Using Functional Mobility Scale for Assessment Ambulation and Study of Association of Lesion and Ambulation Level with Kidney Malposition in Spina Bifida

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INTRODUCTION

Spina Bifida (SB) refers to a wide range of neural tube defects affecting the spine and spinal cord. With a marked geographic and ethnic variation, the incidence of SB is 1-5 cases per 1000 live birth (1, 2). Basic urological problem in SB is neurogenic bladder dysfunction resulting with urinary tract infections, incontinence, vesicoureteral reflux, hydronephrosis, chronic renal failure, hypertension and kidney malposition (3). Many studies showed that level of spinal lesion, muscle tone and strength is related to ambulation level of children with spina bifida (4).

Functional Mobility Scale (FMS) is a simple assessment tool used for measuring ambulation abilities in children with cerebral palsy (CP) and SB (5,6). The FMS evaluates functional mobility in children aged 4 to 18 years. Hoffer classification is used to categorise ambulation in patients with spina bifida. This is a pilot study to investigate the association of lesion and ambulation level with kidney malposition and correlation of total score of FMS and Hoffer classification in children with SB (Table 1).

Table 1. Functional ambulation classification according to Hoffer.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tbody>
<tr>
<td>Community ambulators</td>
<td>Patients walk indoors and outdoors for most activities; may need crutches, braces, or both. Wheelchair used only for long trips out of community.</td>
</tr>
<tr>
<td>Household ambulators</td>
<td>Patients walk only indoors with orthoses. Able to get to and out of chair and bed with little, if any, assistance. May use wheelchair for some indoor activities at home and school. Wheelchair is used for all activities in community.</td>
</tr>
<tr>
<td>Non-functional ambulators</td>
<td>Patients walk during therapy session at home, in school, or in hospital. Wheelchair used for all other transportation.</td>
</tr>
<tr>
<td>Non-ambulators</td>
<td>Patients are mobile only via a wheelchair but usually can transfer from chair to bed.</td>
</tr>
</tbody>
</table>

MATERIAL METHODS

This study involved retrospectively collected clinical data on the Spina Bifida center of Istanbul Bilim University. Our study was performed in accordance with Helsinki criteria. The study was approved by Ethical Committee of Istanbul Bilim University. Written consent was obtained from each participating child's
parent for legal guardian. All the patients attended to SB outpatient clinic at regular intervals and underwent monitoring by several specialists.

Ultrasound imaging was performed by an experienced radiologist with Siemens Acuson S100 (Germany) device using 4 Hz convex prob and if necessary in younger patients 9 Hz linear prob.

Patients that underwent ultrasound examination were investigated for horseshoe kidney anomaly, position anomaly secondary to rotoscoliosis, ectopic kidney, crossed fused renal ectopia, renal agenesis, renal pelviectasis, grade 2-3 hydrenephrosis, difference in kidney length, renal parenchymal thinning, increased renal parenchymal echo, renal parenchymal scarring, bladder wall thickening, bladder wall trabeculation and pseudodiverticulum of the bladder.

Children with SB were rated with FMS. A rating of 1 to 6 is performed according to child’s ability to walk different three distances (5, 50 and 500 meters). 5 meters represent home, 50 meters represent school and 500 meters represent community. Rating changes according to different levels of assistance required in specific distances. For example, a child who is able to walk independently at home, he is rated 6 for 5 m. The child uses crutches at school (50m) and wheelchair for longer distances (500m) is rated 3 and 1. Rating is 5, 3, 1. It was based on information given by patients and parents at the clinical examination.

We used this rating system as a scoring one and total sum of FMS score was calculated for each patient. A limitation for using this type of modeling is that this assumption may not be valid.

Statistical Analysis

Mc Nemar Test was used to comparison and Pearson Test was used to assess the correlation results. By using Fisher’s Exact Test we studied association findings. In all cases p<0.05 was considered statistically significant.

RESULTS

In this study 46 children (25 boys, 21 girls) with SB were enrolled. Mean age of the patients was 5.1±2.6 (2-14) years. 31 patients had thoracic and upper lumbar lesion (67.4%), 10 had mid-lumbar (21.7%) and 5 had lumbosacral and sacral lesion (10.9%) (Table 2). Patients were classified non-ambulators (54.3%) non-functional ambulators (17.4%), household ambulators (%10.9), community ambulators (17.8%) according to the Hoffer ambulation scale. Mean score of FMS was 5.82 (3-17). A significant correlation was found between FMS scores and Hoffer classification (r=0.871, p<0.000), lesion level and FMS scores (r=0.853, p<0.000). Fourteen patients (31.6%) had renal malposition and 32 patients (68.4%) had no kidney malposition. Twelve patients with thoracic-upper lesions and 2 patients with mid-lumbar had kidney malposition. Patients with sacral lesion had no malposition anomaly. There was a statistically significant differences in FMS scores between patients with kidney malposition and patients without kidney malposition (p=0.02) (Table 3).

DISCUSSION

Hoffer functional ambulation classification is most commonly used measurement system in SB (7). FMS was developed to evaluate measure of functional mobility in children with CP aged 4 to 18 years. It has been shown to be valid and reliable in CP (5-8). There are several studies that FMS was used to evaluate gait in SB (4,7). Battibugli and friends (9) compared functional gait differences between ventriculoperitoneal shunted and non-shunted patients with myelomeningocele using FMS. Although Hoffer functional ambulation classification is most commonly used measurement system in spina bifida, this system does not provide quantifiable data for the patient. FMS rates a child’s usual ambulation abilities over three distances which represent home, school and community setting which allows us to quantify patient’s mobility performance. We calculated FMS rating one total score instead of using three different scores for each settings (home, school and community). We found a significant correlation between FMS scores, Hoffer functional ambulation classification and lesion level. Non-ambulator patients and patients with thoracic and upper lumbar lesion had lowest scores of FMS.

In this study we found positive correlation between renal malposition and lesion level, this can be explained by rotaoscoliosis and skeletal anomalies of spina bifida. The major factor related to the occurrence of scoliosis is the spinal lesion level (10). This can explain kidney malposition and lesion level relationship which was found in our study. The correlation of FMS scores and kidney malposition can be explained by the mobilition anomalies of upper lesion levels and the functional disability of rotaoscoliosis at sipina bifida patients.

CONCLUSION

There is no quantible system for patients with spina bifida to measure mobility performance. Calculating and using one total score of FMS may be practical and easy way for evaluating of mobility; however validation studies are needed. Patients with upper spinal lesions should be evaluated for renal malposition.
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The manuscript has been reviewed and approved by all the authors. All the authors participated in data collection, analysis and final manuscript preparation. Conflict of Interest: Authors declare that they have no conflict of interest.

Ethical approval: This article does not contain any studies with animals performed by any of the authors.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

Conflict of Interest: None.

REFERENCES


