



The Turkish Validity and Reliability of the Pediatric Vestibular Symptom Questionnaire

Pedriatrik Vestibüler Semptom Ölçeği'nin Türkçe Geçerlik ve Güvenirliğinin Araştırılması

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ABSTRACT

Aim: The Pediatric Vestibular Symptom Questionnaire (PVSQ) identifies and measures subjective vestibular symptoms such as dizziness and imbalance in children. The aim of this study was to investigate the validity and reliability of the Turkish PVSQ in children with dizziness and balance disorders.

Materials and Methods: Fifty-two children (10.9±3.28 years) with complaints of dizziness and 40 healthy children (9.65±2.45 years) aged 6-17 years in the control group were included in the study. The scale normalized score ranges from 0-3. The reliability of the scale was evaluated by Cronbach's alpha coefficient, and validity was evaluated by confirmatory factor analysis (CFA). ROC curve was used to calculate the sensitivity and specificity of PVSQ in discriminating healthy children from those with vestibular symptoms.

Results: The mean PVSQ score of the children included in the study group was 9.81±6.16, and the control group was 1.10±3.12, and a statistically significant difference was found between the mean scores of the two groups (p<0.001). As a result of CFA, it was seen that the model was compatible. Turkish PVSQ has a high degree of internal consistency (Cronbach's alpha=0.890). The cut-off point of the PVSQ was 0.35, and the maximum sensitivity of the scale was 0.885, and the specificity was 0.950 at this point.

Conclusion: Turkish version of the PVSQ, used in the diagnosis and evaluation of dizziness and balance disorders in children, is a reliable, valid, easy to use, and brief measurement tool in the evaluation and severity of vestibular symptoms in children.

Keywords: Vertigo, dizziness, pediatrics, questionnaire

ÖZ

Amaç: Pedriatrik Vestibüler Semptom Ölçeği (PVSÖ), 6-17 yaş arası çocuklarda dizziness, denge bozukluğu gibi subjektif vestibüler semptomları belirlemekte ve ölçmektedir. Bu çalışmada baş dönmesi ve denge bozukluğu problemi olan çocuklarda Türkçe PVSÖ'nün geçerlilik ve güvenilirliğinin araştırılması amaçlanmıştır.

Gereç ve Yöntem: Çalışmaya 6-17 yaş arası baş dönmesi/dengesizlik şikayeti olan 52 çocuk (10,9±3,28 yaş) ve kontrol grubuna sağlıklı 40 çocuk (9,65±2,45 yaş) alınmıştır. Ölçek normalize puanı 0-3 arasında değişmektedir. Ölçeğin güvenilirliği Cronbach's alfa katsayısı, geçerliği doğrulayıcı faktör analizi (DFA) ile değerlendirilmiştir. PVSÖ'nün sağlıklı çocuklarla vestibüler belirtileri olanları ayırmada duyarlılığını ve özgüllüğünü hesaplamak ve kesim noktasını belirlemek için ROC eğrisi kullanılmıştır.

Bulgular: Çalışma grubuna alınan çocukların PVSÖ puan ortalaması 9,81±6,16, kontrol grubunun 1,10±3,12 olarak elde edilmiş ve iki grubun ortalamaları arasında istatistiksel açıdan anlamlı fark bulunmuştur (p<0,001). DFA sonucunda modelin uyumlu olduğu görülmüştür. Türkçe PVBÖ yüksek derecede iç tutarlılığa sahiptir (Cronbach's alfa=0,890). PVSÖ'nün kesim noktası 0,35 puan, bu noktada ölçeğin maksimum duyarlılığı 0,885, özgüllüğü 0,950 olarak elde edilmiştir.

Sonuç: Çocuklarda baş dönmesi ve denge bozuklukları problemlerinin tanınması ve değerlendirilmesinde kullanılan PVSÖ'nün, Türkçe sürümü çocuklarda vestibüler belirtilerin değerlendirilmesinde ve şiddetinin belirlenmesinde güvenilir, yüksek geçerliğe sahip, uygulaması kolay ve kısa süreli bir ölçüm aracıdır.

Anahtar Kelimeler: Baş dönmesi, denge bozukluğu, pediatri, ölçek

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INTRODUCTION

Vestibular problems are the most common cause of dizziness in childhood and its prevalence is thought to be between 5% and 15%¹⁻³. In addition to dizziness and imbalance complaints in children, vestibular disorders can negatively affect educational success and quality of life and cause psychological symptoms and avoidance behaviors³. While the leading causes of vestibular problems are benign paroxysmal vertigo and vestibular migraine in childhood, head trauma is the third most common cause of vertigo in children⁴. In addition to these, dizziness associated with otitis media (OM), psychogenic vertigo, vestibular neuronitis, Meniere's disease and central vertigo can also be seen^{5,6}.

Despite the diversity and incidence in pediatric vestibular diseases, it is noteworthy that when compared to adults, vertigo and imbalance complaints in children have received less attention in the literature. However, it often remains undiagnosed, as health professionals may describe these symptoms in children as a behavioral disorder or "clumsiness"⁷. The reason for this situation may be that children usually cannot express or describe their symptoms without asking appropriate questions, cannot easily accept the symptom terminology suggested by an adult, and may show behaviors such as hugging their parents while experiencing dizziness or lightheadedness⁸. A detailed medical history is the most important parameter of the diagnostic decision-making process to identify the symptoms, triggers, and process of the disease⁹. Therefore, in order to determine the etiology of the problem and make a diagnosis, it is extremely important to help the child describe his symptoms by providing different descriptors to express his complaints.

Although there are a number of questionnaires/scales to evaluate the presence, severity, and impact of vestibular symptoms in adults, there is no Turkish validity and reliability study for the pediatric population. The Pediatric Vestibular Symptom Questionnaire (PVSQ) is a scale developed by Pavlou et al.¹⁰ in 2016 to determine and measure subjective vestibular symptoms such as dizziness and imbalance in children aged 6-17 years. The aim of this study is to investigate the usability of the PVSQ by conducting validity and reliability studies in children with dizziness and balance disorder in Turkish society¹⁰. Thus, it will be possible to better analyze the problems of children with dizziness and balance disorders and to determine diagnosis-specific treatment and rehabilitation options.

MATERIALS AND METHODS

Participants

The study included 52 children aged 6-17 years, who met the inclusion criteria and were followed up in Hacettepe

University Hospital Dizziness and Balance Disorders Research and Application Center and Ear Nose and Throat Department, with the complaints of dizziness and balance disorder between March 2018 and December 2019. Forty children who did not complain of dizziness/imbalance were included as the control group. Participation in the study was on a voluntary basis and written informed consent of the children and their families was obtained. The study was conducted in accordance with the principles of the Declaration of Helsinki and permission was obtained from the Hacettepe University Non-interventional Studies Ethics Committee (decision no: GO 18/162-23, date: 13.02.2018). Twenty-nine girls and 23 boys, with a mean age of 10.9±3.28 (6-17 years), were involved in the study group, and 21 girls and 19 boys, with a mean age of 9.65±2.45 (6-17 years), were involved in the control group. Diagnostic and demographic information of the children are shown in Table 1.

Inclusion criteria for the study;

- Complaints of dizziness and/or balance disorder,
- Being at the age range of 6-17 years.

Exclusion criteria for the study;

- Presence of cognitive and/or orthopedic problems,
- Presence of central disorder other than vestibular migraine.

| Variables | Patient group (n=52) | Healthy group (n=40) |
|---|--------------------------------|------------------------------|
| Age | 10.9±3.28 | 9.65±2.45 |
| Gender | 29 F (55.77%) 23 M (44.23%) | 21 F (52.5%) 19 M (47.5%) |
| Diagnosis | | |
| BPV | n=8 (15.38%) | |
| VM | n=10 (19.23%) | |
| Dizziness following OM | n=10 (19.23%) | |
| BVH | n=3 (5.76%) | |
| UVH | n=3 (5.76%) | |
| VN | n=2 (3.84%) | |
| MD | n=2 (3.84%) | |
| MS | n=2 (3.84%) | |
| BHL (using CI) | n=8 (15.38%) | |
| BHL (using HA) | n=7 (13.46%) | |
| PVSQ score (mean±SD) | 9.81±6.16 | 1.10±3.12 |
| BPV: Benign positional vertigo, VM: Vestibular migraine, OM: Otitis media, BVH: Bilateral vestibular hypofunction, UVH: Unilateral vestibular hypofunction, VN: Vestibular neuronitis, MD: Meniere's disease, MS: Motion sickness, BHL: Bilateral hearing loss, CI: Cochlear implant, HA: Hearing aid, PVSQ: Pediatric Vestibular Symptom Questionnaire, SD: Standard deviation, F: Female, M: Male | | |

Methods

Volunteer children or parents/caregivers who met the inclusion criteria were asked to complete the PVSQ. For the Turkish adaptation of the scale, Marousa Pavlou, who developed the scale, was contacted and necessary permissions were obtained. The scale was translated into Turkish independently by two translators, one with clinical experience and the other with good command of the language, and then the two translations were compared and turned into a single translated text. Then, the text was re-examined by considering the problems encountered by field experts and independent translators and cultural differences, and was translated back into its original language, English, by two translation experts who had not seen the scale before. This form was compared with the original form and it was accepted that it was equivalent to the Turkish form and it was put into practice.

Pediatric Vestibular Symptom Questionnaire

The PVSQ identifies and measures subjective vestibular symptoms such as dizziness and imbalance in children aged 6-17 years¹⁰. The scale has two factorial structures: dizziness and balance. Dizziness is a nonspecific symptom defined as "rotational, positional or recurrent dizziness with vestibular vertigo, nausea, gaze instability and/or postural instability". The implementation of PVSQ takes approximately 10 minutes. There are four answer options in the scale, each item is scored between 0 (never) and 3 (most of the time), and there is an option of "I don't know". There are a total of 11 questions in the scale and the total score varies between 0 and 30. Normalization is achieved by dividing the total score by the number obtained by subtracting the number of "I don't know" answers from the total number of questions [total score / (total number of questions - "I don't know" answers)]. Ten questions are used in the normalization equation. For example, if the participant scored seven of the 10 questions between 0 and 3 and got 20 points, and gave the answer "I don't know" to the remaining three, the participant's score obtained as a result of normalization is $20/(10-3)=20/7=2.85$. The eleventh question asks whether symptoms prevent participation in activities and, if so, what activities. Higher scores from the scale indicate an increase in symptom severity.

Statistical Analysis

Descriptive analyses are given using mean (X) and standard deviation (SD). In order to examine the normality assumptions of continuous variables, before determining the construct validity of the scale, the correlation matrix was examined with the Bartlett's Test of Sphericity and whether the determinant was close to zero or not was evaluated with the Kaiser-Meyer-Olkin (KMO) coefficient. In order for the factor analysis to give reliable results, the KMO should be higher than 0.60 and the

Bartlett's test should be significant at the $p<0.001$ significance level¹¹. Afterwards, confirmatory factor analysis was performed and the Cronbach's alpha analysis was used to determine the internal reliability of the scale. The ROC (receiving operating characteristics) curve was used to calculate the sensitivity and specificity of PVSQ in distinguishing healthy children from those with vestibular symptoms. In all analyses, $p<0.05$ was accepted as the level of significance. Statistical Package for the Social Sciences (SPSS) V23.0 and AMOS 23.0 (IBM SPSS Statistics, USA) statistical programs were used for data analysis.

RESULTS

There was no statistically significant difference between the mean ages of the participants in the study group and in the control group ($p=0.082$). The mean PVSQ score of the children included in the study group was 9.81 ± 6.16 and 1.10 ± 3.12 in the control group and a statistically significant difference was found between the mean scores of the two groups ($p<0.001$).

Validity of the Scale

Construct Validity

As a result of the analyses, the KMO coefficient was determined as 0.872. The Bartlett's test of sphericity χ^2 value was determined as 528,329 (SD=10, $p<0.001$). The scale originally had two sub-dimensions. Among the parameters used to determine the fit adequacy of the model tested in confirmatory factor analysis (CFA), the chi-square goodness test was obtained as 49.462, the Goodness of Fit Index as 0.906, the Adjusted Goodness of Fit Index as 0.844, the Comparative Fit Index as 0.959, the Normed Fit Index as 0.889, and the Root Mean Square Error of Approximation (RMSEA) as 0.74. The value of RMSEA below 0.8 and other values above 0.9 indicates that the adaptability of the scale is appropriate. The value of chi-square/degrees of freedom (χ^2/SD) was found as 1.49. In Figure 1, the path diagram showing the distribution according to dizziness and balance factors is given.

Reliability

Internal Consistency Reliability

In this study, the reliability of the PVSQ was calculated with the internal consistency coefficient (Cronbach's alpha). This value was found to be 0.896, which is above 0.70 and indicates that the scale has a high degree of internal consistency. The sub-dimensions of the scale and the total Cronbach's alpha coefficients are given in Table 2. When the item was deleted, there was no significant change in Cronbach's alpha scores (range, 0.87-0.89). All items have a significant correlation with the total score and a high level of consistency with each other (Table 3).

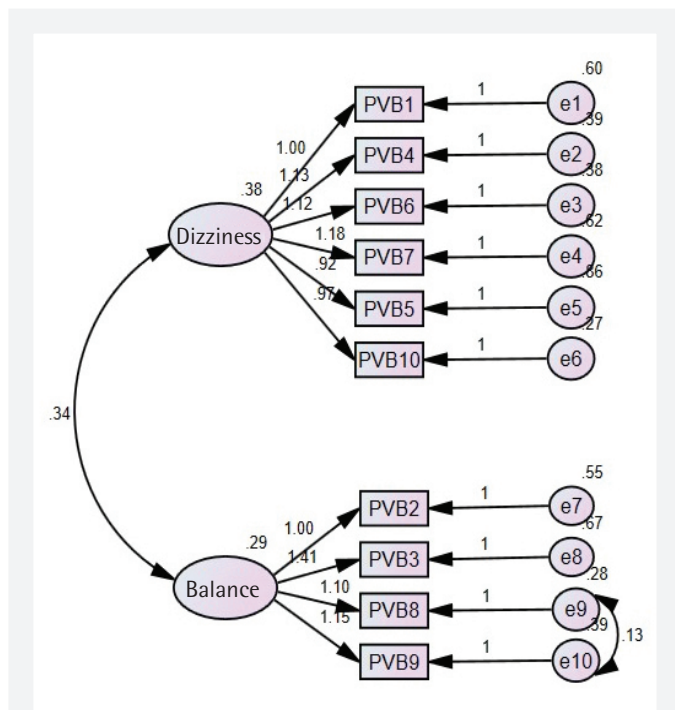


Figure 1. Confirmatory analysis path diagram of PVSQ in Turkish

PVSQ: Pediatric Vestibular Symptom Scale

Sensitivity and Specificity

The ROC curve of the PVSQ total score of children with vestibular problems is given in Figure 2. The area under the ROC curve calculated using the Youden index was 0.957, $p < 0.001$. The cutoff point was 0.35, and at this point, the maximum sensitivity of the scale was 0.885 and the specificity was 0.950.

DISCUSSION

In the present study, which aimed to establish the Turkish validity and reliability of the PVSQ, 92 children aged 6-17 years were included. The Turkish version of the scale was found to have high sensitivity and specificity. While the cut-off point of the scale was 0.68 out of 3, with 95% sensitivity and 85% specificity in the original scale, it was calculated as 0.35 with 88% sensitivity and 95% specificity in our study. The cut-off point was only compared with the original scale, as there was no other PVSQ validity study to which the scale could be compared. However, while children from a primary school were randomly included in the study in the original of the scale, in our study, children who did not have the complaints of dizziness and imbalance were included in the study group. Since the prevalence of vertigo and dizziness in school-age children is approximately 15%, the possibility that randomly selected children may also have undiagnosed

Table 2. Internal validity coefficient values of PVSQ and its sub-dimensions (Cronbach's alpha)

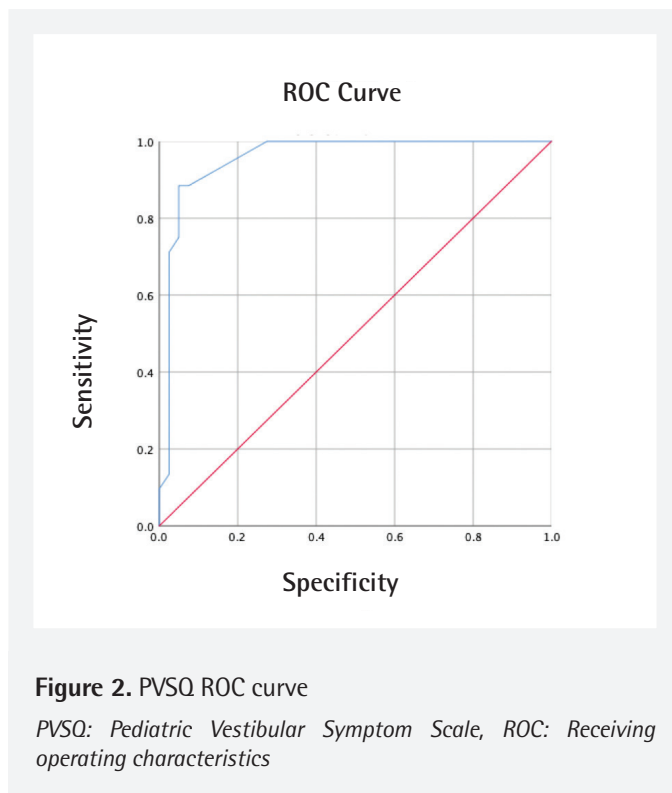
| Sub-dimensions | Items | Mean±SD | Cronbach's alpha | ICC |
|----------------|-------------------------|-----------|------------------|-------|
| Dizziness | 11, 14, 15, 16, 17, 110 | 3.66±4.31 | 0.835 | 0.829 |
| Balance | 12, 13, 18, 19 | 2.55±2.92 | 0.796 | 0.784 |
| Total | | 6.21±6.86 | 0.896 | 0.892 |

I: Items, ICC: Intraclass correlation coefficient, SD: Standard deviation, PVSQ: Pediatric Vestibular Symptom Questionnaire

Table 3. Mean scores, item/total correlation and alpha coefficient values of PVSQ items

| Item | Mean±SD | Scale average when item was deleted | Item/total correlation | Alpha coefficient when item was deleted | Adjusted total item correlation |
|---|-----------|-------------------------------------|------------------------|---|---------------------------------|
| 1. Feeling that objects are spinning or moving around | 0.65±0.83 | 5.47 | 0.369 | 0.883 | 0.572 |
| 2. Unsteadiness so bad that you actually fall | 1.24±0.85 | 5.49 | 0.340 | 0.884 | 0.549 |
| 3. Feeling sick | 1.70±0.87 | 4.98 | 0.488 | 0.878 | 0.656 |
| 4. A light-headed or swimmy feeling in the head | 1.82±0.83 | 5.48 | 0.577 | 0.875 | 0.687 |
| 5. Feeling of pressure in the ear(s) | 1.75±0.89 | 5.24 | 0.270 | 0.890 | 0.500 |
| 6. Blurry vision, difficulty seeing things clearly, and/ or spots before the eyes | 1.07±0.92 | 5.48 | 0.503 | 0.875 | 0.683 |
| 7. Headache or feeling of pressure in the head | 1.24±0.92 | 5.26 | 0.479 | 0.879 | 0.626 |
| 8. Unable to stand or walk without holding on to something or someone | 1.82±0.86 | 5.64 | 0.660 | 0.876 | 0.694 |
| 9. Feeling unsteady, about to lose balance | 1.09±1.00 | 5.48 | 0.626 | 0.877 | 0.670 |
| 10. A fuzzy or cotton wool feeling in the head | 0.92±0.94 | 5.57 | 0.662 | 0.874 | 0.722 |

PVSQ: Pediatric Vestibular Symptom Scale, SD: Standard deviation



vestibular problems is thought to be one of the reasons for this higher rate. The internal consistency coefficient of the Turkish PVSQ was found to be 0.892. Since this ratio is close to 1, it is seen that the scale has a high degree of internal consistency. When the item was deleted, there was no significant change in Cronbach's alpha scores (range, 0.87-0.89). All items have a significant correlation with the total score and a high level of consistency with each other. The corrected total item correlation of >0.5 indicates that each item has discriminative capacity. It was stated that the original scale had high internal consistency (Cronbach's $\alpha=0.88$)¹⁰.

There are two factor structures in the scale, namely dizziness and balance. While "dizziness" is defined as a non-specific symptom, "vestibular vertigo" is defined as rotational, positional or recurrent dizziness with nausea, gaze and/or postural instability¹⁰. While the items 1, 4, 6, 7, and 10 were defined in the dizziness sub-factor and the items 2, 3, 5, and 8 were defined in the balance sub-factor in the original scale, item 9 (feeling of imbalance or feeling of being out of balance) was taken into two factor structures due to factor loads. However, CFA was performed in our study and the fit indices were not obtained at normal values. The items were evaluated in terms of CFA results and significance, and the 5th item was included in the dizziness, and the 10th item was included in the balance sub-factor. As a result, the items 1, 4, 5, 6, 7, and 10 were taken into the dizziness sub-factor and the items 2, 3, 8, and 9 into the balance sub-factor, and the CFA results show that the construct validity of the Turkish

version of the scale is appropriate. The value of RMSEA below 0.8 and other values above 0.9 show that the adaptability of the scale is appropriate. However, it is seen that some items of the scale indicate both dizziness and balance complaints, so it is thought that it would be more appropriate to evaluate the scale in one dimension.

Item 11 of the scale ("Do any of these symptoms keep you from doing what you want to do? If your answer is "yes", please specify") was not included in these analyses as it was an open-ended question. In the study of Pavlou et al.¹⁰, 87.5% of the participants answered to this question, while they reported the symptoms of headache and a feeling of pressure (79.6%), a feeling of lightness in the head (65%), and a feeling of rotation or movement of objects (57%), nausea (42.9%), and loss of balance (40.8%). In our study, 65.38% (n=34) of the participants answered "yes" to this question, 29.4% (n=10) of these children had headache, 44.11% (n=15) had loss of balance, 47.05% (n=16) complained of the sensation of objects turning or moving, 44.11% (n=15) of them complained of nausea, and 5.88% (n=2) had the complaint of the sense of pressure.

In a review study with ten articles covering a total of 724 subjects, benign paroxysmal vertigo (18.7%) and migraine-related vertigo (17.6%) in childhood were shown as the two main conditions associated with vertigo and dizziness in children, and head trauma was found to be the third most common cause of vertigo (14%)⁵. Similarly, in our study, 19.23% of the participants had a diagnosis of VM and 15.38% of them had a diagnosis of benign positional vertigo.

In addition, 15.38% of the children who participated in our study had the complaints of dizziness/imbalance after OM. It is thought that this situation can be explained by the fact that children with conductive hearing loss due to OM have more oculomotor abnormalities than their peers with normal hearing¹². Casselbrant et al.¹³ stated that OM attacks may affect children's balance, make them more clumsy and prone to accidents, and possibly impair motor development. In addition to conductive hearing loss, it is stated that vestibular function is also impaired in children with sensorineural hearing loss, and children with hearing loss have worse balance performance compared to children with normal hearing¹⁴. In our study, it is seen that approximately 29% of children with dizziness and balance disorder have hearing loss and use hearing aids such as cochlear implants and hearing devices.

Study Limitations

The study has some limitations. First of all, correlation with other scales could not be evaluated since there is no other Turkish scale evaluating dizziness/imbalance in children. Since there is no adaptation study in the literature other than the

original language of the scale, validity, reliability and cut-off point values in other languages could not be compared. While determining the number of participants, it was planned to take 10 participants for each item, considering the number of scale items, but since 100 participants could not be reached, a study was conducted with 92 participants. The desired sample size could not be reached due to the faster recovery of vertigo problems in children compared to adults and fewer clinical applications. Further studies with more participants are needed.

CONCLUSION

Dizziness and balance disorders are important problems affecting motor and cognitive development and quality of life in childhood. In this study, the Turkish validity and reliability of the PVSQ, which is used in the diagnosis and evaluation of dizziness and balance disorders in children, was investigated. Turkish PVSQ is a reliable, highly valid, easy-to-apply and short-term measurement tool for the evaluation and severity of vestibular symptoms in children. It is thought that the use of such scales will contribute to the early intervention and rehabilitation process by determining the balance problems experienced by children and the degree of disability.

Ethics

Ethics Committee Approval: The study was approved by the Hacettepe University Non-interventional Studies Ethics Committee (decision no: GO 18/162-23, date: 13.02.2018).

Informed Consent: Participation in the study was on a voluntary basis and written informed consent of the children and their families was obtained.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: B.A., Concept: S.A., Design: B.A., S.A., Data Collection or Processing: B.A., Analysis or Interpretation: B.A., S.A., Literature Search: B.A., Writing: B.A., S.A.

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

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