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ORIGINAL ARTICLE

Evaluation and follow-up in functionality in patients with Pediatric Multisystem Inflammatory Syndrome associated with COVID-19 (MIS-C)

Evaluación y seguimiento de funcionalidad en pacientes con Síndrome Inflamatorio Multisistémico Pediátrico asociado a COVID-19 (SIM-C)

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What do we know about the subject matter of this study?

COVID-19-associated Multisystem Inflammatory Syndrome in Children (MIS-C) is a multisystem inflammatory condition described as a complication of SARS-CoV-2 infection, which may require ICU stay. To date, the functional sequelae following ICU stay in the pediatric population are unknown.

What does this study contribute to what is already known?

We present a descriptive, prospective study that included 28 patients with MIS-C. Functional status was assessed during hospitalization, the first and fourth month after discharge with functional scales, muscle strength, cardiorespiratory endurance, and post-traumatic stress measurement scales. It was concluded that the sample presented functional compromise with favorable recovery in spite of the severity of this condition.

Abstract

In June 2020 appeared the first cases of Multisystem Inflammatory Syndrome in Children (MIS-C) associated with COVID-19 in Chile. Possible sequelae associated with this condition are still unknown. **Objective:** To describe the functional status of children with MIS-C admitted to a high complexity Hospital. **Patients and Method:** Descriptive, prospective study. Sample of 28 patients. The functional status was evaluated during Hospitalization, and in the first and fourth months after discharge with the Functional Status Scale (FSS), Pediatric Evaluation of Disability Inventory (PEDI-CAT), 6-minute walk test (6MWT), PImax and PEmax, and dynamometry. Post-Traumatic Stress Disorder was screened with the Child PTSD Symptom Scale (CPSS). **Results:** Mean age 63.6 months. Sixteen were women and 60.7% presented no comorbidities. Half of the cases presented with Shock. Mean hospitalization was 9 days. Twenty-two patients were admitted to the ICU; 54% required me-

Keywords:
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chanical ventilation and/or vasoactive drugs, and 82% had cardiac repercussions. During hospitalization, 82.3% presented some physical alteration, 29.1% of them were confirmed ICU-acquired weakness (ICU-AW), and 16.6% were suspected cases. Thirteen patients presented emotional symptoms, 39.2% had post-ICU syndrome. Most of the patients (58.8%) had an unfavorable Functional Situation and recovered 4 months post-discharge. All patients reversed echocardiographic abnormalities in the first month and regained muscle strength in the fourth month. 38.5% of subjects reported suboptimal values in the 6MWT and 66.6% presented alteration in the post-traumatic stress screening. **Conclusion:** Most of the patients presented functional compromise with favorable recovery despite the severity of the symptoms and possible secondary complications after ICU.

Introduction

In December 2019, a severe acute respiratory syndrome caused by the SARS-CoV2 coronavirus, known as COVID-19, was reported in China[1] and the World Health Organization (WHO) declared it a pandemic[2].

Clinical manifestations have been described in pediatric and adult populations, with a lower incidence of COVID-19 in children[3], less clinical severity, and low hospitalization and mortality rates[4].

In April 2020, the United Kingdom issued an alert on a new manifestation of COVID-19 in children, reporting cases that required hospitalization in intensive care units (ICU), due to a multisystem inflammatory condition called COVID-19-associated Multisystem Inflammatory Syndrome in Children (MIS-C), which shares clinical characteristics with other inflammatory conditions such as Kawasaki disease (KD), toxic shock syndrome, and macrophage activation syndrome[3,5]. This condition occurs 4 to 6 weeks post SARS-Cov2 infection and usually presents with mild symptoms or asymptomatic. Cases occur at school age, with a median age of 8 years, predominantly in males and with a higher frequency in the Latino and African-American population[6,7]. According to published systematic reviews, it is characterized by febrile symptoms associated with gastrointestinal symptoms in 70-90% of cases (diarrhea, vomiting, or abdominal pain), mucocutaneous symptoms in 53-73% of cases, cardiac involvement in 51-71% of cases, shock in 26-60% of cases, and neurological symptoms in 19.5-22% of cases[8-12]. The cardiac alterations described are diverse, reporting 54% of echocardiographic alterations, with ventricular dysfunction in 45 to 51% of cases and coronary artery involvement in 8 to 23% of cases; these symptoms may or may not be accompanied by hypercoagulability, inflammation, or clinical picture similar to KD in 50% of cases[8-12]. Around 86% would present the latter characteristics, with multiple organ dysfunction[13], requiring management in the ICU in 60 to 73% of cases[1,8-12].

The pathophysiology and etiology are not clear, although, in the most severe group, there would be a severe and late immune-mediated inflammatory response[7].

In 2021, 4 clinical phenotypes of MIS-C have been characterized: no KD without shock, KD without shock, shock/myocarditis without KD, and MIS-C with shock associated with cytokine storm/multiple organ failure/macrophage activation syndrome (MAS)[14].

According to different scientific organizations, the management recommendations include life support in ICU, use of intravenous immunoglobulins, glucocorticoids, acetylsalicylic acid, and low molecular weight heparin, according to the different phenotypes reported and the results of laboratory tests[14].On the other hand, it has been reported that pediatric ICU stay itself, generates higher risks of morbidities and functional alterations both physical, cognitive, and emotional in about 50% of cases, some prevailing up to 3 years after discharge[15].

Post-Intensive Care Syndrome in children (PICS-p) is described as a group of cognitive, physical, emotional, and social impairments that occur after discharge from the ICU, altering functionality and/or quality of life[15]. Physical alterations include pulmonary function impairment, pain, sensory alterations, scarring, muscle strength and mobility impairments , fatigue, and impairment in activities of daily living such as self-care and feeding[15-17]. Regarding neurocognitive alterations, mainly attention and memory disorders are described, which interfere with school performance. Psychological alterations include fatigue, sleep disturbances, mood disorders, anxious symptoms, and post-traumatic stress disorder (PTSD) as the most frequent[15,18].

Since the beginning of the pandemic, the *Hospital Dr. Exequiel González Cortés* (HEGC) received more than 50 children with SARS CoV-2 acute respiratory infection by June 2020; however, none of them required ventilatory and/or hemodynamic support[19]. The first case of MIS-C occurred on June of 2020, requiring ICU admission. Thereafter, patients admitted to the ICU with a diagnosis of MIS-C were recorded.

Currently, there are no published studies in Chile aboutthe evaluation and follow-up of the functio-

nal status of patients with MIS-C. The severity of the condition and the need for management in critical units leads us to believe that this population would be at greater risk of acquiring functional sequelae in the short and medium term.

The objective of this study was to describe the functional status of a pediatric population with MIS-C and to evaluate changes at 4 months after discharge, along with clinical and sociodemographic characterization of these patients+

Patients and Method

Prospective, descriptive study conducted by the Physical Medicine and Rehabilitation Unit of the HEGC between June 1 and August 30, 2020, as part of a Protocol for the management and follow-up of patients with a diagnosis of MIS-C. All patients meeting diagnostic criteria defined by WHO[2], registered in the medical record were included. Patients for whom it was not possible to obtain data were excluded. Table 1 details the demographic description.

The clinical phenotypes were classified according to the recommendation of the Chilean Society of Pediatrics (SOCHIPE) and the management recommendations published by the Chilean Society of Infectious Diseases (Table 2)[14].

Data collection

Patients were recruited during the hospital period. Data collection was by review of clinical records where sociodemographic data and clinical history were obtained, such as previous pathologies, previous functionality, admission diagnosis, support measures required, length of stay in the ICU, days without family visits, and echocardiographic findings. Patients were evaluated by a physiatrist during hospitalization, at the first and fourth months after discharge.

Functional variables

Muscle strength: It was evaluated in cooperative patients. We used the Medical Research Council (MRC) scale scoring from 0 to 5 points in six muscle groups, for the detection of ICU-acquired weakness (ICUAW)[20]. Scores equal to or lower than 48 points were considered diagnostic criteria for ICUAW. Patients who were unable to perform single-joint exercises assessment or lost axial muscle control with respect to their baseline were classified as suspected ICUAW.

Functional Status: is defined as the patient's capacity regarding basic physical and cognitive activities, categorized in this case according to the final score obtained in the Functional Status Scale (FSS), which evaluates 6 domains: mental, motor, feeding, communication, and breathing, scored between 1 and 5 each, where 1 is normal function and 5 is severe dysfunction, resulting in an overall score between 6 and 30 (Annex 1). It has been validated in Spanish and is one of the most widely used scales to describe functional outcomes of patients in Pediatric Intensive Care Units (-PICU)[21]. Global scores were categorized into "Adequate functional status" with a score of 6 points for children without alterations and "Unfavorable functional status" with a score greater than or equal to 7.

Global Functionality: In outpatient follow-up, it was evaluated using the Pediatric Evaluation of Disability Inventory Computer Adaptive Test (PEDI-CAT), which allows to objectify and quantify the level of disability in a population aged between 6 months and 21 years. It evaluates functional performance in daily activities, mobility, and social/cognitive domain; it is validated in Spanish and is used as a standard for functional assessment in children and adolescents. A scaled score is used to assess changes in functional domains over time, with age-referenced normative scores.

Other symptoms: During hospitalization, the presence of physical, cognitive, and/or emotional symptoms was screened, including swallowing disorder, pressure injuries, and anxious and depressive symptoms. The Child PTSD Symptom Scale (CPSS) was used to evaluate the presence of symptoms of PTSD , which is validated in the Chilean population in children and adolescents aged 8 to 18 years[23]. A score higher than 24 points indicates a probable PTSD diagnosis.

Aerobic capacity: It was evaluated with the 6-minute walk test (6MWT) measuring the physiological impact of lung function impairment on exercise capacity, based on the recommendations of the Chilean Society of Pediatric Pneumology, using the reference values described by Geiger et al.[24,25]. This evaluation was performed after the normalization of the echocardiograms of all patients, considering as a criterion the normality of the echocardiogram evaluation performed on all patients as part of our hospital protocol.

Table 1. Demographic description of the sample

Sex, Female (n; %)	16; (57.14%)
Age in months (mean ± SD)	63 ± 40
Number of children ≥ 6 years (n; %)	11 (39%)
Children with regular school attendance (n; %)	17 (60%)
Children with comorbidities (n; %)	11 (39%)
- Obesity (n; %)	3 (10%)
- Asthma (n; %)	4 (14%)

n: number of patients included. SD: Standard deviation

Respiratory muscle strength: This was evaluated by maximal expiratory pressure (MEP) and maximal inspiratory pressure (MIP), according to the technique described by Black and Hyatt[26]. In both tests, the best score of a minimum of three attempts was selected, using the reference values described by Szeinberg et al.[27].

Handgrip strength: It was measured with a hand dynamometer, according to the technique and reference values described in the Chilean population by Gómez-Campos et al.[28].

For the calculation of the lower limit percentages (LL%) of the strength and 6MWT tests, the average reference value according to age and sex corresponding to the variable of interest was used and two standard deviations were subtracted, recording this value as 100% of the LL%.

The diagnostic criterion of PICS-p was defined as the presence of alterations in the physical and cognitive/emotional areas since discharge from the ICU.

This study was approved by the Scientific Ethics Committee of the South Metropolitan Health Service. All participants' guardians gave informed consent.

Statistical analysis

Quantitative data were presented with summary and dispersion measures and categorical data were presented with absolute and relative frequency indicators. Data analysis was performed using STATA® 13 statistical software. The Shapiro-Wilk test was used for evaluating the normality of the quantitative variables. Parametric quantitative data were presented as means and standard deviations and nonparametric data were described as median and interquartile range (IR). For the evaluation of association between qualitative and quantitative variables, the t-student test was used for parametric variables and the Mann-Whitney U test for nonparametric variables. Statistical significance was established with an alpha error of less than 0.05.

Results

Population characteristics

Twenty-eight patients met the inclusion criteria. Of these, 17 were evaluated during the in-hospital period and 28 attended the first check-up with a physiatrist. No patients died due to MIS-C. Figure 1 details the recruitment and Table 3 shows the characteristics of the subjects.

Regarding hospital stay, 78.5% were admitted to the ICU, of whom 54% required mechanical ventilation (MV) and/or vasoactive drugs (VAD). The 82% presented some type of cardiac involvement associated with MIS-C (echocardiographic alteration, shock, and/or myocarditis).

In-hospital evaluation

Of the 17 patients evaluated, 29.1% presented ICUAW characteristics, and 16.6% were registered in the clinical record as suspected ICUAW. 16.6% of patients required nasogastric tube (NGT) and 54.1% presented emotional symptoms reported by their parents. Other complications were detected such as one case of brachial plexus compression by hematoma, one with hypertrophic scar at the catheter insertion site, one with pressure injury in the occipital area, and other associated infections in six patients. 39.2% met the diagnostic criteria for PICS-p. 100% of patients received rehabilitation interventions, at least kinesiotherapy, and only 4 patients required admission to an in-hospital interdisciplinary rehabilitation program.

Patients with cognitive/emotional symptoms had a median ICU stay of 5 days (4-6), which was statistically significantly longer than those without symptoms [median 3 days (0-5)] ($p < 0.03$). The diagnosis of ICUAW was associated with more days in MV, use of VAD, and longer hospital stay.

Post-discharge functional status

Twenty-eight patients attended the first check-up with a physiatrist and 23 attended the second check-

Table 2. Clinical characteristics during the hospital stay (n = 28)

Hospital stays, days *	9; (7-11)
Stay in PICU, days*	4; (2,5-5,5)
Mechanical ventilation, days*	1,5; (0-3)
Days without family visits*	5; (3-7,5)
Vasoactive drug use, days*	1; (0-2)
Management category (n (%))**	
- Mild	3 (10,71%)
- Phase 1	16 (57,14%)
- Phase 2	9 (32,14%)
Classification (n (%))	
- MIS-C without KD, without shock	5 (17,8%)
- MIS-C with KD without shock	9 (32,1%)
- MIS-C with shock/myocarditis	13 (46,4%)
- MIS-C with shock associated with cytokine storm/MFO/MAS	1 (3,5%)
Altered echocardiogram on admission	16 (57,12%)

*Data represented as (median; p25-p75) Values corresponding to the 25th percentile and 75th percentile separated by a hyphen. **Phase 1 management: IV immunoglobulin 2 g/kg over 12 hours + methylprednisolone 2mg/kg/d IV for 3 days, plus ceftriaxone 100mg/kg/d IV + clindamycin 40 mg/kg/d IV. Phase 2 management: IV immunoglobulin 2 g/kg over 12 hours + methylprednisolone 10mg/kg/d IV for 3 days. N: total number of patients; PICU: pediatric intensive care unit; n: number of patients included; IV: intravenous; MIS-C: COVID-19-associated Multisystem Inflammatory Syndrome in Children. KD: Kawasaki disease; MFO: multiple organ failure; MAS: macrophage activation syndrome

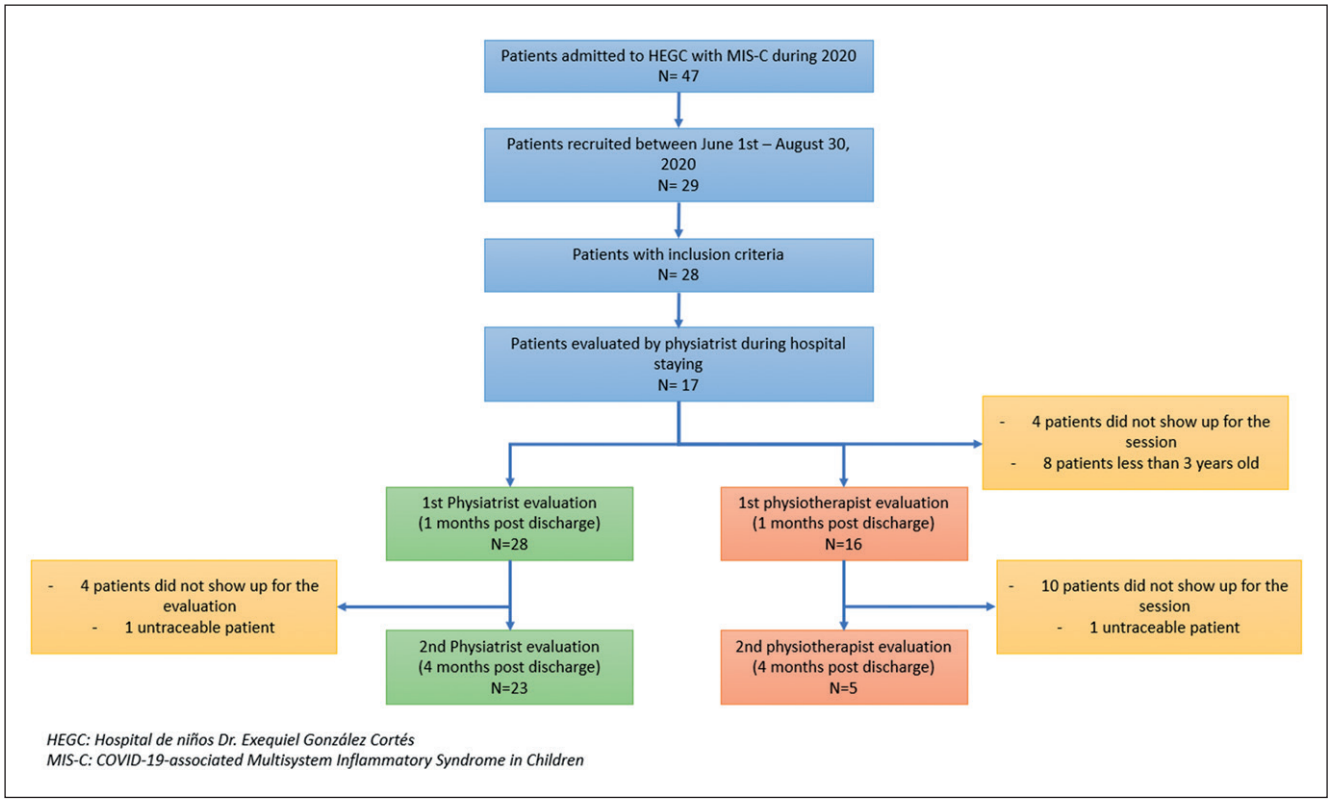

Figure 1. Patient recruitment and selection flowchart

Table 3. Functional evaluations

Variable	In-hospital (n = 17)	1st month after discharge (media ± SD) (n = 28)	4th month post discharge (media ± SD) (n = 23)
Functional Status Scale (FSS) (% with more than 6 points)	58.82%	5.88%	5.88%
Medical Research Council scale (MRC) (% of patients with 60 points	26.32%	78.95%	100%
Cognitive/emotional symptoms (% of patients with symptoms)	72.73%	81.82%	46.4%
PEDICAT- Daily life activities (T-score)	No	60±11	60 ± 10
PEDICAT-Mobility (T-score)	No	58 ± 10	58 ± 8
PEDICAT-Social (T-score)	No	54 ± 7	53 ± 7

PEDI-CAT: Pediatric Evaluation of Disability Inventory Computer Adaptive Test, n: number of patients included. SD: Standard deviation.

up. 16 patients completed the first-month kinesic evaluation and 5 completed the fourth-month evaluation, so the latter was not included in the analysis.

In the functional evaluation with FSS, 58.8% had a score higher than 6 points, being 15 points the highest value (unfavorable functionality); this normalized in 94.1% of the patients, reaching 6 points (adequate functionality) at the first check-up and maintained the value at 4 months. In relation to the MRC scale, two patients (10.5%) scored 60 points, which increased to 78.9% and then to 100% at the first and fourth months, respectively. All patients reversed the echocardiographic alterations at the first month post-discharge.

Regarding the cognitive/emotional areas, during hospitalization, 76.4% of the 17 patients evaluated spontaneously reported symptoms. After the first month, through a directed anamnesis, 67.8% presen-

ted irritability, anxiety, emotional lability, sleep disorders, social withdrawal, and attention and concentration alterations; in 11 of them, the guardians reported that this interfered with their daily functioning. When applying the post-traumatic stress screening, it was altered in 4 of 6 children evaluated, therefore they were referred to psychiatry.

During the first kinesic evaluation, 13 patients completed the 6MWT, the median distance walked was 510 meters (463.5-529.5), 38.5% had a suboptimal performance with respect to their age.. In the respiratory muscle strength assessment, 13 children were able to follow assessment instructions, the median MIP was 85.9 (71.8-110.3) cmH_2O, 38.5% achieved above LL%, and the median MEP was 63 (47-95.5) cmH_2O, with 46.2% of patients below the LL%. Table 4 details the kinesic evaluations.

There was no association between in-hospital variables or comorbidities with the post-discharge functional status outcome.

Table 4. Cardiopulmonary evaluations and muscle strength.

Test	Mean ± SD	Median (p25-p75)
6MWT* (m)	512 ± 62	510 (463 - 529)
MIP* (cmH2O)	64 ± 21	86 (71 - 110)
MEP* (cmH2O)	73 ± 29	63 (47 - 95)
PFC* (L/Min)	236 ± 18	220 (180 - 290)
HGS R° + (Kg)	11 ± 5	14 (7 - 16)
HGS L° + (Kg)	10 ± 6	10 (5 - 15)

The variables 6MWT, MIP, MEP, HGS, with their respective mean, standard deviation (SD), median and 25th percentile - 75th percentile (P25-P75). 6MWT: 6-minute walk test, MIP: Maximum inspiratory pressure, MEP: Maximum expiratory pressure, PFC: Peak flow in cough, HGS: Handgrip strength, R°: Right, L°: Left. *: n = 13, +: n = 17, m: meters, cmH2O: centimeters of water, L: liters, Min: Minute, Kg: kilograms.

Discussion

This is the first study in Chile that describes the functional status during hospitalization and follow-up in children diagnosed with MIS-C.

The median age was 5.3 years and most had no previous comorbidities, similar to that described in available national references[29]. Regarding clinical presentation, we report that half of the patients presented shock with or without KD and/or multiple organ failure, and most patients presented cardiac involvement with or without echocardiographic alterations. All these values are similar to those described in the literature[30]. It is important to note that all patients normalized their echocardiograms 1 month after discharge regardless of the subcategory and severity of MIS-C.

Although the sample size appears to be low, this is comparable with other case series published,[31-33] with similar clinical characteristics, but evaluating different outcomes (ICU days, vasoactive drugs, mortality).

Concerning management, most patients required admission to the ICU, with a median stay of 4 days, c to other studies[8-12]. Regarding the support provided, half of the patients required MV, a higher percentage than that reported in the systematic reviews; related to the use of vasoactive drugs (VADs), half of our patients also required them, which is similar to those studies[8-12].

In our sample there were no deaths,and, to date, no deaths associated with MIS-C have been reported in the 52 patients hospitalized with this diagnosis in the HEGC (which is one of the national reference centers that has reported the most cases), unlike other reports with a case fatality rate of 3%[34]. This could be explained by the interdisciplinary management of the professionals who care for the patients in the HEGC:the high index of suspicion within the health team, the presence of international health alerts, and the early implementation of the management protocols.

Noteworthy was the high percentage of patients who presented some physical complication during the hospital stay (82.3% of the patients evaluated) and that a third of them developed ICUAW, which was significantly associated with more days of MV, use of VADs, and a longer hospital stay. This percentage is slightly higher than that reported by Choong et al.[17] whose work described patients with a PICU staying longer than 48 hours with heterogeneous pathologies. Although the studies would not be comparable, ICU management and the use of corticosteroids could explain this level of alterations. It was also surprising that, at follow-up, all patients recovered their muscle strength measured with the MRC scale independently of the presence of ICUAW, which could be explained by the lower life-support treatments requirements compared with other studies.

We evaluated respiratory muscle strength and handgrip strength, because we suspected, in the context of the severity of the disease, that there could be secondary alterations affecting global strength, whichcould not be detected with the MRC only. However, we were unable to perform an evolutionary follow-up to compare results.

Another remarkable finding for the whole health team was the high percentage of patients with cognitive/emotional compromise (76.4%) , which was associated with a longer ICU stay.Therefore we decided to

include standardized post-traumatic stress screening evaluations in the follow-up after discharge. Thus, we reported new symptoms in almost all patients, and in children older than 8 years, two-thirds presented altered results, a total of 11 children were referred for psychiatric evaluation. We believe that one of the factors that could explain the magnitude of this finding was the restrictions on visits by their relatives. To date, there are no studies that collect these data for comparison.

Eleven patients met our criteria for post-ICU syndrome (PICS-p), a complex and little-studied condition in children, which involves psychosocial development, family interdependence, with different health recovery trajectories, which is truly relevant since it could potentially affect long-term functionality.

In relation to the impact on the social area, although we did not assess it with standardized scales, the family members did spontaneously report the repercussions that MIS-C had on their lives.

Relative to global functionality measured with FSS during hospitalization, 58.8% presented an unfavorable functional status, improving in all patients at follow-up. This was different from that reported by Pinto et al.[35] who found an increase in post-ICU morbidities over time (changes greater than 3 points on the FSS scale) of 5.2% in patients at discharge, increasing to 6.5% at 6 months and 10.4% at 3 years, associating a poor functional outcome in the long term.

According to this, mean PEDI-CAT scores were within normal ranges in all areas evaluated in both outpatient check-ups. In the scaled score, the results were similar in each domain which could be interpreted as that the patients maintained their functionality over time. This is comparable with Choong et al.[17] results, regarding recovery over time.

Considering that the physical alterations found in our patients were associated with PICU stay, but evolve with rapid functional recovery, we though that this could be part of the natural history of MIS-C, having a more benign course in its evolution.

In this regard, the high percentage of patients (38%) whose aerobic performance in the 6MWT was altered is striking, which could be explained by the cardiac involvement of this group, but it could also be due to the context of physical inactivity and social confinement associated with the health measures imposed to control the pandemic.

This idea of benign course can be supported by another London study, which reports recovery of echocardiographic, renal, and gastrointestinal involvement 6 months after the onset of the disease, and which, similar to our findings, reports alterations in the 6MWT in 45% of the cases[36].

It is important to consider that all patients received rehabilitation interventions, a factor that could have contributed to their rapid recovery. More long-term studies that measure functionality or with a larger number of cases are needed to corroborate these assertions.

Given that MIS-C is an emerging disease, it is presumed that, due to its severity, the ICU stay, and management could have repercussions and sequelae in multiple domains. It is important to follow up with both clinical and functional evaluations in order to determine its evolution and thus optimize in-hospital management, with interventions focused on improving both the physical and cognitive/emotional health of the children and their families[36,37].

This is the first study in Chile to describe functionality in patients with this health condition. Despite being a small cohort, it is representative, as it included more than half of the cases reported in the HEGC during 2020.

The main limitations of the study were the losses to follow-ups, given the epidemiological context, hospital capacity, patients who did not attend, and concomitant family diseases, among others.

Conclusions

Weobserved that a high percentage of subjects have functional compromise, both in physical and cognitive/emotional aspects, with recovery of global functionality in the short term despite the severity of the condition and the complications secondary to ICU stay. It is relevant to consider conducting functional assessment and early rehabilitation strategies in patients, in addition to favoring the presence of the families during the hospital stay, as factors that could help to improve children outcomes.

This study aims to contribute to solve part of the gap that exists in the literature regarding the functional sequelae in the pediatric population with MIS-C. Future studies should consider the evaluation of functional, physical, cognitive, and emotional aspects, in addition to clinical parameters to clarify whether the functional compromise is associated with factors specific to the disease and/or its management.

Ethical Responsibilities

Human Beings and animals protection: Disclosure the authors state that the procedures were followed according to the Declaration of Helsinki and the World Medical Association regarding human experimentation developed for the medical community.

Data confidentiality: The authors state that they have followed the protocols of their Center and Local regulations on the publication of patient data.

Rights to privacy and informed consent: The authors have obtained the informed consent of the patients and/or subjects referred to in the article. This document is in the possession of the correspondence author.

Conflicts of Interest

Authors declare no conflict of interest regarding the present study.

Financial Disclosure

Authors state that no economic support has been associated with the present study.

Annex 1. Functional Status Scale (FSS)

	1	2	3	4	5
	NORMAL	MILD DYSFUNCTION	MODERATE DYSFUNCTION	SEVERE DYSFUNCTION	VERY SEVERE DYSFUNCTION
MENTAL STATUS	Normal sleep/wake; appropriate responsivity	Sleepy but arousable to noise/ touch/movement and/or periods of social nonresponsivity	lethargic and/or irritable	Minimal arousal to stimulus (stupor)	Unresponsive and/or Coma and/or Vegetative
SENSORY	Intact hearing and vision and responsive to touch	Suspected hearing or Suspected vision loss.	Not reactive to auditory stimuli or Not reactive to visional stimuli	Not reactive to auditory stimuli and Not reactive to visional stimuli	Abnormal response to pain or touch
COMMUNICATION	Appropriate non-crying vocalizations, interactive facial expressiveness, or gestures	Diminished Vocalization Diminished Facial Expression and/or social responsiveness	Absence of attention getting behavior	No demonstration of discomfort	Absence of communication
MOTOR FUNCTION	Coordinated body movements and Normal muscle control and Awareness of action and why it's being done	1 limb functionally impaired	2 or more limbs functionally impaired	Poor head control	Diffuse Spasticity, Paralysis, Decerebrate/Decorticate Posturing
FEEDING	All food taken by mouth with age appropriate help	NPO or need for age-inappropriate help with feeding	Oral and tube feedings	Parenteral Nutrition with oral or tube feedings	All parenteral nutrition
RESPIRATORY	Room air and no artificial support or aids	Oxygen and/or Suctioning	Tracheostomy	CPAP for all or part of the day and/or Mechanical ventilator support for part of the day	Mechanical ventilatory support for all of the day and night

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