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Imaging of Covid-19; an Irish Perspective

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Covid-19 infection predominantly affects the respiratory tract. While the diagnosis is often made by a combination of clinical and positive findings on swab testing, imaging with Chest X-ray and CT are essential in establishing the severity of the disease and monitoring response. Imaging also sometimes suggests the diagnosis in unexpected cases. In this article we review the current imaging in Ireland in symptomatic Covid-19 patients and compare our experience to other countries, particularly China and Italy.

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is responsible for Covid-19; recently given pandemic status by the World Health Organisation (WHO) on 11/03/2020, with world-over cases rapidly rising. While RT-PCR screening is now considered the standard laboratory test for diagnosis of COVID-19, it may sometimes yield a false-negative result. This may relate to inadequate viral material in the sample or technical issues during nucleic acid extraction[1]. In such cases with typical clinical manifestations, chest CT may prove to be an invaluable asset because it may show characteristic features of the disease even when the RT-PCR screening test is negative[1]. In Ireland, a significant number of patients are being referred for chest imaging with symptoms of coughing and/or dyspnoea, potentially related to Covid-19. Two separate cohorts of patients are being encountered: 1) Referrals from General Practitioners (GPs) who tend to have mild to moderate symptoms where the diagnosis is not always suspected and 2) Emergency department patients and inpatients, often where the diagnosis is known or strongly suspected. The second cohort of patients often have more advanced symptoms and radiological findings. A chest x-ray, while not as sensitive as CT, is often sufficient in establishing disease activity. In the inpatient setting, a portable chest X-ray is usually sufficient. CT is reserved for more severe cases or complex cases where there is worry about alternative or co-existing pathology. While imaging such patients should be straightforward, it is important that adequate precautions are obtained to protect health care staff dealing with these patients. In particular, CT requires the patient to lie on the CT gantry table for up to 10 minutes, increasing risks of exposure and requiring appropriate sterilisation measures of the CT table to prevent cross infection. For this reason, portable chest X-rays are strongly preferred to CT for most patients in the majority of Irish institutions.

Chest X-rays are often normal in early disease. As the disease progresses, patchy airspace changes occur. These are usually bilateral. There is often rapid progression over a few days with the bilateral patchy airspace opacities progressing to an Acute Respiratory Distress Syndrome (ARDS) type pattern (diffuse bilateral coalescent opacities) (See Case 1) (Next Page).

Case 1: 54-year-old patient with dyspnoea, cough and pyrexia.

Figure 1(a): Day 1 CXR: There are only minor patchy airspace opacities in the bilateral lower zones.

Figure 1(b): Day 7 CXR: Marked progression with development of multifocal airspace opacities and more confluent consolidation.

Interestingly pleural effusions are a rare feature of this disease. This is a very useful differentiating feature and may help distinguish Covid-19 pneumonia from other causes of dyspnoea such as cardiac failure. Of course, some patients may have co-existing disease with Covid-19 disease on a background of emphysema or cardiac failure. This makes evaluation more difficult. There does seem to be a relationship between pre-existing lung and cardiac disease and severity of Covid-19 pneumonia. It seems smoking may particularly have an impact on the severity of disease on imaging.

In the literature, for majority of documented COVID-19 cases, the initial chest CT tends to show some abnormality, even if mild. Some patients without any evident symptoms, who were imaged solely on the basis of exposure, have abnormal CT findings[1]. On CT, the imaging features include bilateral, multi-lobar ground glass opacities. These often have a peripheral or posterior distribution. The lower lobes are most commonly affected. As the disease progresses, crazy paving and consolidation become the dominant pattern[3]. The next stage of progression is overt consolidation (See Case 2).

Case 2: 78-year-old patient with productive cough and dyspnoea.

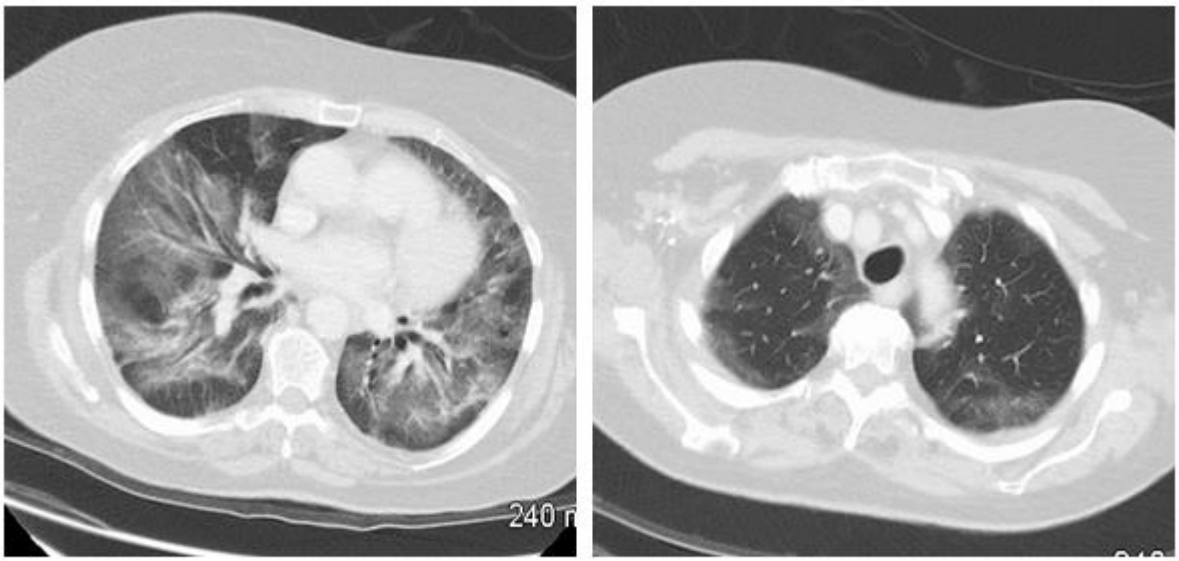

Figure 2(a) & 2(b): CT Thorax: Lung windows. There are multifocal central and peripheral ground-glass opacities involving all lobes of the lungs bilaterally with lower zone predominance.

This again tends to be bilateral and peripheral in nature with the lower lobes being most involved[2,3]. Lymphadenopathy and pleural effusions are uncommon on CT; useful distinguishing features[2]. Pericardial effusions and pneumothorax are also uncommon but may occur with disease progression[2]. The greatest severity of CT findings seems to occur at around day 10 after symptom onset[1]. ARDS is the most common indication for transferring patients with COVID-19 to the ICU and is also the major cause of ICU death in these patients[1]. Patients that survive usually start to show improvement in their imaging after week 2 of their disease. There is a gradual improvement with resolution of the air space disease and consolidation.

When compared to the general literature on Covid-19 infections, the presentation in Ireland appears to be very similar to cases in the rest of the world, in particular the Italian and Chinese situations. The pattern of imaging features we have encountered so far in Ireland is in keeping with the described CXR and CT thorax features of Covid-19 from other countries[1,2,3]. It is important that the patterns found on imaging should be used in conjunction with clinical and biochemical studies as they are not specific to Covid-19 and can be seen in other disease processes. It is probable that our data will grow over the coming weeks; hopefully the pattern of recovery and whether there are any long-term imaging sequelae will become evident. In the meantime, for Irish hospitals, we would advocate chest X-ray as the mainstay of imaging and follow up of Covid-19 patients.

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