domain	46.88 (26.33)	62.50 (16.97)	69.23 (11.25)	9.85	0.007	0.19
Environment domain	58.20 (13.87)	60.07 (11.72)	72.12 (11.12)	11.59	0.003	0.22
Individual's overall perception of QoL	46.88 (16.02)	54.17 (23.09)	69.23 (20.38)	8.97	0.011	0.17
Individual's overall perception of health	34.38 (22.90)	40.28 (22.91)	63.46 (25.72)	11.70	0.003	0.23
Psychopathological status						
HADS-Anxiety	9.63 (4.72)	11.33 (4.86)	7.08 (3.53)	9.32	0.009	0.18
HADS-Depression	7.75 (3.50)	5.61 (3.87)	3.04 (3.12)	12.04	0.002	0.23
HADS-Total score	17.38 (7.58)	16.94 (8.45)	10.12 (6.33)	11.76	0.003	0.23
Physical status						
HDI-Functional	24.0 (14.62)	25.72 (12.06)	0.08 (0.40)	43.10	< 0.001	0.83
HDI-Emotional	16.5 (14.80)	22.56 (13.42)	0.00 (0.00)	39.10	< 0.001	0.75
HDI-Total score	40.5 (29.04)	48.28 (24.60)	0.08 (0.40)	43.21	< 0.001	0.83
NDI	23.88 (7.92)	14.11 (7.90)	1.65 (2.86)	37.05	< 0.001	0.71
OLBPDQ	17.13 (6.00)	8.72 (6.14)	2.85 (6.71)	25.44	< 0.001	0.49

H: Kruskal-Wallis test; HADS: Hospital Anxiety and Depression Scale; HDI: Headache Disability Index; η^2: eta squared; NDI: Neck Disability Index; OLBPDQ: Oswestry Low Back Pain Disability Questionnaire; PFD: Posterior Fossa Decompression; WHOQOL-BREF: World Health Organization's Quality of Life short version scale. [a] Data are shown in raw scores.

Table 3. Post hoc results of physical and psycho-emotional status between clinical and control group (Bonferroni test)

Status	PFD *vs.* Controls		Non-PFD *vs.* Controls		PFD *vs.* Non-PFD	
	M (SD)	p	M (SD)	p	M (SD)	p
Quality of life (WHOQOL-BREF)						
Physical domain	-25.53 (6.11)	0.000	-19.26 (4.64)	0.000	-6.27 (6.42)	0.987
Psychological domain	-12.96 (6.10)	0.101	-15.24 (4.63)	0.003	2.29 (6.41)	1.000
Social relationships domain	-18.55 (6.05)	0.006	-7.25 (4.59)	0.341	-11.30 (6.36)	0.227
Environment domain	-15.24 (6.11)	0.038	-13.78 (4.63)	0.009	-1.46 (6.42)	1.000
Individual's overall perception of QoL	-14.61 (5.76)	0.034	-10.06 (4.37)	0.064	-4.54 (6.06)	1.000
Individual's overall perception of health	-16.03 (5.91)	0.020	-12.65 (4.48)	0.014	-3.38 (6.21)	1.000
Psychopathological status						
HADS-Anxiety	8.86 (6.10)	0.439	13.90 (4.63)	0.008	-5.04 (6.41)	1.000
HADS-Depression	19.32 (6.09)	0.005	10.75 (4.62)	0.060	8.57 (6.41)	0.543
HADS-Total score	16.26 (6.12)	0.024	13.39 (4.64)	0.012	2.88 (6.43)	1.000
Physical status						
HDI-Functional	25.12 (5.78)	0.000	26.39 (4.38)	0.000	-1.26 (6.07)	1.000
HDI-Emotional	21.31 (5.63)	0.000	25.19 (4.27)	0.000	-3.88 (5.91)	1.000
HDI-Total score	24.38 (5.78)	0.000	26.72 (4.38)	0.000	-2.35 (6.07)	1.000
NDI	30.89 (6.05)	0.000	21.71 (4.59)	0.000	9.18 (6.36)	0.446
OLBPDQ	27.14 (5.95)	0.000	15.61 (4.51)	0.002	11.54 (6.25)	0.195

HADS: Hospital Anxiety and Depression Scale; HDI: Headache Disability Index; η^2: eta squared; NDI: Neck Disability Index; OLBPDQ: Oswestry Low Back Pain Disability Questionnaire; PFD: Posterior Fossa Decompression; WHOQOL-BREF: World Health Organization's Quality of Life short version scale. *Note:* Data are shown in raw scores.

on daily living for CM-I patients, and therefore, it could be a negative factor to their quality of life. Therefore, a MANCOVA analysis was run considering HDI, NDI and OLBPDQ total scores as covariates. After controlling for the effect of chronic pain, the differences between CM-I patients and healthy controls were eliminated for physical domain (F = 0.367, p = 0.548), psychological domain (F = 2.245, p = 0.141), social relationships domain (F = 0.242, p = 0.0625), environmental domain (F = 0.219, p = 0.642), individual's perception of quality of life (F = 0.700, p = 0.407), and individual's perception of their health (F = 0.247, p = 0.622).

Correlation analyses were also performed to study the association between physical and psychosocial measures. The *HDI score* showed a significant correlation with the HADS's anxiety (*Rho* = 0.598, p = 0.001), depression (*Rho* = 0.571, p = 0.002), and total score (*Rho* = 0.680, p < 0.001), physical domain (*Rho* = -0.553, p = 0.003), psychological domain (*Rho* = -0.800, p < 0.001), environmental domain (*Rho* = -0.494, p = 0.010), individual's perception of quality of life (*Rho* = -0.430, p = 0.028), and perception of their health (*Rho* = -0.396, p = 0.045). No correlation was found between the HDI score and social relationships domain (*Rho* = -0.293, p = 0.146). The *NDI score* showed significant correlation with HADS's depression score (*Rho* = 0.427, p = 0.030), physical domain (*Rho* = -0.657, p < 0.001), social relationships domain (*Rho* = -0.403, p = 0.041), individual's perception of quality of life (*Rho* = -0.405, p = 0.040), and perception of their health (*Rho* = -0.617, p < 0.001). No correlation was found between the NDI score and the HADS's anxiety (*Rho* = 0.154, p = 0.452) and total score (*Rho* = 0.337, p = 0.092), psychological domain (*Rho* = -0.285, p = 0.158), and environmental domain (*Rho* = -0.361, p = 0.070). The *OLBPDQ score* showed significant correlation with HADS's depression score (*Rho* = 0.503, p = 0.009), physical domain (*Rho* = -0.641, p < 0.001), social relationships domain (*Rho* = -0.574, p = 0.002), environmental domain (*Rho* = -0.444, p = 0.023), individual's perception of quality of life (*Rho* = -0.504, p = 0.009), and perception of their health (*Rho* = -0.640, p < 0.001). No correlation was found between the OLBPDQ score and the HADS's anxiety (*Rho* = 0.149, p = 0.468) and total score (*Rho* = 0.375, p = 0.059), and psychological domain (*Rho* = -0.297, p = 0.140).

As it can be observed, the HADS's depression score showed significant correlation with all pain-related measures, including headache, neck and low back pain. Likewise, HDI, NDI and OLBPDQ total scores showed negative significant correlations with physical domain, individual's perception of quality of life and individual's perception of their health. The largest correlation was between HDI score and psychological domain.

3.3. Effect of demographic variables

Considering the associations between sociodemographic and clinical data, only age at diagnosis showed a significant correlation with HADS's anxiety score (*Rho* = -0.426, p = 0.030). No significant correlations were found between tonsillar ectopia and chronic pain or quality of life-related measures (p > 0.05).

4. Discussion

In this study, the quality of life, level of chronic pain, and psychopathological status of 26 patients with CM-I (of whom eight underwent decompressive surgery) were evaluated and compared with 26 gender, age, and education-matched healthy controls. Clinical group showed lower scores than control group in all domains of their perceived quality of life, including physical, psychological, social relationships and environmental (p < 0.001). Likewise, CM-I patients showed higher scores in disability caused by chronic pain, such as headache, neck pain and low back pain (p < 0.001). The comparison between both surgical status (decompressed and non-decompressed) showed no differences in their physical and psychosocial profile. However, when chronic pain was controlled for, the differences between both groups in quality of life-related measures were eliminated. Patients also reported higher scores in anxious-depressive symptomatology, but only depression showed a significant correlation with all pain-related measures, while anxiety and the HADS's total score correlated with headache, but not with neck and low back pain.

The term "quality of life" refers to the physical, psychological, and social domains of health (*24*). On the one hand, the relationship between chronic pain and quality of life is close and multifactorial (*25*), having a negative impact on overall health and psychological well-being (*26*). To our knowledge, there is scarce literature that has examined quality of life in CM-I patients, taking into consideration the negative effect that chronic pain has on daily living, perhaps due to the asymptomatic nature of the disease in some individuals (*27,28*). In cases where patients experience pain, headaches are the most common manifestation, and sometimes the only one (*29*). Therefore, pain management in CM-I patients is crucial as it may largely determine the perceived quality of life. On the other hand, the present study also supports the well-established comorbidity between chronic pain and affective symptoms (*30*), which may affect the perception of pain itself. Depressive disorders are common among patients with chronic pain, resulting in a substantial disease burden and a barrier to effective pain relief (*31*), which can also amplify the experience and perception of pain (*32,33*). Historically, the relationship between depression and pain has been a significant area of study in the health field, being two main reasons to address this relationship in CM-I patients. First, around 45% of patients exhibit depressive symptoms (*11*). Second, increased pain is related to higher levels of depression (*34,35*), forming a negative feedback which affects quality of life.

Considering our findings, a recent work has also suggested high levels of disability in adult patients, identifying chronic pain and depression as significant factors, regardless of surgical status (*36*). Our results are in accordance with Labuda *et al.*'s (*36*) study because depressive symptomatology is the only variable that showed significant correlations with chronic pain-related measures. Another recent work published by Balasa *et al.* (*13*) also suggested a strong relationship between depression and pain in CM-I adults, leading to worse quality of life. Moreover, previous literature supported these findings, stating that chronic pain could be a key factor for negative assessment of the CM disease impact (*7,9*). There seems to be a consensus in the accumulated evidence regarding the identification of chronic pain and affective disorders as remarkable factors influencing quality of life in CM-I patients.

Taking into account the research to date, one of the main focus has been the study of the reported outcomes after undergoing surgical procedures (*15,16,37,38*). The most referred intervention is the PFD, which consists in a suboccipital craniectomy. Generally, pain-related symptoms constitute the primary motivation for undergoing surgery, making symptom-related quality of life a key outcome measure for effectiveness studies (*39*). Perhaps, the lack of differences found in our study between non-decompressed patients and controls in social domain, overall perception of quality of life and depressive symptomatology could be related with that fact. The baseline status of non-operated patients is more optimal or have minor comorbid conditions such as syringomyelia than those requiring surgery, and therefore more similar from healthy controls. However, this is an idea which needs further research because pre-post analyses were not conducted. This is an important aspect of clinical management since it has been noted that headaches range between 50% (*40,41*) and 81% of cases (*42*). In general, this type of surgery has shown positive results, but there is scarce literature considering patients' follow-ups done appropriately (*15,17*). Similarly, the procedure is not without controversy, as symptoms sometimes persist along with medical complications (*43,44*). Therefore, it is important to individualize treatments and select the most appropriate procedure for each patient according to their symptomatology (*16,45*). Moreover, as it has been aforementioned and also found in our study, when decompressed and non-decompressed patients are compared on their perceived quality of life and reported symptomatology, similar results have been found, probably related to the chronicity of the disease, regardless of the therapeutic alternatives (*11,13*). This is particularly worrying and shows that surgical intervention alone is not fully effective, therefore, further studies should consider complementing treatments with other approaches such as psychological therapies.

Exclusive biomedical approach for the burden of living with pain is often criticized for its weakness to account for psychosocial variables. In fact, the psychosocial health of the patient has been somewhat overlooked, perhaps with the expectation that reducing pain would lead to improve mental health and subsequently, the quality of life. However, chronic pain is both a psychosocial and physiological problem: anxiety, depression, insomnia, loss of financial independence, disability, and family instability are closely associated with long-term pain (*46*). Our results support this statement, pointing to the chronic pain as the primary mediator of altered quality of life in these patients, but without underestimating the influence of affective disorders.

Often, when no clear neurological deficits are present, individuals with CM-I are labeled as depressed or considered to be suffering from psychosomatic symptoms. Additionally, a significant portion of these patients are initially diagnosed with fibromyalgia, chronic fatigue, or anxious-depressive disorders, which slows and complicates the process of establishing a clear diagnosis of the CM-I. Among general medical conditions, psychiatric comorbidity has been associated with reduced physical functioning and quality of life. To that, it may be added the possible concurrence of mood disorders after brain surgery (*47*), however, in our study no differences were observed comparing both surgical status regarding affective variables. In addition to surgical treatments, psychological therapy has shown some beneficial effects on chronic pain in different conditions (*48,49*). Some of the most widely studied therapies are cognitive-behavioral therapy (CBT), Acceptance and Commitment Therapy (ACT), and Pain Management Programs. All the previously mentioned therapeutic approaches have demonstrated efficacy in the treatment of chronic pain and have the common goal of reducing the influence of pain on daily life, improving the quality of life (*50*). In the case of CM-I, an online intervention based on ACT has shown preliminary evidence for improvement in mental flexibility, pain acceptance and willingness and activity engagement, but still without enough impact on sleep disturbances, anxious-depressive symptoms and pain interference (*18*). Therefore, future studies addressing psychological treatment for pain management in patients with CM-I, such as CBT-based programs, can take into consideration these findings for other pathologies and try to study the potential benefits of these therapies among Chiari-type diseases.

Our study has notable limitations. First of all, sample size is small and not equally distributed between both surgical status (decompressed and non-decompressed patients), which reduces the representativeness and validity of the results. Moreover, quality of life has been measured with a general instrument (WHOQoL-BREF) and is not specifically designed for CM-I population. This aspect does not allow to identify specific symptomatology or features related to CM diagnosis appropriately. Another important limitation in our study is the lack of comparative measures before and after surgical intervention, which should be managed in further research. Likewise, there is a lack of information about decompression details from medical records, because the recruited data were obtained from patients' interviews. All these limitations should be addressed in future studies, considering pre-post-surgery comprehensive assessments that include physical, psychological and psychosocial measures.

5. Conclusion

In sum, this study delves into the components of quality of life in individuals with CM-I and the significant role that chronic pain plays on their life. Pain seems to be the factor that explains the differences in quality of life reported between CM-I patients and healthy population. Furthermore, this study found no differences in pain or quality of life measures between operated and non-operated patients. With that in mind, future studies should investigate whether systematic approaches to pain, such as those based on psychological therapies, can significantly improve the quality of life of patients.

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