

Referral Patterns to a Pediatric Orthopedic Clinic: Implications for Education and Practice

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ABSTRACT. *Objective.* Musculoskeletal medicine is becoming an increasingly essential part of primary care medicine. The American Academy of Pediatrics (AAP) Surgical Advisory Panel recently published voluntary guidelines to establish diagnoses that should be referred to a pediatric specialist rather than a general specialist (pediatric orthopedic surgery vs general orthopedic surgery). Given the crisis in pediatric orthopedic surgery manpower and resources, we believe that these guidelines are useful in defining appropriate referrals. The purpose of this study was to compare diagnoses that primary care pediatric providers believe commonly need referral to the AAP Guidelines for Referral to Pediatric Specialists recommendations for referral to pediatric orthopedic specialists.

Methods. A chart review of successive new referrals ($n = 286$) to the pediatric orthopedic clinic during a 12-month period was conducted. The following information was collected: 1) diagnosis from referring provider, 2) diagnosis and treatment plan by the pediatric orthopedic surgeon, 3) type of referring provider (eg, pediatrician, family practitioner, resident physician, physician assistant), and 4) patient age. The referring diagnosis, final orthopedic diagnosis, and treatment plan for each patient was compared against the AAP Guidelines for Referral to Pediatric Specialists. The terms "appropriate" and "inappropriate" were used to differentiate those diagnoses that matched versus those that did not match the AAP Guidelines, respectively.

Results. This analysis shows that a significant percentage (64.7%) of definitive diagnoses of referred cases were not consistent with the new AAP recommended guidelines for referral to pediatric orthopedic surgeons. In addition, a 23.8% (68 of 286) false-positive rate of referring diagnoses is noted. Cases that required no treatment or follow-up to monitor demonstrated a 32.8% (60 of 183) [(40 no treatment + 20 monitor inappropriate)/(116 no treatment + 67 monitor total)] false-positive rate.

Conclusions. Inappropriate referrals create a large use of pediatric orthopedic resources, which delays care of other, more appropriate patients. A large proportion of referrals indicated either a lack of basic textbook knowledge or lack of examination skills and appropriate diagnostic tools as demonstrated by a high number of defini-

itive diagnosis indicating normal variants. *Pediatrics* 2004;113:e163–e167. URL: <http://www.pediatrics.org/cgi/content/full/113/3/e163>; *pediatric orthopedics, inappropriate referrals, pediatric education, musculoskeletal problems, torsional variations.*

ABBREVIATIONS. AAP, American Academy of Pediatrics; CI, confidence interval.

Musculoskeletal medicine is becoming an increasingly essential part of primary care medicine. Approximately 20% of visits to primary care and emergency medical practitioners are attributable to musculoskeletal complaints.¹ According to de Inocencio,² >6% of total office visits in the pediatric clinic were for musculoskeletal pain complaints, with trauma and overuse accounting for nearly 30%. Schwend and Geiger³ reported that approximately one third of medical problems in children are related to the musculoskeletal system. Historically, it has been shown that graduating pediatric residents rate their level of comfort regarding musculoskeletal problem management the lowest compared with all other areas of pediatric medicine and believed that residency training should place greater emphasis on musculoskeletal medicine.⁴

Little agreement exists regarding which orthopedic problems a primary care pediatrician should understand to care effectively for children. Although other authors have looked at referrals and judged them appropriate or inappropriate, no 1 set of referral guidelines has been established. Judgment has been primarily subjective. Previous attempts to create orthopedic referral guidelines have not been successful, even with primary care support.⁵ It therefore is difficult to establish criteria for appropriate referral to a pediatric orthopedic surgeon.

The American Academy of Pediatrics (AAP) Surgical Advisory Panel recently published *Guidelines for Referral to Pediatric Surgical Sub-specialists*.⁶ These voluntary guidelines attempted to establish diagnoses that should be referred to a pediatric specialist rather than a general specialist (pediatric orthopedic surgery vs general orthopedic surgery). Given the crisis in pediatric orthopedic surgery manpower and resources, we believe that these guidelines are useful in defining appropriate referrals.

The purpose of this study was to compare appropriateness of referring diagnosis and definitive diagnosis to a pediatric orthopedic specialty clinic based

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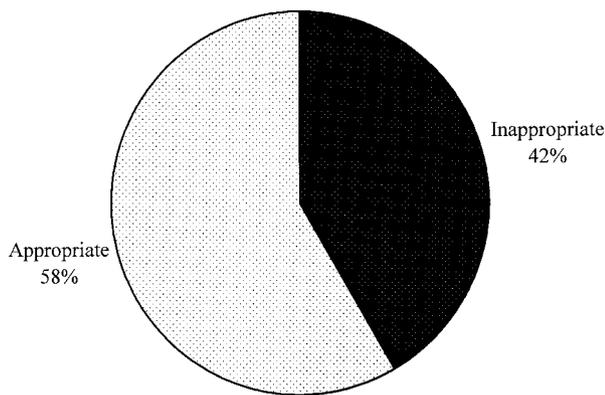


Fig 1. Appropriateness of referral diagnoses.

on the AAP Guidelines for Referral to Pediatric Specialists.⁶ In addition, this study compared appropriateness of referral diagnosis to definitive diagnosis on the basis of prescribed treatment. Attention is given to which types of diagnoses were referred and the subsequent orthopedic diagnosis. The goal of analyzing these data is to compare diagnoses that primary care pediatric providers believe commonly need referral to the AAP Guidelines for Referral to Pediatric Specialists recommendations for referral to pediatric orthopedic specialists.⁶ The local Institutional Review Board approved this study.

METHODS

A chart review of successive new referrals ($n = 286$) to the pediatric orthopedic clinic during a 12-month period (January to December 2001) was conducted. The following information was collected: 1) diagnosis from referring provider, 2) diagnosis and treatment plan by the pediatric orthopedic surgeon, 3) type of referring provider (eg, pediatrician, family practitioner, resident physician, physician assistant), and 4) patient age. Individual patients were not identified in the study. All new referrals under the age of 16 years were included. All obvious fractures were excluded. Furthermore, referrals to the pediatric fracture clinic were not analyzed, as most of those were for emergency department follow-up.

The referring diagnosis, final orthopedic diagnosis, and treatment plan for each patient were compared against the AAP Guidelines for Referral to Pediatric Specialists.⁶ The terms "appropriate" and "inappropriate" were used to differentiate those diagnoses that matched versus those that did not match the AAP Guidelines, respectively. An appropriate referral carried a diag-

nosis that was consistent with 1 of the following AAP recommended categories: infants with serious malformations of the limbs (eg, idiopathic clubfoot, congenital limb deficiency); children and adolescents with significant limb deformity secondary to metabolic bone disease or other types of growth arrest; infants, children, and adolescents with developmental dysplasia of the hip (screening for developmental dysplasia of the hip is performed by the primary care pediatrician); infants, children, and adolescents with bone or joint infection (eg, osteomyelitis, septic arthritis), in conjunction with the primary care pediatrician and pediatric infectious disease specialist; children with Perthes disease (ie, osteochondritis of the femoral head); children and adolescents with slipped capital femoral epiphysis; infants, children, and adolescents with severe scoliosis or limb length discrepancy; infants, children, and adolescents with deformity or gait abnormality secondary to neuromuscular conditions (eg, cerebral palsy); and infants, children, and adolescents with complex fractures and dislocations. We recognize that the recommendations were set to help a referring provider determine which patients should definitely see a pediatric orthopedic specialist versus a general orthopedic surgeon. A problem may indeed require orthopedic input but not necessarily need a pediatric specialist, using limited resources.

Statistics

The relationship between the appropriateness of referral and type of referring practitioner, the final diagnosis and referring practitioner, and the referred versus the final diagnosis were tested using a χ^2 test of homogeneity; 95% confidence intervals (CIs) for selected percentages were calculated on the basis of z approximations. When testing for a significant relationship between referred and final diagnosis, a Cochran-Mantel-Haenszel test was also used, controlling for type of treatment. Statistical significance was declared at the .05 level.

RESULTS

Sequential new referrals ($N = 286$) in 2001 (January–December) were reviewed. Inappropriate referrals constituted 41.6% (119 of 286) of cases from the referring practitioner (95% CI: 35.9%–47.3%; $P = .0045$; Fig 1). Inappropriateness referral is based either on referring physician diagnosis or on pediatric orthopedic specialist diagnosis. Inappropriate referrals constituted 41.6% on the basis of referral diagnosis and 64.7% on the basis of final orthopedic specialist diagnosis. Age distributions of final orthopedic diagnoses are displayed in Table 1. Distribution of referring provider type is displayed in Fig 2.

The 2 most common sources of referral, pediatricians and family practitioners, demonstrated inappropriate rates of 46.2% (67 of 145) and 34.7% (25/

TABLE 1. Orthopedic Diagnoses: Number and Age Distribution Based on Final Orthopedic Diagnoses

	No. of Cases	Diagnosis Percentage of Total	Age Mean (SD, Median)
Torsional variation	50	16.2	2.80 (2.61, 1.76)
Normal	42	13.6	5.98 (6.29, 2.49)
Musculoskeletal pain	24	7.8	9.72 (4.77, 8.64)
Angular variation	20	6.5	1.96 (3.62, 1.32)
Scoliosis	19	6.2	11.52 (3.88, 12.99)
Trauma/fracture	19	6.2	9.75 (5.84, 10.84)
Neurodevelopmental deficit	12	3.9	1.7 (5.99, 10.63)
Developmental dysplasia of the hip	11	3.6	0.12 (0.176, 0.02)
Equinovarus deformity	10	3.2	0.063 (1.7, 0.03)
Legg-Calve-Perthes	8	2.6	6.80 (4.13, 5.32)
Leg length discrepancy	8	2.6	10.55 (4.39, 12.2)
Other*	85	27.6	
Total	308	100	

SD indicates standard deviation.

* Other constitutes all diagnoses with <8 cases.

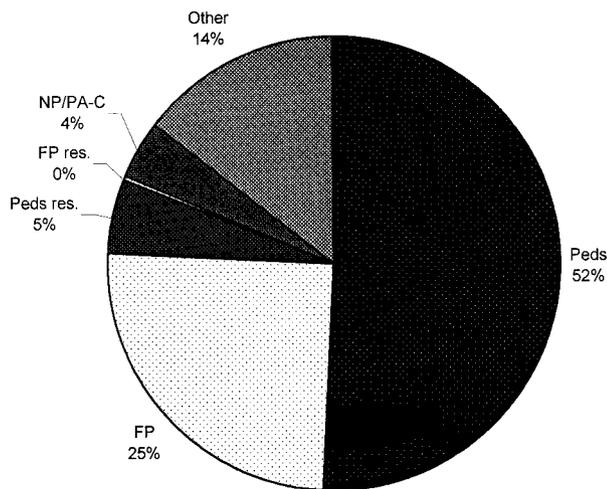


Fig 2. Distribution of referrals by provider. Peds, attending/community pediatrician; FP, attending/community family practitioner; Peds res., pediatric house officer in training clinic; FP res., family practice house officer in training clinic; NP/PA-C, nurse practitioner or certified physician assistant (not separated by specialty); Other, all other referral sources including neurologist, hematologist/oncologist, general orthopedic surgeon, emergency medicine, health department, and plastic surgery.

Glossary of terms:

- Peds = attending/community pediatrician
- FP = attending/community family practitioner
- Peds res. = pediatric house officer in training clinic
- FP res. = family practice house officer in training clinic
- NP/PA-C = nurse practitioner or certified physician assistant (not separated by specialty)
- Other = all other referral sources including neurologist, hematologist/oncologist, general orthopedic surgeon, emergency medicine, health department, plastic surgery

72), respectively, indicating no significant correlation between referral source and percentage of inappropriate referrals ($P = .3237$). Resident pediatricians and resident family physicians were included in "pediatricians" and "family practitioners" categories, respectively, for the analysis of appropriateness of referral by practitioner type because the attending physician in our clinic must approve all referrals. The overall contribution of referrals from the residents to this series was very small (<5% of referrals.)

Figure 3 demonstrates a 64.7% (185 of 286) inappropriate rate of final orthopedic diagnosis (95% CI: 59.2%–70.2%; $P < .0001$). The 2 most common

sources of referral, pediatricians (50.7%) and family practitioners (25.2%), demonstrated 68.3% (99 of 145) and 59.7% (43 of 72), respectively, of final pediatric orthopedic diagnosis not consistent with the AAP recommendations for referral, again indicating no significant correlation between referral source and percentage of inappropriate referrals ($P = .5098$).

Table 2 demonstrates that 23.8% (68 of 286) of the total referrals were appropriate for referral on the basis of the diagnosis from the referring provider but inappropriate on the basis of the final pediatric orthopedic diagnosis (false positive). Also, 40.9% (117 of 286) of referrals demonstrated inappropriate reason for referral on the basis of both the referring and the definitive diagnosis (true negative). The most common definitive orthopedic diagnoses categories

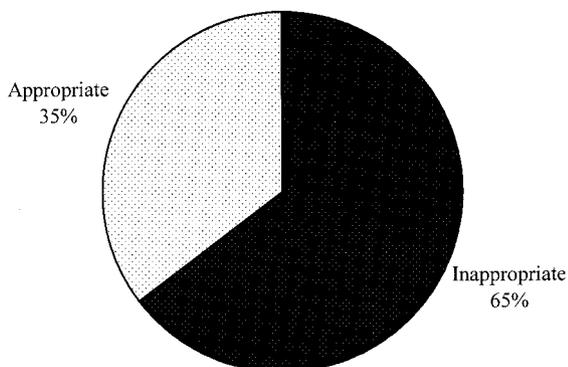


Fig 3. Appropriateness of definitive diagnoses.

TABLE 2. Comparison of Referral Diagnosis Versus Definitive Orthopedic Diagnosis

Definitive Diagnosis	Referral Diagnosis		Total
	Appropriate	Inappropriate	
Appropriate	99 (34.6%)	2 (0.7%)	101 (35.3%)
Inappropriate	68 (23.8%)	117 (40.9%)	185 (64.7%)
Total	167 (58.4%)	119 (41.6%)	286

P value for significant relationship between referral and definitive diagnosis is $<.0001$ (χ^2 test).

TABLE 3. Inappropriate Rate for Most Frequent Orthopedic Diagnoses (>8 Cases)

Definitive Pediatric Orthopedic Diagnosis	Percentage Inappropriate With AAP Guidelines (Inappropriate/Total of Diagnosis)
Torsional variation	94% (47/50)
Normal	97.6% (41/42)
Musculoskeletal pain	87.5% (21/24)
Angular variations	85% (17/20)
Trauma/fracture	57.9% (11/19)
Scoliosis	52.6% (10/19)
Neurodevelopmental deficit	16.7% (2/12)
Developmental dysplasia of the hip	9.1% (1/11)
Equinovarus deformity	0% (0/10)
Leg length discrepancy	62.5% (5/8)
Legg-Calve-Perthes	0% (0/8)

$P < .0001$ for relationship between percentage of inappropriate referrals and diagnosis.

demonstrating a high rate of inconsistency with the AAP recommendations are shown in Table 3.

The pediatric orthopedic treatment prescribed was compared against the final pediatric orthopedic diagnosis for each referral case as displayed in Table 4 ($\chi^2 P < .0001$; Cochran-Mantel-Haenszel controlling for treatment $P < .0001$). Of the 116 cases given a treatment plan of "no treatment," 108 (93.1%) of the diagnoses were inappropriate for referral. All of the 14 cases that required surgical intervention were appropriate.

This analysis shows that a significant percentage (64.7%) of definitive diagnoses of referred cases were not consistent with the new AAP recommended guidelines for referral to pediatric orthopedic surgeons. In addition, a 23.8% (68 of 286) false-positive rate of referring diagnoses is noted (Table 2). Cases that required no treatment or follow-up to monitor demonstrated a 32.8% (60 of 183) [(40 no treatment + 20 monitor inappropriate)/(116 no treatment + 67 monitor total)] false-positive rate.

DISCUSSION

Inappropriate referrals create a large use of pediatric orthopedic resources, which delays care of other, more appropriate patients. Nearly 2 of 5 of referrals in our study were determined to be conditions that should be adequately managed by a

primary care pediatrician. A large proportion of referrals indicated either a lack of basic textbook knowledge or lack of examination skills and appropriate diagnostic tools as demonstrated by a high number of definitive diagnosis indicating normal variants. Our data show a rate with nearly 40% (112 of 286) of all referrals determined to be normal or benign torsional or angular variations. The AAP Guidelines for Referral to Pediatric Specialists were devised to help the primary care pediatrician decide which conditions should be seen by a pediatric orthopedic specialist. The guidelines were strictly adhered to in determining appropriateness of referral for the purpose of this article. Although other orthopedic conditions might well be treated by a general orthopedic surgeon, the AAP guidelines were used to highlight those specific conditions that might better be treated by a pediatric orthopedic specialist.

Two problems exist in the poor knowledge of pediatric orthopedics by the pediatric primary care provider. First, developmental variations are viewed as anomalies. A developmental variation is part of normal growth and development. The primary care provider needs to have a solid fund of knowledge as to what is normal, be able to educate and reassure parents of such normalcy, and know when such variants deviate from the typical path and therefore require evaluation by a pediatric orthopedic surgeon.

TABLE 4. Comparison of Referral Diagnosis Versus Definitive Orthopedic Diagnosis Based on Treatment Recommended by Orthopedic Surgeon (Number of Cases)

Definitive Diagnosis	Referral Diagnosis		Total
	Appropriate	Inappropriate	
Appropriate	No Tx = 7	No Tx = 1	No Tx = 8
	Monitor = 27	Monitor = 0	Monitor = 27
	Nonsurgical = 43	Nonsurgical = 1	Nonsurgical = 44
	Surgical = 14	Surgical = 0	Surgical = 14
Inappropriate	Referral = 8	Referral = 0	Referral = 8
	No Tx = 40	No Tx = 68	No Tx = 108
	Monitor = 20	Monitor = 20	Monitor = 40
	Nonsurgical = 6	Nonsurgical = 26	Nonsurgical = 32
Total	Surgical = 0	Surgical = 0	Surgical = 0
	Referral = 2	Referral = 3	Referral = 5
	No Tx = 47	No Tx = 69	No Tx = 116
	Monitor = 47	Monitor = 20	Monitor = 67
	Nonsurgical = 49	Nonsurgical = 27	Nonsurgical = 76
	Surgical = 14	Surgical = 0	Surgical = 14
	Referral = 10	Referral = 3	Referral = 13
			Total = 286

Tx indicates treatment.

Many of the torsional variations referred to the pediatric orthopedic surgeon required only reassurance by the surgeon, a job that ideally would be done by the primary care provider who has had time to develop a relationship with the child's family. Second, many of the patients seen in the pediatric orthopedic surgeon's office had their referring diagnosis modified to "normal" when no pathology existed. This points to the poor examination skills of pediatric primary care providers, as adequate skills would give the practitioner the confidence to determine whether pathology existed. Other musculoskeletal specialists have found similar rates of inaccurate diagnoses by primary care specialists.⁷ Many times, patients are referred with symptoms rather than a diagnosis.⁸ Previous studies in the United Kingdom have shown greater than half of all referrals to a pediatric orthopedic clinic to be inappropriate with diagnosis of either normal or benign conditions. Referrals marked as urgent were found to have a 75% inappropriate referral rate.⁹ That a condition did not require surgical intervention does not suggest an inappropriate referral. Rather, it is important to realize that a high percentage of the conditions that did not require any treatment, surgical or nonsurgical, were inappropriate. Inappropriateness is based on diagnosis, not on the treatment needed.

Musculoskeletal concerns represent a significant number of all visits to the pediatric primary care office. Many schools are expanding their musculoskeletal education at both the medical school and resident training levels. However, a general incorporation of musculoskeletal medicine is still lacking.^{10,11} Recent data additionally shows a continued lack of knowledge base in newly graduated medical students.¹² This poor fund of knowledge has been shown not to be cost-effective in the adult population and potentially endanger the patient with the use of inappropriate diagnostic tests, inappropriate referrals, and lack of suspicion for urgent diagnoses.¹³ A lack of fundamental knowledge and skills in musculoskeletal medicine has the potential for leading to permanent disability, as shown by Davis and Stothard in the United Kingdom that one fourth of all hand cases were handled inappropriately by emergency department physicians.¹⁴

Educational intervention has been shown to improve performance and knowledge of musculoskeletal problems at the resident and medical student levels as well as in the practicing pediatrician.^{15,16} Unfortunately, in as little as 9 months postintervention, the effects are lost with no continuing teaching on the subject of musculoskeletal medicine.¹⁵

A better understanding of the natural history of a musculoskeletal process will allow the primary care provider to discuss the diagnosis with the parents and prevent delay in treatment, if needed, and avoid

referral to the wrong specialist. A push for improved education is a must. A formal musculoskeletal curriculum should be instituted in all primary care residency programs. The pediatric primary care provider is the front line of evaluating musculoskeletal conditions in children.

Limitations of this study include that it does not look specifically at the length of time in practice of a primary care provider to look for variations in training eras. The method of retrospective chart review does not allow the reviewer to establish other factors in the referral, such as parental pressure for a referral or previous litigation against a provider leading him or her to have a lower threshold for referring when a diagnosis is suspected.

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