

# Inter-Observer Reliability of Brachial Plexus Outcome Measure in Children with Brachial Plexus Palsy

## Brakiyal Pleksus Felci Olan Çocuklarda "Brachial Plexus Outcome Measure-Brakial Pleksus Sonuç Ölçümü" nün Gözlemciler Arası Güvenilirliği

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### INTRODUCTION

Obstetrical Brachial Plexus Palsy (OBPP) is the brachial plexus injury due to a problem that occurs in the event of birth at the rate 0.4-4/1000 of livebirths (1). The end of the injury and the duration of the healing depend on the type of nerve damage and on the wounded nerve roots, which also affects functionality (2). Clinical scales used as evaluation criteria are objective tests, but also subjective tests depend on the usage of the clinician. The Brachial Plexus Outcome Measure (BPOM) is a impact of disease functional evaluation in children whoschool-aged with OBPP. The BPOM has two components: Activity and Self-Evaluation Scales. The BPOM-

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### Öz

**Amaç:** Brakiyal pleksus felci olan hastaların günlük yaşam aktivitelerini, klinik işlevlerini değerlendirmek için birçok ölçek geliştirilmiştir. "Brachial Plexus Outcome Measure-Brakial Pleksus Sonuç Ölçümü", 2012 yılında Emily Ho tarafından geliştirildi, aktivite ve kendini değerlendirme bileşenlerden oluşan toplam 14 madde içeren bir ölçektir. Çalışmamız gözlemciler arası güvenilirliği araştırmak ve hastalara klinikte uygulamayı amaçlamaktadır.

**Hastalar ve Yöntem:** 2016 ve 2017 yılları arasında demografik ve klinik veriler kaydedildi, "Brachial Plexus Outcome Measure-Brakial Pleksus Sonuç Ölçümü" iki farklı değerlendirmeci tarafından uygulandı. Gözlemciler arası güvenilirlik Kappa istatistikleri kullanılarak yapıldı.

**Bulgular:** On sekiz kadın (% 37,5) toplam 48 hasta dahil edildi. Gözlemler arası güvenilirlik mükemmeldi (kappa 0.93). Uyum istatistiklerinde, gözlemcilerin madde analizlerinin ılımlı (kappa 0.57) olduğu görüldü.

**Sonuç:** "Brachial Plexus Outcome Measure-Brakial Pleksus Sonuç Ölçümü", Türkiye'de brakiyal pleksus felci olan çocuklarda fonksiyonların değerlendirilmesi için güvenilir bir ölçümdür. Klinik kullanımı uygundur.

**Anahtar Kelimeler:** Brakial pleksus, fonksiyon, gözlemciler arası güvenilirlik, sonuç ölçümü

### Abstract

**Aim:** Many scales have developed to assess daily living activities, clinical functions of patients with brachial plexus palsy. "Brachial Plexus Outcome Measure " was developed by Emily Ho in 2012, activity and self-rating substance scale consisting of components total 14 items. Aim of this study, make an inter-observer reliability of scale, to make clinical trial in patients.

**Patients and Methods:** Demographic and clinic datas recorded, "Brachial Plexus Outcome Measure " was applied by two different observers between 2016-2017. Inter-observer reliability in items examined by using kappa statistic. Inter-observer reliability in items examined by using kappa statistic.

**Results:** Eighteen female (37.5%) totally 48 patients included. Mean inter-observer agreement in the items was almost perfect (kappa 0.93) in raters. Fitted statistics showed much variation in observers had moderate (kappa 0.57) agreement in items.

**Conclusion:** Between observes, "Brachial Plexus Outcome Measure" is reliable measurement for assessing functions in children with brachial plexus palsy in Turkey. Clinical usage is appropriate.

**Key words:** Brachial Plexus, function, observer variation, outcome assessment

Activity scale evaluates functional motion models that are deficient of the child affected extremity. The child's performance is scored with a 5-point ordinal likert scale pursuant to the ability of completing the task and the quality of the action model. The subtitle of BPOM is Self-Evaluation scale consists 3 visual analog scales (10 cm) for evaluating arm, hand sensed function, and limb cosmetic appearance (3). There is no Turkish evaluation scale in this area. Inter-observer results are important for reliability and widespread usage in assessment. Our study was planned to assess inter-observer agreement for Brachial Plexus Outcome Measure and identify sources of conflict. It is aimed to spread the clinical usage of the scale.

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## PATIENTS AND METHODS

The study is planned after getting required permission, and power analysis was performed. The study has included 52 patients selected according to eligibility criteria from 62 cases who had been operated in Istanbul Medical Faculty, department of Plastic Reconstructive and Aesthetic Surgery. Four cases were excluded from the study due to exclusion criteria. Study including criterias were while 4-18 years old children, who had a microsurgery in early term for treatment of brachial plexus, had a secondary operation in the late period, no cooperation problem with using upper limb in their daily living activities, 6 months after surgery and voluntary consent with written approval have been received. If the patients were removed any neurological and/or musculoskeletal disorders, congenital extremity malformations and hereditary disorders. Totally 48 patients with brachial plexus met the participation criteria. Collected data included demographics such as sex, age, side of injury, involvement type and Narakas Classifications etc. Detailed clinical evaluations were performed on affected extremities and functions with both arms on scales. This study was approved by the Clinical Research Ethics Board dated 25/12/2015 and numbered 96351633-108.99 with the number of files and made in accordance with the Helsinki Declaration. The study done between January 2016 - January 2017 in Istanbul Medical Faculty, department of Plastic Reconstructive and Aesthetic Surgery, Hand Rehabilitation unit by two physiotherapists.

Brachial Plexus Outcome Measure which was allowed to use with permission from developer was performed by 2 independent observers who were all had clinical experiments on brachial plexus for years. Observer one, the physiotherapist, and work at hand surgery rehabilitation unit 23 years. Second observer, the physiotherapist, had experience in this field for 16 years'. The two observers are members of

the hand rehabilitation physiotherapists, and studied in developmental neurology master education in department of pediatric neurology, they also worked in one of the pediatric rehabilitation council while they studied master and doctorate terms in the university. At the beginning of the study, observers made an agreement on a standardized assessment and used an average of 15-30 minutes per each child. Observers who performed BPOM had a history, physical examination and physiotherapy evaluations (such as range of motion, muscle strength, etc.) for each patient before study. BPOM was performed on upper limb functions and self evaluation part of scale was filled by patient with asking verbally.

### Statistical Analysis

Patient demographics, BPOM scale data were analyzed with descriptive statistic. Inter observer reliability refers to agreement or non-agreement between observers. Cohen Kappa was formed an estimated of two observers to stand for the interobserver reliability of the statistic. The values of Kappa statistic are between 0 and 1 (0.01-0.20 small agreement, 0.21-0.40 fair agreement, 0.41-0.60 moderate agreement, 0.61-0.80 significant agreement and 0.81 -0.99 show an almost perfect deal) (4,5). Percentage agreement means the raw numeric value for the total number of agreements of the valuation. Bonferroni correction was considered statistically significant for 48 patients with  $p < 0.001$  in order to maintain the error rate of 0.05. Statistical analyses were performed by using SPSS software, version 20 (SPSS Inc., Chicago, Illinois).

## RESULTS

Data from the BPOM of 48 children analysis was included. Demographical and clinical information is ensured in Table 1. All patients were tested with bilateral upper extremity testing. Agreement status, kappa of each BPOM total and item scores between

**Table 1.** Demographic and clinical informations of children with OBPP

|                                | N               | %                 |
|--------------------------------|-----------------|-------------------|
| Sex (Girl/boy)                 | 18/30           | 37.5/62.5         |
| Lesion side (Right/Left)       | 32/16           | 66.7/33.3         |
| Involvement type (I/II/III/IV) | 6/23/12/7       | 12.5/47.9/25/14.6 |
| Birth type (vaginal/cesarean)  | 41/7            | 85.4/14.6         |
|                                | <b>X±SD</b>     | <b>Min-Max</b>    |
| Age (years)                    | 8.68±2.432      | 5-14              |
| Birth weight (gram)            | 4054.86±538.504 | 2840-5350         |
| Birth height (centimeter)      | 51.11±1.729     | 48-56             |

a=Narakas Classification; I, represents involvement of C5 and C6 nerve roots, II, C5-7; III, C5-T1, IV, C5-T1 with Horner syndrome, X=Mean, SD=Standard Deviation, Min=Minimum, Max=Maximum, OBPP=Obstetrical Brachial Plexus Palsy

**Table 1.** Overall agreement among two observers in determining BPOM

|            | <b>Kappa</b> | <b>p</b> | <b>Agreement Status</b> |
|------------|--------------|----------|-------------------------|
| BPOM total | 0.925        | <0.01    | Almost perfect          |
| BPOM 1     | 0.567        | <0.01    | Moderate                |
| BPOM 2     | 0.826        | <0.01    | Almost perfect          |
| BPOM 3     | 0.592        | <0.01    | Moderate                |
| BPOM 4     | 0.875        | <0.01    | Almost perfect          |
| BPOM 5     | 0.737        | <0.01    | Substantial             |
| BPOM 6     | 0.890        | <0.01    | Almost perfect          |
| BPOM 7     | 0.567        | <0.01    | Moderate                |
| BPOM 8     | 0.647        | <0.01    | Substantial             |
| BPOM 9     | 0.875        | <0.01    | Almost perfect          |
| BPOM 10    | 0.664        | <0.01    | Substantial             |
| BPOM 11    | 0.665        | <0.01    | Substantial             |
| BPOM 12    | 0.764        | <0.01    | Substantial             |
| BPOM 13    | 0.768        | <0.01    | Substantial             |
| BPOM 14    | 0.910        | <0.01    | Almost perfect          |

BPOM=Brachial Plexus Outcome Measure

observers are presented in Table 2.

## DISCUSSION

According to the results of our study, the usage of scales by physiotherapists; clinical experience, easy applicability of the scale and comprehensibility of scale items. The structural problems are seen in upper extremity OBPP limit the performance of ADL and participation in home and society activities. Strömbeck and colleagues emphasized that although the purpose of both conservative and surgical treatments enhance the child's functional level, there are few studies concerning the functional rehabilitation of OBPP in literature (6). The evaluations in OBPP are gathered in 4 groups including classification, diagnostics, physical examination and functional outcome (7).

Measurements of brachial plexus in clinically are substantial to describe problems and conceive therapeutics targets and schemes for children who are OBPP. Determination of the aim and standardized variables and understanding of the rehabilitation team of the hand rehabilitation team in the brachial plexus palsy examination will contribute to better results. Inter and intra observer credibility of the overall evaluation of function by BPOM in children with brachial plexus have not been studied in Turkey. Although there is no literature to support the reliability and validity of the studies in other languages without original-English. Our study is unique in this side.

There are several published data on inter-observer evaluation in children with OBPP. Most studies are identified in the literature that assessed inter and intra observer reliability were limited also (8). Hill et al. (9)

reported the preliminary analysis support the validity of internal structure in order to evaluate the post traumatic brachial plexus injury activity regardless of injury level, age of recruitment, premorbid limb pressure and time posture. They said that test-retest reliability and the need for further investigation to determine whether to respond.

The findings of our study promote a guide for assessment and a quantitative inter-observer reliability of function and movement by BPOM. The highest inter observer reliability was for the observers (kappa 0.93). These results may led to a number of possibilities. Presently there is no standard protocol or guidelines in the literature for the consideration of brachial plexus paralysis. There was moderate deal in the appraisalment of the functional movement scale differences between 3 and 4 scoring; 3 means that completes task, absent active motion on primary carriers. You can use passive range of motion to complete the motion pattern, complete 4 tasks, activate all movement actively, or the position of the primary actuators are sufficient for the function. Compensatory techniques used to complete the motion pattern. The studies reviewed contained evaluation of general functions and mesasurements (10), however limited of the literature is no evidence-based levels of function measurements and there is no standart protochols to manage the treatment. It is important to developpe new scales with clinical outcomes. There is a need for evaluation the disease which in specific scales to decide the objective and clear results with more related conditions.

We evaluated the interobserver deal for overall considerations which were used range of motion,

muscle strength, etc. Broachard et al. (11) reported that their emphasizes the promotion of authenticated shoulder strengths in children with brachial plexus paralysis, helps presume deformity progress. There was close agreement for these measures in our study. These results also specify the significance of using objective criteria in our study. Additionally, observers may have had different time of measurements. However there is no more differences between them and intra-observers.

Long-term follow-up of children with brachial plexus palsy by the as well observers of the team could induce a partiality. Before we worked, we tried to avoid these standardized methods and evaluated children who were obtuse to every person.

Limitations of our study; there was no work to compare with which is made to translate from the another language.

## CONCLUSION

In conclusion, normalized of evaluation and usage of objective variances among observers of the hand surgery rehabilitation group are needed. It increases the success of the cooperative and treatment in affected extremities.

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