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Clinical Diagnostic Accuracy and Magnetic Resonance Imaging of Patients Referred by Physical Therapists, Orthopaedic Surgeons, and Nonorthopaedic Providers

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Study Design: Nonexperimental, retrospective design.
Objectives: This study was designed to compare clinical diagnostic accuracy (CDA) between physical therapists (PTs), orthopaedic surgeons (OSs), and nonorthopaedic providers (NOPs) at Keller Army Community Hospital on patients with musculoskeletal injuries (MSI) referred for magnetic resonance imaging (MRI).
Background: US Army PTs are frequently the first credentialed providers privileged to examine and diagnose patients with musculoskeletal injuries. Physical therapists assigned at Keller Army Community Hospital have also been credentialed with privileges to order MRI studies for several years.
Methods and Measures: To reduce provider bias, a retrospective analysis was performed on 560 patients referred for MRI over an 18-month period. An electronic review of each patient's radiological profile was performed to assess agreement between clinical diagnosis and MRI findings. Data analyses were performed through descriptive statistics and contingency tables.
Results: Analysis on agreement between clinical diagnosis and MRI findings produced a CDA of 74.5% (108/145) for PTs, 80.8% (139/172) for OSs, and 35.4% (86/243) for NOPs. There was a significant difference in CDA between PTs and NOPs ($P<.001$), and between OSs and NOPs ($P<.001$). There was no difference in CDA between PTs and OSs ($P>.05$).
Conclusions: Clinical diagnostic accuracy by PTs and OSs on patients with musculoskeletal injuries was significantly greater than for NOPs, with no difference noted between PTs and OSs. *J Orthop Sports Phys Ther 2005;35:67-71.*

Key Words: *diagnostic agreement, direct access, primary care*

US Army physical therapists (PTs) have been credentialed with privileges to practice in orthopaedic primary care roles since the Vietnam War era.[4] They frequently are the first privileged providers to diagnose and manage patients with musculoskeletal complaints or orthopaedic trauma.[4,9] The importance of this role to autonomously manage patients with acute musculoskeletal injuries (MSI), with or without physician referral, has historically enabled US Army orthopaedic surgeons (OSs) to focus their practice on more complicated trauma or surgical cases. The strength of the close working relationship between US Army PTs and OSs has anecdotally produced greater efficiency and effectiveness for both services.

RESEARCH REPORT

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This study was approved by the Human Subjects Research Review Board of the US Army MEDDAC West Point. The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Departments of the Army or Defense.
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The efficacy of US Army PTs functioning in an orthopaedic primary care role over the last 38 years has enabled them to be credentialed with clinical privileges to examine patients with and without physician referral, order radiographs and bone scans, perform electromyography/nerve conduction studies (EMG/NCS) examinations, order laboratory tests, and prescribe medications.[4] Within the last 10 years, US Army PTs at Keller Army Community Hospital (KACH), West Point, NY have also obtained privileges to order magnetic resonance imaging (MRI) studies and computed tomography (CT) scans. Like most PTs practicing in military clinics, and specifically those in US Army clinics, the PTs assigned at KACH have all undergone postgraduate specialty training in the COL Kersey Neuromusculoskeletal Evaluation Course, conducted annually by the US Army-Baylor University Doctoral Program in Physical Therapy.

Previous studies have reported conflicting results between orthopaedic and nonorthopaedic providers on both differences in clinical diagnosis and regarding the need to order MRIs.[6,7,8] This led to the intuitive questions underpinning this study on how PTs would compare in clinical diagnostic accuracy (CDA) for MSI, and whether patient referrals to radiology for MRIs would be appropriate? Therefore, the purpose of this study was to retrospectively assess CDA between PTs, OSs, and nonorthopaedic providers (NOPs) privileged to practice at KACH on patients with MSI using MRI findings as the reference standard. Our hypothesis was that PTs would demonstrate a comparable degree of CDA with other privileged providers at KACH.

METHODS

To reduce provider bias, a retrospective analysis was performed on 41% (560/1397) of patients (males, n = 362; males' mean age ± SD, 33.2 ± 14.6 years; females, n = 198; females' mean age ± SD, 35.3 ± 16.1 years) referred for MRI by all providers at KACH from January 2001 to June 2002. All patients selected for this study were referred for MRI due to musculoskeletal complaints in the spine or extremities.

Instrumentation

The 1.5 Telsa Phillips Intera Magnet (Phillips Medical Systems, Andover, MA) at KACH was used for all MRIs. The specific MRI sequencing protocols were selected for the spine and each joint by a fellowship-trained musculoskeletal radiologist and neuroradiologist assigned to KACH. The specific protocols were (1) sagittal T1, (2) sagittal proton density with fat suppression, (3) axial proton density with fat suppression, (4) coronal proton density with fat suppression, and (5) coronal T2 with fat suppression. These protocols were consistent, regardless of which provider ordered the exam.

Procedures

The radiology appointment log was accessed to obtain a complete listing of all patients referred for musculoskeletal MRI during the specified time. The appointment log was strictly maintained by the MRI technician and was inclusive for all patients scheduled to undergo MRI at KACH. All patients referred for MRI, other than those specifically referred by the OSs, were analyzed in this study. The number of patients selected for this study represents the total sum referred for MRI by PTs (145) and NOPs (243). Due to the volume of patients referred for MRI by the OSs, a random sample (172/1009) was analyzed.

For the purpose of this study it was decided to determine CDA based on the agreement between each provider's clinical diagnosis and documented MRI findings. An electronic review of each patient's radiological profile, utilizing the Radiology Exam Inquire (REI) menu on the Composite Health Care System, was performed by the primary investigator and both coinvestigator radiologists to assess agreement between the referring provider's clinical diagnosis and MRI findings from 23 providers: PTs (5), OSs (3), and NOPs (15) (Table 1). Providers were given the benefit of doubt and as much latitude as possible in order to obtain credit on agreement between what they typed on the computer entry for a diagnosis and the final report on REI provided by the radiologists. Patient's medical records were used when needed to further assess the provider's clinical diagnosis when not recorded or described clearly on REI. If the provider's clinical diagnosis did not match anything within the radiologist's report, or if the report was determined to be normal, the provider was not given credit for CDA. However, if a provider's diagnosis was a torn anterior cruciate ligament (ACL), and the radiologists reported a torn ACL and a lateral meniscus tear, the provider was still given credit. Three board-certified radiologists assigned to KACH reviewed all of the MRIs. Two of the radiolo-

TABLE 1. Providers participating in study by specialty.

Providers	Military	Civilian	Total
Physical therapists	4	1	5
Orthopaedic surgeons	3	0	3
Family practice physicians	3	2	5
Internal medicine physicians	1	2	3
Pediatric physicians	1	0	1
Emergency physicians	1	1	2
Podiatrist	1	0	1
Physician assistants	1	1	2
Clinical nurse practitioners	0	1	1
Totals	15	8	23

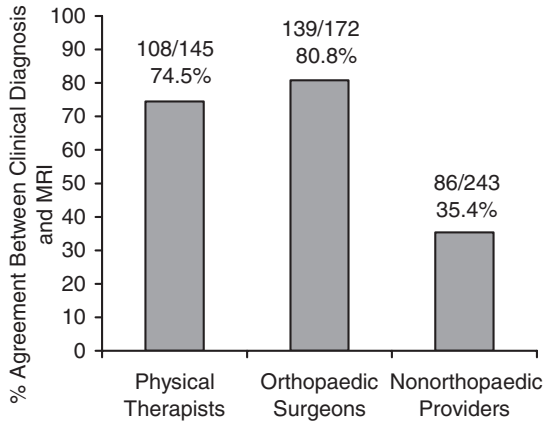

FIGURE 1. Clinical diagnostic accuracy on musculoskeletal complaints between physical therapists, orthopaedic surgeons, and nonorthopaedic providers (NOPs). Percentage agreement for the NOPs was significantly lower than for the other groups ($P<.001$).

gists read and dictated over 90% of the MRIs into REI. Both were fellowship trained, one in musculoskeletal anatomy and the other in neuroradiology. All MRI reports were entered into REI by the radiologists before data collection began.

Statistical Analysis

Descriptive statistics and contingency tables were used to determine whether PTs could demonstrate a comparable degree of CDA with OSs and NOPs when ordering MRIs. Alpha level for all statistical tests was set at .05. All statistics were performed with Microsoft Excel (Office 2000) and SPSS for Windows (Version 9.0) software.

RESULTS

Provider agreement between clinical diagnosis and MRI findings is depicted in Figure 1. There was a significant difference in CDA between PTs and NOPs ($\chi^2 = 55.6$, $df = 1$, $P<.001$), and for OSs compared to NOPs ($\chi^2 = 62.1$, $df = 1$, $P<.001$). There was no difference in CDA between PTs and OSs ($P>.05$). Table 2 provides the CDA breakdown of all providers by specialty, with Table 3 depicting CDA by the physical therapists based on years of experience and board certification. Of the total patients examined by PTs, 53% (77/145) were seen through direct access without physician referral. The PTs demonstrated 90.9% (70/77) CDA for the patients seen through direct access. The OSs and radiologists using professional judgment unanimously agreed that the PTs in this study had appropriately requested MRIs for all patients (145/145) referred to radiology. Table 4 lists the diagnoses and frequency of occurrence made by the PTs.

TABLE 2. Percent agreement between clinical diagnosis (CD) and magnetic resonance imaging (MRI) by specialty.

Providers	CD/MRI Agreement	Total MRI	Agreement
Physical therapists	108	145	74.5%
Orthopaedic surgeons	139	172	80.8%
Nonorthopaedic providers (all)	86	243	35.4%
Family practice physicians	38	89	42.7%
Internal medicine physicians	21	69	30.4%
Pediatric physicians	1	3	33.3%
Emergency physicians	7	17	41.2%
Podiatrist	4	4	100.0%
Physician assistants	9	31	29.1%
Clinical nurse practitioners	6	30	10.1%

TABLE 3. Percent agreement between clinical diagnosis (CD) and magnetic resonance imaging (MRI) by physical therapists at Keller Army Community Hospital based on years of experience and board certification.

Physical Therapists	Number	Years of Experience	CD Agreement
Board certified	3	11.5	86% (85/99)
Non-board certified	2	10.5	50% (23/46)

TABLE 4. Clinical diagnoses confirmed by magnetic resonance imaging and frequency for each diagnosis made by the physical therapists.

Clinical Diagnosis	Frequency
Cervical disc herniation	4
Lumbar disc herniation	11
Lumbar osteoarthritis	3
Lumbar degenerative disc disease	1
Lumbar disc bulge	1
Femoral stress fracture	3
Knee osteoarthritis	1
Knee medial collateral ligament sprain	2
Knee anterior cruciate ligament sprain	10
Knee tibial (medial) meniscus tear	12
Knee lateral meniscus tear	4
Patellar tendon tendinopathy	2
Knee osteochondritis dissecans	3
Tibial stress fracture	7
Shoulder labral tear	15
Rotator cuff tear	8
Rotator cuff tendinopathy	4
Subacromial bursitis	1
Humeral myositis ossificans	1
Talar dome osteochondritis dissecans	3
Pelvic osteoarthritis	2
Osteitis pubis	2
Achilles tendon tendinopathy	1
Plafond osteochondritis dissecans	1
Tarsal navicular stress fracture	1
Elbow ulnar collateral ligament sprain	1
Triangular fibrocartilage complex sprain	3
Scapholunate ligament sprain	1

DISCUSSION

The findings of this study did not support our hypothesis regarding CDA. We can presume that PTs and OSs privileged to practice at KACH during the period of this study demonstrated a high degree of CDA on patients referred for musculoskeletal MRI. However, the PTs demonstrated significantly better CDA than the NOPs on patients with MSIs. Of notable interest, this finding was irrespective of whether patients were referred to physical therapy or were seen on direct access without physician referral.

While other studies have addressed the clinical efficacy of MRI utilization by various providers, none have included PTs in the analysis.[7,8,9] This is not surprising, considering this privilege is typically only granted to PTs in military practice, specifically in certain US Army facilities. The US Department of Defense recognizes the need for military PTs to serve in an orthopaedic primary care role for musculoskeletal disorders, allowing them to evaluate, diagnose, and provide interventions for military personnel and their families, with and without an initial referral from a physician.[4,10] Physical therapists in this study were able to demonstrate comparable CDA to the OSs when ordering MRIs.

At KACH, the PTs do not practice in isolation but work very closely with the orthopaedic surgeons and primary care and emergency room physicians. By functioning in an orthopaedic primary care role for MSIs, the PTs and OSs are able to work more efficiently and effectively, reducing excessive patient visits and making sure serious injuries are expedited to orthopaedic surgeons. This close working relationship between the PTs and all credentialed providers at KACH enables the PTs to autonomously manage nonsurgical MSIs, providing the OSs, and primary care and emergency room physicians the opportunity to manage patients with more complex surgical and medical problems.

Clinical Relevance

The findings from this study further support the basic premise that PTs are not only capable of making good clinical judgments regarding the ordering of diagnostic imaging studies and the diagnosis of musculoskeletal conditions, but that these decisions can be made independent from physician referral. Granted, the PTs in this study, like most PTs working in military clinics, have advanced postgraduate training through the COL Kersey Neuromusculoskeletal Evaluation Course. While this training is not necessarily unique on how to perform a clinical examination, it does provide extensive training in advanced diagnostic imaging.

Limitations

Using MRI examination as the criterion reference for the clinical diagnosis is a limitation. While previous studies have documented the accuracy, sensitivity, and specificity of MRI on knee pathology, which improved the clinical diagnostic certainty for the provider and decreased the number of diagnostic arthroscopic procedures, the same cannot presently be said for other peripheral joints or the spine.[1,2,3,5,6] Ideally, surgical confirmation should be used when applicable. However, given the fact that the decision was to include all spine and extremity disorders, surgical confirmation would not have been possible for many of the patients in this study. Additionally, a retrospective study can be a design limitation; however, we believe it added credibility to this study by reducing provider bias. Patient age and gender by provider was also not analyzed. Perhaps this information might offer some insight into the discrepancy on CDA between the PTs and NOPs given that some of their patients are older and present with comorbidities usually not seen in a younger, healthier population.

Future Research

The findings from this study should be looked at prospectively across a broader spectrum of health care facilities. Furthermore, a prospective study involving PTs could correlate the clinical and MRI results with surgical findings. Finally, although our descriptive data indicate that the PTs in this study with board certification produced a higher CDA rate compared to PTs without board certification, despite comparable years of experience, this preliminary finding warrants further testing before conclusive statements are made.

CONCLUSION

Clinical diagnostic accuracy by PTs and OSs on patients with musculoskeletal injuries was significantly greater than that of NOPs, with no difference noted between PTs and OSs. Interestingly, the CDA demonstrated by PTs was high irrespective of whether patients were referred or seen through direct access without physician referral.

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