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Sickle Cell Disease and Psychosocial Well-Being: Comparison of Patients With Preclinical and Clinical Avascular Necrosis of the Femoral Head

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What is already known on this topic?

- *Sickle cell disease affects physical and mental health. In childhood and adolescence, sickle cell disease has significant adverse psychosocial impacts, such as behavioral problems.*

What this study adds on this topic?

- *Children and adolescents with sickle cell disease, whether or not complicated with clinical femoral head avascular necrosis have lower prosocial scores compared to healthy peers.*
- *This is the first sickle cell disease study that contributes to understanding the strengths and difficulties in pediatric patients by exploring avascular necrosis.*

ABSTRACT

Aim: Sickle cell disease (SCD) has significant adverse psychosocial impacts in childhood. Patients with SCD may be affected by avascular necrosis (AVN) and the most commonly involved site is the femoral head. We aimed to conduct a comparative investigation of the psychosocial well-being of pediatric SCD patients with preclinical and clinical femoral head AVN.

Materials and Methods: Patients with homozygous SCD and healthy peers aged 7–17 years were included in this cross-sectional study. Psychosocial well-being was assessed by the Strengths and Difficulties Questionnaire (SDQ), parent version. SDQ scores were compared between the groups.

Results: A total of 74 mother–child couples were enrolled in this study. The SCD with clinical AVN (stages I–IV) group consisted of 17 patients, SCD with preclinical AVN (stage 0) group consisted of 20 patients, and the control group consisted of 37 individuals. The sociodemographic characteristics and medians of total difficulties, emotional problems, conduct problems, hyperactivity, and peer problems scores were not different between the 3 groups ($P > .05$). There was a significant difference between the 3 groups in the prosocial score that indicates more positive social behaviors. Both groups, SCD with clinical AVN and with preclinical AVN, had lower prosocial scores than the control group ($P < .001$). The 2 patient groups did not differ in any SDQ scores or disease-related characteristics of vaso-occlusive crises and blood/exchange transfusions in the recent year ($P > .05$).

Conclusions: Pediatric patients with SCD, whether or not complicated with clinical AVN, had lower prosocial scores than healthy peers. This study has presented the first comparison of the psychosocial well-being of pediatric SCD patients with preclinical and clinical femoral head AVN.

Keywords: Sickle cell disease, psychosocial well-being, avascular necrosis

INTRODUCTION

Sickle cell disease (SCD) is a monogenetic disorder characterized by the production of sickle hemoglobin (HbS). An alteration in a single DNA base causes the substitution of the amino acid valine to glutamic acid in the β-globin chain, and HbS occurs as a less soluble hemoglobin. Deoxygenation transforms the red blood cells from the biconcave to the sickle shape due to the HbS, and the subsequent reoxygenation transforms the red blood cells back to the biconcave shape. These recurrent sickling and unsickling transformations lead to hemolytic anemia.[1] Based on the inheritance, SCD includes sickle cell anemia, sickle beta

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thalassemia, hemoglobin SC disease, and others. Patients encounter several acute and chronic manifestations because of multi-organ and multi-system failure. The clinical manifestations usually appear by 5 or 6 months of age. Several manifestations and complications are seen among older children and adolescents. Severe hemolytic anemia and vaso-occlusive and sequestration crises increase morbidity and mortality in SCD patients.[2]

SCD has a broad clinical spectrum. Some patients live a normal life with nil symptoms, while some others struggle with severe crises and complications.[3] Avascular necrosis (AVN, osteonecrosis) is one of the complications of vaso-occlusion in SCD. Ten percent of patients with SCD are affected by AVN, and the most commonly involved site is the femoral head.[4] AVN of the femoral head can develop at any age, including the preschool age.[5] AVN may be asymptomatic in earlier stages. However, later stages of AVN course with pain, limited motion, abnormal gait, and limb-length discrepancy in children and adolescents.[6] The other causes of AVN, except hemoglobinopathies, are traumatic conditions such as femoral neck fracture or dislocation of the femoral head from acetabulum and non-traumatic conditions such as chronic steroid use, autoimmune and chronic inflammatory disorders such as systemic lupus erythematosus, metabolic diseases such as Gaucher's disease, hematopoietic cell transplantation, inherited thrombophilia and hypofibrinolysis, and Legg–Calve–Perthes' Disease.[7]

Adverse psychosocial impact is another complication of SCD. Quality of life, psychosocial well-being, daily personal and social life, affectivity, attention, concentration, and motivation may be negatively affected in pediatric SCD patients.[8-11] An increased risk for developing internalizing problems, interpersonal relationship problems, self-esteem problems, poor coping potential, and poor body image has been reported.[12] SCD studies have frequently focused on associations between psychosocial issues and pain phenomena.[8,9,13] Alternatively, Matos et al.[14] verified the impact of AVN of the femoral head on the quality of life of children and adolescents, and reported that the SCD group had lower quality of life scores—both in the global evaluation and in the domains of physical functioning and school functioning—compared to healthy peers. There is also an ongoing need to assess the impact of femoral head AVN on psycohosocial well-being in pediatric SCD patients. We speculate that pediatric SCD patients with clinical femoral head AVN may have more strengths and difficulties as a result of hip pain and physical limitation. This study aims to comparatively investigate psychosocial well-being of pediatric SCD patients with preclinical AVN and clinical AVN.

METHODS

Study Design

A comparative cross-sectional study was conducted on the psychosocial well-being of pediatric patients with SCD complicated with clinical AVN of the femoral head. All patients with sickle cell anemia (homozygous) monitored in the Pediatric Hematology department and healthy peers from well-child department in the same medical center were the subjects. The study included subjects living in the same province and aged between 7 and 17 years, and their literate mothers who had adequate cognition. The purpose and procedure of the study were described, and written consent for participation was obtained from the patients and the mothers. The study was carried out from August to December 2019 and conducted in accordance with the Declaration of Helsinki. The Ethics Committee of Mersin University approved the study (MEU 2019/320).

Data Collection

The Ficat and Arlet classification performed by the same pediatric orthopedist was used to group the patients. A combination of plain radiographs, Magnetic Resonance Imaging (MRI) findings, and clinical features guided the grouping.[15,16] The group with preclinical AVN (stage 0) consisted of patients with nil clinical symptoms and with a history of normal plain radiographic and MRI findings. These patients had no hip pain or hip dysfunction, while hip X-ray and hip MRI examinations were performed due to bilateral lower extremity pain in the previous 6 months. The other patient group consisted of patients with clinical AVN (stages I, II, III, and IV) of the femoral head. These patients had clinical and radiologic signs. The early-stage AVN subgroup consisted of patients with stage I and II signs, and the advanced-stage AVN subgroup consisted of patients with stage III and IV signs. Patients with overt cerebrovascular accident, neurologic sequale, musculoskeletal disorders, previous and concomitant systemic diseases (except those secondary to SCD), and psychiatric diagnosis were excluded.

The control group comprised healthy children from the well-child outpatient clinic, with no family history of SCD. To ensure absence of hip disorder, a detailed medical history and careful joint examination were performed during the well-child visits. No radiologic evaluation was performed in the control group, considering ethical issues.

The sample size was calculated by comparing 2 mean values of the quality of life total scores reported in the studies of Matos et al.[14] and Dale et al.,[17] considering 95% confidence interval and 90% test power in "OpenEpi" program.

A descriptive form and the Strengths and Difficulties Questionnaire (SDQ, parent version) were filled by the mothers during a routine outpatient visit. Mothers completed the survey forms in the outpatient rooms when they were alone and when their children were not having any acute health problem. Age, sex, parental ages and educational levels, family structure, number of child(ren) in the family, SCD in the family, and monthly income details were collected as sociodemographic data. Left ventricular ejection fraction, splenectomy status, acute chest syndrome, sequestration crises, pain crises, blood transfusion, exchange transfusion, and hospitalization histories for the past year were collected as clinical data by reviewing medical records. Body mass index (BMI = kg/m^2) values were calculated as anthropometric data.

Strengths and Difficulties Questionnaire

The SDQ is a behavioral screening tool with 25 items and 5 scales. There are equal numbers of items on each of 5 relevant dimensions, namely emotional symptoms, conduct problems, hyperactivity, peer relationship problems, and prosocial behaviors.[18] The SDQ has good support for its validity in Turkish children.[19] In the current study, SDQ and impact supplement

form were completed by the mothers. The mothers marked items as 0, 1, or 2 for "not true," "somewhat true," and "certainly true," respectively. Total difficulties score (range 0-40) is generated by summing scores from the scales of emotional problems, conduct problems, hyperactivity, and peer problems. Higher scores argue for serious problems, except for the prosocial scale, for which lower scores argue for more negative social behaviors. SDQ scores were classified into a 3-band categorization as normal, borderline, and abnormal. The cut-off points were defined as suggested in the literature. The externalizing score ranges from 0 to 20 and is the sum of the conduct and hyperactivity scales. The internalizing score ranges from 0 to 20 and is the sum of the emotional and peer problems scales. The impact supplement score ranges from 0 to 10 and is the assessment of the impact of difficulties on the child's life.[20]

Statistical Analysis

The data were analyzed by Statistical Package for the Social Sciences (SPSS) version 21.0 (IBM SPSS Corp.; Armonk, NY, USA). The *Shapiro–Wilk test* and histograms were used to test for normality. Median and (min–max) values were stated. Number and percentage values were given for the categorical variables. Kruskal–Wallis or Mann–Whitney *U*-test was used to compare independent groups. A chi-square test checked the differences in frequencies between the groups. The statistical significance level was set as $P < .05$.

RESULTS

General Characteristics

Throughout the study period, 17 SCD patients with clinical femoral head AVN and 20 SCD patients with preclinical femoral head AVN were evaluated, so 37 healthy children were selected for the control group. Overall, 74 mother–child couples were enrolled in this study.

All subjects were living at home with family, going to school, and all patients were taking Hydroxyurea and Folic acid. There were 5 (29.4%) patients with stage I, 4 (23.5%) patients with stage II, 5 (29.4%) patients with stage III, and 3 (17.7) patients with stage IV AVN of the femoral head. Eleven (64.7%) patients had bilateral and 6 (35.3%) patients had unilateral femoral head involvement. The median (min–max) duration of the presence of AVN was 2 (0.5-8) years. None of the patients had hospitalization history in an intensive care unit in the last year and none of the patients with AVN had hip surgery history. There were no significant differences in the SCD-related characteristics when the patients with clinical AVN were compared to the patients with preclinical AVN (Table 1).

Sociodemographic characteristics and median values of BMI were statistically similar in the 3 groups, namely SCD with clinical AVN, SCD with preclinical AVN, and healthy controls (Table 1).

Table 1. Comparison of the Sociodemographic and Clinical Characteristics

	SCD with Clinical AVN (*n* = 17)	SCD with Preclinical AVN (*n* = 20)	Healthy Controls (*n* = 37)	*P*
Age, years	15.5 (8-17)	15.2 (7-17)	15 (7-17)	.078
Male	12 (70.6)	10 (50.0)	18 (48.6)	.295
Maternal age, years	38.5 (31-48.5)	39.5 (32.5-46.5)	39.0 (30-45)	.872
Paternal age, years	41.5 (32-49)	43.5 (32-48)	42.5 (30-50.5)	.135
Maternal educational level				
Primary	11 (64.7)	17 (85.0)	21 (56.8)	.098
High school or college	6 (35.3)	3 (15.0)	16 (43.2)	
Paternal educational level				
Primary	13 (76.5)	15 (75.0)	23 (62.2)	.452
High school or college	4 (23.5)	5 (25.0)	14 (37.8)	
Number of child(ren) in the family	3 (1-8)	2 (1-6)	3 (1-8)	.487
Family structure				
Nuclear	16 (94.1)	18 (90.0)	30 (81.1)	NA
Single parent or extended	1 (5.9)	2 (10.0)	7 (18.9)	
Monthly income, $	375 (175-850)	475 (150-850)	500 (250-1350)	.129
Body mass index, kg/m^2	18.6 (16.4-22.6)	17.3 (14.0-22.3)	16.9 (14.8-26.4)	.124
SCD in the family	7 (41.2)	6 (30.0)	-	.478
LV ejection fraction, %	65 (59-77)	64.5 (60-80)	-	.445
History of splenectomy	8 (47.1)	6 (30.0)	-	.286
In the recent year, occurrence of acute chest syndrome or splenic sequestration crisis	5 (29.4)	8 (40.0)	-	.501
In the recent year, number of				
Painful crises	1 (0-8)	2 (0-4)	-	.605
Blood transfusions	0 (0-2)	0 (0-2)	-	.876
Exchange transfusions	0 (0-3)	0 (0-2)	-	.425
Hospitalizations	2 (0-8)	2 (0-5)	-	.828

Data as median (min–max) and number (percentage).
SCD, sickle cell disease; AVN, avascular necrosis; LV, left ventricular.

Table 2. Scores of the Strengths and Difficulties Questionnaire in the Groups

	SCD with Clinical AVN (*n* = 17)	SCD with Preclinical AVN (*n* = 20)	Healthy Controls (*n* = 37)	*P*
Emotional problems score	3 (0-8)	2 (0-6)	2 (0-10)	.691
Normal	58.8	70.0	64.9	.777
Borderline or abnormal	41.2	30.0	35.1	
Conduct problems score	1 (0-3)	2 (0-5)	1 (0-7)	.421
Normal	82.4	65.0	78.4	.407
Borderline or abnormal	17.6	35.0	21.6	
Hyperactivity score	3 (0-9)	3 (0-7)	2 (0-10)	.406
Normal	76.5	75.0	70.3	.868
Borderline or abnormal	23.5	25.0	29.7	
Peer problems score	3 (0-6)	2 (0-6)	2 (0-6)	.178
Normal	47.1	60.0	67.6	.356
Borderline or abnormal	52.9	40.0	32.4	
Prosocial score	8 (7-10)[a]	7.5 (5-9)[a]	10 (5-10)	**<.001**
Normal	94.1	90.0	94.6	.407
Borderline or abnormal	5.9	10.0	5.4	
Total difficulties score	11 (2-23)	10 (2-18)	9 (1-30)	.380
Normal	64.7	80.0	75.7	.550
Borderline or abnormal	35.3	20.0	24.3	
Externalizing score	5 (0-11)	5.5 (0-10)	4 (0-17)	.546
Internalizing score	6 (0-12)	3 (1-9)	5 (1-15)	.310
Impact score	0 (0-5)	0 (0-1)	0 (0-8)	.473

Scores as median (min–max) and categorizations as percentage.
[a]Comparison of the medians between patient groups, *P* value = .141.
SCD, sickle cell disease.

Strengths and Difficulties Questionnaire Scores

The total difficulties score of the Strengths and Difficulties Questionnaire, and the scores on the scales of emotional problems, conduct problems, hyperactivity and peer problems, and externalizing, internalizing and impact scores were not different between the 3 groups ($P > .05$). There was a significant difference between the 3 groups in the prosocial score ($P < .001$). Median (min–max) of prosocial score was 7.5 (5-9) in the SCD with preclinical AVN group, 8 (7-10) in the SCD with clinical AVN group, and 10 (5-10) in the control group. Percentages of subjects in terms of normal and borderline or abnormal categorization were not different between the 3 groups ($P > .05$) (Table 2).

A comparison of the 4 groups of early-stage AVN, advanced-stage AVN, preclinical AVN, and control group showed a significant difference in the prosocial score ($P < .001$). When we compared the patient subgroups with the control group separately, both SCD with early-stage AVN subgroup and SCD with advanced-stage AVN subgroup had lower prosocial scores than the control group ($P < .001$). When we compared the SCD with early-stage, advanced-stage, and preclinical AVN groups, there were no significant differences in any SDQ scores ($P > .05$) (Table 3).

When we compared the patient groups with the control group separately, both SCD with clinical AVN group and SCD with

Table 3. Scores of the Strengths and Difficulties Questionnaire in the Subgroups

	SCD with Clinical AVN		SCD with Preclinical AVN (*n* = 20)	Healthy Controls (*n* = 37)	*P*
	Early stage (*n* = 9)	Advanced stage (*n* = 8)			
Emotional problems score	1 (0-7)	5 (0-8)	2 (0-6)	2 (0-10)	.126
Conduct problems score	1 (0-3)	1.5 (0-3)	2 (0-5)	1 (0-7)	.528
Hyperactivity score	3 (0-9)	3.5 (2-8)	3 (0-7)	2 (0-10)	.542
Peer problems score	2 (0-6)	3.5 (1-6)	2 (0-6)	2 (0-6)	.225
Prosocial score	9 (7-9)[a,b]	8 (7-10)[a,d]	7.5 (5-9)[b,d]	10 (5-10)	**<.001**
Total difficulties score	9 (2-19)	14.5 (4-23)	10 (2-18)	9 (1-30)	.222
Externalizing score	4 (0-11)	5.5 (2-11)	5.5 (0-10)	4 (0-17)	.664
Internalizing score	6 (0-8)	9 (2-12)	3 (1-9)	5 (1-15)	.154

Scores as median (min–max); a, b, c, d, e, f ; comparison of 2 independent groups.
[a]$P = .611$, [b]$P = .132$, [c]$P < .001$, [d]$P = .331$, [e]$P = .001$, [f]$P < .001$.

preclinical AVN group had lower prosocial scores than the control group ($P < .001$). When we compared the SCD with clinical AVN group and SCD with preclinical AVN group, there were no significant differences in any SDQ scores and categories ($P > .05$).

Comparisons between the overall SCD patients group ($n = 37$) and healthy controls showed that medians of prosocial scores were significantly different [8 (5-10) vs. 10 (5-10), $P < .001$], while medians of emotional problems, conduct problems, hyperactivity, peer problems, total difficulties, externalizing, internalizing, and impact supplement scores were not different ($P = .772$, $P = .245$, $P = .266$, $P = .114$, $P = .265$, $P = .271$, $P = .353$, and $P = .328$ respectively).

The frequencies of having difficulties in emotions, concentration, behaviour or being able to get on with other people were not different between the patients with clinical AVN and with preclinical AVN ($P > .05$). Impact supplement characteristics of the patients who had difficulties are summarized in Table 4.

DISCUSSION

In the present study, the findings demonstrated that children and adolescents with sickle cell anemia had significantly poorer prosocial scores compared to demographically similar peers. Contrary to the predictions, the comparison of patients with clinical femoral head AVN and with preclinical femoral head AVN revealed that total difficulties and prosocial scores were not different. This study has presented the first comparison of the psychosocial well-being of pediatric SCD patients with preclinical and clinical AVN of the femoral head.

SCD, as a chronic illness, impacts psychosocial well-being of pediatric patients. Children and adolescents with chronic illness often have socialization difficulties because they have to spend time in hospital and remain seperated from the social environment.[21-23] School absenteeism, lack of academic motivation, and being away from peers and activities may compromise social relations. Hospitalizations can disrupt interpersonal interactions with family. Children and adolescents with SCD may have anxiety for social isolation, fear of judgment and being viewed as different, and avoidance behaviors. SCD can disrupt seeking autonomy and authority, developing self-identity, and establishing social relationships in childhood and adolescence.[21-25] Our finding that points to a poorer prosocial score in SCD patients supports existing literature data.

Literature reports in the psychosocial well-being of the patients with SCD are contradictory. In the study of Noll et al.,[26] 8-15 year-old children with SCD were described by teachers as more prosocial and less aggressive than healthy classmates. Simon et al.[27] reported that adolescents with SCD and their

Table 4. Descriptive Characteristics of the Patients According to SDQ Impact Supplement

Items	SCD with Clinical AVN ($n = 17$)	SCD with Preclinical AVN ($n = 20$)
Having difficulties in emotions, concentration, behavior or being able to get on with other people, *n* (%)		
No	10 (58.8)[a]	15 (75.0)[a]
Yes, minor difficulties	6 (35.3)	5 (25.0)
Yes, definite difficulties	1 (5.9)	-
Yes, severe difficulties	-	-
Duration of difficulties, *n* (%)		
Less than a month	1 (5.9)	-
1-5 months	-	-
6-12 months	3 (17.6)	1 (5.0)
Over a year	3 (17.6)	4 (20.0)
Being upset or distressed by the difficulties, *n* (%)		
Not at all	3 (17.7)	5 (25.0)
Only a little	4 (23.5)	-
Quite a lot	-	-
A great deal	-	-
The difficulties interfering with, *n* (%)		
Home life	1 (5.9)	0
Friendship	3 (17.7)	0
Classroom learning	0	1 (5.0)
Leisure activities	2 (11.8)	0
The difficulties putting a burden on the mother or the family, *n* (%)		
Not at all	2 (11.8)	1 (5.0)
Only a little	4 (23.5)	4 (20.0)
Quite a lot	-	-
A great deal	1 (5.9)	-

[a]Comparison of the frequencies between patient groups, *P* value = 0.295.
SDQ, Strengths and Difficulties Questionnaire; SCD, sickle cell disease.

healthy siblings had similar internalizing symptoms within non-clinical range. Kelly et al.[28] found that internalizing symptoms of older adolescents with SCD were not different from those of healthy peers. Trzepacz et al.[29] demonstrated that children with SCD at a mean age of 11.1 years had higher total scores in behavior and internalizing problems, and lower social competence scores than peers. Bakri et al.[30] stated that younger children with SCD had an increased risk of having internalizing, externalizing, and aggressive behavior problems. In this study, pediatric SCD patients with a mean age of 14.5 years had a lower prosocial score but similar total difficulties, externalizing, and internalizing scores compared to healthy peers. These inconsistent findings might be a result of disease factors, demographic, national, and cultural factors, social support and family functioning factors, neuro-cognitive status, and methodological differences.[31,32]

Previous studies in the matter of SCD and psychosocial well-being did not give any data about the patients' bone and joint health status.[26-30] AVN is a complication of vaso-occlusion via bone infarction. Initial bone infarctions progress to eventual cortical collapse and in the course of these events, pain, stiffness, reduced mobility, femoral deformity, and gait disorder occur.[4] A SCD study from 1991 reported that individuals diagnosed with AVN of the hip in childhood had exhibited pain as the first symptom at an average age of 12 years (range 7-15 years).[6] Chronic pain and psychosocial distress are associated and accompany each other.[33] Although the patient groups had similar SDQ scores in this study, physicians should consider that in contrast to patients without AVN, patients with clinical AVN have skeletal pain that can deteriorate psychosocial well-being later on. Initial AVN stages may be asymptomatic or mildly symptomatic.[4,6] In this study, 53% of patients with clinical AVN were at early stages (stage I-II), due to which the SDQ scores may have been found similar between the patient groups. Matos et al.[14] reported lower Charnley (a quantitative and qualitative assessment of the hip joint) scores indicating hip dysfunction in a pediatric patient group consisting of patients with Perthes disease and SCD with AVN, and found the Charnley score as a predictor of physical functioning but not of school or social functioning. In the study by Malheiros et al.,[34] hip dysfunction was determined to negatively influence quality of life in the physical activity and psychosocial domains in pediatric patients with SCD. Girard et al.[35] concluded that osteonecrosis was a rare late effect with a strong negative impact on the physical domains of quality of life in pediatric leukemia survivors who received steroid treatment. The consequence of Legg-Calve-Perthes disease in adulthood was reported to be a lower quality of life compared to general population.[36] In the study by Ito et al.,[37] health-related quality of life was reported to be poorer before the hip arthroplasty in adults with systemic lupus erythematosus. Pain catastrophizing, anxiety, and depression were reported in patients with hip disorder, including adolescents with AVN.[38] In addition to existing literature, we can suggest that SCD patients with clinical AVN have lower prosocial scores than patients with preclinical AVN, and although this difference is statistically insignificant for the present, the patients should be monitored in terms of development of antisocial behavior later on. We performed no multivariate evaluation in the analysis because of the low statistical power, but studies with a larger sample size may analyse correlations between hip function scores and behavioral scores, and associations between hip dysfunction and behavioral problems.

In the present study, 41% of the patients with clinical AVN were stated to have difficulties in emotions, concentration, behavior, and the ability to get along with other people; this frequency was 25% in patients with preclinical AVN. These problems lasted for longer than 6 months in almost all patients. Therefore, we can infer that the patients had chronic difficulties, and suggest that psychosocial support should be integrated into early-term SCD management to prevent long-term socialization problems. In this study, some patients with clinical AVN were stated to have difficulties interfering with home life, friendship and leisure activities, and to be upset or distressed by the difficulties, while those with preclinical AVN were not. Therefore, physicians should focus on preserving mobility and mood, so as not to worsen prosocial behavior in SCD patients with clinical AVN. The majority of mothers stated that the difficulties put a burden on them or the family as a whole. Previous studies reported similar experiences of difficulty in pediatric SCD patients and their families.[9,11,23]

The major limitations of the present study are including a small-sized sample from only one medical center and combining AVN stages of I-IV in a single group without evaluating hip functional level, which limits interpretation of the results. There are eligible scales to measure functional scores of the hip in children and adolescents with hip disorder.[39] Further studies considering hip functional scores should be performed in the area of SCD and psychosocial well-being. The other limitations are absence of an objective measure of mothers' mental health, family and school functioning, time spent in hospital and social settings and disease severity. Family dynamics and parental psychiatric disorders and attitudes may have an impact on SCD patients' behavioral problems and social limitations.[9,40] It would be more valuable if subjects' sleep quality and body perception concurrently with psychosocial well-being. Adolescents with SCD may experience dissatifaction with their physical appearance and/or experience sleep disturbances that can disrupt psychosocial well-being.[41,42] We did not include patients who had an overt stroke, so our findings cannot be generalized to all SCD patients. However, neurologic insults are suggested to be associated with social problems in children.[43] We would probably have found consequent results in prosocial scala if we had included patients with cerebrovascular accident. This was a hospital-based study and we recruited the healthy control group from the same medical center, so this strategy may not have control over some potential confounding factors such as housing and neighborhood quality. Confounding could also be reduced with information about the kinship relations. Further multicentered studies with a larger sample size may be able to assess the state of the hip joint quantitatively and qualitatively, and examine the impact of SCD severity and hip dysfunction on psychosocial well-being.

CONCLUSIONS

Children and adolescents with SCD, whether or not complicated with clinical femoral head AVN, had lower prosocial scores than healthy peers. Even patients in early stages of AVN

would have problems, not just physically but also socially. As far as we know, this is the first SCD study that sheds light on the strengths and difficulties in pediatric patients by exploring AVN. Individuals with SCD complicated with AVN subsequently may develop reduced mobility. Therefore, early intervention and early diagnosis of AVN to preserve function and psychosocial well-being in pediatric SCD patients, who are still growing and developing, seem rational.

Ethical Committee Approval: Ethical committee approval was received from the Ethics Committee of Mersin University, (Approval No: MEU 2019/320).

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