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Pro-Con Debate

Pro con debates in clinical medicine infection prevention and control in cystic fibrosis: One size fits all? The argument in favour

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The reader will come to:

- Appreciate that infection control measures in cystic fibrosis are based on theoretical benefit rather than proven efficacy.
- Understand that to be successful, infection control measures need to be simple, universally applied and acceptable.

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ABSTRACT

This article advocates for a universal approach to infection control measures in cystic fibrosis. The central tenets of infection control include hand hygiene, contact precautions, regular microbiological surveillance and adopting inpatient, outpatient, domestic and social practices to minimise acquisition of common CF pathogens. Infection control measures should be proactive and prospective, assuming all patients harbour aggressive pathogens, and not relying on past culture results. The challenges of implementing these policies include cost, equipment, education, consistency, meticulousness all whilst balancing additional procedures to a busy clinical workload.

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Recurrent pulmonary exacerbations mediate the progressive decline in lung function and shortened survival observed in cystic fibrosis (CF) [1,2]. Infection control is central in mitigating the predisposition to infection posed by CF. A comprehensive evidence based guideline addressing infection prevention and control was first commissioned by the Cystic Fibrosis foundation in 2003 with a subsequent update published in 2014 [3]. Following the 2013 revised guidelines the most adopted measures were contact precautions and universal mask use by all CF patients [4]. Mask use by all CF patients and widening the distance from 3 feet to 6 feet represented a major shift in practice but gathered favour with many centres adopting and enforcing this recommendation [5].

More poignantly, in a world in the grips of the COVID-19 pandemic, few would raise any concerns if this suggestion were introduced today. Perceptions and acceptance change with time and circumstances, even in the absence of evidence from randomised controlled trials.

The approach to infection control in patients with cystic fibrosis is wide ranging and extends into all spheres of life. These intrusive and impersonal measures influence nearly all interactions a patient has within their community and environment. The motivations for adopting such measures are the prevention of new pathogen acquisition and colonisation, and the preservation of lung function and general health.

In the following article we aim to demonstrate that a uniform approach to infection control, i.e. a one size fits all approach, is preferable. We make the case that infection control practices should be pathogen rather than patient orientated, and proactive rather than reactive. We demonstrate that once patients and their families are understanding of our aims, they are accepting of these pervasive strategies and finally conclude that ultimately the universal approach is a standard to aspire to but ultimately impossible to reach.

PATHOGEN NOT PATIENT BASED

Pulmonary exacerbations are mostly caused by specific bacterial pathogens associated with CF. Specifically; *Staphylococcus aur-*

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us, *Haemophilus influenzae*, *Pseudomonas aeruginosa*, *Burkholderia cepacia* and more recently Non-tuberculous mycobacterium (NTM) [6].

Infection control measures are directed against specific CF pathogens as well as other respiratory and nosocomial infectious agents. It is the pathogen rather than the patient characteristics that determine our practice, therefore the approach to all patients should be consistent.

Key aspects of infection control practices [3]:

- Hand hygiene:

This is the most important practice in preventing direct (person-person) and indirect (contaminated object infects another person) pathogen transmission [7]. This should be implemented before and after all patient contacts and when respiratory secretions contaminate the hands. For health care workers (HCW), it is independent of the need for wearing gloves. Additional components of hand hygiene recommend against the use of artificial finger nails and good skin care [3].

- Standard precautions (effective for NTM, *P. aeruginosa* and *S. aureus* (non-multidrug resistant)):

Outpatient: barrier precautions (gown and gloves) only for HCW when performing aerosol generating procedures (eg. chest physiotherapy, sputum sampling, spirometry), patients to wear a surgical mask in healthcare settings, minimised patient waiting times in common CF waiting areas.

Inpatient: no room sharing or common facilities with other CF patients (unless of the same household),

Social: recommended patients with CF are at least 2 m apart, people with CF should not meet in person. Recommendations for children attending the same school to avoid contact or the sharing of facilities. Avoid activities associated prolonged exposures to dust/soil/animal faeces/still water bodies including spas.

Respiratory equipment handling: require appropriate cleaning and disinfection according to recommendations.

- Contact Precautions (effective for MRSA, *B. cepacia* complex, Multidrug resistant *P. aeruginosa*, *Stenotrophomonas maltophilia*):

Hand hygiene, HCW don both gloves and gown on room entry, appropriate environmental cleaning and disinfection.

- **Other Precautions:** Droplet precautions (Viruses, eg. Influenza, Adenovirus) and airborne precautions for *Mycobacterium tuberculosis*.
- **Surveillance practices:** Respiratory tract cultures should be performed at least quarterly and processed for culture and susceptibility according to CF guidelines.
- **Immunisation:** children should receive routine immunisations and the additional annual influenza vaccination.

Amalgamating contact precautions into routine clinical practice would offer a simple and standardised approach. This would broaden infection control measures to be efficacious for multidrug resistant pathogens both known and emerging. Furthermore, HCW cannot always anticipate potential contact with infectious bodily fluids, acknowledging and adopting routine contact precautions would reduce transmission risk. Specifically, this would mean HCW don gloves and gowns for patient interactions. Potential challenges to implementing routine contact precautions include cost,

availability of personal protective equipment (PPE) and HCW may alter delivery of care because of PPE [8].

PROACTIVE NOT REACTIVE

In CF, from an infection risk, you are only as good as your last sputum! With this in mind, Infection control practices are more effective when applied prospectively.

We propose that culture results should not be used to determine empiric antibiotic treatment or outpatient cohort practices. Culture results are often not available at the time of treatment decisions and perhaps more importantly are not sensitive enough to be reliable. This was shown in a retrospective study of respiratory cultures collected from patients admitted for a pulmonary exacerbation. In this paediatric study of 672 admissions, 17% were negative for typical CF bacteria but showed clinical improvement to empiric treatment [9].

The practice of cohorting outpatient clinics is a deviation from the one size fits all approach. The latest (2013) CF foundation recommendations state there is insufficient evidence for or against routinely segregating patient clinic on the basis of specific pathogens from respiratory tract cultures [3]. Segregation of outpatient clinics remains a common practice in Australia and New Zealand occurring in around 75% of CF centres [10]. Segregation of clinics has been employed along-side other interventions in controlling epidemic pathogen outbreaks in CF populations [11,12]. We advocate against the routine use of this practice, as it introduces false reassurance and may invite complacency to infection control measures. As HCW we must assume all patients have aggressive pathogens and employ our infection control strategies as such. However, we concede that it may be appropriate for segregation to be added to routine measures in the case of pathogen epidemics [13].

The use of antistaphylococcal antibiotic prophylaxis treatment in young children is an example of a uniform approach to infection control. A 2017 Cochrane review reported children receiving empiric antibiotics are less likely to isolate *S. aureus* than those not treated. The clinical benefits of this approach are uncertain. Importantly this review reported no association between the use of prophylaxis and earlier acquisition of *P. aeruginosa* [14]. Further studies underway on the efficacy of early staphylococcal prophylaxis will be informative.

THE IMPORTANCE OF BEING EARNEST

Healthcare associated infections are caused primarily by inadequate adherence to infection prevention practices [15]. For infection control practices to be effective all stakeholders adherence needs to be meticulous and consistent. A consistent approach to these practices should be modelled and taught to patients and staff. Inconsistent use of PPE by HCW has been reported as a source of confusion and anxiety to patients [16].

An understanding of these comprehensive measures requires appropriate delivery of education, with consistent messages to HCW, patients and families. Studies have identified this to be an area for improvement. In a U.S survey of 17 clinics with nearly 1400 respondents, 65% of patients were aware of the CF infection control guidelines and 30% had discussed them more than once with their care team. More than one discussion was associated with increased knowledge of pathogen transmission routes and an increased confidence and belief in practicing infection control measures [17]. Another survey of children and their carers reported 40% of patients did not feel they could get sick from physical contact with another CF patient and nearly 80% of patients

were only compliant with recommendations because they had not had the opportunity to make a friend with CF [18]. Infection control restrictions may be more efficacious if the social needs of CF patients can be met in other ways, with the expanding area of digital social media particularly suited to this patient group [19].

Education is similarly important to health care workers and needs to be delivered broadly across the multidisciplinary team. Surveys of HCWs have identified difficulty accessing guidelines and low confidence in self efficacy as barriers to infection control adherence [20]. A study from a paediatric CF clinic in Chicago demonstrated the efficacy of applying a singular approach to infection control. The clinic implemented contact precautions (mask, gown, gloves) for all HCW and provided education to families (mask, hand hygiene and immediate rooming without a communal waiting area). These measures were associated with significant reductions in positive culture rates of *P. aeruginosa* (30% to 21%, $p < 0.0001$) and MRSA (10.8% to 8.7%, $p = 0.008$) [21]. Supporting HCW with education and initiatives to promote infection control is associated with greater accountability and ownership of infection control compliance [22].

STRIVING FOR EXCELLENCE

Good infection control practice is reliant on personal choices, the zero tolerance policy aimed at HCW with hand hygiene has fallen well short of 100% compliance [23]. The design of effective infection control practice needs to better understand real world constraints including clinic spaces, the number of patients managed by a clinic and access to personal protective equipment. These factors may contribute to clinics not meeting infection control practices as reflected by 25% of Australian CF clinics using mixed waiting areas and mask wearing implemented by around 70% of CF patients [10]. When clinical staff are overstretched infection control measures are compromised [24]. Furthermore there is evidence that doctors, as a group, are consistently less compliant than nurses and at times model contempt and indifference to the recommendations [24,25]. Surveys of children and their families suggest the majority of parents and patients support infection control measures when the rationale is explained [26].

REAL WORLD PRACTICALITIES OF UNIVERSAL INFECTION MITIGATION PRACTICES

There are always barriers to the implementation of universal infection mitigation practices. Cost is the main adversary and as clinicians we have a responsibility to be practical to the health care system. We strive for protective, practical and achievable strategies able to function within the real world of health care delivery. Utilising single rooms in the outpatient setting, the wearing of gowns, gloves and masks by HCW and masks by patients are simple and efficacious strategies for reducing cross-infection [4,10]. These measures are readily understood with appropriate education [17] and overall the cost savings more than compensate the positive costs of implementation [27]. More sophisticated issues such as the higher cycling of air in clinic and inpatient rooms may be aspirational and less important, even when studied in more detail, if cheaper routine measures are universally undertaken.

For infection mitigation practices, a practical universal strategy should be embraced. The message must be simple, safe and serviceable for it to be accepted by HCW and people and families living with CF.

DIRECTIONS FOR FUTURE RESEARCH

- Provide evidence for or against simple measures such as masks, gowns and gloves as the centrepiece of infection prevention.
- Justify the role of highly expensive frequent air cycling in clinical rooms.

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