As professionals working in the Veterinary Sector -
What should the Science and Experiences of Covid have taught us?

Part 1

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Covid has focused many minds on infection control, biosecurity, zoonosis and nosocomial infections, which is undoubtedly good. If anything positive can come from the pandemic, perhaps it might act as a ‘light bulb moment’, just as cleanliness was to Florence Nightingale so many years ago, as well as in teaching us all some valuable and uncomfortable home truths. Covid was not the first, nor will it be the last global pandemic. All of us in health care sectors have a duty of care to patients, staff and populations alike to undertake basic infection control procedures. As references demonstrate, we cannot rely on human cleaning and disinfection in busy clinical settings. We must use methods and techniques that can run simultaneously with ‘on-going clinical activities’, that are proven safe (for patients, staff and the environment) and appropriate (to national or international standards) to match the requirements of that specific clinical setting. We must test and measure outcomes and record and investigate nosocomial and zoonotic incidents. We must continue to learn and improve.

COVID

Now that it seems most likely that the infection was derived from bats in a ‘wet market’ in Wuhan, China (Haider et al. 2020), we are reminded that differing inpatients and out-patients each carry a variable endemic contagion risk to our facilities, staff and other patients (Wright et al. 2008). Patients should be assessed and managed on a contagion and infection risk control basis at all stages of their journey through our facility.

Covid is not the first, nor will it be the last zoonotic pandemic infection. Scientists estimate that more than 60% of known infectious diseases can be spread from animals, and 75% of new or emerging infectious diseases in people come from animals. They can be distributed in several ways, including direct or indirect contact, vector-borne, foodborne or waterborne (MSD 2021).

Covid has been a timely reminder that in these days of globalisation, high population densities and frequent international travel, infection and contagion control must be considered in a global sense, in which the weakest link in the chain creates the most significant risk.

As veterinarians – clinicians, and business owners, we have a duty to our clients and businesses to maintain effective control of contagious infections both those we know about now, as well as those that are unknown). Such infections are not only a danger to our clients, patients, staff and business, but sick animals are accepted to be the source of 75% of new emerging infectious diseases in humans (MSD 2021).

Whilst we have all been focusing on Covid-19, Laximinarayanan (2022) reminds us of the ‘forgotten pandemic of anti-microbial infection’. Laximinarayanan quotes Murray (2022) in estimating 1.27 million human deaths globally due to Anti-Microbial Resistance in 2019, a figure which is almost identical to the combined global deaths over the same period caused by HIV and Malaria, whilst WHO figures (November 2019 to January 2022) for Covid-19 are four times higher, all be it over a more extended period.

ANTI-MICROBIAL RESISTANCE (AMR)

Despite all the hype of the last five years, the recent Lancet publication (Laximinarayanan 2022) demonstrates clearly that AMR is a silent pandemic. It is killing more people than Malaria or AIDS. It is close to Covid-19, so despite the infection control measures thrust upon us by the experience of Covid, we are still failing to meet the challenges of infection control and hence as a spin-off, of the AMR pandemic. The responsible use of antibiotics is essential, but more importantly, we must continue the drive to reduce the requirement for antibiotics by improving animal husbandry (particularly in food-producing species). It can only be achieved by improved biosecurity and infection control, improved standard operating procedures, better cleaning, disinfection and the monitoring of the infection control outcomes.

Whilst we have all been excited and focused on Covid, we are reminded that in recent years the incidence of nosocomial infections in humans after hospital visits was outed as a scandal (Boyle 2016). However, the incidence in human hospitals has been drastically reduced by applying an ‘effective disinfectant’ delivered in an aerosolised form (fogging).

Gebel et al. (2013) confirmed the role of contaminated surfaces in transmitting pathogenic microorganisms causing healthcare-acquired infections.

White et al. (2007) demonstrated that detergent cleaning reduces the bacterial load by 80% from surfaces. Disinfectant cleaning does not generally maintain a surface pathogen free for any longer than detergent alone (Dharan et al./1999), whilst a ‘two-stage cleaning’, with detergent removal of biofilm, followed by disinfectant treatment achieved the best results overall. Moreover, laboratory evidence suggests that biocides used at a sub-lethal concentration may trigger the expression of biocide resistance and/or select bacteria resistant to antibiotics (Maillard & Denyer 2009, Karatzas et al. 2008). In light of this, biocides are not recommended for use in situations where environmental conditions will compromise their efficacy, i.e. where excessive organic material remains present, as the cleaning has not been undertaken before disinfection. Unannounced cleanliness audits in human hospitals using bacterial swab culture (Anderson et al. 2011) showed 86.8% hygiene failure, whilst using adenine triphosphate (ATP) testing (a much quicker system with results being made available immediately ‘patient side’ yielded hygiene failures of 84% (Schabrun & Chipchase 2006). Post-cleaning hygiene monitoring using fluorescent markers, ATP or microbiological testing has proven valuable in improving cleaning efficacy (Carling et al. 2016), Dancer (2012) demonstrated that simple infection control procedures are abandoned, ignored, or forgotten when staff are overworked in demanding clinical situations. Indeed, all hygienic practices are consistently challenged in a busy ward. For this reason, using fogging with effective anti-microbial solutions is beneficial. However, no one should ignore the need for the regular use of detergents to remove organic material before disinfection. Byrns and Fuller (2011) trialled various methods of aerolisation of biocides for sterilising spaces in buildings. Where effective biocidal agents were applied, they reported high levels of efficacy, particularly noting the benefit of reaching and penetrating areas that would not otherwise be sanitised. However, the technique is not universally recommended unless the agent is safe for staff and patients or in situations where the facility can be emptied before application. Many fogging agents can only be used when clinical areas are empty of patients and staff, which inevitably limits their application, especially in facilities with multiple patients that are rarely empty. In contrast, optimal efficacy is achieved when fogging is done using effective agents that can safely be used with either patients or staff in situ. However, few anti-microbial solutions meet these exacting requirements (effectiveness and safety).

Some disinfectant compounds comprising of a surfactant plus an anti-microbial substance, such as quaternary ammonium compounds (QAC) (of which there are now six generations, with sequential advances just as seen in penicillins or cephalosporins), are designed to minimise bacterial contamination of surfaces by maintaining their anti-microbial activity on surfaces for weeks or months. These compounds’ ability to prevent surface contamination for prolonged periods is unclear. Two studies have reported persistent anti-microbial activity of varying levels for differing periods (Baxa et al., 2011, Tamimi et al. 2014). Further evaluation of organosilane-type compounds using a variety of application methods appears warranted. Polyhexamethylene biguanide disinfectant was
found to reduce bacterial levels on surfaces for at least 24 h after application in one study. It is noteworthy that both the surfactant plus QAC and the polyhexamethylene biguanide technologies are already included in at least one readily available veterinary disinfectant (F10. Health and Hygiene). Disinfectant application techniques, either by using aerosolisation (fogging) or applying some disinfectants with a microfiber cloth, are demonstrated to have marked advantages over the cotton-based fabric. QACs can bind to cotton fabric, limiting disinfection availability (Engelbrecht et al. 2013). It should be remembered that just as antibiotics (e.g. penicillin and cephalosporins) are available in ‘generations’, so are many disinfectants. Categorisation and consideration of the efficacy and safety of a disinfectant product should not be based simply on the class of constituent chemical but rather on external certification by a government-approved laboratory, in respect of its patient and user safety, its efficacy (against standard pathogen types and models), as well as its environmental residue safety. Users should know what constitutes efficacy based on their geographical area requirements. In the UK, standards require:

- Log\(^{-1}\) kil of bacteria (standard tests, e.g. Staph., Pseudomonas, Mycobacterium, E. Coli)
- Log\(^{-1}\) kil of viruses (standard tests, e.g. FMDV, AI, Parvo, - enveloped and non-enveloped)
- Log\(^{-1}\) kil fungi and yeasts (standard tests, e.g. Aspergillus spp, Trichophyton, Candida)
- Log\(^{-1}\) kil bacterial spores.

Clinicians must be aware of the necessary contact time using their disinfectant under standard operating conditions (i.e. temperature and concentration). They must consider if this is realistic, e.g., spraying a dirty consulting room table and immediate wiping with a dry paper towel before the next patient is ushered in may not be practical or effective.

As busy clinicians always struggle to manage excessive caseloads, the reliance on human staff to complete effective cleaning and disinfection in the clinical workplace has been proven to be flawed. In truth, achieving effective disease control cannot be delegated to over-stretched cleaning and nursing staff, as cleaning and disinfection are simply too important, and the risks and effects of failure are too significant. Facility cleaning protocols must consider the importance of cleaning to include periodic ‘deep cleaning’ with the chemical removal of the lipid surface layer. The frequency of cleaning and deep cleaning must consider the likely contamination challenge and the risk effect of contamination in each clinical setting.

**CONCLUSION**

It is clear that;

1. **Infection Control is more important than ever.**
2. Any disinfectant must have proven efficacy against Covid and all relevant veterinary pathogens.
3. Disinfectant delivery by the fogging method is the most effective delivery form for control of both Covid and all other pathogens which remain pathogenic on any solid surface, although prior detergent cleaning is essential.
4. Fogginess is pointless if the disinfectant used is not efficacious at the concentration recommended.
5. Few veterinary disinfectants have proven efficacy against all relevant pathogens and can be safely delivered by fogging; however, there are exceptions.
6. Cleaning and regularly removing the lipid-surface layer to maintain disinfectant efficacy remains essential.
7. Measuring and monitoring the outcomes of cleaning, disinfection, infection control, and the prevalence of nosocomial infections is essential.

**References:**

As professionals working in the Veterinary Sector - What should the Science and Experiences of Covid have taught us? Part 2

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ABSTRACT

Covid has focused many minds on infection control, biosecurity, zoonosis and nosocomial infections, which is undoubtedly good. If anything positive can come from the pandemic, perhaps it might act as a ‘light bulb moment’, just as cleanliness was to Florence Nightingale so many years ago, as well as in teaching us all some valuable and uncomfortable home truths. Covid was not the first, nor will it be the last global pandemic.

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INTRODUCTION

Now that it seems most likely that the infection was derived from bats in a ‘wet market’ in Wuhan, China (Haider et al. 2020), we are reminded that differing inpatients and out-patients each carry a variable endemic contagion risk to our facilities, staff and other patients (Wright et al. 2008). Patients should be assessed and managed on a contagion and infection risk control basis at all stages of their journey through our facility.

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DISINFECTANT EFFICACY AGAINST COVID AND WHY?

In these challenging times, any disinfectant used in veterinary practice must have proven efficacy against Covid-19 and all common veterinary pathogens relevant to the practice.

Corona is part of a large family of viruses. Some coronaviruses that infect animals can be spread to people and then spread between people, but this is rare. It happened with SARS-CoV-2 (i.e. Covid-19), which likely originated in bats. Such infections may cause cold-like illnesses in people. Others cause disease in certain types of animals, such as cattle, camels, and bats.

The Centre for Disease Control (2021) has shown that many animals worldwide have been infected with COVID-19, including pets like cats and dogs, farmed mink, large cats, gorillas, and otters in zoos, sanctuaries, and aquariums. Reptiles and birds have not been affected by this virus.

The UK Government has reported that Covid can infect a range of animals. Their published advice is as follows:

Animals can catch SARS-CoV-2. It is rare, and they may show only mild clinical signs and recover within a few days. We don’t yet know all of the animals that can get infected. There is evidence that the following species can catch the virus that causes COVID-19:

- big cats
- coatimundis
- domestic cats
- dogs
- ferrets and polecats
- fruit bats
- hyenas
- mink
- primates
- pangolins
- pigs (these are less prone to catching SARS-CoV2)
- raccoon dogs
- rodents, including hamsters
- white-tailed deer

There is growing evidence that mink, cats, white-tailed deer and hamsters can spread the virus through close contact with their species in captivity.

Animal fur can act as a carrier (known as fomite transmission) for the virus that causes COVID-19 for short periods, in the same way as other surfaces.

Limited evidence suggests that COVID-19 can pass:

- from infected humans to the listed animals after close contact or sharing their equipment or airspace; this is referred to as reverse zoonosis; a good case example is described by Koeppel (2022)
- between mink kept in captivity and then transferred to humans in close contact
- between ferrets, raccoon dogs, white-tailed deer and mice infected by experimental testing
- from infected hamsters to humans in close contact
- between ferrets infected by exploratory testing and transfer to humans

Veterinarians must always be aware of the danger of spreading covid by in-hospital and out-patient patients contracting the virus and taking it home. They must reassure and protect pet owners, staff and business owners by doing all possible to reduce the risk of infection by domestic, farm animal or wildlife patients.

In the article above, we have described the need for detergent cleaning of surfaces before disinfection. Likewise, we have highlighted references to the typically poor outcomes achieved when cleaning and disinfection are left in the hands of clinical staff. Still, the aerosolised (fogging) disinfection method (after cleaning) is the infection control method of choice.

FOGGING

Fogging is applying an anti-microbial disinfectant solution (of external, quality controlled government licensed laboratory proven efficacy) which sanitisises large
areas of a building quickly and effectively. It can kill off the virus and other biological agents in the air and on surfaces. The task involves spraying a fine mist from a spray gun which is then left to evaporate. Some fogging solutions require the air space to be cleared by patients and staff and for the operator to wear a chemical suit, gloves, air-fed ventilator, a sealed mask, etc. The product used must be safe on all equipment. The mist is exceptionally fine but is still effective in penetrating all areas to control the virus; this is particularly important when attempting to prevent air-borne infections, e.g. Coronaviruses (including Covid-19), Kennel Cough, Cat Flu, Equine Influenza, Strangles, Psittacine Beak and Feather Disease, Newcastle Disease, Avian Influenza, Mycobacterium, Foot and Mouth Disease, Psittacosis, Distemper, Mycoplasma and many more. After the fogged solution settles on surfaces, rendering them slightly damp, although the aqueous carrier will dry, the chemical ingredients remain on the surface and continue to act. However, the duration will vary from disinfectant to disinfectant.

**FOGGING IN THE VETERINARY ENVIRONMENT**

First, check the efficacy of your disinfectant, and request a copy of the efficacy test certificate. e.g. Microsoft Word - BT-HAH-02 EN14476 Vaccinia Report 03 Sep 20 LM CW (healthandhygiene.co.za)

Foggers can be plug-in electrical, battery-operated electrical, plugged-in compressed air or static compressed air (typically ceiling suspended). Equipment can be staff operated or automated, i.e. to go off at certain times of day/night and to run for a particular duration. Generally, a droplet size of 5-10μ is optimal in achieving a dry mist and dampness to surfaces without creating surface fluid and thereby risk to electrical equipment.

**The pre-requisites for a successful outcome from disinfection by fogging:**

1. The disinfectant must be effective against all ‘pathogens of interest’.
2. The disinfectant should be non-corrosive to metal so that it can be delivered through appropriate fogging equipment.
3. The disinfectant should be safe to use through the fogging method whilst patients and staff remain in or walk through the area being fogged.
4. The disinfectant applied must be effective at the concentration at which the fogger administers it (bear in mind, if a disinfectant is effective against pathogen A when used at 1:250, but is only recommended for use by fogging at 1@2000, then whilst it may be safely used by fogging at that concentration, it is not anticipated to be effective).

Few veterinary disinfectants meet the above criteria; a critical review of the literature will be required to ensure that a safe and effective agent is being used.

**CONCLUSION**

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**References**

7. MSD (2021). Humans, animals and the environment - our health is all connected - MSD.