

# Evaluation of Self-Concept and Emotional-Behavioral Functioning of Children with Brachial Plexus Birth Injury

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## Abstract

**Background** The reported incidence of brachial plexus birth injury (BPBI) is 0.87 to 2.2 per 1,000 live births. The psychological functioning, including self-concept and emotional-behavioral functioning, of children with BPBI has only been examined to a limited extent.

**Objective** The purpose of this study was to describe the self-concept and emotional-behavioral functioning in children with BPBI from both the child's and parent's perspective.

**Methods** Thirty-one children with BPBI, mean age 11 years 1 month, completed the Draw A Person: Screening Procedure for Emotional Disturbance (DAP:SPED) and Piers Harris Children's Self-Concept Scale (PHCSCS). The parents answered questions from the Behavior Assessment System for Children, Parent Rating Scales (BASC-2 PRS).

**Results** The scores from the DAP:SPED drawings showed further evaluation was not strongly indicated in the majority of the children. The PHCSCS Total score demonstrated that the children had a strongly positive self-concept. The parental responses to the BASC-2 PRS indicated that few children were at risk or in the clinically significant range for the four composite scores and all of the component clinical or adaptive scales. Gender comparison revealed females exhibited greater anxiety than males.

**Conclusion** Both children and parents reported a positive psychological well-being for the majority of the children. Parents had greater concerns about their child's social-emotional functioning, particularly anxiety. An interdisciplinary approach (occupational therapy evaluation, clinical observation, and parental interview) is necessary to determine the need for mental health referral.

## Keywords

- ▶ brachial plexus
- ▶ birth injury
- ▶ self-concept
- ▶ Draw A Person: Screening Procedure For Emotional Disturbance
- ▶ Piers Harris Children's Self-Concept Scale
- ▶ Behavior Assessment System for Children

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## Introduction

The estimated incidence of brachial plexus birth injury (BPBI) ranges from 0.87 to 2.2 per 1,000 live births.<sup>1-3</sup> While spontaneous recovery occurs in the majority of cases,<sup>4,5</sup> some children still present with residual deficits. The nerve injury results in muscle imbalances of the upper extremity, causing musculoskeletal changes and deformities over time. Despite advances in identifying risk factors, and early treatment and intervention, including primary and secondary surgical techniques, this population still faces upper limb deformity, which influences aesthetics and functionality.<sup>6</sup> The variability in the severity of injury and clinical presentation requires a multidisciplinary, client-centered approach, which addresses not only the physiological but also the psychological status of the child.<sup>7</sup>

Psychological status includes self-esteem, self-concept, self-image, emotional-behavioral functioning, anxiety, and adaptability. Piers and Herzberg<sup>8</sup> defined self-concept as “a relatively stable set of attitudes reflecting both description and evaluation of one’s own behaviors and attributes.” The importance of psychological health as an indicator of outcome has been acknowledged; however, research regarding self-concept and emotional-behavioral functioning of children with BPBI has been limited.

Previous research has examined the psychological functioning in children with various congenital/acquired limb deficiencies other than BPBI. Varni et al<sup>9</sup> reported, in a cohort of 42 children with congenital limb loss and 7 with acquired limb loss, the degree of limb loss was not significantly related to the level of psychological adaptation. Not surprisingly, perception of strong social support among classmates, family, and friends was related to higher self-esteem among 34 children with congenital limb loss and 7 with acquired limb loss.<sup>10</sup> Further investigating the relationship of the degree of deformity and self-concept, ninety-two 9- to 11-year-olds with hand deformities and upper extremity deformities/deficiencies were found to have self-esteem as high as children in an unaffected comparison group. Contrary to the researchers’ hypothesis that the children with severe deformities would show low self-esteem, actually the children with mild deformities showed lower self-esteem than those with more severe deformities. The authors suggested that children with severe deformities received empathy from the beginning, as the deformity was so apparent. It was hypothesized that children in the mild deformity group appear to be more similar to their peers and they and their caregivers may minimize the deformity. Both the lack of extra support and attempts to dismiss the deformity may lead to poorer self-esteem.<sup>11</sup> In contrast, for a group of adolescents with mild hemiplegia, a negative correlation was found between self-esteem and the amount of elbow flexion posturing in this group with movement deviations in one upper extremity. That is, patients with greater elbow flexion posturing had lower self-esteem.<sup>12</sup>

Few studies have evaluated the psychological status of children with BPBI. Al-Qattan and Al-Khawashki<sup>13</sup> focused on the self-image of a group of Saudi Arabian children whose primary complaint was the impact on social functioning,

including peer rejection and school refusal. Improved social interaction was reported following surgical procedures to correct supination contractures and distal extremity weakness. Bellew et al<sup>14</sup> examined developmental and behavioral problems of toddlers with BPBI, finding those with more severe injuries may be at increased risk for problems with independence, peer interaction, and activities of daily living.

For health professionals in a pediatric setting, a variety of tools are available to evaluate children’s psychological status. Human figure drawings have been used frequently to assess emotional functioning in children and adolescents. In a large brachial plexus clinic, Ramos and colleagues<sup>15</sup> observed asymmetries in pediatric patients’ self-portraits. As a result of these preliminary findings, the present study was designed to further explore self-concept and emotional-behavioral functioning in this population. The purpose of this study was to describe the self-concept and emotional-behavioral functioning in children with BPBI from both the child’s and parent’s perspective through the use of standardized assessments.

## Methods

Thirty-one children with diagnosis of BPBI participated in this institutional review board–approved study. All children and their parents have given informed assent and consent, respectively. The level of brachial plexus injury was classified as C5/C6, C5/C6/C7, or C5–T1 (global). From May 2012 to January 2013, each patient was evaluated at the Brachial Plexus Clinic at one of two hospitals using the following instruments: Draw A Person: Screening Procedure for Emotional Disturbance (DAP:SPED),<sup>16</sup> Piers Harris Children’s Self-Concept Scale, Second Edition (PHCSCS),<sup>8</sup> and Behavior Assessment System for Children, Parent Rating Scales, Second Edition (BASC-2 PRS).<sup>17</sup>

The DAP:SPED<sup>16</sup> is a screening instrument to identify children and adolescents, aged 6 to 17 years, who may have emotional and behavioral difficulties. Each examinee draws a picture of a man, woman, and self on three separate pages and is allotted 5 minutes per drawing. Each drawing is scored according to 55 items. A total raw score for each drawing is derived and converted to a T-score (mean = 50, standard deviation = 10), with higher scores suggesting more emotional disturbance. The reliability coefficients for the DAP:SPED have been found to be good to excellent. The DAP:SPED is the most psychometrically sound human figure drawing instrument currently available.<sup>18</sup>

The PHCSCS,<sup>8</sup> which has the subtitle “The Way I Feel About Myself,” is a 60-item self-report instrument developed for children and adolescents, aged 7 to 18 years. It usually takes 10 to 15 minutes for the child to complete. The PHCSCS includes a Total score, measuring overall self-concept, and six domain scales, measuring specific components of self-concept. The six domain scales are: Behavioral Adjustment, Intellectual and School Status, Physical Appearance and Attributes, Freedom from Anxiety, Popularity, and Happiness and Satisfaction. Results are based on T-scores, with higher scores indicating a more positive self-evaluation. For the Total score, scores  $\geq 60T$  are classified as high range, 40T to 59T as average range, and  $\leq 39T$  as low range. For the domain scales,  $\geq 56T$  is

classified as above average range, 40T to 55T as average range, and  $\leq 39$  as low average range.

The BASC-2 PRS,<sup>17</sup> widely used to aid in clinical diagnosis and in treatment planning, is a comprehensive questionnaire completed by the caregiver that measures aspects of a child's or adolescent's behavior and adaptive functioning in community and home settings. The BASC-2 PRS uses a four choice response format, indicating frequency of occurrence, and can be completed in 10 to 20 minutes. Depending on the child's age, the caregiver completes the Child (ages 6–11 years) or Adolescent (ages 12–21 years) Form. Raw scores are converted to T-scores. For three of the four composite scores (Externalizing Problems, Internalizing Problems, and Behavioral Symptoms Index) and their component clinical scales (Hyperactivity, Aggression, Conduct Problems, Anxiety, Depression, Somatization, Atypicality, Withdrawal, and Attention Problems), T-scores between 60 and 69 fall in the "at-risk" range and T-scores of  $\geq 70$  fall in the clinically significant range. For the fourth composite score (Adaptive Skills composite score) and its component adaptive scales (Adaptability, Social Skills, Leadership, Activities of Daily Living, and Functional Communication), T-scores between 31 and 40 indicate "at-risk" of adaptive impairment and scores of  $\leq 30$  indicate clinically significant adaptive impairment. The BASC-2 PRS demonstrated high reliability, stability over time, and validity.

### Data Analysis

For all three instruments, T-scores, which have a mean of 50 and standard deviation of 10, were determined. The frequency and percentage of clinical classifications were calculated for the instruments. The ages and T-scores for males and females were compared using the *t*-test for independent samples. *p*-value of  $< 0.05$  was considered statistically significant.

### Results

The 31 children, 17 females and 14 males, had a mean age of 11 years 1 month (range, 7 years 4 months to 17 years 10 months). The level of injury was C5/C6 in 19 patients (61%), C5/C6/C7 in 7 (23%), and global in 5 (16%).

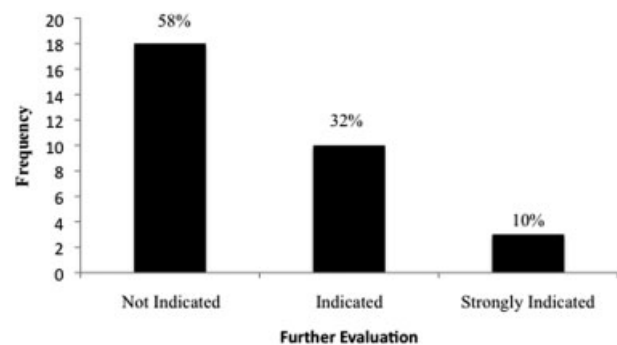
The mean, standard deviation, and range of the T-scores for the three tests are reported in ►Table 1. All of the means of the test scores were within 1 standard deviation, that is, within 40 to 60 points.

►Table 2 contains the division of the cases on the basis of the clinical classifications of the test scores for each of the instruments. For the DAP/SPED,<sup>16</sup> further evaluation was strongly indicated for three children (10%) (►Fig. 1).

On the basis of the self-evaluation PHCSCS<sup>8</sup> Total score, all of the children scored themselves at least in the average range, with 10 (32%) children scoring in the high range ( $\geq 60$ ), indicating strongly positive self-concept. None of the children scored in the low range ( $\leq 39$ ) (►Fig. 2). For all of the domains, the majority of the children's scores were average. Scores were in the low range ( $\leq 39$ ) for four children for Freedom from Anxiety, four for Popularity, two for Behavioral Adjustment, one for Intellectual and School Status, one for

**Table 1** T-scores for assessments

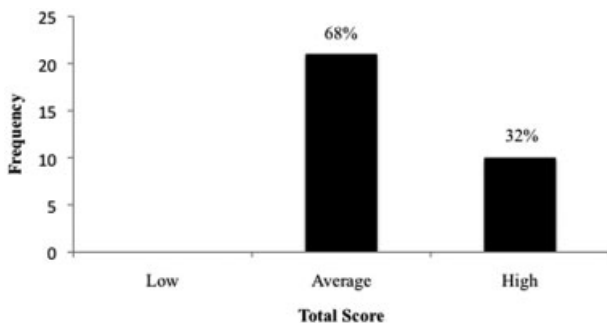
Assessment	Mean (SD)	Range
Draw A Person	53.0 (11.5)	32–80
<b>Piers-Harris Children's Self-Concept Scale</b>		
Total Score	53.6 (7.5)	40–66
<b>Domains</b>		
Behavioral Adjustment	54.7 (7.0)	37–62
Intellectual and School Status	51.5 (7.6)	30–65
Physical Appearance and Attributes	52.5 (7.4)	38–65
Freedom from Anxiety	51.2 (8.0)	37–65
Popularity	50.8 (8.4)	33–68
Happiness and Satisfaction	54.7 (6.2)	40–59
<b>Behavior Assessment System for Children</b>		
<b>Composite Scores</b>		
Externalizing Problems	46.9 (8.2)	35–68
Internalizing Problems	50.6 (11.4)	34–83
Behavioral Symptoms Index	48.3 (8.1)	36–66
Adaptive Skills	51.7 (9.3)	30–66
<b>Scale Scores</b>		
Hyperactivity	48.6 (9.3)	36–67
Aggression	46.8 (7.7)	37–64
Conduct Problems	46.2 (8.1)	34–73
Anxiety	52.5 (13.0)	30–76
Depression	48.8 (11.4)	37–94
Somatization	50.0 (10.3)	36–84
Atypicality	48.3 (7.1)	41–65
Withdrawal	50.1 (9.9)	34–78
Attention Problems	49.5 (10.6)	35–72
Adaptability	53.8 (10.1)	21–68
Social Skills	51.5 (10.6)	32–69
Leadership	53.5 (10.0)	34–68
Activities of Daily Living	49.1 (8.9)	34–67
Functional Communication	49.3 (9.3)	28–66



**Fig. 1** Draw A Person: Screening Procedure of Emotional Disturbance: frequency distribution of levels of need for further evaluation.

**Table 2** Clinical classifications

Assessment	Frequency	Percent
<b>Draw A Person (N = 31)</b>		
Further evaluation:		
Not indicated	18	58
Indicated	10	32
Strongly indicated	3	10
<b>Piers Harris Children's Self-Concept Scale (N = 31)</b>		
Total score		
Low	0	0
Average	21	68
High	10	32
<b>Behavioral Assessment System for Children (N = 30)</b>		
Externalizing problems		
Within normal limits	29	97
At risk	1	3
Clinically significant range	0	0
Internalizing problems		
Within normal limits	25	83
At risk	2	7
Clinically significant range	3	10
Behavioral symptom index		
Within normal limits	27	90
At risk	3	10
Clinically significant range	0	0
Adaptive skills		
Within normal limits	26	87
At risk	3	10
Clinically significant range	1	3



**Fig. 2** Piers-Harris Children's Self-Concept Scale: frequency distribution of Total score.

Physical Appearance and Attributes, and none for Happiness and Satisfaction.

Parents' responses on the BASC-2 PRS<sup>17</sup> indicated for the composite scores that two children (7%) were at risk and three (10%) were in clinically significant range for Internalizing

Problems, three children (10%) were at risk and one (3%) was in the clinically significant range for Adaptive Skills, three children (10%) were at risk for Behavioral Symptom Index, and one child (3%) was at risk for Externalizing Problems (► Fig. 3). For each of the scales, the number and percentage of children who were scored as at risk or clinically significant are included in ►Table 3. Seven children (23%) were considered to be at risk for difficulties in Social Skills, and four each (13%) for Hyperactivity, Anxiety, and Functional Communication problems. The most frequent clinically significant score was for Anxiety ( $n = 4$ , 13%). Seven of the eight children (88%) who had at risk or clinically significant Anxiety scores were female. Clinically significant scores were also found for two children (7%) for Depression, and one each (3%) for Conduct Problems, Somatization, Withdrawal, Attention Problems, Adaptability, and Functional Communication. One parent's BASC-2 PRS data were excluded because the form was not completed properly.

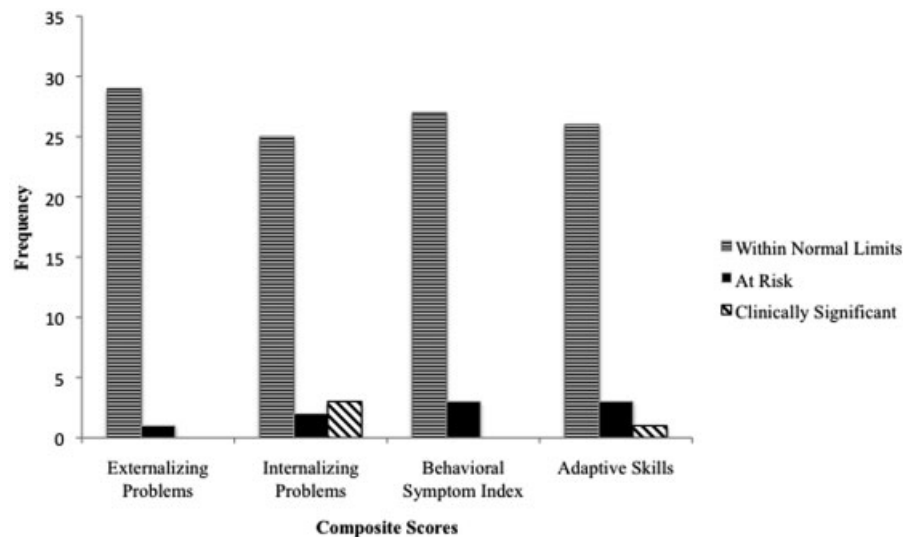
For the gender comparison, the males and females were of similar ages (11 years 5 months vs. 10 years 10 months;  $t(29) = 0.637$ ,  $p = 0.529$ ). The only significant differences in test scores were found on the BASC-2 PRS,<sup>17</sup> with females having higher scores than males for Internalizing Problems (54.3 vs. 45.9;  $t(28) = -2.133$ ,  $p = 0.042$ ) and Anxiety (57.0 vs. 46.8;  $t(28) = -2.270$ ,  $p = 0.031$ ) (►Table 4).

Individual's scores across the PHSCS<sup>8</sup> and BASC-2 PRS<sup>17</sup> showed that two children had scores outside of the normal range on multiple scales on the BASC-2 PRS.

## Discussion

In general, a positive psychological well-being was reported for the majority of children in the present study by both the children and their parents. The children described themselves as having an overall positive self-concept, with only a few expressing concerns with anxiety, peer relationships, acknowledgment of problematic behaviors, academic capabilities, physical appearance, leadership, and/or ability to express ideas. Additionally, the children's drawings showed that most of them did not indicate emotional or related behavior problems, but for a small percentage, their drawings suggested further evaluation was warranted. Andersson et al,<sup>11</sup> also using the PHSCS,<sup>8</sup> found similar results of no difficulties in self-concept and psychological well-being in a group of preadolescents with mild or severe hand deformities. When they divided their sample on the basis of the degree of deformity, the females categorized themselves as having greater anxiety than the males in the severe deformity group. Additionally, the males with mild deformities had poorer self-concept than those with severe deformities. The authors suggested that the child with a milder disability, by concealing their less obvious deformity, does not attract the needed support, leading to a diminished self-concept.

Parental responses revealed greater concerns about their children's social-emotional functioning, particularly symptoms of anxiety. A gender difference, with females exhibiting greater anxiety than males, was noted on the parental report. Seven of the eight subjects with "at risk" or "clinically



**Fig. 3** BASC-2 Parental Rating Scales: frequency distribution of composite scores.

significant” scores on the Anxiety Scale were females. Other than for anxiety, only an occasional child was deemed to have clinically significant issues on any of the BASC-2 PRS scales.<sup>17</sup> In a comparison of children with BPBI and a control group,<sup>19</sup> parents evaluated their children’s emotional and behavioral symptoms using a comparable test, the Child Behavior Checklist, and similarly viewed their children to have higher levels of anxiety than the control group. For all scales representing similar psychological constructs (i.e., aggression, anxiety, somatization, withdrawal, attention problems, social skills), a greater percentage of the children in the BPBI group were scored in the clinically significant range than the children in

the current study. In contrast to these authors’ findings of 26% of the scores being in the clinical range for externalizing problems as well as internalizing problems, the present group had only 10% in the clinically significant range for internalizing problems and none for externalizing problems. Furthermore, these percentages were similar to those of their control group, 12 and 0%, respectively.

Overall psychological adjustment should not be based on the results of one measure. For the three cases whose DAP/SPED<sup>16</sup> scores suggested further evaluation, their scores on the other two assessments were not elevated. Similarly, two different children had at-risk or clinically significant scores on multiple scales of the BASC-2 PRS,<sup>17</sup> but their scores on the other two instruments did not indicate similar concerns.

One limitation of the study was the inability to compare the child’s and parent’s assessment of self-concept and emotional-behavioral functioning utilizing their responses to the child and parent versions of the same standardized test. An evaluation of current functional abilities was not included and therefore the potential relationship between function and self-concept could not be examined. The initial level of brachial plexus injury was reported, but this was not an adequate indicator of function as many of the children have had surgical intervention, which could have had an effect on their abilities.

In conclusion, the children with BPBI had good self-concept and emotional-behavioral functioning, and their parents viewed them similarly. Because the staff of the Brachial Plexus Clinic have a greater awareness of the possibility of children with BPBI having social-emotional problems, the pediatric occupational therapists currently screen each child using the Self-Evaluation Scale of the Brachial Plexus Outcome Measure.<sup>20</sup> This combined with clinical observation and parental interview as well as interdisciplinary team discussion would determine if a mental health referral is warranted.

**Table 3** Frequency of clinical classifications of BASC-2 PRS Scale Scores

Scale	At risk (%)	Clinically significant (%)
Hyperactivity	4 (13)	0
Aggression	2 (7)	0
Conduct Problems	0	1 (3)
Anxiety	4 (13)	4 (13)
Depression	1 (3)	2 (7)
Somatization	3 (10)	1 (3)
Atypicality	3 (10)	0
Withdrawal	3 (10)	1 (3)
Attention Problems	3 (10)	1 (3)
Adaptability	1 (3)	1 (3)
Social Skills	7 (23)	0
Leadership	2 (7)	0
Activities of Daily Living	3 (10)	0
Functional Communication	4 (13)	1 (3)



**Table 4** Comparison of males and females (*t*-test for independent samples)

Assessment	Males	Females	<i>p</i> -value
	Mean (SD)	Mean (SD)	
Draw A Person	50.1 (12.0)	55.3 (10.9)	0.222
<b>Piers-Harris Children's Self-Concept Scale</b>			
Total Score	52.8 (7.1)	54.2 (8.0)	0.601
<b>Domains</b>			
Behavioral Adjustment	53.8 (7.1)	55.5 (7.0)	0.513
Intellectual and School Status	49.5 (5.7)	53.1 (8.7)	0.201
Physical Appearance and Attributes	53.5 (7.1)	51.6 (7.8)	0.483
Freedom from Anxiety	51.6 (7.9)	50.9 (8.4)	0.817
Popularity	50.2 (9.4)	51.4 (7.6)	0.712
Happiness and Satisfaction	53.6 (7.0)	55.5 (5.5)	0.405
<b>Behavior Assessment System for Children</b>			
<b>Composite Scores</b>			
Externalizing Problems	46.9 (10.2)	46.8 (6.5)	0.974
Internalizing Problems	45.9 (7.3)	54.3 (12.8)	0.042
Behavioral Symptoms Index	47.0 (7.9)	49.3 (8.3)	0.450
Adaptive Skills	51.3 (8.9)	52.1 (9.9)	0.831
<b>Scale Scores</b>			
Hyperactivity	47.5 (10.2)	49.4 (8.9)	0.607
Aggression	47.1 (9.5)	46.7 (6.4)	0.883
Conduct Problems	47.0 (10.1)	45.7 (6.5)	0.659
Anxiety	46.8 (9.2)	57.0 (14.0)	0.031
Depression	44.9 (7.2)	51.9 (13.2)	0.094
Somatization	48.2 (8.5)	51.4 (11.5)	0.418
Atypicality	48.1 (7.5)	48.5 (6.9)	0.883
Withdrawal	48.5 (9.5)	51.2 (10.3)	0.470
Attention Problems	50.1 (12.0)	49.0 (9.7)	0.788
Adaptability	55.9 (7.4)	52.2 (11.7)	0.323
Social Skills	50.1 (12.1)	52.6 (9.5)	0.529
Leadership	51.8 (10.0)	54.9 (10.1)	.408
Activities of Daily Living	49.5 (9.0)	48.7 (9.0)	.804
Functional Communication	48.2 (9.7)	50.1 (9.3)	.592

**Conflict of Interest**

The authors declare that they have no conflict of interest.

**Compliance with Ethical Approval**

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 (informed assent was obtained from children and informed consent from parents).

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