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Knowledge and understanding among medical imaging professionals in India during the rapid rise of the covid-19 pandemic

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Abstract

During the first week of March,2020 the surge of coronavirus disease (COVID-19) cases reached all over the globe with more than 100,000 cases. Healthcare national and international authorities have already initiated awareness and lockdown activities. A poor understanding of the disease among medical imaging professionals (MIPs) may result in rapid spread of infection. This study aimed to investigate the knowledge and understanding of MIPs about COVID-19. A cross-sectional, web-based study was conducted among MIPs about COVID-19 during the fourth week of March 2020. An online sample of MIPs was successfully recruited via the authors' networks in India using data collection tool – write google forms. A self-developed online KAP questionnaire was completed by the participants. The knowledge and understanding questionnaire consisted questions regarding the clinical characteristics and transmission routes of COVID-19. Assessment on practices towards COVID-19 included questions on techniques while imaging against COVID-19 suspected patients. Of 700 participants, a total of 550 MIPs completed the survey (response rate: 78.57%); 56.7% were males, 85.4.1% were aged 17–26 years, and most were undergraduates (77.6%) and postgraduates (17.1%). Regarding COVID-19, most of the participants answered correctly (95.5%) on symptoms, (84.4%) time interval for visible symptoms, (98.0%) transmission and (44%) airborne transmission respectively. A significant proportion of MIPs (36.4%) had poor knowledge about wearing multiple masks as an effective measure against coronavirus infection. Most of the respondents (48.5%) incorrectly considered X-ray as the reliable method of diagnosis for suspected COVID-19 patients. 44.6% of the respondents lacked knowledge about the steps involved in hand washing technique which is one of the most important safety practice methods in medical imaging to prevent spread of infection. Factors such as age and occupation were associated with inadequate knowledge and poor perception of COVID-19. As the current global threat of COVID-19 continues to emerge, it is crucial and critical to improve the knowledge and understanding of MIPs. Educational videos and live webinars are urgently needed to reach MIPs and further detailed studies are the need of the hour.

Keywords Knowledge · Attitude · Practice · COVID-19 · India

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1 Background

Coronavirus disease 2019 (abbreviated "COVID- 19") is a life threatening respiratory disease caused by a novel coronavirus and was first detected in December 2019 in China. The disease is considered highly infectious, with clinical symptoms of fever, dry cough, fatigue, dyspnea and myalgia. In India, approximately 1834 patients were tested positive with COVID-19 by the first week of April, 2020 and 41 deaths reported. Clinical data have shown that the overall death rate of COVID-19 is between 0.2% to 1.6% in India, much lower than those of SARS (9.5%), MERS (34.4%), and H7N9 (39.0%) (1–4).

The COVID-19 was declared pandemic on March 11th 2020 by WHO and by then had inflicted 114 countries and caused 4291 deaths. The World Health Organization immediately responded to this serious situation and declared it as a public health emergency of international concern on January 30 and requested for collaborative efforts of all countries in the world to prevent the rapid spread of COVID-19 (5). India, has also been seriously hit by the COVID-19 pandemic. Some unprecedented measures have been adopted by our Prime Minister Shri Narendra Modi to control the COVID-19 transmission in India including complete lockdown with stay at home policy in the country from March 23rd, 2020 till April 14, 2020.

The fierce battle against COVID-19 is still a matter of major concern in India. To guarantee the final success, adherence to these control measures by the Medical Imaging healthcare providers are essential, which is largely affected by their knowledge, attitudes, and practices (KAP) towards COVID-19 in accordance with KAP theory because imaging diagnosis is the second step for COVID-19 confirmation after blood test. Lessons learned from the SARS outbreak in 2003 suggest that knowledge and attitudes towards infectious diseases is of utmost importance which can further complicate attempts to prevent the spread of the disease (6).

To facilitate outbreak management of COVID-19 in India, there is an urgent need to understand that the medical imaging professionals (MIPs) awareness of COVID-19 at this critical moment. In this study, we investigated the KAP towards COVID-19 of MIPs during the rapid rise period of the COVID-19 outbreak.

2 Methods

2.1 Participants

An online cross-sectional survey during the rapid rise period of the COVID-19 outbreak was used to assess the knowledge and understanding among MIPs on COVID-19 in India between March 31, 2020 to April 05, 2020, the second week after the national lockdown. This was an online survey as it was not convenient and feasible to do a community-based national sampling survey due to the global emergency.

The questionnaire were sent to 700 participants via Google forms, the identity of the contributors were kept anonymous. The minimum eligibility to participate in the survey was that the respondents were from the medical imaging fraternity. The questionnaire used in the present study was formed by referring information about COVID- 19 on website of World Health Organization, Centre for Disease Control and Prevention (CDC), expert discussion and their opinion. The questionnaire was then given to five experts in the field of medical imaging, public health and community medicine with more than five years of experience for content validity.

2.2 Ethical considerations

Confidentiality of the study participants' information was maintained throughout the study by making the participants' information anonymous. An informed consent was obtained from each participant prior to participation.

2.3 Data collection

The data collection was done between 31st March to 5th April 2020. The questionnaire was administered after by

Table 1 Demographic characteristics of participants and knowledge score of COVID-19 by demographic variables

Characteristics		Number of participants %
Gender		
	Male	312 (56.7)
	Female	238 (43.3)
Age groups		
	17–26	471 (85.6)
	27–36	54 (9.8)
	37–46	11 (2)
	47–56	14 (2.6)
Education		
	PhD	4 (0.7)
	Postgraduate	94 (17.1)
	Undergraduate	427 (77.6)
	Diploma	21(3.8)
	Distance education	4 (0.8)
Occupation		
	Student	320 (58.2)
	Intern	64 (11.6)
	Technologist	126 (22.9)
	Teaching Staff	35 (6.4)
	Administrator	5 (0.9)

Government of India had declared the lockdown. The details of the study was provided to the participants before beginning the survey. The questionnaire was administered in English language.

2.4 Measures/ content of the study tool

The questionnaire consisted of 15 items to assess their knowledge and attitudes of COVID-19 which took approximately 3 min to complete. The questionnaire consisted of two parts namely: demographics and KAP. Demographic variables included age, gender, education and occupation. The overall questionnaire had 15 questions (Table 1): regarding clinical presentations, regarding transmission routes and regarding prevention and control during Medical Imaging procedures of COVID-19. Attitudes towards COVID-19 were assessed through questions about training and safe use of personal protective equipment. The assessment of practices were through questions on various imaging procedures. These questions were answered on a multiple choice option, true/false basis with an additional "Not so sure" option.

2.5 Data analysis

The data analysis was done using descriptive statistics of mean & SD for continuous variables and for disc rete variables frequency and percentage was used. The responses obtained in the study was analysed using SPSS 16.0.

3 Results

A total of 700 MIPs were requested to participate in the study by sending questionnaire through e-mails and social media whatsapp application and 550 responded (response rate 78.57%). Majority of them (77.6%) had undergraduate qualification in medical imaging, 17.1% had postgraduate qualification in medical imaging, 3.8% had diploma in medical imaging, 0.7% had distance education in medical imaging and 0.7% had PhD in medical imaging. A total of 550 participants completed the survey questionnaire. Among this final sample, the average age was 23.39 years (standard deviation [SD]: 6.42, (56.7%) were men and (43.3%) were women. Other demographic characteristics are shown in Table 1.

Most of the respondents answered correctly on (95.5%) symptoms, (84.4%) time interval for visible symptoms, (98.0%) transmission however it was low for airborne transmission respectively (44%). Most of the respondents (36.4%) wrongly considered wearing multiple masks as an effective measure against coronavirus infection. The ideal distance to be maintained from a person infected with COVID-19 was rightly answered by only (43.5%) of the respondents. When it came to steps involved in handwashing, it was observed that

only 56.4% respondents were fully aware about this technique. Most of the respondents (48.5%) incorrectly considered X-ray as the reliable method of diagnosis for suspected COVID-19 patients. About (81.6%) of the respondents were also aware about infection control at the radiology department after imaging suspected COVID-19 patients. The most preferred investigation of choice for COVID-19 suspected patients as portable x-ray was answered only by (29.5%) MIPs. Majority of respondents (50.7%) considered computed tomography as the preferred investigation for COVID-19 suspected patients. While analysing questions pertaining to attitude of medical imaging professionals, it was found that in majority (46.5%) underwent training for the safe use of personal protective equipment (PPE). The questions regarding practices followed by the imaging professionals on considering air-exchange rate in imaging rooms, after scanning a suspected COVID-19 patient was unclear with respondents having mixed responses (15.5%) 15 min, (28.4%) 30 min, 1 (28.5%) and 2 (27.6%) hour respectively. The right answer was one hour of air exchange after imaging suspected COVID-19 patients. While analysing question pertaining to awareness about two radiographers using the 'one clean, one in contact with patient system (47.3%) were aware about this technique. Interestingly, it was observed that (57.5%) respondents were aware about the use of lead gown before wearing the PPE. Lastly, (91.5%) respondents were very well aware about the necessary steps to limit COVID-19 transmission. The detailed summary of the results are depicted in Table 2-3.

4 Discussion

To the best of our knowledge, this is the first study in India examining the KAP towards COVID-19 among MIPs. Currently, COVID-19 is a topic of global discussion in the media and among the public, especially among MIPs and patients. With the current case surge of COVID-19 transmission raising tensions for everyone, including health officials and National health systems, an important question arises regarding how to disseminate information to help frontline MIPs in times of public health crisis. For this reason, we investigated their knowledge and understanding on the precautions and control of COVID-19 during a global epidemic.

The finding of a high correct rate of COVID-19 knowledge in MIPs was unexpected, because this epidemiological survey was conducted during the very early stage-II of the pandemic. We consider that this is primarily due to the sample characteristics: 77.6% of the study respondents held an bachelor's degree and 17.1% of the respondents held a postgraduate degree. Because of the serious situation of the pandemic and the overwhelming news reports on this public health emergency, this population would actively learn knowledge of this infectious disease from various TV and news channels and the official

Table 2 Responses of medical imaging professionals to knowledge; attitude and practice questionnaire on COVID-19

Question no	Questions (Correct rate, % of the total sample)	Options (%)
1	Most common symptoms of Coronavirus (COVID −19) are fever, tiredness & dry cough.*(95.5%)	True, false (3.5%), not sure (1.1%)
2	The coronavirus infection can be transmitted through small droplets from nose or mouth of infected person.* (98%)	True, false (1.1%), not sure (0.9%)
3	Does the coronavirus infection spread through airborne transmission?* (44%)	True (36.5%), false, not sure (19.5%)
4	Wearing multiple masks is effective against coronavirus infection? * (25.5%)	Yes (36.4%), no, maybe (38.2%)
5	Ideal distance to be maintained from a person infected with COVID-19 is? * (43.5%)	1(23.8%),3,6(27%) & 10 (5.6%) feet
6	The symptoms of COVID-19 in an infected person are visible after? * (84.4%)	0–2 (1.1%), 2–14, 15–20 (12.5%) & beyond (2%)20 days
7	How many steps are involved in hand washing technique?* (56.4%)	2 (1.5%),4 (10%), 6 & 8 (32.2%)
8	Can x-ray be regarded as the reliable method of diagnosis for suspected COVID-19 patients? * (25.3%)	Yes (48.5%), no, not sure (26.2%)
9	Which among the following is important for infection control in radiology department after imaging suspected COVID-19 patients.* (81.6%)	Environmental cleaning (6.5%), decontamination of room (9.8%), maintaining airflow (2%) & all of the above
10	Which of these is the preferred modality in order to screen a patient for COVID-19? * (29.5%)	CT (50.7%), ultrasound (2.9%), portable x-ray machine & x-ray (16.9%)
11	Amidst this COVID-19 pandemic, have you undergone the training for the safe use of personal protective equipment (PPE).**	Yes (46.5%), no (41.5%), maybe (12%)
12	Considering the Air-Exchange rate in rooms, after scanning a suspected COVID-19 patient, the radiographic suite may need to be completely avoided for* (28.5%)	15 min (15.5%), 30 min (28.4%), 1 h & 2 h (27.6%)
13	Are you aware of the two radiographers using the 'one clean, one in contact with patient' system? **	Yes (47.3%), no (28.5%), not sure (24.2)
14	When should the Lead gown be worn by the radiographer? * (57.5%)	Before the radiographer wears the PPE, after wearing the PPE (26.9%) & not sure (15.6%)
15	The necessary steps to limit COVID-19 transmission involves* (91.5%)	Cleaning and draping the x-ray machine (2.2%), cleaning the cassette (5.8%), cleaning the anatomical markers (0.5%) & all of the above

website of the National Health Commission of India. The levels of education and COVID-19 knowledge scores supports this speculation. However when it came to questions pertaining to practices during medical imaging procedures of suspected COVID-19 patients, most of the MIPs have insufficient knowledge about dealing with COVID-19 suspected patients and managing the radiology imaging room.

Interestingly, as most of the respondents answered correctly about the symptoms of COVID-19, majority of the respondents 44% answered incorrectly about the airborne transmission of COVID-19 virus. The coronavirus infection can be transmitted through small droplets from nose or mouth of an infected COVID-19 individual and this might have caused confusion among the respondents about its airborne transmission route. The findings about lack of knowledge about steps involved in hand washing technique was a vital finding of this study and needs to be corrected immediately if we want to contain the spread of COVID-19 infection in India as MIPs are the first line healthcare providers.

44.6% of the respondents lacked knowledge about the steps involved in hand washing technique which is one of the most important safety practice methods in medical imaging to prevent spread of infection. Blood test is the first and most reliable method of diagnosis for suspected COVID-19 patients. However, x-ray investigation can only be used as a supplementary measure for confirming COVID-19. Majority of the respondents 48.5% wrongly answered that x-ray can be regarded as the reliable method of diagnosis for suspected COVID-19 patients. The preferred imaging modality of choice to screen a suspected COVID-19 patient is portable x-ray because it is easy to follow infection control measures and the radiology imaging room will also not be contaminated. It is also easy to disinfect and clean the portable x-ray unit and the isolated room where the imaging procedure was done. However, most of the respondents 50.7% considered computed tomography (CT) scan as the preferred modality in order to screen a suspected patient for COVID-19. CT may provide the following vital findings in COVID-19 positive cases: ground glass opacities in the lungs, air space consolidation, crazy paving appearance and broncho-vascular thickening in the lesion (7–10). Hence, we presume that the respondents might have gone through these studies and hence they considered

Table 3 Knowledge about Novel coronavirus (COVID-19) among MIPs (N = 550)

Sr.no	Questions (Correct rate, % of the total sample)	PhD n = 4	Postgraduates n = 94	Undergraduates n = 427	Diploma n = 21	Distance education n = 4
1	Most common symptoms of Coronavirus (COVID −19) are fever, tiredness & dry cough.*(95.5%)	4	93	404	20	4
2	The coronavirus infection can be transmitted through small droplets from nose or mouth of infected person.* (98%)	4	95	415	21	4
4	Wearing multiple masks is effective against coronavirus infection? * (25.5%)	3	25	105	7	0
5	Ideal distance to be maintained from a person infected with COVID-19 is? * (43.5%)	2	49	175	13	0
6	The symptoms of COVID-19 in an infected person are visible after? * (84.4%)	4	90	357	11	2
7	How many steps are involved in hand washing technique?* (56.4%)	4	60	235	10	1
8	Can x-ray be regarded as the reliable method of diagnosis for suspected COVID-19 patients? * (25.3%)	1	33	103	4	0
9	Which among the following is important for infection control in radiology department after imaging suspected COVID-19 patients.* (81.6%)	4	81	347	16	1
10	Which of these is the preferred modality in order to screen a patient for COVID-19? * (29.5%)	3	24	127	8	0
11	Considering the Air-Exchange rate in rooms, after scanning a suspected COVID-19 patient, the radiographic suite may need to be completely avoided for* (28.5%)	1	48	192	11	4
12	Are you aware of the two radiographers using the 'one clean, one in contact with patient' system? **	2	23	125	6	1
13	When should the Lead gown be worn by the radiographer? * (57.5%)	4	55	189	11	1
14	The necessary steps to limit COVID-19 transmission involves* (91.5%)	3	65	231	14	3

CT to be the preferred modality of choice for suspected COVID-19 patients. The participants of the current study showed fair knowledge about general precautions about COVID-19 but showed poor knowledge about practices to be followed while dealing with COVID-19 suspected patients. Majority of the respondents 71.6% were unaware about air-exchange rate in rooms, after scanning a suspected COVID-19 patient and avoiding the radiographic suite for one hour. And lastly, among the MIPs 52.7% were also unaware about two radiographers using the 'one clean, one in contact with patient' system while imaging suspected COVID-19 patient.

The strength of this study lies in its large sample recruited during a critical period, the early stage of the COVID-19 outbreak in a given Allied health speciality. Given the significant associations between these demographic variables and KAP towards COVID-19 revealed in this study, we may have overestimated knowledge and rates of preventive practices and underestimated rates of positive attitudes towards COVID-19 of MIPs. The present study was conducted in a standardized manner. The authors used a questionnaire which was developed through stages of item development, content validation and test-retest reliability. However, the study had few inadvertent limitations. To improve response rate, the number of questions were kept limited. Hence, the knowledge, attitude and practice of the MIPs cannot be fully determined. In addition, the data presented in this study are self-reported and partly dependent on the participants' honesty and

recall ability; thus, they may be subject to recall bias. There may be a responder bias as only respondents who have better knowledge of COVID-19 may have responded.

Finally, due to the four-week closure of higher educational institutions in India during the COVID-19 outbreak, the institutional review board was not approached. Despite these limitations, the present study provides vital information about the knowledge and understanding of medical imaging professionals during the rapid rise period of COVID-19.

5 Conclusion

In summary, our findings suggest that MIPs, have poor knowledge, attitudes, and appropriate practices towards COVID-19 during the rapid rise period of the COVID-19 outbreak. However, the MIPs had good knowledge about the symptoms and general awareness on COVID-19.

Hopefully, under the combined efforts of Indian authorities and all Indian residents, India surely will win the battle against COVID-19 in the near future.

Authors' contributions RK conceptualized the study. DF and SPK have given inputs in study design. RK and DF collected the data. RK analysed the data and wrote the first draft of manuscript and all co- authors contributed in critical review of data analysis and manuscript writing. RK will act as guarantor for this paper.

Compliance with ethical standards

Ethics approval and consent to participate The study protocol followed was reviewed and approved by the Research Committee of Srinivas University telephonically and approved online. The consent to participate approval was also taken.

Ehical approval reference number Not applicable.

Consent for publication A detailed explanation about the study was given by the principal investigator after which they provided consent for publication. All the patients included in this research gave written informed consent to publish the data contained within this study.

Competing interests The authors declare that they have no competing interests in this study.

Conflict of interest The authors declare that they have no competing of interests.

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