Mycobacterium chimaera and cardiac surgery: information for clinicians

This information is intended to provide clinical advice to medical practitioners caring for patients who have undergone open cardiac surgery involving cardiopulmonary bypass, regarding potential infection from non-tuberculous mycobacteria (NTM) acquired during surgery performed between July 2011 and July 2016.

Also refer to the Australian Commission on Safety and Quality in Health Care (ACSQHC) National Infection Control Guidance: Non-tuberculous Mycobacterium infections associated with heater-cooler devices.

Background

Since first noted several years ago in Switzerland[1], there have been several clusters of *Mycobacterium chimaera* infections (predominantly prosthetic valve endocarditis) reported from multiple countries in Europe and the United States of America. *M. chimaera* is an uncommon cause of NTM infection in Australia. It is a member of the *Mycobacterium avium* complex (MAC) complex and not routinely identified to species level.

Heater-cooler devices (HCD) are used to regulate temperature of the blood during cardiopulmonary bypass. There is no direct contact between the patient's blood and the fluid contained in the water reservoir within the HCDs. The infection transmission route appears to be linked to biofilm that develops inside the HCD water reservoir, allowing growth of NTM such as *M. chimaera*[2]. The microorganisms are thought to potentially contaminate the operative suite via the airborne particularly via aerosolisation by the HCD fan. This is due to a combination of issues including some aspects of the design and manufacture of the HCDs[3].

As at 31 March 2023, all patient infections with *M. chimaera* reported to the Therapeutic Goods Administration (TGA) have been associated with HCDs from only one manufacturer (LivaNova, formerly called Sorin, Germany). In South Australia, the LivaNova Stöckert 3T HCDs have been used at Flinders Medical Centre, Flinders Private Hospital, and Ashford Hospital.

The TGA issued a Recall Notice regarding this device in June 2015 and a Medical Devices Safety Update[4] was issued in May 2016 updating the information and listing recommended actions that hospitals should take. Further updates have been issued with the latest update in January 2023 confirming 11 cases of *M. chimaera* infection in Australian patients that were potentially linked to a contaminated unit[4]. NTM is a notifiable disease and as at 31st March 2023 no cases have been reported in South Australia.

The Australian Commission for Safety and Quality in Health Care has recently issued updated national infection control advice on this issue[5].

Risk assessment

Information indicates that the infections are almost always associated with surgery involving some form of prosthetic implant (e.g. heart valves or aortic grafts)

suggesting that the organism forms a biofilm on prosthetic surfaces. Patients who have had coronary bypass grafting, transplantation, or other cardiac procedures without any prosthetic implants are likely at an extremely low risk of NTM infection from HCDs.

The time to diagnosis can be several years following exposure to this organism as the incubation period for infection can be up to twelve years[8], although median time to symptoms is approximately 18 months. Reported manifestations of *M chimaera* infection associated with HCD exposure include prosthetic valve endocarditis, prosthetic vascular graft infection, sternal wound infection, mediastinitis, and disseminated infection including embolic and immunologic manifestations.

The risk of *M. chimaera* infection in patients undergoing open-heart surgery has been estimated as 0.4-16 per 10,000 patient-years[4].

This guidance applies to people potentially exposed to *M. chimaera* via LivaNova Stöckert 3T HCDs during open heart surgery between July 2011 and July 2016. In South Australia these devices were used between July 2011 and July 2016 at Flinders Medical Centre, Flinders Private Hospital and Ashford Private Hospital. No other hospitals in South Australia have used the implicated brand of HCD. There is no paediatric open-heart surgery performed in South Australia.

Melbourne's Royal Children's Hospital do not use this brand of heater-cooler unit. Persons who have had surgery using the implicated brand of HCD interstate or overseas may be at risk.

SA Health actions

SA Health issued a Safety Notice to all SA Health and private hospitals that undertake cardiac surgery in July 2016 requiring all HCDs to be tested and to ensure that the mitigation strategies recommended by the TGA have been actioned.

Patient assessment

Initial assessment

Every effort should be made by medical practitioner(s) to perform an initial patient assessment prior to referral to an infectious diseases physician if indicated.

Clinicians should be vigilant for non-specific signs and symptoms of *M. chimaera* infection which may include one or a combination of the following, occurring for two weeks or more:

- unexplained fevers
- unexplained weight loss
- increasing shortness of breath
- night sweats
- joint or muscular pain
- nausea, vomiting or abdominal pains
- malaise (note: fevers or night sweats or weight loss should also be present if malaise)
- pain, redness, heat or pus around the surgical site.

Consideration should also be given as appropriate to more common potential diagnoses in patients with these symptoms. For example, conventional blood

cultures should be taken where there is concern for bacterial endocarditis (non-*M. chimaera*) which occurs at a rate of 1-3% in the first year after surgery and 3-6% after five years.

Patient assessment for *M. chimaera* infection

Diagnosis of prosthetic valve endocarditis or disseminated infection due to *M. chimaera* is based on:

- detailed patient history
- physical examination – including for signs of valvular pathology, and peripheral findings of infective endocarditis such as splenomegaly and retinal involvement
- routine blood tests: full blood count, biochemistry, C reactive protein (CRP); disseminated NTM infections should be considered in the symptomatic patient with unexplained anaemia, thrombocytopaenia, pancytopaenia or unexplained elevated liver function tests
- imaging studies based on signs and symptoms
- echocardiography including transoesophageal echocardiography
- microbiological studies on blood, and on tissue biopsies as indicated, to confirm the presence of *M. chimaera*

Microbiological studies on blood and tissues to evaluate for the presence of *M. chimaera* should only be ordered by (or on advice from) an infectious diseases physician or consultant microbiologist. When culture is recommended, two Myco/F lytic blood culture bottles should be collected on separate days.

Only patients who have signs and symptoms consistent with prosthetic valve endocarditis or a disseminated infection syndrome such as pyrexia of unknown origin should be investigated.

For a symptomatic patient with a prolonged period of unexplained illness of two weeks or more despite routine work-up, strongly consider referring the patient to their treating cardiac surgeon and/or an infectious disease physician.

There is no indication to investigate asymptomatic patients for possible systemic NTM infection. There is no recommended screening laboratory test, culture or imaging modality for the asymptomatic patient.

Patient treatment

Treatment for NTM infection requires prolonged combination antibiotic therapy based on sensitivity testing and should be prescribed by an infectious diseases specialist.

The optimal duration of therapy is unknown, but 12 months is commonly cited.

In cases reported overseas, revision cardiac valve surgery is commonly required.

There is no antimicrobial prophylaxis treatment for the potentially exposed patient. In this instance, antimicrobial prophylaxis could promote resistance if subclinical disease is already present.

Patient referrals and notification

It is strongly recommended that an infectious diseases physician be consulted prior to requesting specialised tests for mycobacteria especially as laboratory capacity to provide such testing is very limited. Long term management requires an interdisciplinary approach and is best managed and co-ordinated by an infectious diseases physician experienced in the treatment of mycobacterial diseases.

All patient cases of *M. chimaera* or other mycobacteria are notifiable under the *South Australian Public Health Act 2011*.

References

1. Sax H, Bloemberg G, Hasse B, Sommerstein R, *et al.* Prolonged outbreak of *Mycobacterium chimaera* infection after open-chest heart surgery. Clinical Infectious Diseases. 2015;61(1):67-75.
2. Haller S, Holler C, Jacobshagen A, *et al*. Contamination during production of heater-cooler units by *Mycobacterium chimaera* potential for invasive cardiovascular infections: results of an outbreak investigation in Germany, April 2015 to February 2016.Euro Surveillance. 2016;21(17).
3. Sommerstein R, Ruegg C, Kohler P, *et al*. Transmission of *Mycobacterium chimaera* from heater-cooler units during cardiac surgery despite an ultraclean air ventilation system. Emerging Infectious Diseases. 2016; 22(6).
4. Therapeutic Goods Administration: Infections associated with heater-cooler devices.
5. ACSQHC National Infection Control Guidance: Non-tuberculous Mycobacterium infections associated with heater-cooler devices, 2022.
6. Public Health England. Infections associated with heater cooler units used in cardiopulmonary bypass and ECMO: information for healthcare providers in the UK: V.2 January 2017.
7. Sommerstein R, Hasse B, Marschall J, *et al*. Global health estimate of invasive *Mycobacterium chimaera* infections associated with Health-cooler devices in cardiac surgery. Emerging Infectious Diseases. 2018; 24(3).
8. Vendramin et al. Longest incubation period of Mycobacterium chimaera infection after cardiac surgery. Eur J Cardiothorac Surg. (2021).

For more information

Communicable Disease Control Branch
11 Hindmarsh Square
Adelaide SA 5000
www.sahealth.sa.gov.au/infectionprevention

Version 2.3 (May 2023)