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A UK-wide British Society of Thoracic Imaging covid-19 imaging database – design, rationale and implications for education and research

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Declarations / Conflicts of interest

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The number of cases of COVID-19 continues to rise in the United Kingdom and around the world. The precise role for computed tomographic (CT) imaging in the diagnosis and triage of suspected cases, assessing for complications and surveillance is subject to change and are explored in other articles in this edition [Ref Clin Rad Update for the Radiologist and Considerations in designing local imaging diagnostic algorithms].

The British Society of Thoracic Imaging (BSTI) will provide a simple online portal to upload the imaging of patients with COVID-19, thereby creating a national database of UK patients. The aim is to rapidly disseminate breaking clinical and diagnostic advice to frontline healthcare nationally. This editorial makes recommendations about key attributes of a national COVID-19 database and highlights: 1) the urgent need for a national imaging database at the initial stages of the outbreak, 2) how implementation would help garner thoracic CT expertise across the UK radiology community.

The BSTI, in conjunction with Cimar (Ambra Health Inc.), has designed, built and deployed a fully auto-anonymised, encrypted and secure cloud-based database to capture diagnostic grade digital imaging and communications in medicine (DICOM) radiology in patients with suspected and/or confirmed COVID-19. Imaging can be uploaded at http://bit.ly/BSTICovid19_Database. The published teaching library and its content will be accessible without log-on via the BSTI website (bsti.org.uk)

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The role of registries in Radiology

Registry data / databases can be essential in improving our understanding of the imaging characteristics of disease and to promote shared learning. They have sometimes changed practice (eg. the identification of high rates of morbidity in patients undergoing emergency biliary procedures via the Swedish Registry GallRiks (Ref: Sandblom G, Videhult P, Crona Guterstam Y, Svenner A, Sadr-Azodi O. Mortality after a cholecystectomy: a population-based study. *HPB (Oxford)*. 2015;17(3):239–243. doi:10.1111/hpb.12356); Vascular Services Quality Improvement Programme (VSQIP) through the National Vascular Registry).

The Royal College of Radiologists document “Setting up a regional or national digital teaching archive” (ref: https://www.rcr.ac.uk/system/files/publication/field_publication_files/bfcr184_teaching_archive.pdf) makes clear that such databases are needed for developing the knowledge and skills of radiology trainees, but would also significantly benefit trained radiologists. This is perhaps even more pertinent in the face of a new virus whose imaging features can be varied and unfamiliar. Indeed, it has long been recognised that breaking down technological barriers to contributing imaging studies directly from a PACS viewer to a central imaging repository would make teaching and research in the NHS more efficient and accurate. Overcoming such a bottleneck would also deliver the potential to exponentially upskill the radiology workforce in early and accurate diagnosis of COVID-19, in what is currently a highly dynamic situation. By bringing together thoracic CT expertise across the UK, a central COVID-19 imaging database can help standardise COVID-19 image interpretation, provide better quality care for patients, and provide a resource to rapidly accumulate knowledge. Such a database would also allow real-time tracking of confirmed CT cases and allow

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improved understanding to the significance of cases with positive CT findings but negative reverse transcriptase polymerase chain reaction (RT-PCR) results. This will help collate valuable information for the NHS and Public Health England.

Technical Aspects and registry design

Users can access and view the imaging online using Chrome, Safari, Firefox or Safari – on Apple and PC machines. A diagnostic viewer loads automatically for the user – no special software, downloads or installations are required to access and use the resource.

The platform is provided by Cimar.co.uk. The resource can be accessed inside and outside hospital and clinic networks with equal ease, using any browser or mobile device.

Cases will be automatically anonymized by the cloud-software at the point of upload and access does not require changes to individual/organisation firewalls. All connections are secure and encrypted (https/tls). No software is needed by users anywhere to view cases in full diagnostic quality. This is a zero-footprint PACS interface with the ability to view both imaging and all related training/instruction/diagnostic observations and materials for each case study added. New cases can be uploaded from any hospital or location nationally and will be routed through a BSTI data-base panel for approval and annotation, prior to general access to radiologists nationally and internationally.

All imaging is anonymized automatically at upload and stored at UK Cloud (<https://ukcloudhealth.com>) with no identifiable metadata. If priors exist, the hospital ID allows for previous and current imaging to be identified and amalgamated as related studies. It should be noted that the hospital ID number will be not viewable in any publicly facing training images. The requirement for Data Protection Impact Assessment (DPIA) forms will be the decision of each individual trust, but The Royal United Hospitals Bath, NHS Foundation Trust's completed and signed-off DPIA is available as a template if required (see Appendix 1). A 'frequently asked question document' is also available FAQ (see Appendix 2). All data is anonymised from the point of upload, through to its viewing. The full data set will only be viewable by the BSTI database panel (and other agreed parties – the software is role-based access only). From the database, teaching material will be published and refreshed on a regular basis. The imaging will only be stored for as long as the BSTI executive committee deem it necessary. For BSTI database panel members, access to the full data set is through a pre-registered login with a strong (forced renewable) password. Access is audited, captured and all usage is logged. The published teaching library and its content can be accessed without log on.

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The BSTI covid-19 registry – Education

The reported chest radiograph and CT signs in COVID-19 vary depending upon time of imaging from onset of symptoms and disease severity [Ref Clin Rad Update for the Radiologist]. Patients with COVID-19 may present to any hospital initially and radiologists have a duty to be aware of findings that are compatible with the diagnosis. There is a current national shortfall of approximately 1,104 Radiologists [1]. Of existing Radiologists, though "chest/lung" is the 5th most popular primary subspecialty interest, the provision of

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subspecialty thoracic radiology also varies dramatically across the UK[1]. BSTI aim to produce a resource that helps upskill all radiologists in the evolving clinical climate of COVID-19. In addition, webinars using content from the BSTI COVID-19 data-base are planned in conjunction with the Royal College of Radiologists.

The BSTI COVID-19 data-base – Research

As of 8th March 2020, there were 585 published articles on PubMed (<https://www.ncbi.nlm.nih.gov/pubmed>) using the search phrase “COVID-19”. The World Health Organisation has set COVID-19 research as a priority[2]. The largest imaging study in COVID-19 (in more than 1,000 patients from China) raised the question of the role of CT in diagnosis, particularly in patients who are at high clinical risk but initial real-time transcriptase polymerase chain reaction (RT-PCR) negative for the virus[3]. However, as the authors acknowledge, “clinical and laboratory data were limited during this urgent period when regional hospitals were overloaded”. Consequently it is uncertain if the CT findings are simply an epiphenomenon of the clinical or laboratory findings[3]. Through a united effort to submit cases to the BSTI COVID-19 data-base across the entire National Health Service, there is a real opportunity to add to the evidence base in the diagnosis and risk stratification of cases. The case upload will be accompanied with brief clinic metrics (including patient age, sex, white cell count, c-reactive protein, pO₂, indication for the imaging, RT-PCR status, prior imaging), which will help understand the temporal trends in imaging and the relevance of imaging findings in the context of known clinical and laboratory data.

Unfortunately, COVID-19 may become a global pandemic and the BSTI data-base has the potential to rapidly upscale to host nested registries for other countries and provide a global imaging perspective. All contributors will be considered collaborators on research outputs.

Summary

For the BSTI COVID-19 data-base to realise its potential in education and research in the UK and across the globe, we call on all radiologists to engage and upload cases. Every case of COVID-19 counts.

http://bit.ly/BSTICovid19_Database

