Evaluation of Clumsiness in Children

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Parents and physicians often dismiss seemingly minor motor difficulties in children. Approximately 6 percent of school-aged children have coordination problems serious enough to interfere with academic performance and social integration. These problems often arise during the early school years and manifest in difficulties with such simple motor tasks as running, buttoning, or using scissors. Increasing evidence shows that rather than improving over time, these motor difficulties remain stable throughout adolescence and adulthood. While these children are initially singled out for motor difficulties, their problems are rarely limited to poor motor coordination. Many of them have a range of associated deficits, such as attention-deficit/hyperactivity disorder, learning disabilities, poor handwriting and drawing skills, and emotional immaturity. Associated problems magnify with time, and as teenagers, these children have higher rates of educational, social, and emotional problems. Diagnosis is determined by taking a careful history that includes a review of fine motor, visual, adaptive, and gross motor milestones, and performing a physical examination. Formal standardized testing may be indicated. Referral to occupational therapy that is appropriately individualized to the needs of each child appears to be effective. To aid in management, the family physician must be aware of this condition, as well as the associated coexisting deficits. (Am Fam Physician 2002;66:1435-40. Copyright© 2002 American Academy of Family Physicians.)

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Many school-aged children struggle to learn motor skills that their peers have already mastered. Such children, often described as "clumsy," may have difficulties with writing and self-help skills such as dressing and self-feeding. The diagnosis of clumsiness in children is often missed because parents may not recognize their child's uncoordination as a significant medical problem. When parents mention their child's awkwardness to a physician, their concerns may be dismissed; physicians commonly reassure parents that children will outgrow clumsiness. In the past 20 years, however, research has demonstrated convincingly that in the majority of children, these motor deficits tend to persist throughout, rather than resolve during, adolescence and adulthood.[1,2]

In 1975, Gubbay[3] coined the term "clumsy child syndrome" to describe children of normal intelligence who were without an identifiable medical or neurologic condition but had difficulties in coordination that interfered with academic performance and/or socialization. In recent years, the term "clumsy child syndrome" has been somewhat replaced by the term "developmental coordination disorder" (DCD), essentially a recapitulation of Gubbay's diagnostic criteria, that is formalized in the *Diagnostic and Statistical Manual of Mental Disorders,* 3d ed. (DSM-III)[4] and revised in the fourth edition (DSM-IV).[5] Although various other terms are used to describe children with minor motor difficulties, we have confined terminology in this article to "clumsy child syndrome" and DCD, using them interchangeably.

Learning disabilities, emotional problems, conduct disorder, and oppositional defiant disorder are more common in children with DCD.[6] Children with concomitant DCD and attention-deficit/hyperactivity disorder (ADHD) are particularly at risk for such problems.[1,6-8]

See page 1379 for definitions of strength-of-evidence levels contained in this article.

Prevalence

While epidemiologic studies estimate that significant clumsiness affects 5 to 15 percent of school-aged children, the estimate with the

About 6 percent of school-aged children have coordination problems that interfere with academic performance and social integration.

TABLE 1
Average Age of Attainment of Adaptive and Social Motor Skills

Skill	*Average age of attainment (years)*
Buttoning and unbuttoning	4
Dressing self (except tying shoelaces)	4.5
Riding a bicycle with training wheels	4.5
Cutting across a page with scissors	4.5
Coloring within the lines	4.5
Tying shoelaces	5.5
Printing first and last name	5.5
Jumping down several steps	5.5
Riding bicycle without training wheels	6
Ability to spread with dinner knife	6

Adapted with permission from Blondis TA. Motor disorders and attention-deficit/hyperactivity disorder. Pediatr Clin North Am 1999;46:905.

most scientific basis is a prevalence of 6.4 percent.[9,10] Significant clumsiness affects boys more often than girls.[6] Incidence is not related to the child's level of education or socioeconomic status. Affected children are usually diagnosed between the ages of six and 12 years, and rarely before age five.[9]

Etiology

While the exact cause of clumsiness is unknown, many theories attempt to explain its etiology. Some researchers emphasize the apparent difficulty these children have in planning the execution of motor tasks. This difficulty in motor planning is termed "dyspraxia."[11,12] Researchers who have studied the difficulties with motor control in the clumsy child postulate that problems with motor execution are the primary deficit.[13] Other researchers point to apparent difficulties in the child's ability to understand various sensory relationships and provide research demonstrating that clumsy children have deficits in proprioception, sensory integration, and visual processing.[13-15]

Careful study has revealed that clumsy children are a heterogeneous group, and different theories may better explain motor difficulties in individual children. Insights into the etiology of a particular child's clumsiness may help the physician tailor an appropriate treatment strategy.[9-16]

Diagnosis

The parents of a clumsy child may complain about their child's difficulties with everyday tasks such as tying shoelaces and brushing teeth. They may also report school problems related to poor handwriting or social rejection arising from their child's clumsiness.[11] Physicians should consider the possibility of underlying clumsiness in all children who present with learning difficulties, behavior problems, and psychosomatic aches and pains. Such children should be asked whether they are embarrassed by perceived difficulties with gross or fine motor skills.

During well-child examinations of preschool and school-aged children, physicians can often identify clumsy children by asking if the parent has concerns about clumsiness or coordination problems in the child. Research

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shows that standardized screening tools based on parents' concerns are as accurate as longer measures, including those that require children to demonstrate skills.[17] Physicians may suspect clumsiness in school-aged children who have trouble with developmental screening tasks such as drawing, imitative finger movements, and hopping.

While it is not uncommon for clumsy children to have lifelong delays in achieving motor milestones, such delays are most significant when they begin to interfere with social-adaptive development. Motor delays may interfere with a child's ability to play with other children; difficulties with tasks such as riding a bicycle or catching a ball are common. Problems in early schooling may arise because of a crude pencil grasp and an inability to cut paper on a straight line.[7] Increased friction in the home environment may result from delays in self-care skills such as buttoning clothes and tying shoelaces. *Tables 1 and 2*[9] outline the average age at which school-aged children attain selected motor skills.

Observing the child at home and in school can help a physician gauge the degree of clumsiness. Teachers may report that the child frequently bumps into classmates, desks, and chairs. Clumsy children may collide with objects or drop them. At home and in physical education classes, these children may shy away from competitive sports and may require repeated instruction in learning a new motor skill.[16]

A family history must be obtained to determine the presence of familial clumsiness, ADHD, learning disabilities, or other neurodevelopmental disorders. It is important to ask about a family history suggestive of serious neurodegenerative disorders, typified by a history of wasting and/or early death.[16]

The physical examination should begin with the recording of vital signs, height, weight, and head circumference. A general physical examination may alert the physician to alternate explanations for clumsiness.[12] *Table 3* includes several physical findings that will direct the physician to look elsewhere for the etiology.

TABLE 2
Average Age of Attainment of Motor and Sensory Skills

Skill	*Average age of attainment (years)*
Drawing a square	5
Standing on one foot for 15 seconds	5
Repetitive finger tapping of thumb and index finger	5.5
Tripod pencil grasp	5.5
Rhythmic skipping	6
Drawing a diagonal line	7
Finger gnosia (with eyes closed, can tell you which finger you touch)	8
Alternating foot-hop in place	8.5
Sequential finger tapping at rapid speed	9
Drawing two-dimensional cross with same dimensions	9
Persistent tandem stance for 10 seconds with eyes closed	10
Absence of choreiform movements with arms extended	10
Suppressing mirror movements while doing sequential finger tapping	11
Drawing three-dimensional cube with all sides angulated	12

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TABLE 3
Clumsiness: Differential Diagnosis by History and Physical Findings

Findings	*Diagnosis*
Lost skills	Degenerative disorders (e.g., adrenoleukodystrophies, mitochondrial dystrophies), PDD spectrum
Difficulty rising to standing position, Gowers' maneuver	Duchenne's muscular dystrophy
Ataxia, dysarthria, dysmetria	Cerebellar damage
Poor muscle tone	Mental retardation, peripheral nerve disease, Duchenne's muscular dystrophy, juvenile spinomuscular disease, cerebellar hypoplasia
Increased muscle tone	Cerebral palsy
Asymmetry of muscle tone	Cortical damage on side of brain or spinal cord
Absent deep tendon reflexes	Muscular or peripheral nerve disease
Hyperpigmented macules	Neurofibromatosis
Asymmetry of nail beds	Associated with growth disturbance such as mild hemiparesis
Skeletal abnormalities	Orthopedic disorder, genetic disorder
Dysmorphic facies, minor physical abnormalities (e.g., ear length, hand or finger length)	Genetic syndrome

PDD = pervasive developmental disorder.

Motor deficits caused by developmental coordination disorder tend to persist into adulthood and can result in significant difficulties in social adjustment.

The neurologic examination should focus on evaluation of the fundus of the eye, cranial nerves, muscle tone, strength, and reflexes.

Symptoms such as weakness, ataxia, and pronounced hypotonia or hypertonia, particularly when asymmetric, are inconsistent with a diagnosis of DCD and should compel the physician to expand the diagnostic possibilities. Children with DCD are not thought to have focal brain abnormalities, and studies such as magnetic resonance imaging and computed tomography are not useful in their evaluation[16] [Evidence level C, consensus opinion].

Certain neurodevelopmental tests that can be performed readily in the office are commonly abnormal in clumsy children. These tests require balance, motor planning, and sensory integration. A sample of neurodevelopmental function tests is presented in *Table 4*.[18]

Clumsiness is not a progressive condition. Any loss of milestones already achieved or evidence of progressive uncoordination must be considered a red flag because it precludes the diagnosis of DCD. Physicians would be wise to consider that many progressive neurologic disorders may initially appear to be nonprogressive.[9] Careful follow-up is required when the diagnosis of DCD is less than certain.

Differential Diagnosis

MENTAL RETARDATION

Moderate to severe mental retardation is commonly associated with motor delays and poor dexterity. Usually this degree of mental

TABLE 4
Gross Motor Tasks and Their Underlying Neurodevelopmental Functions

Test	*Description*	*Abnormal result*	*Neurodevelopmental skill tested*
Rapid alternating movement	Child quickly alternates pronation and supination of the hand	Dysdiadochokinesis (i.e., excessive flailing)	Requires ability to inhibit proximal muscle groups
Sustained motor stance	Child is asked to stand erect for 15 seconds with arms extended, feet together	Inability to maintain position for 15 seconds	Balance, somesthetic input, vestibular function
Tandem balance	Child stands with one foot directly in front of the other, holding posture for 15 seconds with eyes closed	Inability to sustain posture for 15 seconds	Motor monitoring, self-righting skills, vestibular function, somesthetic input, balance, body position sense, selective motor inhibition, motor persistence
Hopping in place	Child hops in place, alternating between left and right foot in a specified sequence	Inability to hop, inability to perform particular hopping pattern, poor rhythm	Motor planning, motor sequencing, short-term motor memory, ability to set and maintain rhythm

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retardation is not difficult to identify, but when there is a concern about mental retardation in a clumsy child, formal cognitive testing is indicated.[19] However, physicians should keep in mind that children with DCD generally have normal intelligence.

ADHD

Although ADHD commonly coexists with clumsy child syndrome, children with isolated ADHD can appear to be clumsy. This apparent clumsiness is caused by inattentiveness and impulsivity rather than by uncoordination. These children lack any true motor difficulties and, as they grow, their apparent clumsiness usually disappears.[9] Making the distinction between children with ADHD and children with both DCD and ADHD may be particularly difficult in preschool and early primary-school years.

ACQUIRED BRAIN INJURY

While children are capable of remarkable recovery from even devastating traumatic brain injury, physical, cognitive, and emotional problems often persist. Traumatic brain injury in the very young is usually caused by motor vehicle crashes, falls (e.g., from walkers or shopping carts), and assault (e.g., shaken baby syndrome). Visuomotor and gross motor deficits are among the many reported sequelae of traumatic brain injury.[20,21] Children with a history of significant head trauma should be fully evaluated for acquired brain injury before the diagnosis of clumsy child syndrome can be made.

Other causes of apparent clumsiness include visual impairment, orthopedic disorders, mild cerebral palsy, hereditary ataxia, and congenital chorea.

Prognosis

Research suggests that the motor deficits of DCD persist throughout adulthood and can be associated with significant difficulties in adjustment. A number of prospective studies have examined motor, scholastic, and psychosocial outcomes in clumsy children. Research has demonstrated convincingly that motor deficits from childhood persist into adolescence. Such deficits are often associated with academic, emotional, and behavioral problems beyond those of peers without DCD[1,8] [Evidence level B, other evidence].

Individualized occupational therapy appears to be the best approach to the treatment of clumsiness.

Treatment

When diagnosing clumsiness in a child, the family physician should first demystify the condition for the family. Parents need to know that these motor difficulties are likely to persist but will probably be less troubling in adulthood.[11] The physician may ask an older child whether he or she is teased about uncoordination, while expressing recognition, sympathy, and support. Teachers should be informed that what may appear to be sloppiness or laziness is the manifestation of a disability.

Clumsy children may be encouraged to participate in sports such as swimming and horseback riding to help them experience some athletic success.[11] Some schools will alter a child's academic and physical education classes so that the activities match the child's motor abilities. While there is little evidence that occupational therapy produces sustained improvement in general motor skills, such therapy can serve to improve particular motor skills, educate parents, and address issues of self-esteem.[22]

Occupational therapy, individualized to meet the particular needs of a clumsy child, appears to be the best treatment approach based on current data.[23-25] Research is producing data that may discern whether particular techniques, such as cognitive approaches, are more effective than other forms of occupational therapy.[23,26] The evidence that these

children suffer much more than their peers from academic, emotional, and behavioral problems should compel us to intervene on their behalf.

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