Difäm Health Community (DHC)

Podcast: Sterilisation

Hello everyone, welcome to today's podcast of the Difaem health community. My name is XXX and with me is my colleague XXX. Today we will continue our IPC series and dive a bit deeper into the topic of sterilization. In our last podcasts we have dealt with cleaning and disinfection, so today it is sterilization. I learned that cleaning is important to remove dirt, soil, potential hazardous materials and much more. Furthermore, it reduces some of the bacteria and viruses in our environment. In addition to cleaning, disinfection reduces microorganisms thoroughly. So what is the deal with sterilization then?

You are right about cleaning and disinfection. Sterilization goes one step further. Sterilization is the process of completely removing or killing all forms of microorganisms on an object, a surface or in a substance. This includes bacteria, viruses, fungi and their spores. The goal of sterilization is to eliminate the risk of infection or contamination, particularly in medical and healthcare settings. Sterilization methods may involve physical or chemical means, such as heat, radiation, or chemical agents, depending on the nature of the item being sterilized and its intended use.

This means that sterilization kills all microorganisms and is therefore an essential component of IPC. Where there is no reservoir, there is no transmission and no infection, right? You mentioned several methods of doing that.

Yes, I did, but there is one kind of sterilization that could be called the gold standard: Of all methods available for sterilization, moist heat in the form of saturated steam under pressure is the most widely used and the most dependable method. Moist heat destroys microorganisms through irreversible coagulation and denaturation of enzymes and structural proteins. Steam sterilization is nontoxic, inexpensive, kills all kinds of pathogens and spores, and quickly heats and permeates fabrics. The basic principle of steam sterilization in an autoclave is to expose each item to direct steam contact at the required temperature and pressure for a specified time.

I know these autoclaves, bigger or smaller metal giants, working with electricity or gas or even fire…

Yes, you are right these are the classical autoclaves. You need sturdy material to keep the pressure of more than one atmosphere. You need the pressure to raise the temperature of the steam to over 100°centigrade or 212 Fahrenheit. To achieve full sterilization, all items must be exposed to the steam that means, normal air has to be removed from the pressure chamber. In the autoclave, steam is admitted at the top or the sides of the sterilizing chamber. Since steam is lighter than air, it forces the air to the bottom of the chamber

where it escapes through the drain vent. Normally this elimination is incomplete. This is the reason why you normally have cycles of at least 45 min. with 121° centigrade or 250 Fahrenheit to make sure the steam really gets to all places and all potential air pockets are filled with steam although the necessary exposure time would only be 10 min. If your autoclave includes a vacuum pump that can remove all air, the exposure time is much shorter and can be reduced to about 3 minutes. As a rule, the higher the temperature, the shorter the duration of sterilization. Generally, autoclaves can be run in a temperature range from 121° to 140° centigrade, which equals 205 to 285 Fahrenheit.

Okay, this sounds like a lot of physics to me. Pressure, time, exposure, temperature; can we move on to something a bit more practical? What I have learned from your explanations is that everything I put in the sterilizer must be exposed to steam. If it is not exposed, it is not sterilized.

Yes, this is right. That is why packing is quite important. First, all containers, bottles etc. must be opened to allow the steam to reach the inside. We should pack in at least two layers but should not wrap and pack to tightly. If we would do that the air may be trapped in air pockets and the steam might not be able to penetrate everywhere. Heavier items should be placed on the bottom of the autoclave, because the heavier an object is, the more condensation will be produced. If you put heavy items on the top, the water drops of the condensate will fall down and you will have wet items after the process is finished. All items that come out wet must be considered non-sterile! If this is the case with your autoclave, check the settings and also reconsider packing. Remember: not too dense and heavy objects at the bottom.

I never knew that sterilization is such a complicated process and that there is so much to it.

Yes, and I was only mentioning a tiny fraction of aspects you must pay attention to. That is why specially trained personnel best do sterilization. Maintenance of the machines should be done regularly and monitoring of the functioning of the autoclaves with the respective indicators and test cycles should be conducted according to schedule. Given the fact that the sterility of instruments can decide over life and death, the hospital management would do well to keep up to date with the procedures at the sterilization department.

Until now, we just talked about steam sterilization, are there other ways of sterilization?

Yes there are. There are delicate instruments that need to be sterilized but are not heat resistant. Moreover, although fluids can be steam sterilized, materials like oil, powders or wood cannot. Therefore, there are other options like gas sterilization with Ethylene Oxide gas, in short ETO gas, hydrogen peroxide or formaldehyde. However, all gas sterilization options are relatively toxic they need special machines and trained personnel to do it. This is why they are not an option at district level. However, they might be available at tertiary or university hospitals.

There is also sterilization with radiation like infrared, microwave, ultraviolet and ionizing radiation which is an option used for specific purposes. Gamma radiation for example is mainly used for sterilization in the production process of medical equipment like artificial heart valves.

Dry heat can be used for sterilization as well. However, just like steam sterilization, this is not suitable for heat sensitive objects. The good thing is, that dry heat is non-toxic and sterilizing cabinets working with dry heat are relatively cheap. However, the sterilization process with dry heat is much longer than with steam. If you work with dry heat at 150° centigrade or 302 Fahrenheit, the exposure time is 150 minutes whereas you need 10 minutes if you use steam at 121° centigrade or 250 Fahrenheit.

Okay, what I take with me from this is that there are several options for sterilization, but the only one really relevant at district level and below is steam sterilization. Steam sterilization is done in autoclaves with temperatures between 121 and 140°. Exposure time varies according to temperature from 10 to 3 minutes. Nevertheless, cycle times are longer, because heating has to be considered and removal of air, so that the stream will have contact with every surface. Packing must not be too tight; you must avoid air pockets and put the heavier objects at the bottom. In addition, we must make sure, that all caps and valves are open, so that the steam can reach also the inside of devices.

Thank you very much, that was quite a nice summary. Having covered the technical aspects of cleaning, disinfection and sterilization, we will go into more detail on the reprocessing of instruments and devices in our next podcast.

I am really looking forward to that. As you know, I am the more practical type. I hope our listeners enjoy this series and will tune in again, when we talk about reprocessing – what to look at and what to take care of for a good contribution to IPC. Until then, stay safe and stay blessed.

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