ieQ: COVID-19 pandemic and recommendations on echocardiography for infective endocarditis.

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https://medicine-program.uq.edu.au/school-clinical-medicine/research/infective-endocarditis-qld

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1. Preamble.

COVID-19 is an unprecedented worldwide pandemic in the modern era, with similarities to the Influenza Pandemic of 1918-19.

In terms of Infective endocarditis (IE), the ability to treat patients as “business as usual” is no longer possible in many regions. In this rapidly evolving situation, the statements below may help with patient management, but please take note of your local guidelines and expect guidelines to change rapidly and perhaps without notice. *During sustained community transmission consider all patients at risk of COVID-19 infection.*

2. Risks of TOE.

Trans-Oesophageal Echocardiography (TOE) involves the introduction of an echo probe via the patient’s throat into their oesophagus. TOE is used to obtain cardiac imaging that in many cases are superior to those obtainable by Transthoracic Echocardiogram (TTE), especially in the presence of prosthetic valves, or patients with poor views such as obese patients and those with respiratory disease. During the procedure, the patient usually receives nasal-flow oxygen, often at high flow with the process often causing gagging, coughing or sneezing.

Due to these factors, there is a significant risk of aerosolisation of virus particles. Aerosol generating procedures (AGP) and aerosolisation of organisms usually transmitted by droplet spread changes the transmissivity, potentially infecting people present in the area along with contaminating machinery or other surfaces in the room. Infected healthcare workers may inadvertently infect other patients, workers, or their families and lead to the suspension of TOE services in that centre for a period. Contamination of the area may potentially infect subsequent staff or patients undergoing procedures in that room.

3. Minimising TOEs.

Whilst there is no need for additional measures in COVID-19 negative or low risk patients it is agreed there is a need to minimise TOE during the COVID-19 pandemic. With potential risk of infection transmission, as well as reduced logistics when health facilities are at maximum strain, the first question to ask is "does this patient really need a TOE?", as well as the variant "does this patient need a TOE *now*?"

In the setting of endocarditis /possible endocarditis, accessibility to TOE may depend on logistics. As examples, smaller hospitals may have a single TOE "team" whose members may be on COVID-19 management teams, on quarantine, or ill themselves. Remote hospitals with TTE but not TOE capability may have limited access to transfer to larger centres due to retrieval and transfer services being impacted by the pandemic as well as lack of beds in the referral centres. Even major centres may have logistical difficulties, for example the anaesthetic support staff are already fully employed with COVID-19 and other ventilated patients. PPE and access to appropriate rooms (preferably negative-pressured rooms) may also be restricted at times.

4. Does my patient *really* need a TOE?

If the indication is bacteraemia (i.e. to exclude IE and abbreviate therapy), the risks versus benefit of TOE must be weighed up.

For brief bacteraemia (< 96 hours) without major risk factors for endocarditis (prosthetic valves, central venous access, intravenous drug use, evidence of vasculitis or embolism, or prior IE), the alternatives to TOE include increased duration of therapy on Hospital in the Home (HITH) (e.g. methicillin-susceptible Staphylococcus aureus (MSSA) bacteraemia), serial TTEs, and use of other imaging modalities such as Cardiac computed tomography (CT) or Magnetic Resonance Imaging (MRI) to especially look for aortic root pathology).

For those in the high-risk categories above, the next question is "how would a TOE affect management". If the patient is NOT a surgical candidate (due to age/ comorbidities etc) then a TOE may not be indicated, and the alternatives above may be used.

If significant pathology is revealed by TTE but the patient is NOT a surgical candidate, end of life discussions, palliative approaches may need to also be considered.

5. Does my patient need a TOE *now*?

Similar rules to the above apply. Most of this group will be routine following cardiothoracic surgery (CTS), or recent IE with changes only visible on TOE. If a patient is clinically stable, alternative imaging approaches may be used or the TOE deferred until it is safe to resume normal clinical activities. If TOE is to guide treatment de-escalation, discussion with an IE Multi-Disciplinary Team (MDT) should be held as to whether alternative imaging modalities or clinical parameters may be used instead to guide the decision, or other alternatives (palatable only in COVID-19 pandemic) such as partial de-escalation (to oral therapy). If TOE is to guide re-operation, the patient's clinical stability, the alternative approaches above, and access to surgery should all be considerations.

Suggested list of urgent surgical criteria includes:

- Acute valvular failure/dehiscence
- Uncontrolled sepsis
- Peri-Prosthetic valve abscess.

It may be inappropriate for the patient to be re-operated on in a different CTS centre due to their complex pathology, and CTS may not be possible at short notice in their own centre due to access to ICU, or access to appropriate surgeon. Intra-operative TOE is also an alternative in this setting if surgery can proceed.

If management requires transfer of the patient with IE to a cardiothoracic centre for definitive intervention based on clinical and TTE findings, then preference should be given to performing the TOE at a single centre only, which is usually at the receiving tertiary referral site where surgery is offered.

6. Alternatives to TOE.

Serial TTEs – TTE has very good sensitivity for native valvular abnormalities. An additional advantage is they may also be performed in off-site clinics, reducing risk to patient of contracting COVID-19 by visiting a COVID-19 hospital for their investigations.

Cardiac CT or MRI – The sensitivity of these imaging modalities are good for abscesses. Like TTE, these scans can be performed at sites with low COVID-19 prevalence.

Fluorodeoxyglucose (FDG)-positron emission tomography (PET) (FDG-PET) scan – When combined with TTE. FDP PET may be appropriate for Q fever patients. If patient clinically stable on therapy, FDP PET may allow TOE to be delayed until usual clinical services resume.

Intra-operative TOE – For surgical candidates who are clinically unstable. The TOE can be performed whilst intubated for surgery.

7. Benefit of MDTs for triaging TOEs in COVID-19 pandemic.

Sometimes the situation is not-clear cut and would benefit from a discussion with various viewpoints presented. Up-To-Date have some recommendations to help with decision making (see appendix 2).

Also, as “conventional protocols” will not be followed for reasons above, there will be a potential risk of increased adverse outcomes. A team decision on whether a TOE proceeds or not would hopefully maintain consistency, improve consensus, and reassure families and patients of the clinician’s professionalism if their outcome is unsatisfactory. Clear documentation of these meetings may also aid future decision making, and outcomes should be monitored.

These MDTs as a minimum should include members of the TOE procedure team (cardiologist and anaesthetist), infectious diseases physician/microbiologist, cardiothoracic-surgeon, and member of treating team (if not covered by above).

8. Performing a TOE during COVID-19 pandemic.

a) Risk stratify the patient. This should be done at the time TOE is first considered, and again immediately prior to TOE. Risk stratification should include the use of a risk assessment questionnaire (see appendix 1).

b) Environment. The use of a Negative pressured room is optimal. The ability to restrict access to room and clear signage that entry is prohibited due to a procedure in progress. Allow several air-exchanges between patients (see appendix 3 for details). The use of plastic covers etc over keyboards can minimise the risk of contact cross contamination.

c) Staffing. Keep staff to a minimum (maximum cardiologist, anaesthetist, and anaesthetic technician in room only). Cardiologist may consider assistant to acquire images on machine to limit contamination and reduce procedural exposure time. No students/trainees/observers to be in room. A scout outside may be helpful if extra equipment needs to be obtained. This scout could also observe donning/doffing of PPE and help regulate movement into and out of the procedure environment.

d) If the patient has confirmed COVID-19 status, considerations of staffing may involve changing “high risk staff “(advanced age, comorbidities) with “low risk staff” (which may include the ‘immune’). In these patients an MDT should decide whether or when procedure is performed. Keep procedure time to a minimum (targeted procedure, capture images only, with measurements/report to follow when patient has vacated room).

e) Personal Protective Equipment (PPE):
   - If the patient has no identified risks for COVID-19, and negligible local community transmission, N95s are arguably not necessary; both to preserve PPE and reduced encumbrance of clinicians. This will be dependent on local protocols. If your jurisdiction decrees that N95s are not necessary for this group, a normal surgical mask, face-shield, long-sleeve impermeable gown, and gloves are still necessary for the core staff. Scout personal do not need PPE (apart from surgical mask) if remains outside room.
   - If the patient has identified risks for COVID-19, or in the setting of local community transmission, we recommend N95 mask (instead of surgical mask) and head-covers for all staff in room in addition to the low-risk PPE.

f) Importantly, we recommend following Queensland Health guidelines for the donning and doffing of PPE to minimise the potential of self-contamination: https://www.health.qld.gov.au/ data/assets/pdf_file/0035/945755/covid19-correct-use-ppe.pdf.

g) After the procedure: The room should not be used again until enough air exchanges have occurred to remove 99% of airborne contaminants (see appendix 3 for estimates). This time can be used for image interpretation and report writing outside of the room. We suggest cleaning surfaces with cleaning products as directed by local cleaning procedures. For device cleaning we suggest following manufacturer’s instructions.

9. Summary.

During the COVID-19 pandemic, the need for TOEs should be dependent on clinical urgency and most importantly, how will it impact the patient's management. An MDT decision may be made on if a TOE proceeds, when it proceeds (can it be safely delayed) and possible alternative imaging technologies. TTE imaging is preferred wherever possible in conjunction with astute clinical judgement to guide the decision making. The importance of this approach cannot be understated. Supplemental imaging with cardiac CT/MRI should be considered where TTE findings are suboptimal and peri-annular extension (e.g. abscess) is considered; especially when likely to impact on patient management.

10. Acknowledgments.

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11. References.

CSANZ Imaging Council Position Statement on Echocardiography Services During COVID-19 Pandemic. V1. March 30, 2020.

ASE Statement on Protection of Patients and Echocardiography Service Providers During the 2019 Novel Coronavirus Outbreak. April 1, 2020 version.

https://www.onlinejase.com/article/S0894-7317(20)30209-1/fulltext

CDC guidelines on air changes/hour (ACH) and time required for Airborne Contaminant Removal.

https://www.cdc.gov/infectioncontrol/guidelines/environmental/appendix/air.html

ANZCA statement on personal protection equipment during the SARS-CoV-2 pandemic (9 April 2020).

http://www.anzca.edu.au/documents/anzca-covid-ppe-statement-v24-09042020-(1).pdf

Up to Date COVID-19 recommendations.

https://www.uptodate.com/home

QLD Health Safe fitting and removal of personal protective equipment (PPE) for healthcare staff PDF

https://www.health.qld.gov.au/_data/assets/pdf_file/0035/945755/covid19-correct-use-ppe.pdf

12. Appendix 1: Pre-TOE patient questionnaire.

1. Have you been in contact with a confirmed COVID-19 case? If yes, what was the nature of contact and over what time frame (note: incubation period up to 14 days).

2. Have you travelled ANYWHERE in the past 14 days? This includes ***any*** commercial flights or cruise ships (where and date).

3. What is your occupation?

4. Have you been to any gatherings in past 14 days? (e.g. birthdays, sporting events) Estimated dates/duration/number people.

5. Have you been in contact with multiple people in past 14 days? (e.g. charity work, meals on wheels etc) estimated dates and number people.

6. Have you had within the past 14 days:

    - Fever
    - Cough
    - muscle aches or pains,
    - chest pains,
    - shortness of breath,
    - sore throat,
    - loss of smell,
    - runny nose,
    - loss of taste,
    - loss of appetite,
    - loss of energy,
    - diarrhoea or vomiting.

    (if yes, approximate dates)

7. Have you ever been tested for COVID-19 (circumstances and approximate date)?

If any concerns regarding the above, we suggest contacting your local infectious disease service to discuss before proceeding.

14. Appendix 2: Abridged Up To Date suggestions on TOE during COVID-19 pandemic.

Up-To-Date states it may be reasonable to forgo TOE for circumstances in which all the following conditions are met:

- Nosocomial or healthcare associated acquisition of bacteraemia
- No permanent cardiac device
- No haemodialysis dependence
- No clinical signs of endocarditis or secondary foci of infection
- Removable focus of infection removed promptly, if present
- Defervescence within 72 hours of initial positive blood culture.

If above conditions are not all met, UTD recommends “workforce limitations are likely to require consideration on a case by case basis according to circumstances at the time”.

15. Appendix 3. CDC guidelines on air changes/hour (ACH) and time required for Airborne Contaminant Removal.

Table B.1. Air changes/hour (ACH) and time required for airborne-contaminant removal by efficiency

The number of air changes per hour and time and efficiency.		
ACH § ¶	**Time (mins.) required for removal 99% efficiency**	**Time (mins.) required for removal 99.9% efficiency**
2	138	207
4	69	104
6+	46	69
8	35	52
10+	28	41
12+	23	35
15+	18	28
20	14	21
50	6	8

+ Denotes frequently cited ACH for patient-care areas.

§ Values were derived from the formula:

t2 – t1 = – [ln (C2 / C1) / (Q / V)] X 60, with t1 = 0

where

t1 = initial timepoint in minutes
t2 = final timepoint in minutes
C1 = initial concentration of contaminant
C2 = final concentration of contaminant
C2 / C1 = 1 – (removal efficiency / 100)
Q = air flow rate in cubic feet/hour
V = room volume in cubic feet
Q / V = ACH

¶ Values apply to an empty room with no aerosol-generating source. With a person present and generating aerosol, this table would not apply. Other equations are available that include a constant generating source. However, certain diseases (e.g., infectious tuberculosis) are not likely to be aerosolized at a constant rate. The times given assume perfect mixing of the air within the space (i.e., mixing factor = 1). However, perfect mixing usually does not occur. Removal times will be longer in rooms or areas with imperfect mixing or air stagnation.[213] Caution should be exercised in using this table in such situations. For booths or other local ventilation enclosures, manufacturers' instructions should be consulted.

ANZCA (9 April 2020) suggests 3-5 room air changes on completion on AGP.

16. Appendix 4: COVID-19 testing in echocardiography.

Our view is that all testing should be discussed with an infectious diseases' physician or microbiologist, as the clinical utility may be poor except in certain settings.

Current COVID-19 testing is limited to molecular testing on platforms such as COBAS.

The turn-around time (TAT) for tests is generally at least 6 hours from receipt in the laboratory. *In reality, the true TAT due to request backlog and transport time to lab may be several days.* A negative result may not necessarily reflect patient is non-infectious (test not 100% sensitive, and patient may not have been infectious at time of testing but is by the time of procedure due to the TAT).

If the patient is a confirmed positive, they are viewed as infectious until either (1) symptoms are resolved and they have at least one negative convalescent swab or (2) mild symptoms persisting but have had 2 negative convalescent swabs. For confirmed patients this may be a consideration in the timing of the procedure if the procedure is necessary but can be delayed.