

## Assessment of Knowledge and Attitude Regarding the Indications of Requesting Brain MRI by Medical Physicians in King Fahad General Hospital, Jeddah, Saudi Arabia, 2018: A Cross- Section Study

Hind Alghamdi<sup>1\*</sup>, Doha Ahmad<sup>2</sup> and Aisha Rajab<sup>3</sup>

<sup>1</sup>Department of Neuroradiology, King Fahad General Hospital, Jeddah, Saudi Arabia

<sup>2</sup>Department of Radiology, King Fahad General Hospital, Jeddah, Saudi Arabia

<sup>3</sup>Department of Radiology, Al Noor Hospital, Mecca, Saudi Arabia

\*Corresponding Author: Hind Alghamdi, Department of Neuroradiology, King Fahad General Hospital, Jeddah, Saudi Arabia.

Received: February 19, 2020; Published: March 27, 2020

### Abstract

**Background:** Medical imaging is an important tool in the practice of medicine. MRI (magnetic resonance imaging) has a remarkable role in the process of diagnosis and follow up of many conditions. The high accuracy, detailed information given and the recent availability of MRI imaging has led to over use and often incorrectly request of MRI even in cases where it is not of a diagnostic value. This led to overload the radiology departments, and somehow wasting of resources off the medical institutions; regarding the relatively high cost of MRI imaging technique.

**Objectives:** In our study we aim to assess the knowledge of the appropriate requesting brain MRI in the internal medicine department in King Fahd General hospital, Saudi Arabia.

**Methodology:** We conducted a cross-sectional survey using a self-administered questionnaire to assess the knowledge of requesting brain MRI among 71 physicians. The questionnaire included 13 questions on various uses of imaging.

**Results:** The overall sample size was 71 participants, of which 51% were residents, 26% were specialists, and 23% were consultants. Most participants (69%) scored between 25-50%. About 21% of participants scored less than 25%, and about 7% of participants scored between 50-75%. Only 2 participants (3% of participants) scored more than 75%: they were consultants. The mean score among participants was 4.9 with a standard deviation of 1.8.

**Conclusion:** According to our results, there was a serious lack of knowledge regarding the indication of requesting brain MRI. This may lead to significant cost over a non-indicated imaging of no significant diagnostic value.

We recommend increasing the awareness amongst our targeted sample, this is vital in order to the point where the medical physicians are able to know the appropriate indications of brain MRI and when to specifically request it.

**Keywords:** Medical Imaging; MRI (Magnetic Resonance Imaging); Medical Physicians

### Introduction

Medical imaging has a great value in the practice of clinical medicine, it has a great diagnostic and interventional value. Due to its role in the diagnosis and intervention in many of cases, availability and accuracy this imaging techniques is now considered as one of the most

important tools in the diagnostic and interventional process [1]. One of the most important radiological techniques is magnetic resonance imaging (MRI), it has the ability to examine the anatomical, functional, metabolic and molecular structure and characteristics of various organs and tissues without any invasiveness or injuries. So, it has a great role in clinical detection, diagnosis, staging, grading, and treatment of various diseases [2-5]. Although its role in the diagnostic process, physicians must be aware of and should not ignore or underestimate the medical hazards that accompanies the use of these modalities such as the potential carcinogenicity, and the potential reactions to the contrast solution used in many imaging techniques that may vary from simple allergic reaction up to systemic renal fibrosis and renal failure [6,7]. Another point the physicians should take into consideration is the healthcare system resources, the patient's financial status and the cost value of the imaging techniques before requesting it; as the cost of the false and unnecessary medical imaging could form a huge burden either on the patients or the healthcare system [8].

Recently, the relatively easy of use, availability, accuracy and the various diagnostic information that may make the diagnosis process easier have led to over-use and in most of the cases unnecessary and false requesting of radiological imaging [9,10] and thus leading to unnecessary load on the radiology departments and wasting the healthcare system resources [8]. Previous studies found that the majority of the medical students and the fresh graduated doctors lack the information about the radiological imaging guidelines [9,11].

### **Aim of the Study**

In our study we aim assess the knowledge of the appropriate requesting of brain MRI, and measuring the extent of the false MRI requests in the internal medicine department in King Fahd General hospital, Saudi Arabia.

### **Methods**

#### **Study design and participants**

We conducted a cross sectional study on residents, consultants, and specialists at King Fahd General hospital in Jeddah in Saudi Arabia. This study was conducted in August 2018.

#### **The questionnaire**

Data were collected by an anonymous self-administered questionnaire designed with the collaboration of the departments of the community medicine, radiology, and neurology. The questionnaire's content validity was confirmed by other academic radiology and neurology staff.

The questionnaire consisted of 13 multiple choice clinical questions. These questions assessed the knowledge of participants in the use of different imaging modalities in the field of neurology. The questionnaires were distributed intermittently during the study period when the participants were at the hospital.

#### **Outcomes**

We calculated the scores of the test, and divided the results into less than 25%, between 25% and 50%, between 50% and 75%, and more than 75%. Results of the test were calculated for the overall population, and for each subgroup of participants individually. We also calculated the percentage of right answers for each question individually.

#### **Statistical analysis**

We used SPSS IBM 23 to calculate the test scores with mean and standard deviations. We also used it to calculate the percentages of right and wrong answers for each question.

### **Results**

#### **Baseline characteristics of included participants**

We included 71 participants from our medical center. Of these participants, 37 (51%) were residents, 18 (26%) were specialists, and 16 (23%) were consultants (Figure 1).

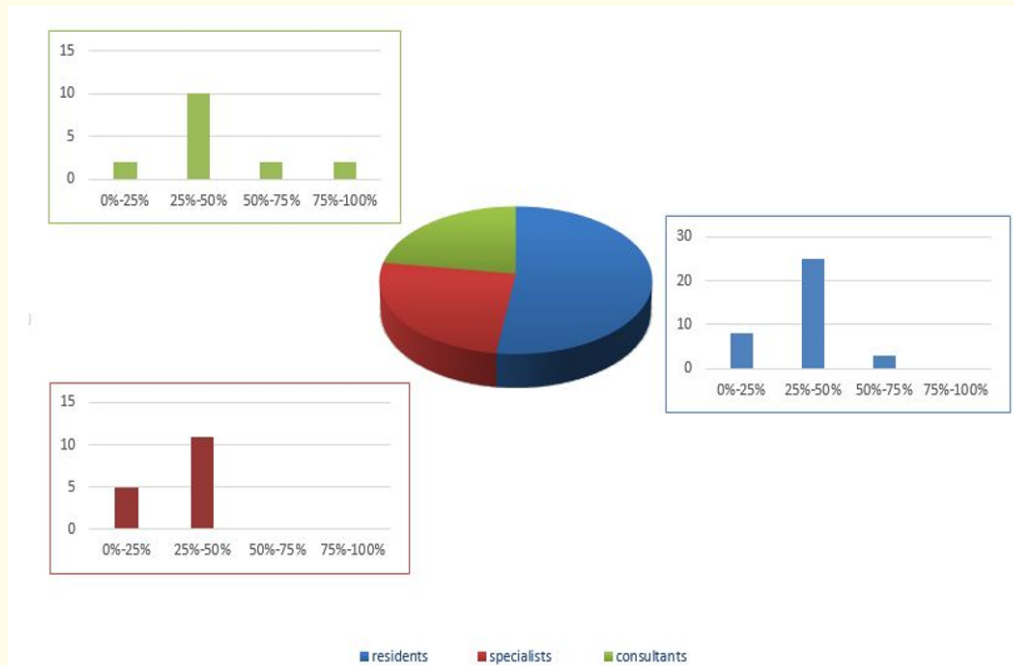
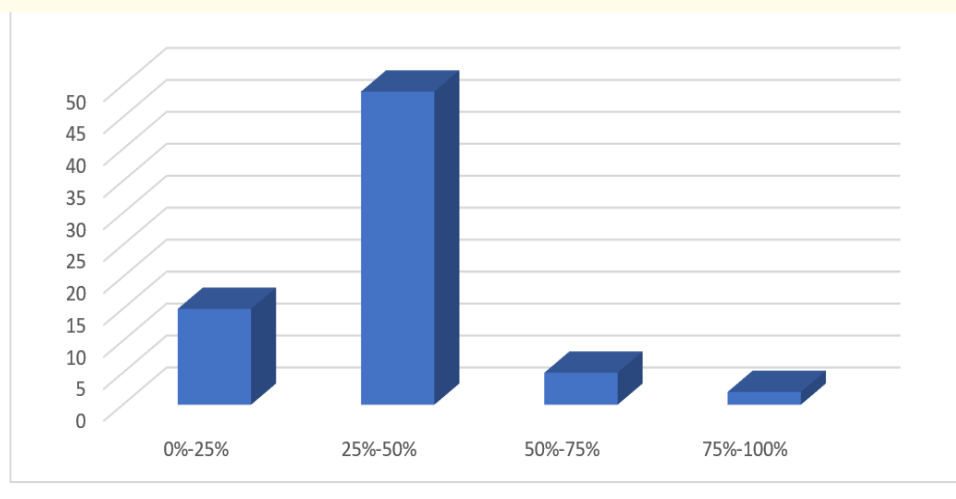


Figure 1: Participants characteristics and the answers of each category.

### Test scores among participants

The mean score among all participants was 4.9 with a standard deviation of 1.8. About 49 participants (69%) scored between 25-50% in the test. On the other hand, 15 participants (21%) scored less than 25%, and 5 participants (7%) scored between 50 - 75%. Only 2 participants (3% of participants) scored more than 75%; these two were consultants (Figure 2).



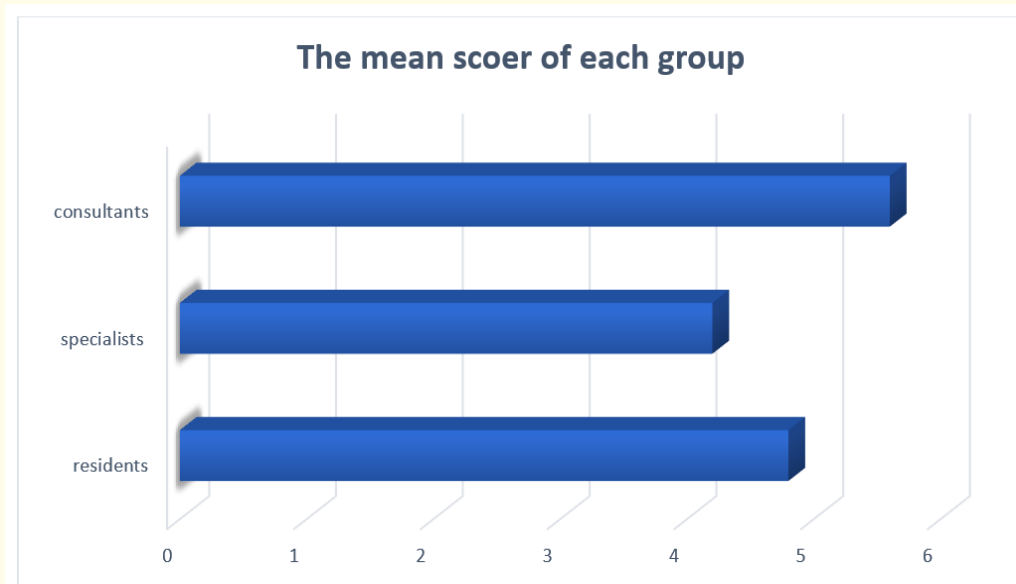


Figure 2: Overall answers.

The mean score among residents was 4.8 with a standard deviation of 1.4. About 25 residents (70% of residents) scored between 25 - 50% in the test. While 8 residents (22%) scored less than 25%, and 3 residents (8%) scored between 50 - 75%. None of the participating residents scored more than 75%.

The mean score among specialists was 4.2 with a standard deviation of 2.8. About 13 specialists (72% of specialists) scored between 25 - 50% in the test. While 5 specialists (28%) scored less than 25%. None of the participating specialists scored more than 50%.

The mean score among consultants was 5.6 with a standard deviation of 2.8. About 10 consultants (64% of consultants) scored between 25 - 50% in the test. While 2 consultants (12%) scored less than 25%, 2 consultants (12%) scored between 50 - 75% in the test, and 2 consultants (12%) scored more than 75%.

### Scores of each question in the test

The question that most participants got right was 'Which one of the following is indicated for evaluation in patient complaining of headache' with 54 participants (76%) having this question right. The questions that most participants got wrong were 'One of the indications for Multiple Sclerosis follow up by MRI is', 'Indications of MRI follow up after modifying the therapy in Multiple Sclerosis patient with no relapse in', and 'The best modality for evaluation of acute brain injury in the first two hours after trauma in non-agitated patient is', with only 11 participants (16%) having each of these questions right. Table 1 summarizes the percentage of right answers for each question.

### Discussion

Medical imaging has an important role in the diagnostic process, intervention, and follow up of the patients. It can improve the outcome of the patient [1]. MRI is one of the most important radiological investigations, as it can examine the anatomy and the function of many organs and tissues without nay invasiveness or injury [2-5].

Physicians should pay attention to the economical and coast effectiveness aspect of the requested investigations, in order to prevent wasting the resources of the healthcare system and the community [8].

The question	Number of participants who got it right (%)
Which one of the following is indication for brain MRI.	14 (20%)
For low risk patients suspected to have Multiple Sclerosis with positive clinical history and negative radiological findings, follow up by enhancing MRI is after.	28 (39%)
One of the indications for Multiple Sclerosis follow up by MRI is.	11 (16%)
Indications of MRI follow up after modifying the therapy in Multiple Sclerosis patient with no relapse in.	11 (16%)
The best modality to start evaluation of Dementia is.	32 (45%)
AVM is the best evaluated by.	26 (37%)
Which one of the following is indicated for evaluation in patient complaining of headache?	54 (76%)
Which of the following is indicated for MRI in facial nerve palsy.	35 (49%)
In patient with meningioma WHO grade 1 (Absent of brain invasion and low mitotic rate) follow up after five years is every.	17 (24%)
In patient with meningioma WHO grade 2 (Brain invasion or mitotic rate from 4 to 9 per HPF) follow up after.	38 (54%)
The best modality for evaluation of acute brain injury in the first two hours after trauma in non-agitated patient is.	11 (16%)
In case of chronic and late brain hemorrhage, the best modality to detect it is.	26 (37%)
The best Method to identify the core of the infarction size and site in the early stages of Ischemic stroke is.	42 (59%)

**Table 1:** Percentage of right answers for each question.

In order to understand the magnitude of the wasted resources on the inappropriate imaging requests, we searched the average price of the different imaging technique in Saudi Arabia. The average price of an MRI image was about (1900) SAR or about (525) USD, the average price of a CT scan was (850) SAR or about (235) USD, while the average price of a normal X-Ray image was (360) SAR or about (100) USD. A previous study in Turkey calculated the estimated cost of the non-indicated requests of radiological imaging modalities in pediatric trauma patients. The mean total coast of the unnecessary radiological imaging pre patient was about (43.1) USD [12].

In our study we aim to measure the knowledge of the indications of requesting MRI scan in the internal medicine residents, specialists, and consultants. The majority of the overall responses (69% of our sample) score between 25% and 50%, and the mean score of the overall participants was (4.9) with stranded deviation of (1.8).

Of our residents, about 92% scored less than 50%, which indicates the lack of theoretical knowledge needed to request the appropriate imaging technique amongst the newly graduated doctors. Such lack of knowledge can be attributed to the several factors like the lack of earlier radiological education, indication and limitations of every radiological imaging modality [9,13]. Other cause of this problem could be the lack of appropriate guidelines and/or the lack of knowledge about this guidelines, a study in Boston university found that the majority of medical students were unfamiliar with the available guidelines for radiological imaging [11].

Previous study suggested that the reason of this problem may be that the medical students learn radiological concepts theoretically rather than practically in their radiology courses during medical school [9].

Such a problem suggests the integration of the essential radiological theoretical knowledge curriculum either during the residency, or during the medical school stage; a previous study in New Zealand showed similar results; where 47% of the fresh graduated house of-

ficers failed to order the appropriate radiological technique, and suggested the inclusion of radiology curriculum in the med school stage [14]. other study suggested the inclusion on the requires radiological curriculum in the residency clerkship program [1].

Regarding the answers of the internal medicine specialists; 100% of them scored less than 50%, with 21% less than 25%. Such results suggest that during their residency, the internal medicine residents have achieved no advance regarding the knowledge needed to request the appropriate imaging technique. While the mean score of the consultants was the highest and 12% of them scored more than 75%.

A previous study suggested that from the medical students and resident's point of view, the priority was to be able to achieve a proper diagnosis, and to be able to understand, interpret and be able to recognize the abnormalities in the radiological images rather than other concerns like knowing the indication for the each medical imaging modality, implication of using any of these modalities like the cost and the adverse effect [13].

Previous study suggested that the medical students were more interested in performing new and sometimes invasive imaging modalities rather than the safer ones, 66% of the headache patients admitted in the acute care hospital in Singapore were prescribed either a head CT or MRI, while only 8% of them were diagnosed with cases that require CT scan or MRI [15].

Other studies suggested a solution of the problem of false and inappropriate medical imaging requests. The answer lies in modifying the system of requesting any medical imaging modality where the doctor requesting the radiological technique must justify his request and explain his choice of the requested particular imaging modality. This will force the doctors to choose the right and appropriate radiological modality and will participate in reducing the resources wasted on unnecessary radiological requests [16,17].

Our study has some limitations such as the lack of demographic data. The sample size is relatively small. The lack of other radiological imaging modalities to compare with such as CT scans, U/S, and normal X-Ray images. It would be better if our questionnaire included an assessment test of radiological knowledge before and after radiology course in order to detect any improvement.

## **Conclusion**

According to our results, there was a serious lack of knowledge regarding the indication of requesting brain MRI. This may lead to significant cost over a non-indicated imaging of no significant diagnostic value.

We recommend increasing the awareness amongst our targeted sample, this is vital in order to the point where the medical physicians are able to know the appropriate indications of brain MRI and when to specifically request it.

## **Bibliography**

1. Chorney ET and Lewis PJ. "Integrating a radiology curriculum into clinical clerkships using case oriented radiology education". *Journal of the American College of Radiology* 8.1 (2011): 58-64, 64.e1-4.
2. Xian J-F, et al. "Magnetic resonance imaging in clinical medicine: current status and potential future developments in China". *Chinese Medical Journal* 128.5 (2015): 569-570.
3. Cammoun D, et al. "Clinical applications of magnetic resonance imaging--current status". *Western Journal of Medicine* 143.6 (1985): 793-803.
4. Greene DJ, et al. "Considerations for MRI study design and implementation in pediatric and clinical populations". *Developmental Cognitive Neuroscience* 18 (2016): 101-112.
5. Chang YC, et al. "Impact of magnetic resonance imaging on the advancement of medicine". *Journal of the Formosan Medical Association* 98.11 (1999): 740-748.

6. Brenner DJ and Hall EJ. "Computed Tomography - An Increasing Source of Radiation Exposure". *New England Journal of Medicine* 357.22 (2007): 2277-2284.
7. Wiginton CD, et al. "Gadolinium-Based Contrast Exposure, Nephrogenic Systemic Fibrosis, and Gadolinium Detection in Tissue". *American Journal of Roentgenology* 190.4 (2008): 1060-1068.
8. Otero HJ, et al. "Twenty years of cost-effectiveness analysis in medical imaging: are we improving?" *Radiology* 249.3 (2008): 917-925.
9. Islami Parkooi P, et al. "Medical students' knowledge of indications for imaging modalities and cost analysis of incorrect requests, shiraz, iran 2011-2012". *Iranian Journal of Medical Sciences* 39.3 (2014): 293-297.
10. Pistolesse CA, et al. "Inappropriateness of breast imaging: cost analysis". *La Radiologia Medica* 118.6 (2013): 984-994.
11. Dillon JE and Slanetz PJ. "Teaching Evidence-Based Imaging in the Radiology Clerkship Using the ACR Appropriateness Criteria". *Academic Radiology* 17.7 (2010): 912-916.
12. Güzel A, et al. "A cost analysis of radiologic imaging in pediatric trauma patients". *Ulus Travma Acil Cerrahi Derg* 16.4 (2010): 313-318.
13. Subramaniam RM, et al. "Radiology curriculum topics for medical students: students' perspectives". *Academic Radiology* 13.7 (2006): 880-884.
14. Subramaniam R, et al. "Radiology knowledge in new medical graduates in New Zealand". *New Zealand Medical Journal* 118.1224 (2005): U1699.
15. Ang SH, et al. "Emergency department headache admissions in an acute care hospital: why do they occur and what can we do about it?" *Annals of the Academy of Medicine of Singapore* 38.11 (2009): 1007-1010.
16. Bosanquet D, et al. "Requesting radiological investigations - do junior doctors know their patients? A cross-sectional survey". *JRSM Short Reports* 4.1 (2013): 3.
17. Triantopoulou C, et al. "Analysis of radiological examination request forms in conjunction with justification of X-ray exposures". *European Journal of Radiology* 53.2 (2005): 306-311.

**Volume 16 Issue 4 April 2020**

**©All rights reserved by Hind Alghamdi, et al.**