

COVID-19 Hazards on the Radiology Teams: A Local Study



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Abstract—Background: The newly emerging covid-19 pandemic has imposed an undeniable burden on the global health care systems and human well-being. **Objective:** To holistically evaluate the perception and knowledge of radiology team members as regards COVID-19 infection and its related aspects. **Methodology:** A cross-sectional anonymous questionnaire-based survey was conducted among radiology teams within the Eastern Province of Saudi Arabia. It targeted both radiologist and radiology technicians. **Results:** one hundred fifty-four radiology team members participated in this study. They were 88 radiologists and 66 technicians. Sixty-two radiologists (70%) had a good knowledge about the new Saudi Ministry of Health (MOH) guidelines for the radiology department teams during the covid-19 pandemic. Their overall perception and practice regarding the protective measures was very high (96.8%). **Conclusion:** Radiology team members within the Eastern Province area were highly acquainted with the MOH guidelines for dealing with covid-19 pandemic. They are also fully oriented with the self-precautionary measures during the pandemic. Although the participants' number is slightly limited, it may highlight the need for further studies with higher participants' number to give a realistic view of the radiologists and their team when dealing with biological hazards such as this pandemic.

Keywords— radiologist, radiology technician, COVID-19, radiology department, precautions.

1. Introduction

The recent seven months have witnessed the pandemic catastrophe of a global viral infection. This is the SARS-CoV-2. It is a β -coronavirus which is an enveloped non-segmented positive-sense RNA virus. Under an electron microscope, it shows a crown-like appearance due to the presence of spike glycoproteins on the envelope. [1] It belongs to the beta CoVs category. It has a round, elliptical or pleomorphic form. Its diameter approximates 60–140 nm. [2]

Since the initial report of this infection, it has shown a wide spread. [3] The World Health Organization (WHO) has announced this virus-related disease as a global pandemic. Currently more than 8,809,092 are confirmed to be positive cases. Moreover, the global mortality has exceeded 463,587 with a daily increase in numbers. However, more than 4,658,621 patients were recovered. In Saudi Arabia the recent reports confirmed the overall infection to be more than 190,823 with 1,649 deaths and more than 130,766 recovered cases. [4] The virus is mainly affecting the respiratory system presenting with the clinical manifestation of anosmia and hyposmia. [5] Yet, it may also manifest with varieties of different clinical presentations. These reflected the different pathological process within the body different vital systems. Generally, the majority of COVID 19 cases presented with fever, dyspnea, cough, hemoptysis, fatigue, headache, myalgia and diarrhea. [6-9] Moreover, coagulation abnormalities do present among severe cases. [10] Also, dermatological manifestation “COVID toes” were reported among those cases, specially at the acral areas. [11] Ocular manifestations were reported mainly pronounced as conjunctivitis. [12]

Health care providers are the main frontline to deal with this pandemic. Therefore, they are highly susceptible to catch the infection. The hazardous effect of this pandemic on the radiologists may be added to the radiology team threats. The viral infection may be transmitted during different radiological process that exists within the formal COVID 19 diagnostic protocols. [13] The current study was designated to

holistically evaluate the perception and knowledge of the radiology team as regards COVID-19 infection and its related aspects.

2. Methodology

A cross-sectional anonymous questionnaire-based survey was conducted. It took place within different health centers of the Eastern Province, Saudi Arabia. Candidates for participation were the radiology doctors as well as technicians. The developed questionnaire was of a semi-structured type. It was created, based on literature review and discussion with radiology subject experts. It was initially piloted on 20 participants. It consisted of 41 items. The first section included the participants' demographic data. The rest of the items concerned with the general information related to covid-19 different clinical presentations. They also focused on the preventive measures and guidelines that was set by the Saudi Ministry of Health (MOH). Questionnaire were electronically distributed as google forms. The targeted candidates were the radiology team members within the health facilities of the Eastern Province either public and private sectors. Participation within the study was voluntary. The ethical issues were approved by our institutional research board before the start of the study. Participants were assured about the confidentiality and the purpose of using the obtained data. Data were collected in an excel sheet before being interpreted on a Likert scale for the purpose statistical analysis. Analysis was done using Statistical Packages for Software Sciences (SPSS) version 26 Armonk, New York, IBM Corporation. Descriptive statistics were presented using numbers and for the comparison of variables, Chi square test was used. *P*-value <0.05 has been accepted as the significant level for all statistical tests.

3. Results

One hundred fifty-four radiology departments' members have participated in this study. They were 88 doctors and 66 technicians. The socio-demographic data are shown in Table 1. Their knowledge of covid-19 guidelines is elaborated in Table 2. Out of the total 88 participating radiologists, 62 (70%) showed full acquaintance of the new MOH guidelines. Nevertheless, their perception and practice concerning the specially taken precautions during the COVID-19 pandemic expressed that 90.6% of them were regularly performing hand hygiene during the radiological procedures such as CT of the chest (Figure 1,2 and Table 3). A comparison between the socio-demographic data and the perception of MOH guidelines among the radiologists and their peers technicians is clearly demonstrated in Table 4.

4. Discussion

Safety and health well-being of medical staff in general, and particularly those who work in radiology department should be considered as their basic human rights. [13-18] The current study was designed to evaluate the perception of medical personal within the radiology department as regards the occupational hazard during the covid-19 pandemic. This perceptual study reported the knowledge and attitude of 154 of the radiology team members in different tertiary healthcare centers within the eastern province of Saudi Arabia. Respondents mean age ranged from 25 up 60 years old with a mean of 31.6 ± 24.5 years. The respondents were 97 males (63%) and 57 females (37%). These data coincide with a previously published literature data of a similar perceptual study. [19] Among the respondents; 48 were trainee residents of educational residency program (31.2%), while senior radiologists with the rank of specialists and/or consultants were 40 (26%). The remaining 66 participants (42.8%) were radiology technicians.

Although existing literature showed concern on professional occupational hazards in the medical field, little have discussed the medical radiation team. [19-25] These studies have included the non-biological hazards, yet, the current study is providing a holistic view of the infection control measures. It also adds more information about the radiology team perception of the safety measures when dealing with patients during the covid-19 pandemics. Literature have highlighted the stress and needle stick injuries as the most major hazards to confront medical teams. [13,15,20,25-28] Our study data evaluated the stress among radiology team simulating a previously published data. [18] However, the cause of stress in our series was directly related to the covid-19 pandemics in relation higher morbidity and mortality rates. The commonest cause of stress among the radiology technicians was the shortage of their numbers (68.2%). This was expressed as elevated workload, imposed pressure with a higher perception of increased liability to contract infection.

These data can be compared to a similar study of 81.3% stress either moderate or high among the radiology team. [18] Occupational exposure has been reported among health care workers with certain viral and blood-borne infections such as varieties of viral hepatitis infections and human immune deficiency virus (HIV). [25] When concerning the guidelines for protection against covid-19 infection, most of the participants (90.3%) were eager to take the necessary precautions during dealing with suspected cases of covid-19. Approximately, 62% of them do believe that personal precautions are sufficient for protection against this infection. Additionally, when dealing with suspected covid-19 patients about (90.3%) of the respondents take extra-precautionary measures. They include changing the personal protective equipment PPE after every patient (85.7%), disposing them in a special hazards trash container (70%). This study also demonstrated 149 respondents (96.8%) were performing the regular hand hygiene practices as the crucial protective measure during their practice. Moreover, 72 participants (64.9%) were using protecting gloves. This coincides with a published data that signifies a reduced infection rate among healthcare provider when appropriately applied such protective measures. [29] A quite good number of the participants has stressed the initial role of radiological team in the triage of covid-19 suspected patients (67.5%). Nonetheless, they agreed and suggested that either or both chest CT and X-ray can be applied for diagnosing covid-19. This correlates with previous studies that highlights the role of radiologists in the diagnosis of covid-19 by detecting the numerous characteristics of pulmonary abnormalities on chest radiograph or CT. [30,31]

The European Centre for Disease Prevention and Control (ECDC) recommended the designating certain rooms and equipment as well as proper sanitization of the equipment. In order to help the limitations of the environmental contamination in radiology departments. [32,33]

In the current study, the respondents were highly acquainted about this notion (53.8%). It was also noted that the radiology department were working with a lesser capacity during the pandemic compared to ordinary situation. This may be attributed to the relocation of physicians within other departments due to increasing number of patients during the pandemic.

5. Conclusion

Radiology team members within the Eastern Province are highly acquainted with the MOH guidelines for dealing with covid-19 pandemic. They are also fully oriented with the self-precautionary measures during the pandemic. Although the participants' number is slightly limited, it may highlight the need for further studies with higher numbers to give a realistic view of the radiologists and their teams perception when dealing with biological hazards such as this pandemic.

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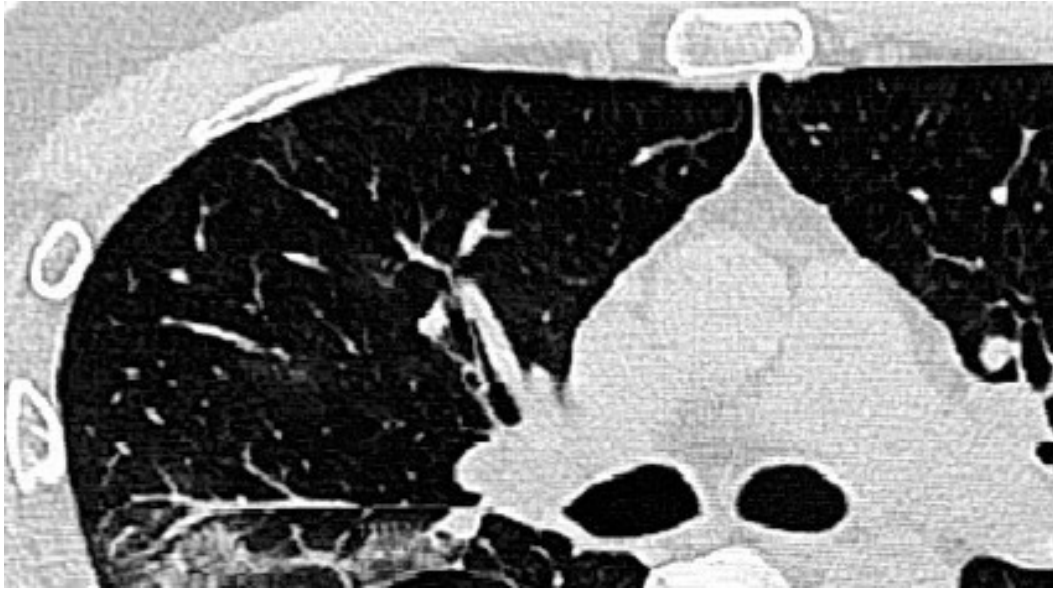


Figure 1

CT demonstrates
Bilateral ground glass opacities (GGOs) and early vascular enlargement



Figure 2

At one week after start of symptoms

Table 1: Socio demographic characteristics of the radiologists.

Study variables	Overall N (%) (n=154)	Radiologist N (%) (n=88)	Rad. Tech. N (%) (n=66)	P-value §
Age Group				
• 20 – 30 years	81 (52.6%)	40 (45.5%)	41 (62.1%)	0.002 **
• 31 – 40 years	51 (33.1%)	39 (44.3%)	12 (18.2%)	
• >40 years	22 (14.3%)	09 (10.2%)	13 (19.7%)	
Gender				
• Male	97 (63.0%)	56 (63.6%)	41 (62.1%)	0.847
• Female	57 (37.0%)	32 (36.4%)	25 (37.9%)	
Marital Status				
• Single	88 (57.1%)	40 (45.5%)	48 (72.7%)	0.001 **
• Married	66 (37.0%)	48 (54.5%)	18 (27.3%)	
Residence				
• Eastern Region	97 (63.0%)	58 (65.9%)	39 (59.1%)	0.386
• Non-Eastern Region	57 (37.0%)	30 (34.1%)	27 (40.9%)	
Socio Economic Status				
• Low	05 (03.2%)	0	05 (07.6%)	0.002 **
• Middle	133 (86.4%)	74 (84.1%)	59 (89.4%)	
• High	16 (10.4%)	14 (15.9%)	02 (03.0%)	
Family members living with				
• 1 – 3	50 (32.5%)	30 (34.1%)	20 (30.3%)	0.506
• 4 – 6	69 (44.8%)	41 (46.6%)	28 (42.4%)	
• >6	35 (22.7%)	17 (19.3%)	18 (27.3%)	
Experience Level				
• Resident	48(39.6%)	48 (46.6%)	0	<0.001 **
• Specialist/Consultant	40 (33.8%)	40 (53.4%)	0	
• Junior/Senior Rad. Tech.	66 (26.6%)	0	66 (62.1%)	

§ P-value has been calculated using Chi-square test.

** Significant at p<0.05 level.

Table 2: Radiologists knowledge regarding COVID 19 guidelines in imaging technique

Statement	Overall N (%) (n=154)	Radiologist N (%) (n=88)	Rad. Tech. N (%) (n=66)	P- value §
Are you familiar with the new MOH's guidelines and plans regarding radiology department during the COVID 19 pandemic?				
• Yes	110 (71.4%)	59 (67.0%)	51 (77.3%)	0.164
• No	44 (28.6%)	29 (33.0%)	15 (22.7%)	
Do you agree that any patient who will undergo an imaging technique during covid-19 must have a negative PCR test before attending the department?				
• Yes	78 (50.6%)	43 (48.9%)	35 (53.0%)	0.609
• No	76 (49.4%)	45 (51.1%)	31 (47.0%)	
If the answer is no, what measure maybe considered be sufficient? †				
• Just Temperature measure	22 (28.9%)	12 (26.7%)	10 (32.3%)	0.938
• Rapid Immunoglobulin testing	02 (02.6%)	01 (02.2%)	01 (03.2%)	
• Both	41 (53.9%)	25 (55.6%)	16 (51.6%)	
• Others	11 (14.5%)	07 (15.6%)	04 (12.9%)	
Do you think that Radiology Department may play a role in the triage of covid-19 suspected patients?				
• Yes	104 (67.5%)	50 (56.8%)	54 (81.8%)	0.001 **
• No	50 (32.5%)	38 (43.2%)	12 (18.2%)	
If the answer is yes, what is the imaging modality should be applied after following the protective guidelines? *				
• Chest X-ray	39 (37.5%)	21 (42.0%)	18 (33.3%)	0.555
• CT Scan	25 (24.0%)	10 (20.0%)	15 (27.8%)	
• Both	40 (38.5%)	19 (38.0%)	21 (38.9%)	

† Only participants who answered "No" from the previous question were included in the analysis.

* Only participants who answered "Yes" from the previous question were included in the analysis.

§ P-value has been calculated using Chi-square test.

** Significant at p<0.05 level.

Table 3: Radiologists perception and practice regarding COVID 19 precautions

Statement	Overall N (%) (n=154)	Radiologist N (%) (n=88)	Rad. Tech. N (%) (n=66)	P-value §
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Do you do hand hygiene regularly?				
• Yes	149 (96.8%)	88 (100%)	61 (92.4%)	0.009 **
• No	05 (03.2%)	0	05 (07.6%)	
If yes, what is your preferred method? *				
• Hand washing	89 (59.7%)	44 (50.0%)	45 (73.8%)	0.004 **
• Hand rubbing	60 (40.3%)	44 (50.0%)	16 (26.2%)	
When do you do hand hygiene?				
• Always	95 (61.7%)	58 (65.9%)	37 (56.1%)	0.010 **
• Usually	21 (13.6%)	16 (18.2%)	05 (07.6%)	
• Often	05 (03.2%)	03 (03.4%)	02 (03.0%)	
• Sometimes	04 (02.6%)	0	04 (06.1%)	
• Before patient contact	03 (01.9%)	0	03 (04.5%)	
• After patient contact	25 (16.2%)	10 (11.4%)	15 (22.7%)	
• Before and after patient contact	01 (0.60%)	01 (01.1%)	0	
Do you wear gloves				
• Yes	100 (64.9%)	39 (44.3%)	61 (92.4%)	<0.001**
• No	54 (35.1%)	49 (55.7%)	05 (07.6%)	
After every patient encounter what should you do?				
• Continue with the same PPE	22 (14.3%)	11 (12.5%)	11 (16.7%)	0.465
• Change PPE	132 (85.7%)	77 (87.5%)	55 (83.3%)	
If you change PPE what do you do with the used one?				
• Dispose of it in a hazard container	109 (70.8%)	61 (69.3%)	48 (72.7%)	0.645
• Dispose of it in a regular trash container	45 (29.2%)	27 (30.7%)	18 (27.3%)	
Do you take the necessary precautions when dealing with a suspected case of covid-19?				
• Yes	139 (90.3%)	84 (95.5%)	55 (83.3%)	0.012 **
• No	15 (09.7%)	04 (04.5%)	11 (16.7%)	
If yes, what are the precaution you take when dealing with a suspected covid-19 patient? *				
• Wear PPE	74 (52.5%)	49 (58.3%)	25 (43.9%)	0.091
• Follow Institutional guidelines/Others	67 (47.5%)	35 (41.7%)	32 (56.1%)	
Do you think that the personal precautions are sufficient?				
• Yes	96 (62.3%)	49 (55.7%)	47 (71.2%)	0.049 **
• No	58 (37.7%)	39 (44.3%)	19 (28.8%)	
Do you take these precautions to guard against				
• To guard against airborne	32 (20.8%)	14 (15.9%)	18 (27.3%)	<0.001**
• To guard against contact	38 (24.7%)	13 (14.8%)	25 (37.9%)	
• To guard against droplet	84 (54.5%)	61 (69.3%)	23 (34.8%)	
Does your department perform special precautions for environmental prevention of Covid-19 contamination?				
• Yes	117 (76.0%)	64 (72.7%)	53 (80.3%)	0.276
• No	37 (24.0%)	24 (27.3%)	13 (19.7%)	

* Only participants who answered “yes” from the previous question were included in the analysis.

§ P-value has been calculated using Chi-square test.

** Significant at p<0.05 level.

Table 3: Radiologists perception and practice regarding COVID 19 precautions (cont'd.)

Statement	Overall N (%) (n=154)	Radiologist N (%) (n=88)	Rad. Tech. N (%) (n=66)	P-value §
If yes, what measure are taken? *				
• Temporary closure of the facility	38 (32.5%)	21 (32.8%)	17 (32.1%)	0.920
• Complete closure of the facility	16 (13.7%)	08 (12.5%)	08 (15.1%)	
• Deep cleaning	63 (53.8%)	35 (54.7%)	28 (52.8%)	
What is the current working capacity during of radiology department in your hospital				
• Same as before	25 (16.2%)	16 (18.2%)	09 (13.6%)	0.733
• 80%	33 (21.4%)	15 (17.0%)	18 (27.3%)	
• 60%	52 (33.8%)	32 (36.4%)	20 (30.3%)	
• 40%	25 (16.2%)	14 (15.9%)	11 (16.7%)	
• 20%	09 (05.8%)	05 (05.7%)	04 (06.1%)	
• Exceed the capacity	10 (06.5%)	06 (06.8%)	04 (06.1%)	
Have you been tested for COVID-19?				
• Yes	55 (35.7%)	26 (29.5%)	29 (43.9%)	0.065
• No	99 (64.3%)	62 (70.5%)	37 (56.1%)	
If yes, what were the result? *				
• Positive	05 (09.1%)	03 (11.5%)	02 (06.9%)	0.550
• Negative	50 (90.9%)	23 (88.5%)	27 (93.1%)	

Do you think that rate of conventional imaging guided procedure should be stopped during the pandemic?				
• Yes	47 (30.5%)	25 (28.4%)	22 (33.3%)	0.511
• No	107 (69.5%)	63 (71.6%)	44 (66.7%)	
Does the radiology department play a role in the diagnosis of COVID 19?				
• Yes	120 (77.9%)	67 (76.1%)	53 (80.3%)	0.537
• No	34 (22.1%)	21 (23.9%)	13 (19.7%)	
If yes, choose the proper technique *				
• Chest X Ray	80 (66.7%)	43 (64.2%)	37 (69.8%)	0.516
• CT scan	90 (72.6%)	54 (77.1%)	36 (66.7%)	0.195
• MRI	08 (06.5%)	03 (04.3%)	05 (09.3%)	0.264
• US	07 (05.6%)	02 (02.9%)	05 (09.3%)	0.126
Is there plan done to limit or minimize the direct exposure to suspected/confirmed cases of COVID 19?				
• Yes	108 (70.1%)	62 (70.5%)	46 (69.7%)	0.919
• No	46 (29.9%)	26 (29.5%)	20 (30.3%)	
At your institution does the use of portable chest radiography increased during COVID 19 pandemic?				
• Yes	133 (86.4%)	76 (86.4%)	57 (56.4%)	1.000
• No	21 (13.6%)	12 (13.6%)	09 (13.6%)	
Is there a difference in precaution between confirmed and suspected covid19 cases?				
• Yes	67 (43.5%)	38 (43.2%)	29 (43.9%)	0.925
• No	87 (56.5%)	50 (56.8%)	37 (56.1%)	
Were the social distancing measures for radiologist applicable at your department? E.g. remote readout				
• Yes	99(64.3%)	50(56.8%)	49(74.2%)	0.026**
• No	55(35.7%)	38(43.2%)	17(25.8%)	
How do you think social distancing measures my affect your practice?				
• Positively	103(66.9%)	62(70.5%)	41(62.1%)	0.277
• Negatively	51(33.1%)	26(29.5%)	25(37.9%)	

* Only participants who answered “yes” from the previous question were included in the analysis.

§ P-value has been calculated using Chi-square test.

** Significant at p<0.05 level.

Table 4: Stress among radiology team members during covid-19 pandemic

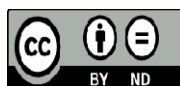
Statement	Overall N (%) (n=154)	Radiologist N (%) (n=88)	Rad. Tech. N (%) (n=66)	P-value §
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Do you have a shortage currently at your department?				
• Yes	71 (46.1%)	26 (29.5%)	45 (68.2%)	<0.001**
• No	83 (53.9%)	62 (70.5%)	21 (31.8%)	
Currently the number of radiology staff at your department				
• Sufficient	83 (53.9%)	56 (63.6%)	27 (40.9%)	0.003 **
• Insufficient	54 (35.1%)	21 (23.9%)	33 (50.0%)	
• Excessive	17 (11.0%)	11 (12.5%)	06 (09.1%)	
If the number of excessive do you agree on redeployment policy of some of the staff to direct patient care settings.				
• Yes	81 (52.6%)	49 (55.7%)	32 (48.5%)	0.376
• No	73 (47.4%)	39 (44.3%)	34 (51.5%)	
Have you been redeployed?				
• Yes	29 (18.8%)	08 (09.1%)	21 (31.8%)	<0.001**
• No	125 (81.2%)	80 (90.9%)	45 (68.2%)	

* Only participants who answered “yes” from the previous question were included in the analysis.

§ P-value has been calculated using Chi-square test.

** Significant at $p < 0.05$ level.



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