DOI: 10.4274/forbes.galenos.2021.03511
Forbes J Med 2022;3(1):32-38

Original Article / Orijinal Araştırma

Evaluation of the Risk and Prevalence of Malnutrition in Patients Hospitalized in Pediatric Neurology Clinic Applies STRONGkids

STRONGkids Uygulayarak Çocuk Nörolojisi Kliniğinde Yatan Hastalarda Malnütrisyon Risk ve Prevalansının Değerlendirilmesi

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Cite as: Örnek HS, Ünalp A, Ecevit ÇÖ. Evaluation of the Risk and Prevalence of Malnutrition in Patients Hospitalized in Pediatric Neurology Clinic Applies STRONGkids. Forbes J Med 2022;3(1):32-38

ABSTRACT

Objective: The aim of our study determination of malnutrition risk and prevalence in patients who were hospitalized in the pediatric neurology clinic.

Methods: Two hundred patients were evaluated in this prospective study using STRONGkids tool and anthropometric measurements.

Results: At the time of admission, it was found that 42 (21%) of the patients had malnutrition; 12 (6%) had chronic malnutrition, and 30 (15%) had acute malnutrition. Epilepsy was the most common diagnosis (44.5%). According to the STRONGkids, 55% of patients had a moderate or high risk. The mean length of hospitalization in high-risk patients was statistically significantly higher than other risk groups (p=0.022). Our study showed that patients at high risk of developing malnutrition in the pediatric neurology service can be identified with STRONGkids in a short time.

Conclusion: Malnutrition is an important problem for patients hospitalized in pediatric neurology clinics. As a result we recommend applying the STRONGkids screening scale to patients to increase the awareness of healthcare professionals in determining the risk of malnutrition at the time of hospitalization in the pediatric neurology service.

Keywords: Malnutrition, pediatric neurology, STRONGkids, children

ÖZ

Amaç: Çalışmamızın amacı, çocuk nörolojisi kliniğine yatırılan hastalarda malnütrisyon riskinin ve prevalansının belirlenmesidir.

Yöntem: Bu prospektif çalışmada STRONGkids anketi ve antropometrik ölçümler kullanılarak 200 hasta değerlendirildi.

Bulgular: Hastaların başvuru anında 42'sinde (%21) malnütrisyon olduğu saptandı; 12'sinde (%6) kronik malnütrisyon, 30'unda (%15) akut malnütrisyon vardı. En sık görülen tanı epilepsiydi (%44,5). STRONGkids'e göre, hastaların %55'i orta veya yüksek risk taşıyordu. Yüksek riskli hastalarda ortalama yatış süresi diğer risk gruplarına göre istatistiksel olarak anlamlı derecede yüksekti (p=0,022). Çalışmamız, çocuk nörolojisi servisinde malnütrisyon gelişme riski yüksek olan hastaların kısa sürede STRONGkids ile tanımlanabileceğini gösterdi.

Sonuç: Çocuk nörolojisi kliniğinde yatan hastalarda malnütrisyon önemli bir sorundur. Sonuçta çocuk nörolojisi servisinde yatış anında malnütrisyon riskini belirlemede sağlık çalışanlarının farkındalığını artırmak amacıyla STRONGkids tarama ölçeğinin hastalara uygulanmasını öneriyoruz.

Anahtar Kelimeler: Malnütrisyon, çocuk nörolojisi, STRONGkids, çocuk

Received/Geliş: 16.09.2021
Accepted/Kabul: 23.12.2021

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INTRODUCTION

Malnutrition can occur because of insufficient nutritional status due to inadequate intake, excessive nutrient losses or increased catabolism and shows as the clinical response of the imbalance between nutrient intake and requirements. It may be accompanied by protein deficiency, energy deficiency, or both.[1] According to ESPEN, malnutrition is defined as a nutritional state that has significant negative clinical effects on tissue/body form (body shape, size and composition) and functions in the event of insufficiency or excess (or imbalance) of energy, protein and other nutrients.[2] It has been reported that protein energy malnutrition varies between 21% and 80% in proportion to the development level of countries in hospitalized children.[3] This value is quite high and increases the mortality risk at the same rate.[4]

High risk of malnutrition in patients with neurological disorders, as well as increased metabolic need such as susceptibility to infection and wound healing, chewing-swallowing disorders, pain, also has an effect. In addition to the increased metabolic needs such as susceptibility to infection and wound healing, the high risk of developing malnutrition in the patients with neurological impairment affects the lack of intake of nourishment due to chewing-swallowing disorders and pain. Additionally, the low socioeconomic level and poverty of these patients who require special care because of not getting adequate care are among the important reasons for developing malnutrition.[5] Motor dysfunction in children with neurological diseases significantly affects growth and nutritional status. The most important nutritional deficiency is energy intake. Therefore, evaluation and management of nutrition in children with neurological disease should be seen as a part of general care.[6] There are various screening methods have been developed to calculate the nutritional risk and the need for nutritional support during hospital stay.[7] The most important features sought in these methods are easy implementation, understandability, time consuming and reliable. It should also be sensitive and specific, able to detect all stages of malnutrition, including the beginning. Very the methods apply to most of the patient group. Among the methods, STRONGkids seem to be more feasible because it is simple, easy, does not require anthropometric measurement and has been proven to be reliable in many study groups compared to other methods.[8] With the STRONGkids method, the's subjective general evaluation, presence of high-risk disease, nutrient intake and losses, weight loss or underweight gain are questioned and the risk of nutrition is rated between 0-5.[9]

The aim of this study was to determine the prevalence and effect of malnutrition at the time of hospital admission by applying the STRONGkids tool and anthropometric measurements to the patients hospitalized in the Pediatric Neurology Department.

METHODS

Approval for this study was obtained from the Ethical Committee of University of Health Sciences Turkey, Dr. Behçet Uz Children's Training and Research Hospital on 20.10.2016 as protocol number 2016/112. Patients who stayed longer than 24 h in the pediatric neurology service over 1 year (between September 2016 and 2017) were included in this prospective study. When the frequency of malnutrition in neurology patients is taken as 75%, the 95% confidence interval and for 80% power, the smallest sample size was calculated as 201 patients.

The population of the research was determined by the hospital on the specified dates. Children between the ages of 6 months-18 years who are newly admitted to inpatient services has created. Meets the criteria for inclusion from the population and setparent consenting to participate in the research children have been taken. Patients who were hospitalized in service other than the neurology service, patients who were hospitalized for the day, patients who had previously been diagnosed with malnutrition, and patients who had been hospitalized in the intensive care service for a long time were excluded from the study. Questions were asked by a physician to the patient's family or her, and various measurements were made.

The patients' hospitalization date, age, gender, diagnosis of hospitalization, weight, height, length, triceps skin fold thickness, and upper middle arm circumference were recorded. Weight from anthropometric measurements; 100 g with thin dress without shoes in patients over 2 years old using sensitive weighing, height was performed using standing 0.1 cm-sensitive stadiometry. Under 2 years old; The weight was made using a 10 g sensitive weighing scale, inpatient plastic tape measure. After measuring the weight, height of the patients, four different Z-scores [weight for age (WFA), height for age (HFA), weight for height (WFH), and body mass index (BMI) for age] were calculated using the World Health Organization (WHO) Anthroprogram (version 3.2.2, January 2011) for children 5 years of age or younger (http://www.who.int/childgrowth/software/en/). For children aged over 5 years, BMI-for-age, WFA, and WFH for age Z scores were evaluated with the WHO AnthroPlus software (http://www.who.int/growthref/en/). Gomez and Waterlow classification used.

Gomez Classification: Those with WFA bbetween 90 and 110 normal, bbetween 75 and 89 mild, 60%-74% those are moderate and those below 60% are severely malnourished.[10]

Waterlow Classification: HFA below 90%, WFA above 95% cases with acute malnutrition (AM), HFA above 90% that with WFA below 95% have chronic malnutrition (CM), cases with HFA below 90% and WFA below 95% are chronic-acute malnourished, HFA above 90%, WFA above 95% above is considered normal.[11,12]

Triceps skinfold thickness was measured with a caliper device to evaluate the decreased subcutaneous adipose tissue. This measurement; was performed on the left arm from the midpoint between the acromion and the olecranon. The midpoint was marked with the elbow flexed to 90 degrees, then the arm was released. The skin and the underlying fat tissue 1 cm above this point were grasped between two fingers and separated from the underlying muscle tissue. Holtain caliper, which is a special measuring tool that applies 10 g pressure per centimeter, was applied to the marked point at a right angle to the long axis of the arm. An average of three consecutive measurements was taken. Triceps skinfold thickness percentiles were calculated according to National Center for Health Statistics data in patients 5 months and older.[13] Patients under 5 months were excluded from the study since triceps skin fold measurement could not be done under 5 months. If the triceps skinfold thickness was found in the low percentile curve for age, it was recorded as 1 point, and if it was in the normal curve for age, it was recorded as 0 points.

For AM, WFH Z score or BMI for age Z, scores of ≥-3 to <-2 were considered moderate malnutrition and scores of <-3 as severe malnutrition, while scores of ≥-2 denoted lack of AM. For CM, HFA Z scores of ≥-3 to <-2 were deemed moderate malnutrition and scores of <-3 as severe malnutrition, while scores of ≥-2 denoted lack of CM in accordance with WHO classification. The risk for malnutrition was evaluated using the STRONGkids questionnaire, which was applied by face-to-face interview method by a pediatrician. This nutritional score identifies three risk categories (low, medium, and high) and correlates well with WHO malnutrition standards.[14] According to the sum of the scores recorded after the evaluations and measurements, the scale in terms of malnutrition risk and need for intervention was rated 0 points for low risk, 1-3 points for medium risk and 4-5 points for high risk. If patients were hospitalized in the neurology service for more than one week, measurements and evaluations were recorded repeatedly by the same physician (H.S.Ö.).

To determine whether the situation was stable, the patient's family was asked by the physician whether there had been any weight loss in the last weeks, or whether there had been a decrease or cessation in weight gain. It was recorded as 1 point if the answer was yes, and 0 point if the answer was no.

To determine whether the situation would worsen, the physician asked the patient's guardian whether the patient had excessive diarrhea (>5/day) and/or excessive vomiting (>3/day) in the last few days or decreased food intake during the last few days. Additionally, it was asked whether there was any previous nutritional intervention and whether there was insufficient food intake due to pain. If the answer to any of these questions was yes, it was recorded as 1 point, and if the answer was no, it was recorded as 0 points.

The patient's family was asked by the physician whether he had an underlying disease order to determine whether his illness had accelerated the deterioration of his nutritional status. It was recorded as 2 points in the presence of a disease within the scope of the underlying diseases and 0 points outside the scope of the scale.

Statistical Analysis

Statistical analyzes were performed using Statistical Package for the Social Sciences software version 22.0 (IBM Corporation, New York, NY, USA). The values for mean and standard deviation were calculated for distributing measurable variables. For distributing measurable variables, the Mann-Whitney U test was used to compare the data determined by the count. The Wilcoxon test was used to compare dependent variables. In the evaluation of the data, $p<0.05$ was considered significant.

RESULTS

A total of 200 patients, 89 (44.5%) female and 111 (55.5%) male, were included in the study. The mean age of the patients was 5.2±4.7 years, and the median age was 4.0 years. Most of the patients were children with epilepsy 104 (52%), this was followed by neurometabolic diseases 22 (11%) and mental motor retardation 12 (6%). 15.5% of the patients were accompanied by infectious causes. The anthropometric measurements of the patients included in the study are shown in Table 1.

It was seen that the STRONGkids tool determined that most patients 90 (45%) had low risk, 80 (40%) had moderate and 30 (15%) high-risk category. When the cases were analyzed by risk groups, there was no statistically significant difference between the groups in terms of gender (p=0.397).

Anthropometric measurements were repeated if the patients completed one week according to the length of hospital stay. One hundred fifty-six (78%) of the patients were hospitalized for less than 1 week. Accordingly, 39 patients were hospitalized for 1-2 weeks, 3 patients were hospitalized 2-3 weeks and 1 patient had 5 weeks of hospitalization. The average length of hospital stay was 5.5±3.9 days. Anthropometric features of patients who have been hospitalized for more than a week are shown in Table 2.

Total malnutrition was detected in 42 (21%) patients; 12 (6%) patients had CM and 30 (15%) patients with AM. A comparison of the basic characteristics of patients according to malnutrition risk groups is shown in Table 3.

As a result, the malnutrition rate in low-risk patients was 13 (6.5%). When we compare the risk groups and malnutrition types, there was no statistically significant relationship between general risk of malnutrition and the presence of acute and CM. There was also no significant difference in the presence of malnutrition among the risk groups (Table 4).

There were 69 (34.5%) patients with underlying disease at the time of hospitalization; 29 (42%) of the patients were in the high risk, 34 (49.2%) were risk and six (8.6%) were in the low risk group. AM was found in 8 (11.5%) of 69 patients with an underlying disease and CM was found in 7 (10.1%) of them. Patients with CM at the time of hospitalization had a higher rate of underlying disease than those with AM ($p<0.001$).

Table 1. Anthropometric measurements of the patients included in the study

	Mean±SD	Minimum	Maximum
Height (cm)	104.6±31.9 (102)	59.0	177.5
Height SDS	-1.03±1.96 (-1.08)	-7.16	6.43
Weight (kg)	21.8±16.3 (16.7)	5.0	77
Weight SDS	-0.62±2.26 (-0.68)	-7.26	22.65
Body mass index	18.2±3.8 (17.6)	8.7	34.7
Body mass index SDS	-0.03±1.99 (-0.005)	-8.37	9.53
Triceps scion fold (mm)	8.6±1.8 (7.2)	5.1	15.6
Height for age (%)	98.1±7.37 (98.3)	72.5	127.2
Weight for age (%)	99.3±19.5 (98.2)	44.4	178.8
Weight for height (%)	101.9±17.9 (100.0)	46.5	171.1

SDS: Standard deviation (SD) score

DISCUSSION

In our study, malnutrition was detected in 42 (21%) patients in the evaluation made by WFH values; 6% of patients had CM and 15% had AM. Similarly, Pawellek et al.[15], using WFH values in 475 hospitalized children, found the rate of malnutritution to be 24.1%.

Nutritional screening tests are important tools to detect whether patients have malnutrition or are at risk of malnutrition. These tests should identify patients at risk of hospital malnutrition simply and quickly.[16] STRONGkids, one of the advanced malnutrition screening tools for children, was developed for doctors in the Netherlands and consists of four parameters: subjective clinical evaluation; assessing recent weight loss; assessing a condition such as vomiting, diarrhea that will cause weight loss; and determining whether there is an underlying disease. Wiskin et al.[17] Applied Screening Tool for the Assessment of Malnutrition in Pediatrics (STAMP), STRONGkids, Pediatric Nutritional Risk Score (PNRS) and Pediatric Yorkhill Malnutrition Score (PYMS) to patients with inflammatory bowel disease in their study. When the scores were compared with HFA, WFA, and malnutrition rating based on BMI, there was a good agreement between STAMP, STRONGkids and PNRS scores and no correlation with PYMS. According to these results, STRONGkids is accepted as a usable scale as a tool to screen the risk of malnutrition.

Recently, Maciel et al.[18] Were conducted an observational, cross-sectional, and analytical study of a representative sample of hospitalized children in the emergency rooms of public hospital of Brazil. In their validation study, STRONGkids tool accuracy showed a sensitivity of 84.8%, specificity of 26.7%, positive predictive value of 49.8%, and negative predictive value of 67.2%, when the patients at nutritional risk were identified by anthropometry. They

Table 2. Anthropometric features of patients who have been hospitalized for more than a week

	2. week	3. week	4. week	5. week
Height (cm) mean±SD Min/max	104.2±32.6 (104.2) 62/170	117.3±48.2 (130) 64/158	158.2	158.2
Height (kg) mean±SD Min/max	22.19±19.1 (15.2) 5/75	36.17±35.3 (28.2) 6/75	75	75
Triceps scion fold (mm) mean±SD Min/max	8.72±2.08 (8.20) 5/15	8.10±2.51 (6.70) 7/11	11.2	11.2
Body mass index mean±SD Min/max	17.86±4.19 (16.70) 10/30	22.43±6.70 (20.8) 17/30	30.1	30.1

Min/max: Minimum-maximum, SDS: Standard deviation (SD) score

concluded that prevalence of malnutrition of 12.18%, showing the wide variation of these values, mainly due to methodological aspects.

Gómez et al.[19] first used WFA values to describe malnutrition. This method shows acute changes, but is not sufficient to detect CM. Studies related to assessment of hospital-based malnutrition as part of childhood malnutrition rates are scarce, and in most studies, reports of malnutrition rates have been determined using WFA method. In a study conducted on patients in childhood age groups to identify malnutrition in hospitalized patients, it was found that the most useful method was to use WFH.[20] However, while determining nutritional risk, other methods can be used depending on the ability to using morbidity-mortality easily and according to time-saving features.

In the study of Durakbaşa et al.[21], 494 pediatric surgery patients demonstrated a prevalence of malnutrition at 13.4%. Additionally, while the total of patients having moderate and high risk of malnutrition was 35.7% in that study. Our study showed a total moderate and high-risk rate of 55%. A possible reason for this difference is that the group in the other study included patients receiving elective pediatric surgery, a group less likely to be prone or suffer from malnutrition than patients admitted to the child neurology service. Also in the other study, AM was found in 8.2% of patients with a low risk of malnutrition and 33.3% of patients with a high risk; CM was detected in 3.5% of patients with a low risk of malnutrition and 16.7% of patients with a high risk of malnutrition. In our study, AM was in 13.3% of patients with low risk of malnutrition and 10% of patients with high risk of malnutrition; CM was detected in 1.1% of patients with a low risk of malnutrition and 16.6% of patients with a high risk of malnutrition. We thought that this difference was due to the demographic characteristics of the patients who were admitted for pediatric surgery.

Using PNRS scoring in pediatric oncology patients in one study, malnutrition was detected in 22.9% of patients at the time of admission to the hospital.[22] In another study conducted in Istanbul, the rate of CM rate was found to be 27%, the AM rate was 40.9%.[3] In a pair of studies done ten years apart by Oztürk et al.[23,24], they found AM rates of 31.8%

Table 3. Basic characteristics of patients within the risk groups of STRONGkids

	Low risk	Medium risk	High risk	p
Mean age (month)±SD	5.4±4.8	5.4±4.6	4.2±4.7	0.451
Mean length of stay (day)±SD	4.8±2.7	5.7±3.4	7.1±6.9	0.022
Mean height (cm)±SD	107.4±31.2	105.4±31.8	95.7±33.9	0.215
Mean weight (kg)±SD	24.1±16.6	21.1±15.7	16.7±16.2	0.091
Mean body mass index±SD	18.6±3.6	17.8±3.9	18.2±4.2	0.418
Triseps scin fold (mm)	9.2±1.5	8.3±1.9	7.3±1.6	<0.001
Mean height for age±SD	100.3±7.24	97.5±6.8	92.9±6.49	<0.001
Mean weight for age±SD	108.0±18.6	95.0±17.4	85.2±15.1	<0.001
Mean weight for height±SD	106.1±18.0	99.2±17.7	96.8±15.8	0.01
Mean height SDS±SD	-0.45±1.95	-1.25±1.88	-2.18±1.60	<0.001
Mean weight SDS±SD	0.16±2.64	-0.99±1.61	-2.04±1.47	<0.001
Mean body mass index SDS±SD	0.57±1.69	-0.29±2.18	-1.17±1.60	<0.001

Min/max: Minimum-maximum, SD: Standard deviation

Table 4. Comparison of risk groups and types of malnutrition

Malnutrition	Low risk	Medium risk	High risk	Total	Comparison	p level
Acute malnutrition						
n (%)					All groups	0.180
Positive	12 (13.3)	15 (18.7)	3 (10)	30 (15)	Low and medium	0.085
Negative	78 (86.7)	65 (81.3)	27 (90)	170 (85)	Low and high	0.120
Total	90 (100)	80 (100)	30 (100)	200 (100)	Medium and high	0.076
Chronic malnutrition						
n (%)					All groups	0.062
Positive	1 (1.1)	6 (7.5)	5 (16.6)	12 (6)	Low and medium	0.213
Negative	89 (88.9)	74 (92.5)	25 (83.4)	188 (94)	Low and high	0.098
Total	90 (100)	80 (100)	30 (100)	200 (100)	Medium and high	0.146

and 30.2% in chronological order. These different rates of malnutrition in these various studies may be linked to the heterogeneity of patient populations and evaluations in different departments. The rates in our study were similar to the literature data.

We found that 15% of our 200 patients had a high risk of malnutrition and need for intervention, 40% had a moderate risk and 45% had a low risk. In a study conducted in Belgium with a 3rd level hospital and two 2nd level hospitals, malnutrition risk and intervention requirement were high in 7.6%, moderate in 45.1% and low in 47.3%.[25] Similar to our study, it was observed that the duration of hospital stay was longer in high-risk patients. In the same study, infectious causes were identified as the most common diagnosis in the low and medium-risk group as a diagnosis of hospitalization, and non-infectious and non-surgical causes were the most common diagnosis in the high-risk group. In our study, epilepsy was the most common diagnosis in all the risk groups. In the same study, while the underlying disease was found in 88.9% of the group with high malnutrition risk, in our study the underlying disease was found in 100% of this group. The appearance of these different rates may be linked to the heterogeneity of patient populations and evaluations in different departments (surgery, internal branch).

In their study of 424 cases attended by 44 hospitals, Hulst et al.[9] found the malnutrition frequency as 19% using the WFH value. They detected an 8% high risk and 54% moderate risk when they used the STRONGkids screening test.

In a study conducted with nutritional risk screening scales in New Zealand, and examining healthy children from a second level hospital and surrounding schools, results showed that only the STRONGkids screening scale employing BMI, standard deviation score, and WFH values detected patients with moderate and high-risk malnutrition. It was observed that patients who had high risk with STRONGkids screening scale had longer hospital stays, in agreement with the literature.[26] In accordance with this study, our study group of patients with a high risk was found to have a long length of hospital stay.

Oruçoğlu and İnanç[27] With a study conducted in our country by the STRONGkids scoring questionnaire it has been confirmed to be sufficiently sensitive and specific to detect malnutrition in hospitalized children. Our study was conducted only on patients hospitalized in the pediatric neurology service, and to our knowledge, such a study has not been conducted before.

Moeeni et al.[28] Applied three nutritional risk screening tools (STAMP, PYMS and STRONGkids) to 119 children who were hospitalized in a 3rd step hospital and found the malnutrition rate as 25.2% during hospitalization. Thirty (25%) patients had an underlying disease. When evaluated with the STRONGkids screening tool, 41.2% of the children were low risk, 55.4% were moderate risk and 3.4% were high risk. At the end of the study, STRONGkids demonstrated itself to be the most useful and reliable screening tool. In our study 69 (34.5%) patients had underlying disease at the time of hospitalization.

Study Limitations

The limitations of our study; the fact that we were unable to identify malnutrition developing in the hospital and to evaluate recovery after nutritional support. In our study, the "yes" response to questions was found to be significantly high among those with high risk among malnutrition risk groups. Additionally, malnutrition risk and intervention requirement were higher in patients with underlying disease at admission. These findings support the use of the STRONGkids tool as a screening tool to identify patients at risk of malnutrition among pediatric neurology service patients and to raise the awareness of doctors to nutritional assessment among hospitalized patients. To our knowledge, there is no study evaluating patients hospitalized in the pediatric neurology service using the STRONGkids screening tool.

CONCLUSION

In conclusion, malnutrition is a common and important problem for patients hospitalized in pediatric neurology clinics too. Malnutrition scoring systems are recommended for determining the risk of malnutrition in these patients. We believe that the STRONGkids questionnaire is one of these scoring systems identifying high-risk patients rapidly without the need for anthropometric measurement. This topic merit support with continuing prospective studies.

Ethics

Ethics Committee Approval: Approval for this study was obtained from the Ethical Committee of University of Health Sciences Turkey, University Dr. Behçet Uz Children's Training and Research Hospital on 20.10.2016 as protocol number 2016/112.

Informed Consent: Written informed consent was obtained from the parents.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Medical Practices: H.S.Ö.., A.Ü., Ç.Ö.E., Concept: H.S.Ö.., A.Ü., Ç.Ö.E., Design: H.S.Ö.., A.Ü., Ç.Ö.E., Data Collection or Processing: H.S.Ö.., A.Ü., Ç.Ö.E., Analysis or Interpretation:

H.S.Ö.., A.Ü., Ç.Ö.E., Literature Search: H.S.Ö.., A.Ü., Ç.Ö.E., Writing: H.S.Ö.., A.Ü., Ç.Ö.E.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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