Motor Proficiency in Children with Psychosis

MARIANNE VAN PELT and RUTH A. KALISH

Twenty-one children, aged 8 to 11 years, whose disorders were diagnosed as childhood psychosis, were tested by using the Bruininks-Oseretsky Test of Motor Proficiency. In addition, two reflex tests, one righting reaction, and a test for muscle tone were administered. The children showed large variations in all motor skill scores, which ranged from average to far below average. Total test battery scores indicated all children but one scored at or below the first percentile of the standardized sample. Delayed reflex integration and delayed mature righting reactions were observed and in some cases were associated with low motor test scores. Hypotonicity was observed in 12 of the 21 children. Results indicate that for children with psychoses, early intervention is important and carefully planned motor and reflex integration programs should be applied.

Key Words: Child development, motor skills; Psychotic disorders, childhood.

At first glance, children with psychotic disorders when compared with physically handicapped children seem to move like normal children. With continued observation, however, one can notice important differences, including low-tone posture (drooping shoulders or hyperextended knees); slow, uncertain, and inaccurate movements; awkward gait; frequent walking into objects; and jerky and clumsy motions evident in everyday activities such as sitting down.

Most of the research on motor disturbances in the psychotic child has been concerned with the preschool ages. In view of the increasing number of programs available for emotionally disturbed children and because motor deficits exist during the early childhood years, the present study investigated the motor and reflex profiles of boys between the ages of 8 and 11 years whose disorders were diagnosed as childhood psychosis. Although the study was not intended to examine the range of neurological abnormalities, two reflex tests and one test for righting reaction were included to indicate the degree of maturation and integration of postural mechanisms and to help interpret motor test results. The reflexes and righting reaction chosen for testing are particularly important in bilateral motor coordination, motor planning skills, and balance. The testing positions used are described by Ayres as especially useful when testing children over 6 years of age. Finally, hypotonicity was assessed to indicate neural activity of the CNS. Data on all the above factors can be useful in planning programs for motor-skill development in emotionally disturbed preadolescent boys.

METHOD

Subjects

The sample consisted of 21 boys whose disorders were diagnosed as childhood psychosis and who were chosen from four psychoeducational centers and from one psychiatric hospital. The boys were selected according to psychological or psychiatric diagnoses made by an attending psychiatrist or psychologist. The designation childhood psychosis was determined by reference to school or medical files. All children selected were able to carry out a two-stage request, for example, “take the ball and throw the ball to me.” So as not to include children who might be considered neurologically impaired, we only selected children with no history of prenatal or paranatal complications, no diagnosed or uncorrected hearing or vision deficit, and no physical handicap or illness. The subject sample consisted of four groups whose mean...
ages were 8.5 years (n = 4), 9.3 years (n = 5), 10.4 years (n = 6), and 11.4 years (n = 6). These groups are hereafter designated by the ages 8, 9, 10, and 11 years, respectively. Intelligence test scores were available for 4, 4, 4, and 3 subjects, respectively, in each of these groups. The mean IQs as measured by the Wechsler Intelligence Scale for Children were 81.8 (s = 7.6), 87.8 (s = 29.8), 52.5 (s = 19.1), and 50.7 (s = 24.0).

Tests

The Bruininks-Oseretsky Test (B-O test) of Motor Proficiency was used to assess motor function.8 The test consisted of 42 individual items representing a broad range of motor skills. Several test items constitute each of eight subtests that are grouped as follows:

Gross motor ability:
1. Gross motor speed—the ability to maintain a high speed during a brief shuttle run.
2. Balance—the ability to maintain body equilibrium while stationary and while moving.
3. Coordinated movements—the ability to coordinate the hands and feet in simultaneous or sequential movement patterns.
4. Strength—the ability to perform tasks requiring the use of certain arm, leg, and abdominal muscles.

Gross and fine motor abilities:
5. Visual-motor coordination—the ability to coordinate visual tracking with both gross and fine movements of the arms and fingers.

Fine motor ability:
6. Response speed—the speed with which a hand stops a moving visual stimulus.
7. Visual-motor control—the eye-hand coordination required to perform a number of paper-and-pencil tasks.
8. Upper-limb speed and precision—the ability to move the arms and hands quickly with manipulative dexterity and precision.

Two reflex tests and one righting reaction test were selected: the Asymmetrical Tonic Neck Reflex (ATNR), the Tonic Labyrinthine Reflex (TLR), and the Neck Righting Reaction acting on the body (NOB-righting). The ATNR is elicited by turning the head. The TLR is stimulated by the position of the head in relation to gravity. The NOB-righting is elicited by activation of neck proprioceptors (turning the head) which evokes further action resulting in the upper trunk twisting to align itself with the head. The movement causes the lumbar area to rotate, and righting of the entire body results. The NOB-righting reaction was also tested by observing the child go from a supine to a standing position. Hypotonicity was assessed in the upper and lower extremities.

Performance on the two reflex tests was measured by rating scales. Low scores indicated reflex integration, and high scores indicated an obligatory condition. For the righting reaction, low scores indicated an immature or absent response. Individual scores for each reflex were correlated with gross motor and fine motor composite scores of the B-O test using a Pearson product-moment correlation analysis. The composite gross and fine motor B-O test results were obtained by adding component standard scores and then converting them to composite standard scores according to tabled values in the B-O test examiner’s manual.

A description of the measurement of the reflexes, reaction, and hypotonicity follows.

Reflex test: ATNR (quadruped position). The child’s head was in the midline, the face was parallel with the floor, and the knees and hips were flexed at 90 degrees. The examiner rotated the child’s head slowly to the left (chin to left shoulder), held the head a minimum of five seconds, and then rotated the head back to the midline. After eight seconds the same procedure was repeated to the right (chin to right shoulder). Elbow flexion responses of skull and face arms were assessed and recorded separately for both sides using the following scale: 1—no elbow flexion, arm neutral; 2—slight elbow flexion (below 30°); 3—definite elbow flexion (30° and above). If elbow flexion was present, the child was asked to “straighten out the arm.” If the child was able to extend the elbow without moving the head, volitional control was recorded as present and a score of 1 was given as for no elbow flexion. Parmenter states that when testing the ATNR, slight elbow flexion in the arm on the skull side due to visible muscle-tone changes in the arm can be considered normal.9 Therefore, in this study volitional control of elbow extension was rated as reflex integration present.

Reflex test: TLR (supine position). The child was asked to curl up with arms folded over the chest and with hips and knees flexed at 90 degrees. The number of seconds that the child was able to hold the position was recorded using the following scale: 1—15 seconds or longer; 2—from 5 to 14 seconds; 3—4 seconds or less.

Reflex test: TLR (prone position). The child was asked to lie face down, with arms horizontal and legs straight, and then raise and hold the head, arms, shoulders, and knees off the surface. The same scale was used as for TLR in the supine position.

Righting reaction: NOB-righting (supine position). The child’s head was turned slowly to the right, back to the midline, and then to the left side counting five, eight, and five seconds respectively for each interval. Trunk rotation in relation to the pelvis was recorded for both sides as follows: 1—no trunk rotation on pelvis; 2—slight trunk rotation on pelvis; 3—definite trunk rotation on pelvis.
For the second measure of NOB-righting, the child was first asked to lie on the floor in the supine position and told to "stand up as fast as you can." The pattern of response was classified according to the following scale: 1—symmetric adult pattern; 2—initiation with the head; 3—definite rotation of trunk on pelvis.

Hypotonicity. The upper and the lower extremities were assessed. Testing for the upper extremities was performed with the child in the standing position with his shoulder girdle held firmly. The examiner horizontally abducted the arm of the child keeping the elbow at 90 degrees. The extremity was then passively moved by the examiner across to the opposite shoulder until resistance was felt. Hypotonicity was rated as present if the horizontally adducted elbow could touch the opposite shoulder. Each arm was tested separately. Hypotonicity for the lower extremities was tested with the child in the supine position by passively flexing his hip at 90 degrees and with knees in full flexion. The legs were then abducted until resistance was felt. Hypotonicity was rated present if both knees, with feet touching each other, made contact with the surface.

Procedure

Each child was individually tested in familiar surroundings and with a teacher or an aide present. The procedure for administering the B-O test was followed as specified in the examiner's manual. Slight changes were made in the instructions to facilitate communication. Usually, the changes amounted to shortening sentences, keeping the number of commands low, and placing more emphasis on demonstration. During testing, the subject's response was recorded for each trial. Reflex and muscle-tone tests were done in separate sessions after the B-O test.

RESULTS

Performance on each B-O test item yielded an item raw score that was converted to a common scale of point scores as given in the manual for the B-O test. The point scores were added and then converted to standard scores also taken from the manual. The standard scores have a mean of 15 and a standard deviation of 5. (Subtest percentile scores are not given in the test manual.)

Figure 1 presents the mean standard score and the standard error of the mean for each of the eight subtests for the sample of 21 boys. Highest scores were in response speed and visual motor control (subtests 6 and 7). Intermediate scores were in upper limb coordination, balance, strength, bilateral coordination, and running speed and agility (subtests 5, 2, 4, 3, and 1, respectively). The lowest score was in upper limb speed and dexterity (subtest 8).

Figure 2 presents mean standard scores by age group on the eight subtests. The youngest (8-year-olds) group had the highest scores on six of the eight subtests (on subtest 1, running speed and agility, and subtest 7, visual motor control, the 11- and 10-year-olds, respectively, scored highest). The 10-year-olds scored lowest, with the exceptions of subtest 3, bilateral coordination, and subtest 7, visual motor control. The 9- and 11-year-old boys scored close together at an intermediate level in most of the subtests.

The Table summarizes the results of the reflex tests and their correlation to the B-O test. The greatest lack of integration was for TLR, next most for NOB-righting, and least for ATNR. (For NOB-righting, the "come to stand" test scores were used. As described by Ayres, this test is more predictive for children over 5 years of age.)

In general, a low score in the frequency with which reflexes were present was associated with higher scores on the gross and fine motor B-O test composite.
In other words, the obligatory response (score 3) of a reflex was frequently associated with lower composite motor scores. Of the 10 correlations in the Table, six were significant at the .05 level or better (df = 19). Four of the significant correlations were associated with gross motor B-O test scores.

Hypotonicity was frequent especially in the upper extremities. Of the 21 children, 12 showed an increase in range of movement, indicating hypotonicity in both upper extremities. Hypotonicity in just the lower extremities was not found, but it was present in both upper and lower extremities in 3 children.

**DISCUSSION**

The motor test results for the psychotic children in this study showed large deficiencies in performing basic motor skills. These deficiencies, however, did not seem to be purely motor; some appeared to be related to other factors, such as motivation, practice, familiarity with the task, and frustration. As Figure 2 shows, there were differences across age groups for each of the eight subtests. The pattern of differences was not consistent, however, and interpretation of the differences was complicated by the possibility that the age samples came from populations differing in intelligence. Therefore, the B-O test results will not be discussed as a function of age. The reflex and muscle-tone test results indicate a lack of maturation and integration of postural mechanisms that resulted in developmental motor retardation. The various deficiencies may be better understood by a review of the children's performance on the B-O subtests.

The children achieved highest scores in the subtest for response speed. This subtest was simple and kept the child's attention in most cases, and it was performed while the child was seated, eliminating gross coordination problems. In addition, the preferred hand, which the child used to stop a measuring stick from sliding, was stabilized (positioned) against a wall.

Children performed next best in visual motor control. Again, all tasks were performed while the child
was seated. Instructions were simple and familiar. A workbook for the items was provided for each child, simulating closely a school situation. A more important factor, however, may have been that all items were activities that the children learned and practiced at school, for example, cutting out circles, drawing lines through paths, and copying geometric shapes. Therefore, one might conjecture that some improvement of abilities in all other areas could be achieved with therapeutic intervention. Indeed, Goldfarb reports such an improvement in a three-year longitudinal study of schizophrenic children 7 to 10 years old.  

Upper limb coordination scores were considerably lower than the response speed and visual motor control scores. Most of the activities were again familiar ones such as bouncing, catching, hitting, and throwing a ball. Stress, however, was placed on gross and fine motor coordination. In addition, instructions for pivoting thumb and index finger, touching a swinging ball with the preferred hand, and touching thumb to fingertips were complex and may have demanded too much concentration for the tasks, thereby creating frustration.

One of the major underlying components of coordination in gross motor activities is balance. All children scored poorly in the eight test items for balance, especially in tests for static balance. Only two boys could stand on one foot on a 2-in balance beam for 10 seconds (the required maximum); one boy could stand for 7 seconds; and all other boys stood for less than 5 seconds or not at all. Scores were considerably lower when eyes were closed, suggesting vestibular involvement. Dynamic balance scores were higher: 13 boys could walk on the balance beam for six steps (required maximum). The skill is considered by Cratty to be mastered normally at about 5 years of age. Poor performance in balance activities in general may be the result of cerebellar or sensory dysfunction, retarded functional maturation, or generalized hypotonia. Results of this study point especially to the two latter possibilities.

Scores for strength were low as expected. One contributing factor might have been that 17 of the 21 children were receiving the following medications: thioridazine, haloperidol, chlorpromazine, and methylphenidate. Second, four boys were considerably overweight and only one boy participated in sports after school. During school time, no regular physical education classes were scheduled.

Bilateral coordination test items were complex. Success depended on how well a child could follow instructions and imitate movements. In addition, the tests required the ability to maintain balance, to anticipate shifts in the center of gravity before making voluntary movements, and to coordinate rapid rhythmical movements. The brain structures involved include the vestibular system, the posterior tracts, and the cerebellum. As mentioned previously, dysfunction of the CNS integrative structures (vestibular system and cerebellum) are present in children with psychoses. Furthermore, when analyzing the performance of children, Touwen found a relationship between coordination of the arms and legs and manipulative ability. Coordination apparently is a prerequisite for fine manipulative abilities. Therefore, lack of coordination skills will result in increased fine manipulative dysfunction.

Lack of manipulative abilities and coordination may have been largely responsible for the children scoring the lowest in the upper limb speed and dexterity subtest. Most of the test items were familiar tasks, such as stringing beads, displacing pegs, and placing pennies into a box. Nevertheless, the test presented some apparent difficulties. Of the children tested, five showed difficulties in isolating proximal gross movements from fine wrist and finger manipulation. Several children had difficulty establishing rhythm. In these cases, an overflow of proximal muscle activity was frequently observed. This overflow made motions jerky, interrupted smooth manipulation, and led to much slower performance, to repetition necessitated by mistakes, and to frustration. Yet it appeared to the examiner that the crucial factor contributing to the poor scores was lack of motivation or interest. All items in this category were time contingent. (This was also true of the subtest running speed and agility, which had the second lowest scores.) The children did not openly show a concern or awareness of the time factor; that is, they had no motivation to perform quickly. Moreover, in all test items, a lack of concentration or disinterest in doing the task was evidenced by the child wanting to get up, starting to play with test objects, laughing uncontrollably, or being extremely passive. These behaviors could also be secondary to the child's reaction to failure. Birch and Walker found that schizophrenic children who experience failure in perceptual-motor function have difficulties making correct perceptual discriminations during a given task.

CONCLUSIONS

The results show that preadolescent psychotic boys have low standardized scores when tested in a broad range of motor skills. Greater deficiencies were observed in gross motor skills than in fine motor skills. Of the 21 children tested, 20 were at or below the first percentile in gross motor ability. In fine motor ability, 6 boys were between the 2nd and 12th percentile and 1 was at the 14th percentile. The others scored at or below the 1st percentile. Scores were higher in test items that the child was familiar with, such as playing ball and drawing geometric shapes, indicating that
improvement might be achieved with training. The data from the reflex and righting reaction tests point to a lack of maturation or faulty CNS integration resulting in movement disturbances.

The findings of this preliminary study suggest the need for therapeutic motor-development and training programs for children whose disorders are diagnosed as psychotic. Such programs should be based on 1) individual analysis of motor impairment according to a developmental pattern, 2) utilization of movement skills already mastered, and 3) provision of developmental experiences that the child does not receive because of lack of movement. Experiencing frustration and failure influences not only motor development but also cognitive, social, and emotional development of children.

REFERENCES

7. Ayres AJ: Sensory Integration and Learning Disorders. Los Angeles, California, Western Psychological Services, 1972