

Assessment of Iraqi Patient Knowledge Regarding Magnetic Resonance Imaging Safety Before the Scanning

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Abstract

Background: Magnetic resonance imaging (MRI) scans provide more detailed three-dimensional anatomical and physiological information than other imaging modalities. This research aims to assess patients' MRI safety awareness and evaluate related demographic characteristics. **Patients and Methods:** A descriptive, cross-sectional study was conducted at the radiology department of Al-Kindy Teaching Hospital in Baghdad, Iraq. A random 200 patients were scheduled to go through MRI examinations. All interviewed patients personally filled out a 15-item questionnaire. Gender, age, marital status, education level, employment, and domicile are collected in the first six questions. The second half tests MRI knowledge with 9 questions. **Results:** The participant's age ranged between 18 and 65 years. The majority of the participants provided were aware of the protocols for preparing for an MRI scan, the noise emitted by the machine, and the incompatibility of contrast material during an MRI procedure in pregnant women. There was a greater degree of awareness regarding the pre-MRI preparation standards among individuals with higher education, independent contractors, and domestic consumers ($P = 0.001$). Knowledge of the rationale for assessing renal function before contrast media administration was significantly correlated with patients' marital status and gender ($P = 0.038$ and 0.007 , respectively). Urban residency and a patient's understanding of the application of a contrast agent in specific MRI procedures were correlated significantly ($P = 0.032$). **Conclusion:** Iraqi patients' understanding of MRI safety was restricted to preparation processes, machine noise, and contrast material incompatibility in pregnant women. Patients' information was influenced by their sociodemographics.

Keywords: Assessment, knowledge, magnetic resonance imaging, safety

INTRODUCTION

Noninvasive magnetic resonance imaging (MRI) scans enable the acquisition of superior anatomical, physiological, and diagnostic information by generating three-dimensional images of the body.^[1,2] In contrast to conventional radiography and computed tomography, MRI has substantially enhanced medical practice in the last four decades due to its superior soft-tissue contrast.^[3-5]

In contrast to alternative imaging modalities, MRI does not employ ionizing radiation. This feature enhances the overall safety of users, particularly children and pregnant women who are more susceptible to the adverse effects associated with ionizing radiation.^[6] In MRI, gadolinium is utilized as a contrast agent. There was a prevailing belief until recently that gadolinium-based contrast media (GBCM) posed a minimal risk of nephrotoxicity;^[7,8] however, certain reports have

suggested an association between GBCM and nephrogenic systemic fibrosis particularly in individuals with renal impairment.^[7] Therefore, a renal function test is conducted before administering contrast.

Patients who are pregnant often have MRI to evaluate a range of health issues; nevertheless, much remains unknown about the safety of MRIs during pregnancy, especially with the administration of contrast agents including gadolinium, which may cross the placenta.^[9]

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As a result of these technological advancements, patients are likely to experience increased anxiety due to their confusion regarding the MRI setting. To promote patients' understanding and preparedness, basic information regarding the imaging procedures they are scheduled to undergo is frequently presented to them. This information serves to alleviate patients' concerns, increase their level of comfort and adherence, and facilitate the prompt provision of healthcare services. The level of awareness of patients is a determining factor in their cooperation and compliance with this information. Patients who possess a comprehensive understanding have the ability to mitigate anxiety, increase satisfaction, and promote active participation in their healthcare.^[10-12]

In general, there exists a disparity in the roles of doctors responsible for ordering radiologic tests and those who conduct the examinations and analyze the findings.^[13] This disparity might result in a communication barrier between patients and the physicians who interpret the data. This poses a significant challenge in achieving this aim in the field of medical imaging. This may result in the patient's incomplete understanding of the next examination.^[14]

The extent to which patients are informed and at ease with MRI scans is a critical determinant in decreasing scan times and enhancing patient compliance, according to a recent study.^[15] However, research assessing the level of awareness among Iraqi patients regarding the safety implications of MRI is scarce. The objective of this study was to identify demographic characteristics that significantly correlate with the level of knowledge that Iraqi patients possess regarding the safety implications of MRI.

PATIENTS AND METHODS

Evaluation and management of survey

This descriptive cross-sectional questionnaire-based study was conducted at the Radiology Department of Al-Kindy Teaching Hospital in Baghdad over the period between November 2022 and February 2023. In total, 200 patients participated in this study, which varied in age from 18 to 65 years. The study was approved by the ethics committee of Al-Kindy College of Medicine.

Exclusion criteria

the patients who were unable to communicate verbally such as comatose, anesthetized, mentally retarded patients or children.

A survey instrument designed to assess respondents' awareness of MRI safety concerns using closed-ended "Yes/No" responses. The survey was composed of a total of 15 questions which were divided into two sections, the initial section comprises six inquiries designed to gather demographic information regarding the patients, including their gender, age, marital status, level of education, occupation, and place of residence. The second section evaluates the patients' understanding of MRI through the use of nine closed-ended queries ("Yes/No" responses) to facilitate the process. Patients were required to submit the questionnaire the day before the MRI examination commenced.

All patients completed the questionnaire in person during the interview; except those who were illiterate who were assisted by the investigator. Completing the questionnaire required approximately 15–20 min.

The reliability of the questionnaire was assessed on 10 patients in a pilot study that commenced 2 weeks before sample collection. The eligibility requirements for participants in the pilot study are identical to those for the study sample. These individuals were excluded from the research sample.

Statistical analysis

The statistical program SPSS version 22.0 (IBM Corporation, Armonk, NY, USA) was used to analyze the data. Observational data were presented as frequency and percentage. Statistical comparisons were performed using the Chi-square test or Fisher's exact tests as appropriate to assess the proportions of nominal/ordinal variables in different groups. $P < 0.05$ was considered statistically significant.

RESULTS

Most of the participating patients (47.5%) were between the ages of 41 and 60, and 79% were married. Males marginally dominated 51.5%. Illiterate participants comprised only 7.5%, whereas 40% were highly educated with a baccalaureate degree. The majority of the participants (93.5%) resided in urban areas, as shown in Table 1.

Participant's knowledge of magnetic resonance imaging assessment

A set of nine questions, listed in Table 2, was designed to assess the level of knowledge that the patients possessed regarding MRIs. A large proportion of the participants provided correct answers for only three questions (1, 3, and 9): the protocols for preparing for an MRI scan, the noise emitted by the machine, and the incompatibility of contrast material during an MRI procedure in pregnant women, as detailed in Table 2.

Relationship between patient sociodemographic traits and knowledge of the safety of magnetic resonance imaging scans

Knowledge of the preparatory guidelines before an MRI scan was significantly correlated with the level of education and knowledge ($P = 0.001$), as shown in Table 3. This correlation was particularly pronounced among university graduates. When it comes to participant's occupation, it was observed that public institution employees possessed a lower level of knowledge regarding the pre-MRI preparation guidelines compared to independent contractors and domestic clients ($P = 0.013$), Table 3. Individuals who lived in urban areas were significantly more aware of the need for contrast media for the diagnosis of certain instances, as compared to those who lived in rural areas ($P = 0.032$), Table 4.

Concerning gender, age, and marital status, there was no significant correlation observed between these variables and patients' knowledge of MRI safety, with the exception

Table 1: Participant's demographic characteristics

Variable	n (%)
Gender	
Male	103 (51.5)
Female	97 (48.5)
Age	
<20	11 (5.5)
20–40	78 (39)
41–60	95 (47.5)
>60	16 (8)
Marital status	
Married	158 (79)
Single	42 (21)
Level of education	
Illiterate	15 (7.5)
Intermediate	26 (13)
Primary	39 (19.5)
Secondary	40 (20)
University	80 (40)
Occupation	
Business	32 (16)
Domestic	57 (28.5)
Employee	44 (22)
Freelancer	51 (25.5)
Student	16 (8)
Residence	
Rural	13 (6.5)
Urban	187 (93.5)
Total	200 (100)

of patient's awareness of the rationale behind assessing the renal function (GFR or creatinine level) before contrast media administration, which was notably greater in married patients ($P=0.007$) and females ($P=0.038$) as shown in Table 4.

DISCUSSION

This study represents the first study to assess patients' awareness regarding the safety implications of MRI before their examination in Iraq, as far as we are aware. This study found that Iraqi patients possessed a satisfactory level of understanding concerning three aspects of MRI safety: the preparatory measures to be taken before the scan, the noise generated by the MRI scanner, and the contraindication for expectant women to receive the contrast agent during an MRI examination.

Based on the findings of the present study, 137 (68.5%) of the patients who consented to undergo an MRI were knowledgeable of the preparatory protocols. This result is slightly superior to, the findings of an Indian study by Shirma and Singh,^[16] which concluded that 58% of patients have adequate knowledge regarding MRI preparation. However, these findings contradict the research conducted by Alelyani *et al.* in Saudi Arabia, where 81% of the patients examined were unaware of the patient preparation before the MRI.^[17] The observed disparity

Table 2: Knowledge of patients towards magnetic resonance imaging safety

Questions	n (%)
1. Whether patients aware of MRI scan preparation instructions	
Yes	137 (68.5)
No	63 (31.5)
2. If the patient is aware of the kind of radiation an MRI uses	
Yes	90 (45)
No	110 (55)
3. If the patient is aware that the MRI scanner generates noise	
Yes	168 (84)
No	32 (16)
4. If the patient thinks the MRI scanner is on when no patient in	
Yes	13 (6.5)
No	187 (93)
5. Whether patients aware that contrast agent used in some cases	
Yes	88 (44)
No	112 (56)
6. Whether patients aware of the adverse effects of the contrast agent	
Yes	23 (11.5)
No	177 (88.5)
7. Whether patients aware of the need for RFT when contrast material required	
Yes	34 (17)
No	166 (83)
8. If MRI scan safe for a pregnant woman	
Yes	7 (3.5)
No	193 (96.5)
9. If MRI with contrast agent safe during pregnancy	
Yes	10 (5)
No	190 (95)

MRI: Magnetic resonance imaging, RFT: Renal function test

may be ascribed to variations in sociodemographic attributes between the present investigation and the study conducted by Alelyani *et al.*^[17]

We have observed that around half of the patients (55%) were unaware of the radiation type utilized in MRI. However, research by Alelyani *et al.* (2021) and Alghamdi *et al.* (2020) suggest that a greater proportion of patients (85%) were unaware of this radiation type.^[17,18] Prior research has demonstrated that inadequate understanding of radiation types was not restricted to patients alone; radiographers, interns, and resident physicians also exhibited a lack of knowledge regarding the safety implications of radiation exposure.^[19] The responses of the study participants suggested that patients possessed limited knowledge concerning adverse reactions to contrast agents used in MRIs. In particular, 88.5% of the participants exhibited an inability to identify the harmful effects of MRI contrast agents. This finding aligns with the knowledge of 67.1% of Saudi patients regarding such reactions.^[20]

Table 3: Association between patient's sociodemographic and magnetic resonance imaging safety-A

Characteristic	1. Whether patients aware of MRI scan preparation instructions		P	2. If patient aware of the kind of radiation an MRI uses?		P	3. If patient aware that the MRI scanner generates noise		P	4. If patient think the MRI scanner is on when no patient in		P
	No (n=63), n (%)	Yes (n=137), n (%)		No (n=110), n (%)	Yes (n=90), n (%)		No (n=32), n (%)	Yes (n=168), n (%)		No (n=187), n (%)	Yes (n=13), n (%)	
Age												
<20	5 (7.9)	6 (4.4)	0.468	7 (6.4)	4 (4.4)	0.253	4 (12.5)	7 (4.2)	0.082	10 (5.3)	1 (7.7)	0.923
20-40	22 (34.9)	56 (40.9)		49 (44.5)	29 (32.2)		14 (43.8)	64 (38.1)		74 (39.6)	4 (30.8)	
41-60	29 (46.0)	66 (48.2)		46 (41.8)	49 (54.4)		10 (31.3)	85 (50.6)		88 (47.1)	7 (53.8)	
>60	7 (11.1)	9 (6.6)		8 (7.3)	8 (8.9)		4 (12.5)	12 (7.1)		15 (8.0)	1 (7.7)	
Sex												
Male	38 (60.3)	65 (47.4)	0.091	53 (48.2)	30 (33.3)	0.299	15 (46.9)	88 (52.4)	0.568	98 (52.4)	5 (38.5)	0.331
Female	25 (39.7)	72 (52.6)		57 (51.8)	40 (44.4)		17 (53.1)	80 (47.6)		89 (47.6)	8 (61.5)	
Marital status												
Married	52 (82.5)	106 (77.4)	0.405	83 (75.5)	75 (83.3)	0.174	26 (81.3)	132 (78.6)	0.733	148 (79.1)	10 (76.9)	0.849
Single	11 (17.5)	31 (22.6)		27 (24.5)	15 (16.7)		6 (18.8)	36 (21.4)		39 (20.9)	3 (23.1)	
Education level												
Illiterate	10 (15.9)	5 (3.6)	0.001**	9 (8.2)	6 (6.7)	0.332	4 (12.5)	11 (6.5)	0.673	15 (8.0)	0	0.831
Intermediate	12 (19.0)	14 (10.2)		16 (14.5)	10 (11.1)		5 (15.6)	21 (12.5)		24 (12.8)	2 (15.4)	
Primary	15 (23.8)	24 (17.5)		16 (14.5)	23 (25.6)		7 (21.9)	32 (19.0)		36 (19.3)	3 (23.1)	
Secondary	12 (19.0)	28 (20.4)		25 (22.7)	15 (16.7)		6 (18.8)	34 (20.2)		38 (20.3)	2 (15.4)	
University	14 (22.2)	66 (48.2)		44 (40.0)	36 (40.0)		10 (31.3)	70 (41.7)		74 (39.6)	6 (46.2)	
Occupation												
Business	6 (9.5)	26 (19.0)	0.019	18 (16.4)	14 (15.6)	0.993	3 (9.4)	29 (17.3)	0.144	29 (15.5)	3 (23.1)	0.087
Domestic	25 (39.7)	32 (23.4)		31 (28.2)	26 (28.9)		9 (28.1)	48 (28.6)		57 (30.5)	0	
Employee	16 (25.4)	28 (20.4)		23 (20.9)	21 (23.3)		11 (34.4)	33 (19.6)		38 (20.3)	6 (46.2)	
Freelancer	15 (23.8)	36 (26.3)		29 (26.4)	22 (24.4)		9 (28.1)	42 (25.0)		48 (25.7)	3 (23.1)	
Student	1 (1.6)	15 (10.9)		9 (8.2)	7 (7.8)		0	16 (9.5)		15 (8.0)	1 (7.7)	
Residence												
Rural	6 (9.5)	7 (5.1)	0.239	7 (6.4)	6 (6.7)	0.931	4 (12.5)	9 (5.4)	0.133	13 (7.0)	0	0.326
Urban	57 (90.5)	130 (94.9)		103 (93.6)	84 (93.3)		28 (87.5)	159 (94.6)		174 (93.0)	13 (100.0)	

**less than 0.01. MRI: Magnetic resonance imaging

Table 4: Association between patient's sociodemographic and magnetic resonance imaging safety-B

Characteristic	5. whether patients aware that contrast agent used in some cases		P	6. whether patients aware of adverse effects of the contrast agent		P	7. whether patients aware of the need of RFT before contrast study		P	8. If MRI scan safe for a pregnant woman		P	9. If MRI with contrast agent safe during pregnancy		P
	No (n=112), n (%)	Yes (n=88), n (%)		No (n=177), n (%)	Yes (n=23), n (%)		No (n=166), n (%)	Yes (n=34), n (%)		No (n=193), n (%)	Yes (n=7), n (%)		No (n=190), n (%)	Yes (n=10), n (%)	
Age															
<20	4 (3.6)	7 (8.0)	0.556	8 (4.5)	3 (13.0)	0.153	9 (5.4)	2 (5.9)	0.881	9 (4.7)	2 (28.6)	0.050*	9 (4.7)	2 (20)	0.103
20–40	43 (38.4)	35 (39.8)		68 (38.4)	10 (43.5)		63 (38.0)	15 (44.1)		76 (39.4)	2 (28.6)		76 (40.0)	2 (20)	
41–60	56 (50.0)	39 (44.3)		88 (49.7)	7 (30.4)		81 (48.8)	14 (41.2)		92 (47.7)	3 (42.9)		89 (46.8)	6 (60)	
>60	9 (8.0)	7 (8.0)		13 (7.3)	3 (13.0)		13 (7.8)	3 (8.8)		16 (8.3)	0		16 (8.4)	0	
Sex															
Male	62 (55.4)	40 (45.5)	0.218	89 (50.3)	14 (60.9)	0.339	91 (54.8)	12 (35.3)	0.038*	99 (51.3)	4 (57.1)	0.761	97 (51.1)	6 (60)	0.581
Female	50 (44.6)	47 (53.4)		88 (49.7)	9 (39.1)		75 (45.2)	22 (64.7)		94 (48.7)	3 (42.9)		93 (48.9)	4 (40)	
Marital status															
Married	90 (80.4)	68 (77.3)	0.595	140 (79.1)	18 (78.3)	0.926	137 (82.5)	21 (61.8)	0.007**	153 (79.3)	5 (71.4)	0.617	151 (79.5)	7 (70)	0.473
Single	22 (19.6)	20 (22.7)		37 (20.9)	3 (13.0)		29 (17.5)	13 (38.2)		40 (20.7)	2 (28.6)		39 (20.5)	3 (30)	
Education level															
Illiterate	11 (9.8)	4 (4.5)	0.404	12 (6.8)	3 (13.0)	0.086	13 (7.8)	2 (5.9)	0.55	14 (7.3)	1 (14.3)	0.953	15 (7.9)	0	0.52
Intermediate	11 (9.8)	15 (17.0)		25 (14.1)	1 (4.3)		24 (14.5)	2 (5.9)		25 (13.0)	1 (14.3)		25 (13.2)	1 (10)	
Primary	23 (20.5)	16 (18.2)		33 (18.6)	6 (26.1)		30 (18.1)	9 (26.5)		38 (19.7)	1 (14.3)		37 (19.5)	2 (20)	
Secondary	23 (20.5)	17 (19.3)		32 (18.1)	8 (34.8)		34 (20.5)	6 (17.6)		39 (20.2)	1 (14.3)		36 (18.9)	4 (40)	
University	44 (39.3)	36 (40.9)		75 (42.4)	5 (21.7)		65 (39.2)	15 (44.1)		77 (39.9)	3 (42.9)		77 (40.5)	3 (30)	
Occupation															
Business	21 (18.8)	11 (12.5)	0.45	30 (16.9)	2 (8.7)	0.281	29 (17.5)	3 (8.8)	0.674	32 (16.6)	0	0.013	31 (16.3)	1 (10)	0.238
Domestic	35 (31.3)	22 (25.0)		48 (27.1)	9 (39.1)		47 (28.3)	10 (29.4)		55 (28.5)	2 (28.6)		52 (27.4)	5 (50)	
Employee	22 (19.6)	22 (25.0)		42 (23.7)	2 (8.7)		37 (22.3)	7 (20.6)		43 (22.3)	1 (14.3)		43 (22.6)	1 (10)	
Freelancer	27 (24.1)	24 (27.3)		44 (24.9)	7 (30.4)		41 (24.7)	10 (29.4)		50 (25.9)	1 (14.3)		50 (26.3)	1 (10)	
Student	7 (6.3)	9 (10.2)		13 (7.3)	3 (13.0)		12 (7.2)	4 (11.8)		13 (6.7)	3 (42.9)		14 (7.4)	2 (20)	
Residence															
Rural	11 (9.8)	2 (2.3)	0.032*	11 (6.2)	2 (8.7)	0.65	10 (6.0)	3 (8.8)	0.546	12 (6.2)	1 (14.3)	0.395	13 (6.8)	0	0.392
Urban	101 (90.2)	86 (97.7)		166 (93.8)	21 (91.3)		156 (94.0)	31 (91.2)		181 (93.8)	6 (85.7)		177 (93.2)	10 (100)	

*less than 0.05, **less than 0.01. MRI: Magnetic resonance imaging, RFT: Renal function test

In contrast to Saudi and Indian patients (17% and 42%, respectively), only 4% of Iraqi patients in this study believed that MRI was safe for pregnant women. According to a study by Alhazmi *et al.*, 64% of medical personnel hold the same view regarding the safety of MRI scans for expectant women,^[21] indicating that this misconception is not unique to patients. Before the MRI examination, 82.5% of higher education graduates were aware of the MRI preparation guidelines compared to individuals with lower levels of education (70% of secondary school graduates and only 33.3% of literate people). This result aligns with the hypothesis put forth by Alsahli *et al.* that patients with a higher level of education are more likely to seek information regarding the safety of MRIs than those with a lower level of education.^[22]

Limited patient knowledge regarding the procedure and precautions can be improved by disseminate the basic guidelines and information to both patients and staff through social activities and seminars. Furthermore, reliable blogs are recommended for the purposes of education, collaboration, and communication due to the welcoming environment they offer for the exchange and discussion of facts, ideas, and viewpoints.

We also observed a significant correlation between specific demographic characteristics of patients and their level of knowledge regarding the rationale behind assessing the GFR or creatinine level before contrast media administration. Specifically, patients who identified as married and female exhibited a notable correlation in their knowledge in this regard. Awareness of the pre-MRI preparation standards was positively correlated with employment and higher education for independent contractors or domestic clients. Aside from the aforementioned parameters, there is no statistically significant correlation between the demographic characteristics of Iraqi patients and their level of safety knowledge; this is consistent with the findings of Alahmari *et al.*^[22]

Limited sample size and implementation in a single medical facility are the only constraints of this research. Thus, it is not possible to generalize the results to the entire Iraqi population. However, to ensure that the findings are not influenced by societal and cultural factors, this study should be expanded to include additional regions and significant sample sizes from multiple centers.

CONCLUSION

Basic knowledge about MRI safety that Iraqi patients held was limited to the protocols for preparing, the noise emitted by the machine, and the incompatibility of contrast material during an MRI procedure in pregnant women. Life and online platforms should be utilized to further the dissemination of educational materials for both staff and patients. The sociodemographic characteristics of these patients had a significant effect on the information that they possessed.

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Conflicts of interest

There are no conflicts of interest.

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