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FACTORS AFFECTING MORBIDITY IN CHILDREN WITH CEREBRAL PALSY SEQUELAE WHO UNDERWENT CORRECTIVE OSTEOTOMY

DÜZELTİCİ OSTEOTOMİ YAPILAN SEREBRAL PALSİ SEKELLİ ÇOCUKLARDA MORBİDİTEYİ ETKİLEYEN FAKTÖRLER

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ABSTRACT

Objective: Cerebral palsy (CP) is a neurodevelopmental disease characterized by movement and posture disorders due to non-progressive damage. Femur varization-derotation osteotomy is a surgical procedure performed to correct femoral anteversion in patients with CP. The aim of this study is to determine the factors affecting morbidity in children with CP sequelae who underwent corrective osteotomy.

Materials and Methods: Children with CP sequelae who underwent correction osteotomy were included in the study between 2007 and 2020. Information about the patients was obtained from the archived files and evaluated retrospectively. 105 patients were divided into two groups according to the perioperative morbidity: Group 1 (no morbidity) including 62 patients and group 2 (presence of morbidity) including 43 patients.

Results: We did not report any significant differences between group 1 and 2 in terms of age and body mass index. In Group 2, ASA scores were higher significantly (p=0.006). Prognostic nutritional index was significantly lower in Group 2 (p=0.001). There was no significant difference in length of hospital and intensive care unit stay.

Conclusion: Malnutrition is an important factor that causes an increase in postoperative morbidity in pediatric patients with CP sequelae. In patients with CP sequelae planned for varization-derotation osteotomy, a treatment plan can be prepared on a patient basis to reduce postoperative morbidity.

Keywords: Cerebral palsy, varization-derotation osteotomy, malnutrition, prognostic nutritional index

ÖZET

Amaç: Serebral palsi (SP), ilerleyici olmayan hasara bağlı hareket ve duruş bozuklukları ile karakterize nörogelişimsel bir hastalıktır. Femur varizasyon-derotasyon osteotomisi, SP'li hastalarda femoral anteversiyonu düzeltmek için yapılan cerrahi bir işlemdir. Bu çalışmanın amacı, düzeltici osteotomi uygulanan SP sekeli çocuklarda morbiditeyi etkileyen faktörleri belirlemektir.

Gereç ve Yöntem: Bu çalışmaya, 2007-2020 yılları arasında SP sekeli olan ve düzeltme osteotomisi yapılan çocuklar dahil edildi. Hastalara ait bilgiler arşiv dosyalarından elde edildi ve retrospektif olarak değerlendirildi. Yüz beş hasta perioperatif morbiditeye göre: Grup 1 (morbidite yok) 62 hasta ve grup 2 (morbidite var) 43 hasta olarak iki gruba ayrıldı.

Bulgular: İki grup arasında yaş ve vücut kitle indeksi açısından anlamlı fark yoktu. ASA skorları Grup 2'de anlamlı olarak yüksek bulundu (p=0,006). Prognostik nutrisyonel indeks Grup 2'de anlamlı olarak daha düşüktü (p=0,001). Hastane yatış süresi ve yoğun bakım yatış süresi açısından anlamlı fark yoktu.

Sonuç: Malnütrisyon, SP sekeli olan çocuk hastalarda postoperatif morbiditede artışa neden olan kritik bir faktördür. Varizasyon-derotasyon osteotomisi planlanan SP sekeli hastalarda postoperatif morbiditeyi azaltmak için hasta bazında tedavi planı hazırlanabilir.

Anahtar Kelimeler: Serebral palsi, varizasyon-derotasyon osteotomisi, malnutrisyon, prognostik nutrisyonel indeks

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INTRODUCTION

Cerebral palsy (CP) is a neurodevelopmental disease characterized by movement and posture disorders due to non-progressive damage to the motor control centers of the developing infant brain (1). The clinic of cerebral palsy can be highly variable (2). Comorbidities such as epilepsy, ocular anomalies, hearing problems, gastroesophageal reflux disease, sleep apnea, incontinence, developmental disorders, and musculoskeletal system diseases may accompany (3). The second most common deformity detected in patients with CP is hip subluxations. Hip subluxations are absent at birth, later develop due to muscle weakness and spasticity, and are progressive (4). If left untreated, it can cause painful hip, severe hip fractures, and deformities. Femur varization-derotation osteotomy is a surgical procedure performed to correct femoral anteversion in patients with CP (5). Considering that patients with CP have many comorbidities, a multidisciplinary approach is required in the management of the pediatric age group. It is known that the patient's cognitive, neurological, respiratory and nutritional status in the preoperative period affect the perioperative morbidity (6). Morbidity and mortality can be reduced by identifying modifiable risk factors and providing preoperative optimization for the patient. The aim of this study is to determine the factors affecting morbidity in children with CP sequelae who underwent corrective osteotomy.

MATERIALS AND METHODS

After obtaining Clinical Studies Ethical Committee of the Istanbul Faculty of Medicine approval (Date: 05.04.2022 No: 836328), this retrospective study was conducted in the Istanbul Medical Faculty, Department of Orthopedics and Traumatology. Children with CP sequelae who underwent correction osteotomy were included in the study between 2007 and 2020.

Inclusion criteria for the study were determined as pediatric patients aged 1-18 years, a diagnosis of CP, ASA I-II-III patients, performing a femur varization-derotation osteotomy operation under general anesthesia. Exclusion criteria were patients who were operated on urgently, ASA IV patients, and cases with missing data in the file. Patients divided into two groups according to the perioperative morbidity. Perioperative morbidity was analyzed under three main factors as perioperative hypotension, arrhythmia, and respiratory complications. The perioperative period was defined as in hospital morbidity for the index procedure. Respiratory complications consisted of laryngospasm, bronchospasm, and pneumonia. The drop of 20% in baseline systolic blood pressure was defined as hypotension. Archived files, perioperative anesthesia forms, intensive care follow up records, and discharge information in the hospital registration system were used to obtain the data. The demographic data (age, body mass index (BMI)) of patients were recorded. Operation duration, the amount of fluid and blood given intraoperatively, and intensive care unit (ICU) and hospital length of stay were registered. The nutritional status of the patients was evaluated with prognostic nutritional index (PNI). Preoperative lymphocyte count and albumin values were recorded. The formula of PNI=10×albumin+0.05×lymphocyte count.

Children who had general anesthesia for correction osteotomy in the study underwent tracheal intubation by administration of 1-2 µg/kg fentanyl and 0.6 mg/kg rocuronium, and maintenance was provided by 1-MAC sevoflurane.

Statistical analysis

The SPSS.21 software was used for the statistical analyses. Descriptive statistical methods were used in the analysis of the data in addition to Student t-Test and Mann Whitney U tests for the two-group comparisons of the qualitative data with and without normal distribution, respectively. Fisher's Exact test were used in comparison of qualitative data. The level of significance was accepted as $p<0.05$.

RESULTS

A total of 138 patients were assessed retrospectively according to the eligibility criteria. After excluding 33 patients because of missing data in the files, the remaining 105 patients divided into two groups according to the perioperative morbidity: Group 1 (no morbidity), including 62 patients, and group 2 (presence of morbidity), including 43 patients.

The mean age of the patients was 10.27±5.56 years. The BMI averaged 14.45±11.04. The mean PNI value is 60.15±10.55 The descriptive and perioperative clinical characteristics of the patients are given in Table 1.

There was no significant difference between the two groups in terms of age and BMI ($p>0.05$). ASA scores were found to be significantly higher in Group 2 ($p=0.006$). Prognostic nutritional index was significantly lower in Group 2 ($p=0.001$) (Table 2).

The duration of operation was similar in both groups ($p>0.05$). Intraoperative fluid and transfused blood amount were similar in both groups ($p=0.110$; $p=0.231$ respectively). We did not report any significant differences in length of hospital and ICU stay ($p>0.05$) (Table 2).

DISCUSSION

In this retrospective study, low preoperative PNI value ($p<0.001$) and high ASA score ($p=0.006$) were found to increase the risk of morbidity in the postoperative period in pediatric patients with CP sequelae who under-

Table 1: Demographic characteristics of the study participants

	n=105
Age (years)	10.27±5.56
Body mass index (BMI)	14.45±11.04
ASA	
II	93 (89%)
III	12 (11%)
Albumin (gr/dl)	4.47±1.13
Lymphocyte (/mm³)	3050.31±1675.16
Prognostic nutritional index (PNI)	60.15±10.55
Operation duration (minute)	142.86±74.68
Perioperative fluid (ml)	873.90±895.51
Length of intensive care unit (ICU) stay (days)	3.91±3.2
Length of hospital stay (days)	5.79±4.49
Complications	43 (40.95%)

ASA: American Society of Anesthesiologists

Table 2: Comparisons of groups

	Group 1 n=62 (59.9%)	Group 2 n=43 (40.1%)	p–value
Age (years)	10.73±5.99	9.60±4.87	0.375
Body mass index (BMI)	15.42±11.09	13.17±10.97	0.448
ASA			
II	60 (96.77%)	33 (76.74%)	0.006*
III	2 (3.23%)	10 (23.26%)	
Albumin (gr/dL)	4.48±1.01	4.43±1.34	0.331
Lymphocyte (/mm³)	2586.78±1362.03	3311.04±1788.61	0.346
Prognostic nutritional index (PNI)	62.75±6.52	58.35±12.34	<0.001*
Operation duration (minute)	141.77±79.78	144.42±67.53	0.235
Perioperative fluid (ml)	775.16±631.11	1016.28±1171.38	0.110
Perioperative blood transfusion			
(-)	60 (96.77%)	39 (96.70%)	0.231
(+)	2 (3.23%)	4 (9.30%)	
Postoperative ICU stay			
(-)	47 (88.68%)	23(82.14%)	0.417
(+)	6 (11.32%)	5(17.86%)	
Length of ICU stay (days)	3.17±2.64	4.80±5.26	0.268
Length of hospital stay (days)	4.98±4.66	6.95±4.01	0.876

ASA: American Society of Anesthesiologists, ICU: Intensive care unit, *: p<0.05 is defined as statistically significant

went varization-derotation osteotomy under general anesthesia.

It has been suggested that preoperative nutritional assessment in patients with CP sequela helps in improving the clinical condition of the patients (7). Malnutrition has been seen as a contributing factor to the development of postoperative complications due to suppressed immune system, delayed wound healing, and worsening of gastroesophageal reflux (8, 9). The simplest method that can be used to evaluate the immune system status is to

calculate the absolute lymphocyte count. The main indicator of the patient's protein status is the serum albumin level (10, 11). Prognostic nutritional index calculated by serum albumin and lymphocyte is a useful biomarker for postoperative complications and systemic inflammation (12). PNI value has been shown to be an independent prognostic factor for predicting postoperative complications and survival in patients undergoing different tumor surgeries (13-16). Obana et al., in a retrospective study including 155 patients with CP sequelae who underwent varus derotation osteotomy, found that the risk of postoperative complications did not decrease in patients who underwent preoperative nutritional evaluation (17). However, in this study, the patients' old and current anthropomorphic measurements, diets, and nutritional recommendations recommended by the hospital dietitian were taken as a basis for preoperative nutritional evaluation. Albumin and total protein values of the patients were not measured routinely.

In our study, the preoperative PNI value was found to be lower in the group with postoperative morbidity, and age and BMI were not associated with postoperative morbidity. Although previous studies in the literature included pediatric patients with sequelae of CP, very few studies have mentioned cases of varization-derotation osteotomy (18-20). At least 1 major complication was found in 49% of pediatric patients with CP sequelae who underwent spinal surgery, and it was observed that 77% of these patients had 2 or more comorbidities in the preoperative period (6). In our study, morbidity was observed in 40.1% of the patients in both groups, and 76.7% of the patients with postoperative morbidity were found to have ASA II and 23.2% ASA III.

There are some limitations of our study. It is based on data from a single center retrospectively, so prospective randomized controlled studies are needed. Another limitation of the study is small sample size. Different results can be obtained with large number of patient groups.

In conclusion, malnutrition is a critical factor that causes an increase in postoperative morbidity in pediatric patients with CP sequelae. In patients with CP sequelae planned for varization-derotation osteotomy, the PNI value, which is very easy to calculate, low cost, and objective parameter can be calculated in the preoperative period, the patients can be diagnosed with malnutrition, and a treatment plan can be prepared on a patient basis to reduce postoperative morbidity.

Ethics Committee Approval: This study was approved by the ethics committee of Istanbul University, Istanbul Faculty of Medicine (Date: 05.04.2022 No: 836328).

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