

Prescription of Medical Imaging Exams by Joseph Ki Zerbo University Doctoral Student in Medicine

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Abstract: Background. Medical imaging consists of a variety of exploration techniques, the modalities of which are often not well known to prescribers. Prescribing these exams must meet certain criteria to ensure the safety of patient care. The objective of this study was to study the knowledge of medical doctoral students on the criteria for prescribing medical imaging exams. Materials and methods. This was a cross-sectional study with a prospective focus, conducted from 1 June 2020 to 31 August 2020 in university hospitals in the city of Ouagadougou. Were included randomly and exhaustively, with 386 medical doctoral students agreeing to respond to the questionnaire. The variables covered socio-demographic items, the type and frequency of prescription of imaging examinations, knowledge of the compliance criteria for medical imaging applications, biophysical principles and countermeasures indications of medical imaging examinations. Results. The sex ratio was 1.88. All doctoral students prescribed medical imaging exams. Standard radiography and ultrasound were the most prescribed examinations in 60.9% and 26.7% of cases. The least known compliance criteria were the requesting service and the purpose of the review in 9% and 11% of cases, respectively. Knowledge of the biophysical principles of medical imaging examinations, modalities using ionizing radiation were well known in 21.24% and 27.46% of cases. Contraindications for prescribing standard radiography, computed tomography and magnetic resonance imaging were known in 5.69%, 4.4% and 2.84% of cases. Conclusion. Medical doctoral students prescribe medical imaging exams with little knowledge of biophysical principles, modalities using ionizing radiation and contraindications related to the use of these techniques. Thinking needs to be done to improve their level of knowledge to ensure a reasoned prescription of imaging exams.

Keywords: Radiology, Medical Imaging, Burkina Faso, Doctoral Student in Medicine

1. Introduction

Medical imaging has become essential in the care of communicable and non-communicable diseases. It includes techniques using ionizing radiation (radiography, computed tomography, nuclear medicine) and non-ionizing radiation (ultrasound and magnetic resonance imaging) to detect, diagnose, monitor and treat multiple pathologies [1].

These modalities carry for the most part risks that any prescriber should know to avoid delays, diagnostic errors and thus ensure the safety of patient care. The request for a radiological examination will lead to the choice of a technique, adapted not only to the clinical question but also to the anamnestic elements [2].

To improve the quality of care, the High Health Authority (HAS) in France has defined certain administrative and

clinical criteria necessary to establish a request for a compliant imaging examination [3]. She has conducted several multi-centre studies that have shown an insufficient completeness rate of imaging requests, which may generate additional costs of health-related expenses or damages related to conducting inappropriate examinations.

In Africa, several studies have also analysed the compliance of prescriptions in medical imaging. In Côte d'Ivoire, Kouakou *et al* [4] showed an incomplete rate of imaging requests at 98.66%. In Cameroon, Kamgnie *et al* [5] showed a 17.2% rate of imaging exam reports without clinical indication. In Burkina Faso, Napon *et al* [6] noted that only 18.7% of imaging requests had a diagnostic hypothesis.

An efficient prescription of a medical imaging exam presents health and economic challenges. Imaging exams are expensive and are largely the responsibility of patients and their families in our context. Also, several imaging modalities, especially those using ionizing radiation, pose risks to the health of patients [7]. It is therefore important for the prescriber to know and take into account the advantages, limitations and contraindications of each modality before prescription. Several studies have explored the practice of prescribers of various qualifications (specialists, generalists, interns and paramedics). We have not found in the literature any specific data on the knowledge of postgraduate students of medical studies, concerning medical imaging means. However, they are entitled to prescribe medical imaging examinations as future practitioners in several medical or surgical departments. Our study aimed to study the knowledge of medical doctoral students on medical imaging techniques and on good prescribing practices for these exams.

2. Materials and Methods

It was a descriptive cross-sectional study, with prospective data collection, conducted from June 1, 2020 to August 31, 2020. It took place in the internship services of the University Hospitals (CHU) of the city of Ouagadougou. These were the CHU Yalgado Ouédraogo, Bogodogo, Pediatric Charles de Gaulle and Tengandogo.

The sampling was exhaustive and random, consisting of doctoral student in medicine, from the Health Sciences Training and Research Unit (UFR/SDS) of the Joseph Ki Zerbo University (UJKZ) of Ouagadougou.

Included were doctoral students present in the services during the investigator's stay and who agreed to participate in the study. A face-to-face interview questionnaire was administered. Non-consensual students were not included.

The variables explored were:

1. Socio-demographic aspects: sex, age, marital status.
2. Whether or not medical imaging exams are prescribed.
3. The type of medical imaging prescribed: radiography, ultrasound, computed tomography, magnetic resonance imaging.
4. The rate of administrative and clinical criteria mentioned on examination reports according to the criteria of the High Health Authority (HAS) in France [3]. There were

five administrative criteria: the patient's identity, the patient's age or date of birth, the date of application, the physician's identity, the requesting service. There were three clinical criteria: the anatomical region, the purpose and the purpose of the examination. A request for review was generally compliant when it included all administrative and clinical criteria.

5. The average score of knowledge of the biophysical principles of medical imaging examinations, on irradiant techniques in medical imaging, the contraindications of irradiant techniques, the contraindications of magnetic resonance imaging.
6. Factors motivating the prescription of medical imaging exams.

To evaluate the questions asked, we used scores corresponding to the percentage of correct answers. The level of knowledge was quantified and restored in four levels: good if above 85%, average if below 85%, insufficient if below 65% and bad if below 50% [8] (ref essi).

We have obtained permission from the UFR/SDS management of the UJKZ and the directorates of the various HUCs to conduct our investigation. Participants were informed of the objectives of the study, of their right to refuse to participate in the study. Verbal consent was given to us by the participants. The confidentiality of the information collected was respected as well as the anonymity of the respondents.

The data was entered and analyzed on a microcomputer using EPI-INFO version 7.1.5.2.

3. Results

A total of 386 doctoral student in medicine accepted to participate in the study. The sample consisted of 252 male subjects (65.28%), with a sex ratio of 1.88. The average age of students was 27.82 years with extremes of 25 and 43 years.

All postgraduate medical students prescribed medical imaging exams with an average of 5 exams per week and extremes of 1 to 15. The most prescribed imaging modalities were standard radiography in 60.9% and ultrasound in 26.7%. Investigations using ionising radiation accounted for 73.3% of imaging examinations.

The criteria most frequently mentioned on the examination bulletin were the reason in 91.96% of cases and the identity of the patient in 94.85% of cases (Figure 1). The rates of mention of the administrative and clinical criteria in the exam bulletin are shown in Table 1. No student had mentioned all the administrative and clinical criteria.

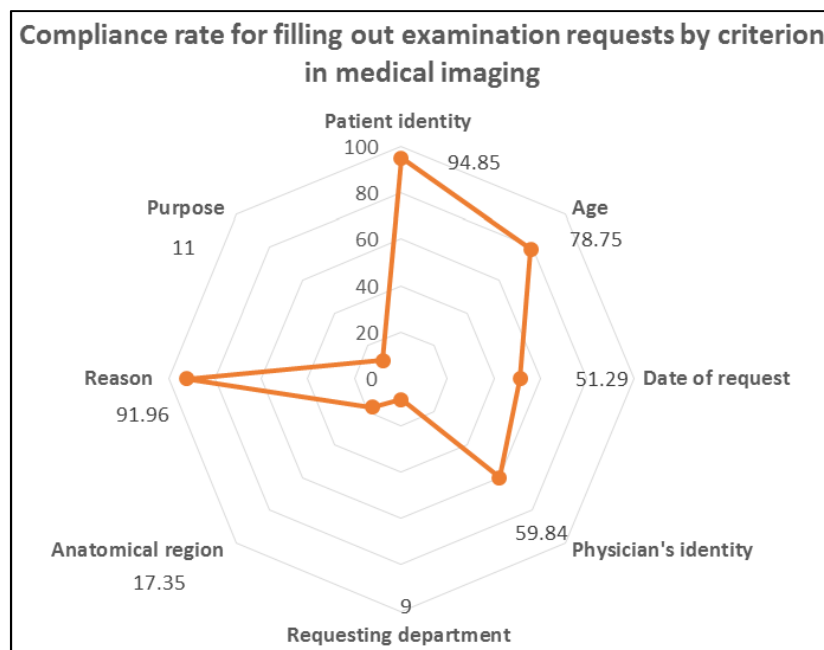
The average knowledge scores of the PhD students were:

- 1) 53.63% concerning the biophysical principles of medical imaging explorations. The score was good for 5.69% of doctoral students.
- 2) 71.05% for examinations using ionising radiation. The score was good for 27.46% of the doctoral students.
- 3) 43%, 46.50% and 29.72% respectively for contraindications to radiographic, CT and MRI examinations. The scores were good for 5.69%, 4.4% and 2.84% of the doctoral students respectively.

Table 1. Characteristics of medical doctoral students.

Features	Frequency	Percentage (%)
Age: 27.82 ans [25-43]		
Sex		
Men	252	65.28
Women	134	34.72
Marital status (N=386)		
Single	335	86.79
Married	41	10.62
Cohabitation	10	2.59
Knowledge of bioph principles. ADR (N=386)		
Average score: 53.63%		
Score \geq 85%	82	21.25
Score: < 85%	304	78.75
Knowledge of ionizing imaging (N=386)		
Average score: 71.05%		
Score \geq 85%	106	27.46
Score < 85%	280	72.54
X-ray knowledge (N = 386)		
Average score: 43%		
Score \geq 85%	22	5.69
Score < 85%	364	94.31
CT Knowledge C-I (N = 386)		
Average score: 46,50%		
Score \geq 85%	17	4.4
Score < 85%	369	95.6
MR C-I Knowledge (N=386)		
Average score: 29.72%		
Score \geq 85%	11	2.84
Score < 85%	375	97.16
Type of examinations prescribed (N=386)		
Standard radiography	235	60.9
Echography	103	26.7
TDM	48	12.4
MRI	0	0.0

Bioph. EIM: biophysics of medical imaging examinations; C-I: contraindication; CT scan: computed tomography; MRI: magnetic resonance imaging

**Figure 1.** Expression of compliance of the filling of requests for medical imaging scans by medical doctoral students.

Clinical symptomatology and the cost of the medical imaging examination were the main reasons for the choice of the imaging modality prescribed in 75.9% and 58.8% of cases.

4. Discussion

This study showed that all medical doctoral students prescribed medical imaging explorations. Standard radiography and ultrasound were the most commonly prescribed examinations. The administrative and clinical criteria to be mentioned on medical imaging applications were not all known to doctoral students. Also, the theoretical knowledge scores of biophysical principles, imaging techniques using ionizing radiation and contraindications of medical imaging examinations were unsatisfactory.

Proper prescribing of a medical imaging exam helps prevent diagnostic errors and contributes to the safety of patient care. A request for examination must comply with a set of conditions set out by the European Commission. Among these conditions, the problem must have been clearly stated in such a way that the radiologist has sufficient information to give an appropriate answer to the clinical question [9]. In fact, sufficient clinical information and a good orientation of the diagnostic question are important for a good examination. These recommendations highlight two criteria, namely the purpose and purpose of the review. In our study, the reason for the examination was known in 91.96% of cases. These rates were higher than in practice [10]. On the other hand, the purpose of the examination was little mentioned as a mandatory criterion in the application for imaging (11% of doctoral student in medicine). The study conducted by HAS showed that the purpose of the examinations requested was the least well completed item in 75% of cases.

However, the reason and purpose of the examination requested are important criteria to mention, as they help guide the radiologist on the modalities of conducting the examination. In France, medical justification is mandatory for imaging, especially imaging using ionizing radiation. This justification requires a written exchange or request for review between the applicant and the radiologist. These two major criteria must be included in the application. Other compliance criteria allow for good planning and optimal scan completion (name, patient age, prescriber identity, requesting department, type of exam) [3].

Standard radiography and ultrasound were the most prescribed imaging examinations in 60.9% and 26.7% of cases. These are exams available in our context and accessible, costing on average 5,000 to 10,000 XOF. These are widely prescribed examinations in common practice [11]. The choice of modality depends on the availability and geographical and financial accessibility of the modality. In countries with limited resources, the cost of imaging such as X-ray or ultrasound is about one-sixth to one-third of the guaranteed minimum wage (SMIG).

Computed tomography and magnetic resonance imaging

represent approximately 2 to 5 times the SMIG. This parameter is therefore important in the decision to prescribe a review, especially since there is no effective universal health coverage for all in Burkina Faso. However, no doctoral students prescribed MRIs. This is an exploration that most of the time requires specialized advice for its prescription.

In our study, scans using ionizing radiation represented approximately $\frac{3}{4}$ of imaging prescriptions. The prescription of medical imaging modalities using ionizing radiation is increasing and they occupy an important part in diagnostic methods. According to Laurier *et al* [11], X-rays and CT scans accounted for 88% and 10% respectively of imaging procedures performed in France in 2010. These prescriptions must be made judiciously. They present risks that must be known and taken into account during the formulation of the application. The biophysical principles of the most common imaging tests were not well known. Several medical imaging methods use ionizing radiation, which can pose health risks. In imaging, the ALARA (As Low As Reasonably Achievable) principle requires prescribing the most effective exam for less radiation. Several authors have shown a lack of knowledge concerning the modalities using ionizing radiation [12–14]. Also, the contraindications of medical imaging examinations were not well known, although some of them can have very serious consequences [15]. Morvan *et al* [16] reviewed the various iatrogenies related to medical imaging examinations, which have become indispensable in the management of patients. Gervaise *et al* [17] noted that 70% of imaging prescribers took these risks into account, but they were little or little known. The knowledge that each modality, these advantages, limitations and especially contraindications would allow better prescription behavior and in the key to better examinations and better diagnostics.

Studies have shown that some practitioners had other motivations in prescribing imaging, even ionising imaging, while knowing that the result would not influence their course of action: to reassure the patient (98.8%), to meet his or her expectations (35%) or to be taken seriously (75%) [12].

Our work had some limitations: there may have been a gap between the actual practice of the doctoral students and their knowledge of the elements studied. A study oriented towards the analysis of their practices would allow a better study of the real impact of their training in radiology on their medical career.

5. Conclusion

Medical doctoral students prescribe medical imaging exams but there are gaps in knowledge of the criteria for filling imaging requests, including the purpose of the exam. There is little knowledge of the contraindications and risks associated with the use of these examinations. Particular emphasis should be placed during their initial training to improve their levels of knowledge and regularly build their capacities to lead to reasoned prescriptions for medical imaging examinations.

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