

IS PRESCRIPTION OF KNEE MRI ACCORDING TO STANDARD CLINICAL GUIDELINE?

SOHEILA REFAHI*, AMIR REZA KACHOOEI**, MAJID FARSAPOUR***, RAMIN SHAHRAYENI***, MARYAM GOUDARZIAN****, YASAMIN MOLAVI TALEGHANI*****, SAMIRA FOJ***, PARASTOO AMIRI****, AKRAM MALEKKAHI***, MOZHDEH SALARI***, MARJAN VEJDANI*****

*Ardabil University of Medical Sciences, Ardabil, Iran - **Mashhad University of Medical Sciences, Mashhad, Iran - ***Sabzevar University of Medical Sciences, Sabzevar, Iran - ****Iranian Research Center on Healthy Aging, Sabzevar University of Medical Sciences, Sabzevar, Iran - *****Health Management and Economics Research Center, Isfahan University of Medical Sciences, Isfahan, Iran - *****Medical School, Sabzevar University of Medical Sciences, Sabzevar, Iran

ABSTRACT

Introduction: Knee pain is one of the most common complaints that caused patients visit their physician. Among all medical imaging technologies; using Magnetic Resonance Imaging (MRI) is significant. The aim of this study was to determine the appropriateness of knee MRI prescription in Sabzevar Vasei hospital in 2014.

Materials and methods: This study is descriptive and analytic, while the statistical population included 115 patients referred to MRI Unit in Sabzevar Vasei hospital, while they were selected randomly. A questionnaire was used for data collection and to determine the appropriateness of prescription; a local clinical guideline was used as well. Data analysis was done by using SPSS16, descriptive statistics, Spearman test, Pearson chi-square and Fisher exact tests.

Results: Among 115 prescribed knee MRI patients, 52 prescriptions (45.2%) were inappropriate, 2 prescriptions (1.7%) were uncertain and 61 prescriptions (53%) were considered appropriate. The financial burden arising from inappropriate prescriptions was 39204000 Rials. Besides, there is a significant difference between the appropriate prescriptions and patients' gender, occupation, education, the specialty of a prescriber physician as well as referral institution ($P < 0.05$).

Conclusion: Considering the high rate of inappropriate prescriptions, it is essential to find some reasons and to do continuous monitoring. The use of local clinical guidelines can improve the quality of the health system and avoid additional costs.

Key words: appropriateness, MRI, knee, hospital.

Received June 30, 2015; Accepted January 02, 2016

Introduction

Various medical imaging methods are conducted by using waves or special radiations. MRI is one of these methods which have the following features⁽¹⁾. MRI is a medical imaging technology while its first version was introduced in 1978 to the clinical arena and it has continually accelerated its evolution. In 1991, the first MRI machine was imported to Iran, and since then this technology has been very rapidly distributed in Iran⁽²⁾. MRI is non-invasive and accurate when it is compared with other paraclinical diagnosis⁽³⁻⁵⁾. No iodinated contrast medium is used in MRI and no recovery time is

needed⁽⁶⁾. On the other hand, it has some limitations such as being expensive, time-consuming, lack of access for all patients, as well as long waiting time for MRI turn⁽⁷⁾. Among the body joints, knee joints are the most involved one, and we usually can witness the most common complications such as perforation and stretching of ligaments, meniscal lesions, cartilage lesions in patients' joints^(8, 9). Despite of high prevalence of knee joint injuries, but its diagnosis is still challenging and it is a difficult mystery in medical science diagnosis.

Health systems have faced with significant and rapid changes in response to change in population needs and cost raises⁽¹⁰⁻¹²⁾.

Studies show that a large part of provided health care is inappropriate or unnecessary which is about 15% to 30% in many countries and 40% in some private clinics^(13, 14). Quality and access to health care is not associated with high costs in the health care system⁽¹⁵⁾. Medical imaging costs have increased all around the world that may be due to their overuses. In fact, among all medical imaging technologies, using magnetic resonance imaging (MRI) is considerable and it has been following an increasing trend^(8,16-22). In a study conducted by Lehnert and Bree, 74% of administrated CT and MRIs were reported as appropriate and 26% as inappropriate, while the inappropriate examples including; knee, back and shoulder MRIs⁽²³⁾. Ebrahimipour et.al assessed the clinical appropriateness of knee MRI prescribed in Mashhad and they found that 54.8% of them were inappropriate, 14.8% were uncertain and 30.4% were appropriate. Meanwhile, the calculated economic costs of inappropriate prescriptions were 38159100 Rials⁽²⁴⁾. Therefore, the concerns about prescribed MRI have been increased.

Experts of the Ministry of Health have suggested developing clinical guidelines as a way to control the induction services and so the physicians can prescribe in accordance with local clinical guidelines. Thus, in order to avoid the patients' wasting time, and to save money and have economic costs imposed on the country's health care system which leads to nothing but a waste of financial resources and loss of opportunity for the people who are in need of health, providing the medical services in accordance with clinical guidelines is required^(25, 26).

Materials and methods

This study is descriptive and analytic, while the statistical population included 115 patients referred to MRI Unit in Sabzevar Vasei hospital and they were selected randomly in 2014. The patients who had knee MRI prescription were included in this study, while the patients with a history of knee surgery were excluded. The number of samples, considering $P = 0.26$ and $d = 0.07$, was related to Lehnert and Bree study⁽²³⁾ in which 115 cases were estimated. Data collection was conducted in the field and by questioning the patients. The questionnaire consisted of 12 items about patients' demographic characteristics and questions related to prescription, while its validity and reliability were con-

firmed in Salari et.al Study⁽²⁷⁾. To determine the appropriateness of the prescriptions, the local clinical guideline by Ebrahimipour et.al was used⁽²⁸⁾. Therefore, the patients' clinical history was given to an experienced specialist who helped in developing clinical guidelines and appropriateness of prescription was determined based on clinical guidelines. Finally, with regard to patients share and different insurances in paying the costs of knee MRI, financial burden for insurance companies and patients was measured. The data analysis was done by using SPSS 16, descriptive statistics, Spearman, Pearson chi-square and Fisher's exact test (Level of significance was 0.05)

Results

Among 115 patients participated in this study, 90 patients (78.3%) were male. Most patients, 38 patients (30.5%) were in the age range of 20-30 years old and most of them 53 patients (46.1%) had a high school diploma. 57 patients (49.6%) were self-employed. 112 patients (97.4%) had insurance and 12 patients (10.4%) had complementary insurance. 108 patients (93.9%) were examined by a physician. Applicant for MRI administration in 110 cases (95.7%) was a specialist. Referral institution in 110 patients (73.3%) was a private office and in 40 patients (26.7%) was a state hospital. 110 patients (95.7%) of requests were made by orthopedic specialist. The frequency of knee MRI prescriptions according to separation of appropriateness was shown in table 1.

Appropriateness conditions	Frequency	percent
Appropriate	61	-53%
Uncertain	2	-1.70%
Inappropriate	52	-45.20%
Total	115	-100%

Table 1: Frequency of knee MRI prescriptions according to the appropriateness conditions.

Based on the statistical test Chi-Square, there is a significant difference between the appropriateness of prescriptions and patients' gender and occupation as well as specialty of physician and referral institution. Also, according to Spearman statistical test, there is a significant correlation between the prescription appropriateness and patients' education ($P < 0.05$).

The price of knee MRI in 2014 was 660,000 Rials. Social security and health services insurances pay 70% of the cost and the remaining 30% as a franchise is done by the patient. Armed Forces Insurance pays 90% of the amount and the patients share is 10%. Other insurance companies including banks and oil organization insurance companies pay 100% of the cost of services. The results showed that from the total financial burden resulting from inappropriate prescriptions, 70% of which have been imposed to insurance companies. Table 2 showed the financial burden imposed on patients and insurance companies.

Insurance	Inappropriate prescription Frequency/ percentage	Cost imposed on patients (Rials) Frequency/ percentage	Cost imposed on patients (Rials) Frequency/ percentage	Total financial burden (Rials)
Health Services	18	3564000	8316000	11880000
	(34.60%)	(30%)	(70%)	
Social security	30	3960000	20724000	24684000
	(57.70%)	(30%)	(70%)	
Armed forces	2	132000	1188000	1320000
	(3.80%)	-10%	(90%)	
Uninsured	2	1320000	0	1320000
	(3.80%)	(100%)		
Total	52	8976000	30228000	39204000

Table 2: Estimated cost of inappropriate knee MRI prescriptions in patients referred to MRI Unit of Vasei hospital.

Discussion

The present study aimed to examine the appropriateness of MRI prescriptions in Sabzevar Vasei hospital in 2014. This study showed that 77% of the financial burden was imposed on insurance companies. If about half of prescribed MRIs in Iran are regarded inappropriate (regardless of uncertain prescriptions), at least half of the cost that insurance companies reimburse to patients or the cost that patients pay for MRI are financial burdens that intentionally or unintentionally have been imposed on patients or insurers by physicians. The rapid rise in the cost of health care around the world has caused that health economists, and even physicians in all countries attempt to find new ways to control the costs⁽²⁹⁻³¹⁾.

The inappropriate and unnecessary care debate is an economic issue related to quality of service which is associated with payment systems, the financing of services, and induced demand. Iran,

like other developing countries suffers from lack of resources. It is expected that despite the lack of resources, available resources be used efficiently and effectively and to use technologies that would avoid wasting resources. The MRI prescription and administration in Iran is higher than the international standards and a lot of recommended MRIs are unnecessary. This diagnostic service is prescribed more than society needs due to unknown reasons. Therefore, these prescriptions have to be reduced through proper strategies^(30,32).

This study showed that from 115 knee MRI prescriptions, 52 cases were inappropriate. Salari et.al evaluated the clinical appropriateness of MRI prescription from lumbar spine and they showed from 300 lumbar spines MRI, 167 cases were inappropriate. The economic costs of inappropriate prescriptions have been 88900000 Rials⁽²⁷⁾. Ebrahimipour et. al investigated the costs of inappropriate prescription of knee MRI in Mashhad and they concluded that 54.8% of prescriptions were inappropriate and the resulting financial burden arising from was 38,159,100 Rials⁽²⁴⁾.

A huge financial burden on insurance companies and patients makes it essential that these evidences be taken into account by policy makers. In this study, there is a statistically significant relationship between patients' gender and appropriateness of prescription which means that inappropriate prescriptions were more in males than females. This finding is consistent with Marzban et.al and Keshtkaran et.al studies^(30, 33). But the results of a study conducted in Mashhad showed no significant difference between inappropriate prescriptions in males and females⁽²⁴⁾.

The results of this study showed a significant relationship between the prescription appropriateness and the referral institution, as the number of inappropriate prescriptions in patients who were referred to the physician office was more than the patients who were admitted in hospital. Besides, the results of a study on inappropriateness of back MRI prescriptions in Shiraz showed a smaller percentage of patients referred to state hospitals have had inappropriate prescriptions. It seems that physicians in training hospitals spend more time on examining their patients⁽³³⁻³⁵⁾. However, Ebrahimipour et.al in a study on appropriateness of knee MRI prescriptions in Mashhad showed no significant relationship⁽²⁴⁾.

According to the results of this study, there is a significant relationship between appropriateness of prescriptions and the patients' occupations, while the most inappropriate prescription was among housewives. However, the results of a study conducted in Shiraz showed that the highest percentage of inappropriate prescriptions was among the students and the lowest was among housewives⁽³³⁾. But Ebrahimipour et.al concluded that there is no significant difference between the appropriateness of prescription and the patients' occupations⁽²⁴⁾.

Limitations of the study include

Sporadic turns of knee MRI during the day and long time for data collection due to no cooperation of some patients.

Recommendations based on research findings

Management of expensive diagnostic and medical equipment in Iran

Development of a culture to eliminate unnecessary prescriptions from the health system

Consideration of final scenario as a basis for payments to physicians by the insurance companies.

Recommendation for future research

Conducting similar research with larger sample size to generalize the results to the society

Doing some researches to investigate the causes of induced demand for the indiscriminate use of diagnostic services by physicians

Developing physician payment reform model to eliminate unnecessary prescriptions

Doing further studies by using developed clinical guidelines of this study to determine the appropriateness of knee MRI prescriptions all around the country.

Conclusion

The results of this study showed that the rate of inappropriate prescriptions of knee MRI is extensively high. High costs of this diagnostic method from one side and access to local clinical guideline in this field in our country from the other side have made it necessary for physicians to use guidelines in order to give proper services for knee MRI prescriptions. Therefore, the use of local clinical guidelines could be a step toward standardizing treatment and avoid from additional costs.

References

- 1) Yazdani S, Mirshahi A. *A case report displacement of metallic intraocular foreign body during MRI*. Journal of Ophthalmology Bina 2002; 2 (8).
- 2) Palesh M, Fredrikson S, Jamshidi H, Tomson G, Petzold M. *How is magnetic resonance imaging used in Iran? International journal of technology assessment in health care*. 2008; 24 (4): 452-8. Epub 2008/10/03.
- 3) Rezaei Y, nia AR, Mirmohamad SM, Vazir K, Fakhrejahani F. *Sensitivity and specificity of MRI and Arthroscopy in knee joint injuries*. Tehran University Medical Journal. 2007; 65 (9): 47-52.
- 4) Chevalier X. *Early diagnosis of knee osteoarthritis*. La Revue du praticien. 2009; 59 (9): 1243-5, 8-9. Epub 2009/12/08. Diagnostic precoce de la gonarthrose.
- 5) Noureddine Y, Bitz AK, Ladd ME, Thurling M, Ladd SC, Schaefer G, et al. *Experience with magnetic resonance imaging of human subjects with passive implants and tattoos at 7 T: a retrospective study*. Magma (New York, NY). 2015. Epub 2015/09/28.
- 6) Alam NR, Salar S, Rahimi SA. *Protocol design MR angiography of the lower extremity using 1.5 Tesla*. Journal of Mazandaran University of Medical Sciences. 2004; 14 (42).
- 7) Barzin M, Abdi R, GHolmohamadi H. *Diagnostic accuracy of ultrasonography in comparison with magnetic resonance imaging in patients with knee trauma*. Journal of Gorgan University of Medical Sciences. 2012; 14 (3).
- 8) Xie L, Ding F, Jiao J, Kan W, Wang J. *Total Hip and Knee arthroplasty in a patient with osteopetrosis: a case report and review of the literature*. BMC musculoskeletal disorders. 2015;16 (1):259. Epub 2015/09/24.
- 9) Neisi K, Ebrahimi E, GHoharpi S. *The effect of starting angle and target angle on angular measurement of the knee joint position sense in healthy men*. Journal of scientific medicien. 2006; 5 (3).
- 10) S OC, McCaffrey N, Whyte EF, Moran KA. *Epidemiology of injury in male adolescent Gaelic games*. Journal of science and medicine in sport / Sports Medicine Australia. 2015. Epub 2015/06/22.
- 11) Hicks NR. *Some observations on attempts to measure appropriateness of care*. BMJ (Clinical research ed. 1994; 309 (6956): 730-3. Epub 1994/09/17.
- 12) Nicollier-Fahrni A, Vader JP, Froehlich F, Gonvers JJ, Burnand B. *Development of appropriateness criteria for colonoscopy: comparison between a standardized expert panel and an evidence-based medicine approach*. International journal for quality in health care: journal of the International Society for Quality in Health Care / ISQua. 2003;15 (1):15-22. Epub 2003/03/13.
- 13) Phelps CE. *The methodologic foundations of studies of the appropriateness of medical care*. The New England journal of medicine. 1993;329 (17):1241-5. Epub 1993/10/21.
- 14) Borowitz M, Sheldon T. *Controlling health care: from economic incentives to micro-clinical regulation*. Health economics. 1993;2 (3): 201-4. Epub 1993/10/01.
- 15) Fisher ES, Wennberg DE, Stukel TA, Gottlieb DJ, Lucas FL, Pinder EL. *The implications of regional*

- variations in Medicare spending. Part 1: the content, quality, and accessibility of care. *Annals of internal medicine*. 2003;138 (4): 273-87. Epub 2003/02/15.
- 16) Kistka HM, Kasl RA, Nayeri A, Utz AL, Weaver KD, Chambless LB. *Imaging of Resected Nonfunctioning Pituitary Adenomas: The Cost of Surveillance*. *Journal of neurological surgery Part B, Skull base*. 2015;76 (5):344-50. Epub 2015/09/25.
 - 17) Shukla J, Mittal BR. *Dimercaptosuccinic acid: A multi-functional cost effective agent for imaging and therapy*. *Indian journal of nuclear medicine: IJNM : the official journal of the Society of Nuclear Medicine, India*. 2015;30 (4):295-302. Epub 2015/10/03.
 - 18) Fuchs VR, Sox HC, Jr. *Physicians' views of the relative importance of thirty medical innovations*. *Health affairs (Project Hope)*. 2001; 20 (5): 30-42. Epub 2001/09/18.
 - 19) Greenberg D, Peterburg Y, Vekstein D, Pliskin JS. *Decisions to adopt new technologies at the hospital level: insights from Israeli medical centers*. *International journal of technology assessment in health care*. 2005;21 (2): 219-27. Epub 2005/06/01.
 - 20) Hillman AL, Schwartz JS. *The diffusion of MRI: patterns of siting and ownership in an era of changing incentives*. *AJR American journal of roentgenology*. 1986;146 (5):963-9. Epub 1986/05/01.
 - 21) Oh EH, Imanaka Y, Evans E. *International journal of technology assessment in health care*. 2005;21 (1):73-80. Epub 2005/03/02.
 - 22) Passariello R. *Cost containment and diffusion of MRI: oil and water?. The situation in Europe*. *European radiology*. 1997; 7 Suppl 5: 259-62. Epub 1997/01/01.
 - 23) Lehnert BE, Bree RL. *Analysis of appropriateness of outpatient CT and MRI referred from primary care clinics at an academic medical center: how critical is the need for improved decision support?* *Journal of the American College of Radiology : JACR*. 2010;7 (3): 192-7. Epub 2010/03/03.
 - 24) Ebrahimipour H, Mirfeizi SZ, Vafae-najar A, Kachooei A, Ariamanesh AS, et al. *Evaluation of Medical costs resulting from Magnetic Resonance Imaging inappropriate prescriptions for Knee joint, using RAND Method in Ghaem Hospital- 2013*. *Hakim Research Journal*. 2015; 17 (4).
 - 25) Lee JY, Jo MW, Yoo WS, Kim HJ, Eun SJ. *Evidence of a broken healthcare delivery system in korea: unnecessary hospital outpatient utilization among patients with a single chronic disease without complications*. *Journal of Korean medical science*. 2014; 29 (12): 1590-6. Epub 2014/12/04.
 - 26) News IR. *Administration unnecessary medical services and treatment, way to earn more income*. 2013 80651732.
 - 27) Salari H, Ostovar R, Esfandiari A, Keshtkaran A, Sari AA, Manesh HY, et al. *Evidence for Policy Making: Clinical Appropriateness Study of Lumbar Spine MRI Prescriptions Using RAND Appropriateness Method*. *International Journal of Health Policy and Management*. 2013; 1: 1-5.
 - 28) Ebrahimipour H, Mirfeizi SZ, Vafae-Najar A, Kachooei AR, Ariamanesh ASH, Ganji R, et al. *Developing an Appropriateness Criteria for Knee MRI Using the Rand Appropriateness Method (RAM)-2013*. *The Archives of Bone and Joint Surgery*. 2014; 2(1): 47-51. Epub 2014/03/04
 - 29) Vincenzino JV. *Trends in medical care costs--rapid increases continue*. *Statistical bulletin (Metropolitan Life Insurance Company: 1984)*. 1991;72 (1):2-11. Epub 1991/01/01.
 - 30) Marzban S, Rajaei R, Gholami S, Keykale MS, Najafi M. *Study of Out-of-Pocket Expenditures for Outpatient Imaging Services in Imam-Khomeini Hospital in 2014*. *Electronic physician*. 2015;7 (4):1183-9. Epub 2015/09/24.
 - 31) Karami I. *Health Economics*. 2005. p. 11.
 - 32) Hamed M, Kermani FA. *Why is deteriorating MRI in Iran?* 2008 October 25, 2008. Report No.
 - 33) Keshtkaran A, Bagheri MH, Ostovar R, Salari H. *Evaluation of appropriateness of Magnetic Resonance Imaging prescriptions for lumbar spine , using RAND Appropriateness Method in selected MRI centers of Shiraz and it's related factors in 2010: Shiraz University of Medical Sciences*; 2011.
 - 34) Abedi Gh, Ebadattalab I, Rostami, F. *Analyzing quality gap of nursing services in the selective academic hospitals*. *International Journal of Collaborative Research on Internal Medicine and Public Health*. October 2012; 4 (10): 1809-1815.
 - 35) Abedi Gh, Azimehr L, Rostami F, Mohammadi, S. *Applying a model of patient's right in the state hospital, Sari, Iran*. *International Journal of Collaborative Research on Internal Medicine and Public Health*. February 2012; 4 (2): 103-110.

Corresponding author

MARJAN VEJDANI

Medical School, Sabzevar University of Medical Sciences, Sabzevar

Email: marjan_vejdani@yahoo.com

(Iran)