

It Could Be Worse but it Should Be Better: COVID-19 and the Lebanese Radiology Departments Preparedness

Ali Kanj MD¹; Ibrahim Ghosn MD²; Antoine Haddad MD³; Aline Geara MD⁴; Assaad Mohanna MD⁵; Bassam Samak MD⁶; Charbel Morad MD⁷; Daniel Mahfoud MD⁸; Jean Abi-Ghosn MD⁹; Joe el-Khoury MD¹⁰; Karen Nicolas MD¹¹; Marwan Haddad MD¹²; Nabil Helou MD¹³; Ahmad Abdallah MPH¹⁴ Georges Rouhana MD¹⁵

^{1, 3, 5, 7, 8, 9, 10, 11, 12, 13} Radiology Department, Faculty of Medical Sciences, Lebanese University, Hadath, Lebanon.

² Fellow of Radiology, Radiology Department, Faculty of Medical Sciences, Lebanese University, Hadath, Lebanon.

⁴ Radiology Department, RHUH, Beirut, Lebanon

⁶ Chairman of radiology Department, RHUH, Beirut, Lebanon

¹⁴ Hammoud Hospital UMC, Sidon, Lebanon

¹⁵ Chairman of radiology Department, Faculty of Medical Sciences, Lebanese University, Hadath, Lebanon.



Abstract – An unprecedented sanitary challenge is threatening human beings due to COVID-19 pandemic. There is no light at the end of the tunnel concerning treatment and worries from a possible second wave start to arise even before the end of the first one. We conducted a multicenter study to reassess the different aspects of radiology departments' preparedness in Lebanon stating the points of strength and more importantly depicting the points of weakness. Lessons were then extracted to be more prepared for possible future similar circumstances.

Keywords – COVID-19, Radiology departments, Preparedness, Infection control.

I. INTRODUCTION

The novel Coronavirus disease (COVID-19) is devastating worldwide and causing an unprecedented sanitary challenge. The medical institutions are not only overwhelmed by the tremendous number of cases, but also international data estimated that 6% (up to 18% in some countries) of all confirmed cases of COVID-19 are among healthcare workers⁽¹⁾, thereby worsening the situation.

The Radiology department, playing nowadays an essential role in the medical field as an inpatient and

outpatient healthcare facility, is not spared by this crisis. Especially that in the beginning of this pandemic, multiple international studies suggested the role of thoracic CT scan as a method for COVID-19 screening⁽²⁾ when RT-PCR is not available, severity assessment⁽³⁾, and follow-up⁽⁴⁾.

While countries are still struggling in the first wave with no definitive treatment or available vaccine⁽⁵⁾, worries from a possible second wave start to arise⁽⁶⁾. This urges us to reconsider the actual preparedness of radiology departments

in order to maintain the right measures and to address the wrong ones aiming to be more prepared for future challenges.

This article is a multicentre evaluation of 18 radiology departments from public and private university and non-university hospitals in Lebanon to assess their preparedness as well as the level of awareness of their medical and paramedical staff and thereby drawing lessons for the near and distant future.

II. METHOD

Study design and sample selection: The study used a cross sectional survey and a convenience sampling method. Inspired from the international experience and from the WHO recommendations for infection control, a phase one survey of 47 questions was addressed to chairmen of 30 radiology departments (or radiologist in charge when not applicable) across Lebanon and they were invited to submit their answers through web based digital format within a short time interval (7 days). The unit of analysis in this study was the radiology department.

In the second phase, technical information concerning the ventilation system was gathered from the hospital engineering department of each participating facility. A survey of 25 questions was addressed at the same time to 205 radiology personnel (radiographers, secretaries and nurses) belonging to each department who responded to the first phase. They were invited to submit their answers anonymously through web based digital format within a short time interval (7 days).

Statistical Analysis: Using Statistical Package for Social Sciences (SPSS) version 23, we performed a descriptive data analysis where frequencies and percentages were used for categorical variables and means and standard deviation were used for numerical (scale) variables.

Three aspects of preparedness were evaluated:

1. Administrative Preparedness:

We studied the application of social distancing measures in each institution since February 21st, 2020 (the first

documented case in Lebanon⁽⁷⁾) by assessing the reorganization of the available human resources per shift as well as the use of video conferencing, teleradiology and paperless reporting.

The outpatient measures concerning non urgent exams rescheduling and patients triage and screening, as well as the in-patient workflow optimization and machines dedication for confirmed or suspected COVID-19 patients were also assessed.

2. Environmental Preparedness:

We assessed the departmental architectural design including the number of entrances, the number and surface of waiting rooms, and the ventilation mode used in waiting areas as well as in the imaging units.

Attention was also given to machines' cleaning, the availability of hydro-alcoholic solution dispensers and to the availability and the proper use of the personal protective equipment.

3. Personnel Preparedness:

We evaluated the knowledge of the radiology staff concerning the transmission of this novel disease, their adherence to infection control rules as well as their satisfaction regarding the measures taken by their administrators to ensure their safety.

III. RESULTS INTERPRETATION

The studied population included:

- 18 radiologists from radiology departments distributed across the Lebanese territory (representing 14 university and 4 non-university hospitals).
- 18 technicians/ engineers in charge of the ventilation and 134 personnel system belonging to these departments.

Gathered data for the administrative preparedness (table 1), environmental preparedness (table 2) and personnel preparedness (table 3) were then divided into points of strength and points of weakness:

Table 1. Radiology departments distribution by administrative preparedness

	Number	Percent
Hospital that decreased the number of Technicians	14	77.8%
Hospital that decreased the number of administrative personnel	12	66.7%
Dedicated team of technicians to COVID-19 exams During day and night shift	8	44.4%

During day shift	3	16.7%
Not at all	7	38.9%
First time when wearing a mask by the personnel became obligatory at the hospital		
Not mandatory	1	5.6%
Since Case 1	10	55.5%
Since the beginning of the confinement (national state of emergency)	7	38.9%
Location of screening of the patients scheduled for exams		
When scheduling an exam by phone	8	44.4%
At the reception of the hospital	15	83.3%
At the reception of the radiology department	8	44.4%
Number of hospitals dedicating the below machine for COVID-19 patients*		
CT scanner	7	38.9%
Portable X-RAY machine	8	44.4%
Portable US machine	6	33.3%
Outpatient re-scheduling after the start of COVID-19 pandemic	13	72.2%
Availability of PACS and digital reporting	15	83.3%
Teleradiology is available in the department	10	55.6%
Virtual staff meetings and videoconferencing availability	3	16.7%
NB: Percentages are calculated out of the total of 18 hospitals		

Table 2. Radiology departments distribution by environmental preparedness		
	Number	Percent
Institutions that has performed zonal separation for COVID-19	11	61.1%
Special measures taken to avoid shortage of Personal Protective Equipment	13	72.2%
Number of hospitals provided appropriate training on the use of Personal Protective Equipments (PPE)	13	72.2%
Presence of HEPA in waiting areas	8	44.4%
Availability of calculated ACH	5	27.8%
Engineering feels satisfied of existent conditions	18	100.0%
Approximate time (Minutes) of cleaning the scan/MRI between 2 patients		
Mean (SD); Min-Max	29.17(19.19); 10-60	
NB: The above data represents the number of respondents who answered by "Yes" to the relevant questions		

Table 3. Personnel distribution by Knowledge, Attitude, and Behavior Relevant to COVID-19.		
	Number	Percent
Measures taken by the department concerning staff are protective and enough *	75	56.0%
The chairman takes into consideration the staff safety *	95	70.9%
After 3 months of COVID-19 crisis do you still consider the same level of alertness? *	98	73.1%
The department rooms design is adequate for distancing *	63	47.0%
Number of personnel who received training on COVID-19 precautions	89	66.4%
Frequency of putting a facemask during work		
Always	70	52.2%
Most of the time	33	24.6%
Sometimes	29	21.6%
Rarely	2	1%
The availability of personal protective equipment in the department as by personnel **		
COVID-19 Suits	69	51.5%
Gloves	130	97.0%
N95 Masks	64	47.8%
Surgical Masks	114	85%
Personnel awareness concerning the transmission of SARS-COV-2: *		
Droplets (Sneezing and coughing)	131	97.8%
Direct Contact	123	91.8%
Indirect contact	128	95.5%
‡: The figures represent respondents who answered by "Yes" to the relevant questions		
*: The starred Answers have categories that may add to more than 100% because more than one answer is possible		

1. Strength:

Social distancing was achieved by decreasing the number of radiographers per shift in 14 departments (77.8%) and the number of administrative personnel in 12 departments (66.7%) according to the need of each institution to ensure fluent work with a minimal presence of personnel and radiologists. 8 departments (44.4%) dedicated teams for COVID-19 patients during day and night shifts.

PACS and numeric reporting is seen in 15 departments (83.3%) leading to a paperless work and avoiding eventual virus transmission between radiologists, secretaries and medical floors.

For outpatients' management, 13 departments (72.2%) cancelled the non urgent scheduled out-patient exams, 8 departments (44.4%) implemented triage to ensure that consulting patients are asymptomatic when taking an appointment and screening control points were deployed at the main entrance of 15 hospitals (83.3%) and in the reception of 8 radiology departments (44.4%).

For inpatients' management, every department had a personalized plan according to its resources. A privileged path for COVID-19 cases was ensured in the 11 departments

(61.1%) having more than one entrance. The remaining departments adopted measures to ensure a fluency of circulation in a way to not perform any simultaneous exam until the evacuation of COVID-19 patients. When available, Portable US was privileged in 6 departments (33.3%) even if the patient is transportable and a CT scan machine was dedicated for COVID-19 or suspected COVID-19 patients in 7 departments (38.9%).

The difference concerning the beginning of the use of surgical masks among departments (50% since the first documented case and a total of 94.4% after the lock down) was contrasted by the strict use of PPE when dealing with confirmed or suspected cases of COVID-19.

2. Weakness:

Weakness points were found in all the studied preparedness aspects.

Lack of teleradiology was a main weakness point in administrative preparedness. In fact a shy implication of teleradiology was noticed. 8 departments (44.4%) still don't have it and only 2 departments (11.11%) increased its use during this pandemic.

Another weakness point is noted for online meetings and video conferencing where 15 departments (83.3%) didn't privilege its use. Awareness-raising workshops weren't done in 5 radiology departments (27%) and 45 personnel (33.6%) stated that they didn't receive proper training concerning PPE use and COVID-19 awareness.

Four points of weaknesses were seen in the environmental preparedness:

1. 5 departments (27.7%) had relatively small waiting rooms (less than 30 m²) making the social distancing difficult to maintain even in an optimal schedule organization.
2. The ventilation system revealed itself as a major lacuna in the infrastructures of radiology examination rooms. 13 radiology departments (72.2%) use a mixed type without strict control of the ventilation parameters. This may be a concern since the WHO stated in 2009 that insufficient ventilation increases disease transmission and published recommendations concerning the recommended ventilation settings and HEPA (High Efficiency Particulate Air) filter use⁽⁸⁾.
3. 8 departments (44.4%) gave less than 30 minutes for CT scan machines cleaning after performing an exam to a confirmed or suspicious COVID-19 patient. All departments used chloride based solutions to clean the machines with a cleaning time ranging between 10 to 60 minutes and a mean of 29.17 minutes. This time doesn't meet the international recommendations in the absence of strict ventilation rules as detailed above. As recommended by the Center of Disease Control and Prevention (CDC), an ACH of 10 is required if the cleaning time was 28 minutes to clear 99% of airborne transmitted organisms⁽⁹⁾.
4. Both radiologists and personnel stated concerns about the unavailability of PPE, 5 institutions couldn't take measures to avoid its shortage and 64 personnel (47.8%) said that the storage of COVID-19 masks may not be enough.

Concerning the personnel preparedness, a worrisome number (98 personnel, 73.1%) are starting to decrease their level of compliance to infection control measures reflecting that they may be more prone to indolence and therefore increasing the risk of contamination. 64 personnel (47.8%) stated that they don't regularly put surgical masks at work. Another big concern is revealed by this study when 39

personnel (29.1%) replied by "No" when asked if their chairman takes into consideration the safety of the staff.

IV. WHAT TO BE LEARNT

The early lockdown of the country helped to mitigate the loss where a small number of cases was registered (796 cases and 26 deaths ⁽¹⁰⁾ by the 7th of May 2020, the date of data analysis). Despite this small number, Lebanese departments continue to take strict measures to avoid further viral spread.

We can't judge if the measures alone helped to block the spread of the virus in the department or the relatively small number of cases diluted the severity of the outcome. Regardless of the cause, the outcome is clear: no documented contamination of radiology staff was seen despite a significant number of CT scans performed for COVID-19 (298 CT scans in this study) and suspected COVID-19 patients (1314 CT scans in this study).

The representative value of this study, even if it uses a convenience method of sampling, is that it included a considerable number of teaching hospitals in this small country. Add to this, these institutions gathered 407 positive COVID-19 cases of a total of 796 confirmed cases (51%) on the 7th of May 2020, the date of data analysis and 250 admitted cases.

The aim wasn't to compare between the performances of each institution but to learn from the heterogeneity in national response sharing experience and addressing the points of weakness.

The result was inlaid with several weakness points reducing the efficacy of the studied aspects of preparedness. In front of a possible worsening of the current situation or a possible second wave, we should start to act firmly to enhance our readiness.

In the short term five steps should be taken:

1. Teleradiology use should be enhanced in our daily practice and especially during pandemics reinforcing the social distancing.
2. Web based meetings should be promoted through the administration of the departments to maintain an adequate and constant communication for an optimal collaboration.
3. Active communication and collaboration with the infection control department in the health care facility should be maintained in order to implement a safe patients' workflow and enhance staff

protection while ensuring the required stock of PPE especially in the most affected departments.

4. Reconsideration of ventilation parameters of the radiology examination rooms especially the cleaning time/room closure and its relation to the air change per hour rate should be done by respecting the international recommendations, a portable HEPA filter may be of value if ventilation optimization is technically unfeasible.
5. There is an urge to provide psychological support for personnel to feel more secure and to reinforce their compliance to infection control rules, because any kind of indolence could help in the spread of the virus through healthcare facilities and may be a knockout for the sanitary system. Reconsideration of personnel's safety is also mandatory, radiologists and infection control departments should take their responsibilities to ensure that every personnel has received sufficient awareness concerning infection control in general and particularly concerning COVID-19 nowadays.

In the long term, a revision of departmental infrastructure is necessary when doing a renewal of the existing departments or when building new ones according to the international requirements especially concerning ventilation improvement, zonal separation and waiting room surface area. Any new radiology department should be prepared to face this kind of challenge in the future.

V. CONCLUSION

COVID-19 is the third serious Coronavirus outbreak in less than 20 years after the emergence of SARS and MERS⁽¹¹⁾. This invites us to think that Coronaviruses will not stop to threaten our existence. While people's memory will fade away after the end of the actual pandemic, any radiology department around the world should put itself under microscope and perform an objective self evaluation to learn from the present and the past and rely on this collective experience for the future outbreaks because with such pandemics, failing to prepare is preparing to failure.

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DISCLOSURE

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ABBREVIATIONS

ACH	Air Change Per Hour
COVID-19 2019	Coronavirus Disease
HEPA	High Efficiency Particulate Air
MERS	Middle East Respiratory Syndrome
PPE	Personal Protective Equipment
SARS	Severe acute respiratory syndrome
SARS-Cov-2 Coronavirus 2	Severe acute respiratory syndrome
WHO	World Health Organization