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Analyzing the Overuse of Magnetic Resonance Imaging for Musculoskeletal Disorders

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BACKGROUND/AIMS
The overuse of healthcare is a growing concern worldwide. Magnetic resonance imaging (MRI) is an important diagnostic tool for the spectrum of healthcare providers who treat musculoskeletal (MSK) conditions. The aim of the present study was to demonstrate the overuse of MRI in MSK system imaging.

MATERIAL and METHODS
MSK MRIs that were conducted between December 31, 2016 and May 1, 2019 in our hospital were systematically selected. MRIs were divided into groups by anatomical regions. All MRI reports were reviewed according to the findings by two orthopedic surgeons and recorded as normal, abnormal, and insignificant. The number of MRIs was determined according to the departments. Descriptive statistics were performed by using SPSS 22.0.

RESULTS
In total, 2413 MRI reports were detected and scanned. The mean age of the patients was 49.5 years. The lumbar was the most frequent region that had been evaluated by MRI. Of the 2413 MRI reports, 7.54% had normal findings, whereas 26.64% had insignificant findings. In addition, 65.82% of the MRI reports had abnormal findings.

CONCLUSION
The overuse of MRI is a serious health problem that leads to an increase in costs. Constitution of appropriate guidelines and education of patients may facilitate a decrease in MRI requests.

Keywords: Imaging, magnetic resonance imaging, musculoskeletal, overuse

INTRODUCTION

Magnetic resonance imaging (MRI) is a medical imaging device that has been used since the early 1980s (1). MRI is a very important diagnostic tool for imaging the musculoskeletal (MSK) system. It continues to be the standard of care for imaging ligament, cartilage, and intraosseous abnormalities. It has a matchless skill display high-resolution anatomy images noninvasively. This has made MRI the preferred imaging technology for detecting pathologies in soft tissues, such as meniscal, ligament, and tendon tears, and in occult bone injuries (2, 3).

It has been revealed that factors, such as hospital physicians to population ratio, MRI units to population ratio, and the financial situation of the family, may all affect MRI usage (4).

Excessive utilization of healthcare, especially MRI, is becoming increasingly problematic (5, 6).

Magnetic resonance imaging has the obvious advantage of having an absence of radiation, but the disadvantages include higher costs, less availability than computerized tomography, and intolerance among young children (7).

The aims of the present study were to determine the extent to which the MRIs of the MSK system were taken in our hospital during a certain period and to detect the percentage of performed MRIs that helped with diagnosis.

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MATERIALS and METHODS

This study was conducted in Kyrenia University. The study protocol was approved by the ethics committee of Kyrenia University. Data were collected from the Picture archiving and communication systems. Since the study was retrospective in nature, informed consent was not obtained.

We systematically selected MSK MRIs from December 31, 2016 to May 1, 2019. All images were performed using a 3T MRI machine (Magnetom Skyra; Siemens, Erlangen, Germany). MRIs were divided into groups by anatomical regions, such as ankle, foot, elbow, knee, wrist, hand, hip, arm, crus, lumbar, shoulder, sacroiliac, cervical, femur, and thoracic. All MRI reports were reviewed by two orthopedic surgeons and recorded as normal, abnormal, and insignificant (Table 1). MRI reports indicating no anatomical or physiological abnormality were recorded as "normal." Reports indicating abnormal findings that caused either medical or surgical treatment were recorded as "abnormal." Minimal abnormalities that were clinically insignificant and did not require further interventions were recorded as "insignificant." The number of MRIs was determined according to the departments.

Statistical Analysis

Descriptive statistics were performed by using Statistical Package for the Social Sciences 22.0 (SPSS IBM Corp.; Armonk, NY, USA) software program.

RESULTS

A total of 2413 MRI reports were detected and scanned. Of the total patient population, 52.55% were female. The mean age of the patients was 49.5 years. The lumbar was the most frequent region that had been evaluated by MRI.

Of the 2413 MRI reports, 7.54% had normal findings, whereas 26.64% had insignificant findings, and 65.82% had abnormal findings (Table 1).

Approximately 1 in 4 (25.4%) of all MRIs were requested by the orthopedic department, and >1 in 3 were requested by the radiology department. The most requested MRI region was the lumbar region with 782, whereas the second most requested MRI region was the knee (Table 2). Approximately 73.4% of the MRI scans were ordered by the radiology, orthopedics, and neurosurgery departments, with 35.7%, 25.4%, and 12.3%, respectively (Table 2) (Figure 1).

TABLE 1. The number of MRI findings by anatomical regions

	Ankle	Foot	Elbow	Knee	Wrist	Hand	Hip	Arm	Crus	Lumbar	Shoulder	Sacroiliac	Cervical	Femur	Thoracic	Total	Total (%)
Normal	6	5	0	31	5	1	27	2	1	18	14	7	36	10	19	182	7.54
Abnormal	46	24	7	256	9	11	43	8	15	639	207	8	263	9	43	1588	65.82
Insignificant	33	25	3	217	17	10	34	2	5	125	58	5	75	7	27	643	26.64
Total	85	54	10	504	31	22	104	12	21	782	279	20	374	26	89	2413	100

MRI: magnetic resonance imaging

TABLE 2. The number and total percentage of MRI types requested by different departments

MRI type	Orthopedics	Neurosurgery	Physical medicine	Emergency	Radiology	Neurology	Others	Total
Ankle	31	0	6	9	36	0	3	85
Foot	16	0	3	4	27	0	4	54
Elbow	5	0	1	0	3	0	1	10
Knee	212	2	21	15	226	0	28	504
Wrist	18	0	2	0	10	0	1	31
Hand	8	0	4	1	8	0	1	22
Hip	35	2	19	2	41	0	5	104
Arm	3	0	1	0	7	0	1	12
Crus	7	0	1	1	9	0	3	21
Lumbar	105	193	96	39	259	28	62	782
Shoulder	132	2	24	8	88	1	24	279
Sacroiliac	3	3	9	0	1	0	4	20
Cervical	26	84	48	21	107	66	22	374
Femur	6	0	0	2	14	0	4	26
Thoracic	5	12	10	1	25	26	10	89
Total (N)	612	298	245	103	861	121	173	2413
Total (%)	25.4%	12.3%	10.1%	4.3%	35.7%	5.0%	7.2%	100%

MRI: magnetic resonance imaging

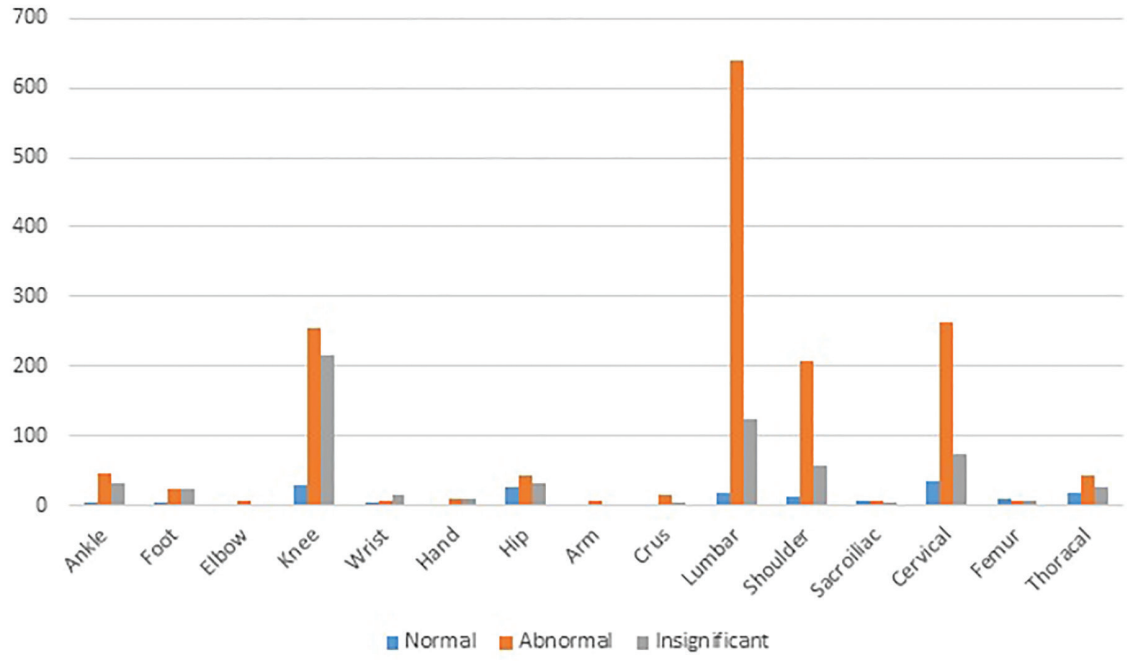

FIGURE I. Anatomical distribution of MRI findings

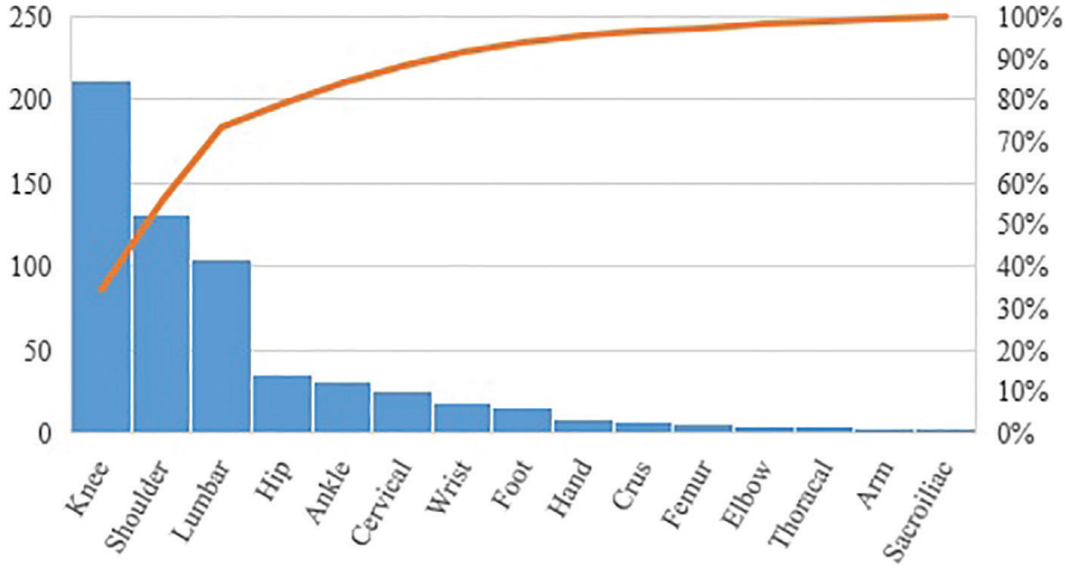

FIGURE 2. Type of MRI requested by the orthopedics department

The most requested MRI by the orthopedics department was the knee with 34.6% (Figure 2).

DISCUSSION

The population characteristics and the existing health system in our country allow the overuse of MRI. In our study, we attempt to consider this fact and to demonstrate the usefulness of the MRIs. For this purpose, the reports of MSK MRIs performed in our hospital for a period covering approximately 2.5 years were reviewed retrospectively. The MRI orders of different departments were examined, and the regions requested for MRIs were also determined. However, the ratio of different department requests has not been investigated.

In our study, when the total number of MRIs was examined, it was found that only a small portion of them had normal findings (7.54%); however, this rate was higher in MRIs for certain regions. For example, we found that approximately 38.5% and

35% of MRI reports were normal for the femur and sacroiliac, respectively.

In our study, we have found that the radiology, orthopedics, neurosurgery, and physical therapy departments had the highest number of MSK MRI requests. More than 1 in 3 of these MRI requests consisted of radiology requests.

The reason for this might be that our hospital has the only 3.0 Tesla MRI in the country. Therefore, the requests of doctors in other centers are ordered by the radiology department to be enforced in our hospital.

Studies on MRI overuse are available in the literature. The overuse of MRI for headaches and migraines has been reported in the literature. In these studies, normal MRI findings were found in more than half of the adult patients with headache (8-10).

In our study, we did not differentiate the requested MRIs according to the symptoms. We only searched the percentages and the number of the findings by departments according to the requested regions.

Normal findings were higher in the femur, hip, and thoracic regions, but lower in other regions. However, when all regions were evaluated, insignificant findings were the least in the lumbar region, whereas in other regions, we found that the number of insignificant findings (wrist) increased >50% (Table 1). The highest abnormal rate appeared in relation to lumbar MRI. However, these findings may be incidental because the correlation between lumbar spine MRI findings and clinical signs and symptoms is poor (11).

In some regions, abnormal findings are equal to the sum of normal and insignificant findings, which may be attributed to non-branch requests. The majority of MSK MRIs consist of the knee and lumbar regions. Insignificant findings, such as bulging discs, discs protrusions in lumbar MRIs, such as bone marrow edema, meniscal, and cartilage signal changes, and fat pad edema, and tendinopathy in knee MRIs, are more common. In our study, MRI findings of symptomatic patients who were admitted to the outpatient clinic were examined, and high rates of positive MRI findings could be seen, even in asymptomatic athletes (12, 13). Insignificant findings were observed in 67.4% of asymptomatic soccer players and 88.9% of kangoo jumpers. These insignificant findings in the MRI reports disturbed the patients and their relatives. All patients should be informed about these insignificant findings by the physician.

In fact, a reason for the overuse of MRI may be the insistence of patients to have an MRI. Awareness of the absence of radiation increases referrals to hospital, especially for patients with high income. However, physicians' medical concerns could also support the overuse of MRI. Patients are often afraid of their symptoms and unfounded comments made by people around them. This fear leads them to demand an MRI from their doctor. With a good physical examination and subsequent disclosure of symptoms to the patient, the majority of patients believe that these demands are unwarranted (14). A good patient–physician relationship and informing the patients is the only way to prevent the overuse of MRI as a result of patient anxiety caused by their symptoms. Considering these factors, further studies may reveal more detailed and enlightening information.

Clinical negligence claims and litigations are constantly increasing. According to the National Health Service statistics in the United Kingdom, the most common cause of claims against orthopedic surgeons is postoperative complications, whereas the second most common cause is wrong, delayed, or failure diagnosis (15). The fact that wrong, delayed, or failure diagnosis is so high in medical litigations leads doctors to conduct more defensive medicine practice. In a web-based survey of 1214 orthopedic surgeons in the USA, 96% of surgeons reported that they practiced defensive medicine by ordering laboratory, imaging, consultation, and hospital admissions to avoid possible litigations. On average, 24% of all tests were reported to be for defensive reasons (16). In our study, normal results (7.54%) and most of the insignificant results (26.64%) may have been ordered due to the practice of defensive medicine.

Kung et al. (4) concluded that factors, such as hospital physicians to population ratio, MRI units to population ratio, and financial situation of the family, may all affect MRI usage. Our hospital is situated in a low populated area, and the MRI units to population ratio is also high. However, the income and socioeconomic status of the families living in the region in which the hospital is located is high compared with the country in general.

Saadat et al. (17) conducted a survey among private MRI centers in Tehran to study the proportion of MRI scans that resulted in significant clinical findings. Of all the MRI reports, 17.2% had normal findings, whereas 54.6% had abnormal findings. Approximately 28% of the reports had indicated substantial changes. In our study, of all the MRI reports, 7.54% had normal findings, whereas 65.82% had abnormal findings, and 26.64% had insignificant findings.

Our study has a limitation. We investigated each department only with respect to the region of MRI that was requested. However, we did not analyze the MRI findings according to departments. This may be the subject of a different study.

The overuse of medical interventions, such as MRI, is an important problem that leads to excessive costs and can have serious consequences. Constitution of appropriate guidelines and education of patients may facilitate a decrease in MRI requests.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Kyrenia University (2019/01-002).

Informed Consent: Since this was a retrospective study, informed consent could not be taken from the patients.

Peer-review: Externally peer-reviewed.

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