

Appropriateness of physicians' lumbosacral MRI requests in private and public centers in Tehran, Iran

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Abstract

Background: Back pain is a common patients' complaint, and its etiology is important because of different potential treatment approaches (based on causes). For a better diagnosis, magnetic resonance imaging (MRI) is widely used in clinical settings that may result in inappropriate requests. This study aims to evaluate the appropriateness of the lumbosacral MRI requests in patients with back pain in two public/referral and private imaging centers in Tehran.

Methods: In this cross-sectional study, 279 patients from both centers were recruited in 2014. A checklist was developed based on the internationally recognized clinical guidelines (NICE, and AHRQ) for determining the indications. An expert panel of related specialties finalized them. Patients' demographic and some anthropometric measures, as well as MRI reports, were collected.

Results: The mean±SD age of patients was 47.9±14.78 years with a dominance of females (M/F=38.4/61.6). About 77% (n=214) of lumbosacral MRIs were requested in accordance with the guidelines. Indicated MRI requests were significantly higher in the private imaging center (p=0.019, OR=2.087, CI 95%: 1.13-3.85). In the private center, 80.6% and in the public center, 70.4% of the MRI requests were in accordance with the guidelines.

Conclusion: The proportion of non-indicated MRI requests based on the valid guidelines is about ¼ of all requests that is compatible with some other studies mostly from developed countries.

Keywords: Back pain, MRI, Practice guideline, Magnetic resonance imaging.

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Introduction

Low back pain is a serious public health problem. Based on World Health Organization report, the global all-age prevalence of low back pain was 9.2% for 2010. As a result, low back pain has been the leading cause of years lived with disability (YLDs) globally and the first or second ranked cause of YLDs in 17 of the 21 global burden of disease (GBD) 2010 regions (1). Back pain is one of the common complaints of patients and medical service requests.

About %80-90 of adults have a lifetime history of back pain, while its prevalence in epidemiological studies varies between 7.5 to 36 percent in different populations, with the highest rate in the range of 45 to 60 years (2). The most recent global review of the prevalence of low back pain in the general adult population showed a point prevalence of 12–33% and 1-year prevalence of 22–65% (3). Usually, acute back pain is relieved within three months in 50 to 90% of cases, but it could last for more

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than twelve weeks which considered as chronic and will require further considerations (2). Back pain is one of the most common reasons for a physician visit with a high socio-economic burden (4).

Because of the broad differential diagnosis and multiple causes, it is important to identify the etiology of the back pain with appropriate physical examinations and diagnostic procedures. Magnetic resonance imaging (MRI) is a non-invasive and the most sensitive imaging procedure for the evaluation of the vertebral column and spinal canal. It gives a better image of the neural structures, especially in comparison with computerized tomography (CT) scan (2).

However, lumbosacral MRI scan may show some changes that could be considered as abnormal while they are not associated with any symptom (5). This may result in unnecessary interventions such as surgery. Using clinical expertise and reliable practice guidelines might help physicians to make a better decision. Although developing the clinical practice guidelines is a challenge in developing countries (due to limited capacity and resources as well as the lack of high-quality local evidence), research shows that many practitioners do not use the evidence-based guidelines for the prescription of MRI. Ignorance, neglect, excessive self-confidence, physicians' personal financial interests or patient's request could be among reasons for this behavior (6).

Although technologies like MRI are helpful tools for addressing some medical problems, they are expensive and potentially harmful to public health. Health systems are under pressure for approval of new technologies due to the rapid and continuous innovations. An increasing number of emerging technologies in the field of medicine increases both the doctors' and patients' demand. The low- and middle-income countries (including Iran) are faced with a rising challenge due to the use of these new technologies. In many cases, the real necessity of importing health technolo-

gies to developing countries has been neglected by giving preference to modernization. As an example in Iran, although the number of installed MRI machines in the capital (Tehran) is enough for the whole country, there is still a demand for it (7).

Since MRI as a diagnostic method has been widely used in Iran, the health system is encountering a high volume of lumbosacral MRI requests in patients with back pain (8). According to a study, four out of five lumbosacral MRI were not requested based on guidelines. To be covered by the insurance, particularly supplementary insurance was an important factor on MRI requests (9). Another study showed that patients with complementary private insurance had a 20% higher rate of previous MRI than other patients. There was a statistically significant relationship between complementary private insurance coverage and the number of MRI performed ($p=0.006$) (10). That study also revealed that the risk of inappropriate use of MRI in the private hospitals was about 2 times more than public hospitals (10). In the present study, we aimed to figure out A) the percentage of inappropriate MRI requests (based on the valid and reliable guidelines and indications), B) how many of requests are based on definite or relative indications, and C) whether there is a difference between private and public (referral) imaging centers. We were also interested to find out any possible relationship between MRI requests and patients' insurance situation.

Methods

Study design and population

This cross-sectional study was performed from April 20th to June 30th, 2014 in Rasoul Akram (public/referral) and private imaging centers, Tehran, Iran. Rasoul Akram Center is a teaching hospital which is affiliated with Iran University of Medical Sciences and is a tertiary and educational center. Patients with acute or chronic back pain and a request for lumbosacral MRI who referred to the above centers were enrolled.

Exclusion criteria were lumbosacral MRI requests for any other reasons, such as previously diagnosed medical conditions (discopathy, metastases).

Data collection

Based on NICE (National institute for health and clinical excellence) (11) and AHRQ (Agency for Healthcare Research and Quality) (12) clinical guidelines for back pain, we derived related indications for requesting an MRI. At first, a list of different indications developed. Then, an expert panel consisting of a clinical neurologist, a diagnostic radiologist, and a neurosurgeon separately judged the indications and a list of indications was developed based on consensus. The list was shared with other specialists in the related fields and finally approved by minimal changes. The indications were divided into two categories: definite and relative. Definite indications included a) chronic back pain, b) radicular pain, c) sexual dysfunctions, d) incontinence (urinary), and e) motor disorders in the lower limbs. Relative indications included either back pain or one of the followings: Age more than 70 years, trauma to the vertebral column, tenderness over the spine, uveitis, inflammatory bowel disease (IBD), morning stiffness, long-term use of steroids, cancer, fever, and pain at night. The final checklist was consisted of the above indications in addition to some demographic and anthropometric characteristics, and insurance situation of the patients. A well-trained registered nurse who had been taught about the checklist asked medical history. Also, the result of MRI scan was recorded based on the report

of a radiologist.

To determine the appropriate sample size, a pilot study was conducted at two centers. Using the Sample XS software and the estimated prevalence of inappropriate indications, the sample size was calculated as 144. Considering possible drop outs, we enrolled 150 persons in each group of the study (final total sample=279). A non-random convenient sampling method was used; all eligible patients were enrolled in the study until the calculated sample size was completed.

Ethical consideration

After giving the full information on the objectives of the study, informed consent was obtained from all patients or guardians. Name and identity of the participants were considered confidential, and additional costs were not imposed on the patients.

Statistical analysis

All analyzes were performed by SPSS 18. Descriptive analysis techniques such as mean, standard deviation, and frequencies (percentage) were used. Also, we used t-test, one-way ANOVA, chi-squared, and logistic regression where appropriate.

Results

The study was conducted from April to June 2014. We recruited a sample of 279 patients with the complaint of back pain and a request for lumbosacral MRI at two different imaging centers: a private and a public. The final sample consisted of 144 patients (51.6%) in the private and 135 patients (48.4%) in Rasoul Akram imaging centers. Most of the patients were female

Table 1. Frequency distribution of the patients' insurance situation

Variable	Category	N	%
Type of insurance	Public (Social health)	237	84.9
	Private	14	5
	None	9	3.2
	Unknown	19	6.8
	Total	279	100
Supplementary insurance	Yes	98	35.1
	No	145	52
	Unknown	36	12.9
	Total	279	100

Table 2. Comparison between clinically indicated and non-indicated MRI requests

Variable		Non-indicated	Indicated	Total*	p
Sex	Female	36 (20.9%)	136 (79.1%)	172	0.089
	Male	32 (29.9%)	75 (70.1%)	107	
Type of insurance	Public (Social health)	53 (22.4%)	184 (77.6%)	237	0.277
	Private	4 (28.6%)	10 (71.4%)	14	
	None	4 (44.4%)	5 (55.6%)	9	
	Unknown	7 (36.8%)	12 (63.2%)	19	
Supplementary insurance	Yes	24 (24.5%)	74 (75.5%)	98	0.570
	No	31 (21.4%)	114 (78.6%)	145	
Reported result	Normal	12 (34.3%)	23 (65.7%)	35	0.135
	Abnormal	54 (22.7%)	184 (77.3%)	238	
Imaging center	Private	28 (19.4%)	116 (80.6%)	144	0.003
	Public	40 (29.6%)	95 (70.4%)	135	

*: differences in total numbers are due to missing data (refusal to respond by patients)

(172, 61.6%). The mean \pm SD age of patients was 47.9 \pm 14.78 with a range of 6-86 years. There was a considerable coverage of basic insurance (84.9%) and only 3.2% did not have any insurance (9 patients). The other information regarding insurance situation is shown in Table 1. The MRIs were administered based on the patient request in eight cases (2.7%) and in others, the physician made the decision to request an MRI. Abnormalities were reported by a radiologist in 80.1% (238) of lumbosacral MRIs while 11.8% (35) were normal. The situation of 8.1% (24) was inconclusive.

Information on indications for 279 people was clear and reliable. Overall, 211 patients (71.04 %) met the criteria for a reasonable request of MRI while 68 patients (24.4%) didn't show any indication. Among patients with at least one indication for an MRI request, 40 patients (13.5%) showed the definite indications only, and the remaining (171, 57.6%), met both definite and relative indications. An MRI had not been requested only based on the relative indications in any case. There was no difference between patients with and without indications in terms of sex ratio, age (48.47 \pm 14.38 vs. 46.47 \pm 15.95), body mass index (BMI) (26.62 \pm 4.21 vs. 25.78 \pm 3.98), insurance condition, and the situation of their MRI report. The only difference was observed based on private or public center; the rate of non-indicated requests was 29.6% (n=40) at the Rasoul Akram (public) imaging center versus 19.4% (n=28) at the private center (p=0.003). Surprisingly, there

was no statistically significant relationship between the presence of the clinical indications and reported abnormalities. Table 2 shows a comparison between clinically indicated and non-indicated MRI requests.

Variables with a p-value less than 0.3 (sex, BMI, type of insurance, and imaging center) were entered in a binary logistic regression equation as independent variables to figure out if they were affecting a non-indicated MRI request (outcome variable). Imaging center was the only significant affecting variable (p=0.019, OR=2.087, CI 95%: 1.131-3.852).

Discussion

Low back pain is a common complaint of patients and also a serious medical problem in some cases. One of the most challenging decisions for a physician is figuring out the best diagnostic modality and the best time for requesting. This may result in confusion especially when there is no valid set of criteria. This study was an effort to check the appropriateness of requests of lumbosacral MRI that received by private and public imaging centers in Tehran.

The most of MRIs were requested for female patients (61.6%). This is consistent with some other studies including Saadat et al. and Allison et al. that showed women are the majority of lumbosacral MRI request cases (13-17).

Low back pain affects people of all ages. The prevalence rate for children and adolescents is lower than adults and peaks between the ages of 35 and 55 (18). Most of

our patients were in the middle age (mean age=47.97) that is both reasonable and consistent with other studies. In a study by Palesh et al., the mean age for lumbosacral MRI was 44±16 years (13) and in two other studies, the most common age range of lumbar MRI was 40-60 years which is approximately coordinated with our study (16,17).

At least one abnormality was reported in 87.2% of MRIs by radiologists. The abnormal findings should not necessarily be considered indicative of appropriate prescription of lumbosacral MRI, especially because there was no significant association between abnormal radiologist reports and the clinically credible indications in our study. This high rate of abnormalities has been shown in similar studies (7,13,16,17); abnormal changes were reported in a range of 88.8% to 96% which is close to our results (7,13). Also, according to a study, 68% of MRI findings in asymptomatic people were abnormal which those incidental findings might lead to additional testing, potential unnecessary interventions, increased cost of care, and possibly worse outcome (19).

In the present study, 211 (75%) of MRI requests were consistent with the indications. Different studies show various results in this case. Some studies show a higher rate of MRI requests (Spain: 88%) (20), while there are studies with the similar (USA: 74% and 78%) (21,4), or lower rates of appropriateness (Canada: 44.3%, Iran: 20.8%) (22,8). In another Iranian study, Saadat showed that 17.2% of all MRI reports were associated with normal results, and the rate for lower back pain was 4.8 % (13).

There are potential interpretations for these various results. Theoretically, we may assume different health system characteristics as the most important determinants of appropriateness including payment system, insurance coverage, medical training and educational systems, the medical culture of practitioners and patients, managed care preauthorization programs, and access to

the national or local guidelines for clinical practice (23-26). The other potential sources for the difference between results could be different methodological issues including study designs and samples. For example, in another study from Tehran, sample recruited from the patients whom covered by a specific complementary insurance company. In this study about 20.8% of MRI requests had indications for lumbosacral MRI and 79.2% of MRI requests had no indication (9).

Although our study showed a relationship between the presence of insurance (public or private) and non-indicated MRI request, it was not statistically significant (based on clinically valid indications). Also, supplementary insurance did not affect the non-indicated request. This could be interpreted as the lack of induced demand for MRI request. In other words, in the presence of induced demand, patients with a supplementary insurance should have a higher rate of referral to take an MRI (because of their broader coverage of insurance). Another interpretation could be a relatively small sample size that would result in less power for detecting differences.

One considerable result was a statistically significant difference between private and public (educational) imaging center in terms of valid MRI requests. Although a private center potentially (and based on stereotypes) may consider as a referral site with higher rates of non-indicated requests, our findings showed a reverse result. A possible explanation for this finding, apart from the differences between private centers, could be based on the type of public center in our study. It was a teaching hospital in which residents (including juniors) were requesting diagnostic procedures (like MRI) in many cases for both treatment and educational purposes. The higher rate of inappropriate MRI requests may be a result of the training process of less experienced physicians.

Conclusion

This study did not find the evidence of

excessive use of MRI for back pain. However, due to the high and unnecessary costs of technologies like MRI (for the health system, patients, and insurance companies), there is a need to emphasize on using relevant guidelines for requesting them. Developing evidence-based clinical guidelines and make them accessible for practitioners are basic requirements of the reasonable administration of medical procedures. Also, it is necessary to teach the principles of rational prescription of imaging procedures to the learners, especially residents.

Limitations

This is a cross-sectional study in two imaging centers that makes it hard to generalize the results. Even though we recruited enough cases based on the sample size calculation, more imaging centers seem to provide a more reliable comparison between two types of private and public centers. Also, because of the considerable differences in big cities like Tehran and other smaller towns, the results should be cautiously generalized to whole Iranian population's and physicians' behavior.

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