Guidance on Reducing Risk from Sharps, Needlestick, Bites and other Injuries that Penetrate the Skin

Guidance

1. The risk from penetrating injury

Intact skin provides an important protective function, preventing harmful materials from gaining access to the body. It is largely waterproof, preventing water soluble chemicals from entering. In addition, it provides a highly effective barrier against microbial infection, as there are almost no infectious agents that are able to enter the body via intact skin. Any workplace activity that disrupts the skin is therefore of high concern, as a route for harmful materials to enter the body, and then become distributed systemically, is created.

As far as infectious agents are concerned, a functioning immune system is an important second layer of defence. In part this is achieved by anatomical concentration, in that regions of the body that are inevitably routinely exposed to the infectious agents from the outside world, such as the oral cavity, the lung and the gut, possess pre-existing concentrations of immune system cells. Examples include the tonsils, Peyer's patches etc. Although the inflammation process enables the immune system to mobilise and relocate components to an anatomical site after infection occurs, there are few resident immune system cells present at many superficial locations in the body. This means that a consequence of an injury that penetrates the skin can be to introduce infectious agents to a location where initially the immune response will be very limited.

For this reason work activities where there is the potential for the skin to be penetrated are a particular source of safety concern. This is reflected in accident records, in that Safety Office regularly receives accident reports relating to an event in which skin penetration in some form occurred. Some of the following repeats guidance in other documents relating to specific risks. However, the frequency of accidents and the potential severity of their consequences justifies the production of the current themed document to focus on measures to reduce the level of this risk.

This guidance will focus on strategies to reduce the risk of mechanical injuries, as these are by far the most frequent. It is worth pointing out that contact with some chemicals can also compromise skin barrier function while not mechanically disrupting the skin itself. It is notable that in the build up to the eradication of smallpox in the 1960's and 1970's, some of the last smallpox cases in the UK were medical photographers, who were probably particularly susceptible because of their contact both with sources of the virus and dark room chemicals that impaired their skin barrier (Pallen, 2018).

2. Sources of Risk

The main activities where this risk presents are work with scalpels or other blades, work with syringe needles, and work with animals which can bite or scratch. Risks arise either because the sharp is contaminated with hazardous material, or because a non-infectious sharp creates a wound through which hazardous agents can enter.

Tetanus Risk. In the absence of other factors, tetanus is widely present in the environment. The tetanus bacillus forms spores that can be found in soil and house dust, and in animal and human faeces. The spores remain viable for years in the environment and are resistant to boiling and freezing. The risk only becomes manifest in certain circumstances, such as wounds which penetrate the skin or

contamination of existing wounds. There is a positive association with rusty sharps such as nails or blades, either because the rust provides increased surface area for the spores to occupy or because the iron provides a local anaerobic environment that is supportive. For this reason care needs to be taken with sharps **even in environments where other hazardous agents are unlikely to be present, such as design studios**. Rusty sharps should be disposed of immediately and sharps should be stored in a robust container when not in use. They should be returned to that container when finished with.

3. Controlling the Risk from Sharps

This guidance will firstly consider ways of reducing the likelihood of sharps injuries occurring, and subsequently consider measures to mitigate the consequences of injury once it has occurred. The emphasis must always be on preventing injury from occurring in the first place as this will inevitably be more effective than even the best procedure for dealing with an injury after it occurs. The guidance will consider potential measures according to the hierarchy of controls, as this means that measures are adopted in order of greatest effectiveness.

4. Elimination

The first step is to consider whether the same task can be performed without use of a sharp. If sharps contaminated with hazardous agents are being considered, because of the potential risk the question should be is there absolutely no way to perform the task without using a sharp, even if increased expense or inconvenience is a consequence ? In the context of dissection, anatomy teaching and necropsy wherever possible use a blunt tool such as forceps rather than a sharp. In human anatomy teaching involving dissection, many features can be revealed or examined by pulling apart with forceps rather than cutting.

5. Substitution

If use of a tool is absolutely required, the next step is to consider whether it is possible to substitute a sharp with a safer alternative. If a hollow metal tube is required, for example to break up materials by repeatedly drawing them through it, consider whether a blunt cannula can be used instead of a broad gauge hypodermic needle. If materials need to be cut, can this be achieved using scissors rather than a free blade ? Even better, can blunt ended scissors be used instead of scissors with a pointed tip ? If sterile transfer of liquids is required, can a micropipette tip, with a barrier filter if sterility or product protection is required, be used ? For larger volumes a plastic pipette with integrated bulb can be considered. If scalpels need to be used, it is better to use single use disposable items rather than attempt to remove contaminated sharp blades from a reusable holder.

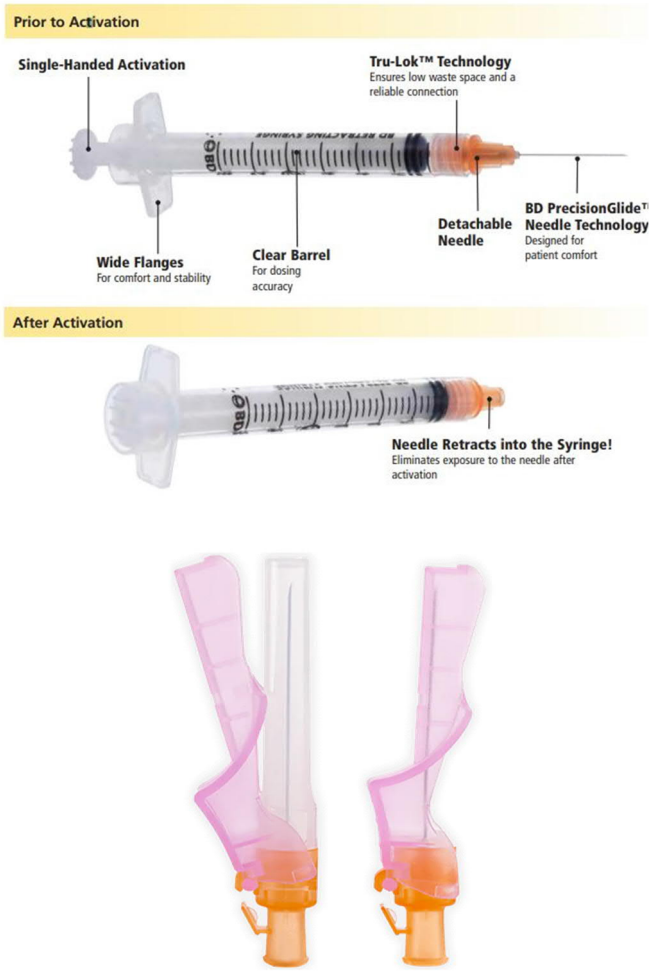
If a substitute for a sharp is used it is important that it achieves an overall reduction in risk; a substitution that reduces the sharp risk but creates another, greater risk as a consequence is futile. If a substitution greatly increases the time required to undertake a procedure or increases the number of times a procedure needs to be attempted then it probably is not leading to an overall reduction in risk. However, if after a period of practice as substitute is found to be a feasible alternative to using a sharp then it should be adopted.

6. Engineering Controls

There will be situations where use of a sharp cannot be avoided, for example where hazardous materials are administered to an animal by injection. It is often possible to use a mechanical device that reduces the chance of sharps injury. One possibility when working with animals is to use a mechanical restrainer, which reduces the likelihood of a needlestick injury when an animal moves. Another possibility is to use chemical restraint, such as anaesthesia, if this is compatible with experimental intentions. Any decision involving changes to procedures involving animals must be subject to approval by CULATR. More generally, the majority of sharps injuries are inflicted on the hand not holding the sharp. Any mechanical device which allows a sharp to be used one handed reduces risk because the other hand can be kept from the area where the area of danger. Pay particular care with microtome or cryostat blades, especially when they are used to cut fresh (unfixed) tissues. Use forceps to remove them.

Devices are available which make injury less likely because the sharp is retracted or can be shielded immediately after use. Examples available in early 2020 can be found here and

here. For sharps contaminated with hazardous material devices of this type should be used unless they are clearly impractical after a period of trial use. It is also important to be familiar with the mechanism of action of these devices



Two examples of syringe needles with safety features available early 2020. Above BD Integra, below BD Eclipse.

before first use with hazardous materials. Some designs will make injury more likely if they are used incorrectly – for example in one design a shield needs to be moved into place by pressing against a resistant surface rather than moved into place with a finger.

7. Procedural Controls

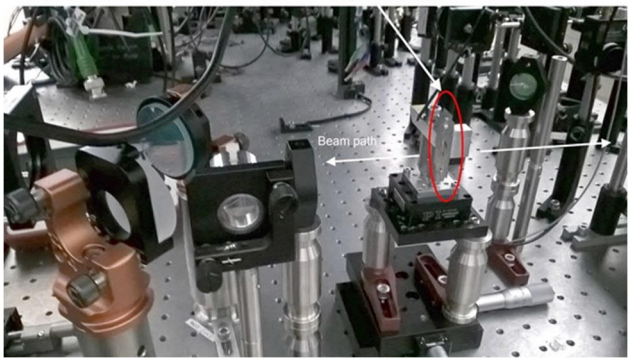
Procedural controls are particularly important for reducing the risk of sharps injury. One of the most important is to **never attempt to resheathe a conventional hypodermic syringe needle** once it has been removed from its plastic case. A very large number of needlestick injuries continue to result from this practice. Although the perception is that this reduces risk, the likelihood of sustaining injury from the act of resheathing greatly outweighs the theoretical benefit of covering the sharp. Do not bend, shear, recap, or remove needles from disposable syringes, or otherwise manipulate by hand before disposal. Do not use needle-cutting devices as they can produce infectious aerosols. Secure access to any areas where contaminated sharps will be used, and grant access only to those personnel trained in the biosafety or chemical safety procedures specific to this area. A practice that does significantly reduce risk is to prepare the area where sharps will be used first, by placing sharps bins so that they are near to hand before work begins. If sharps bins are found to be more than two thirds full they should be sealed and a fresh bin obtained. Work with sharps should not commence until there is a suitable place to dispose of sharps immediately after they are finished with. Do not leave used needles on the table. If it is necessary to use the same sharp on more than one occasion, it should be placed in a robust container between uses. Use a magnet to pick instruments from the table if they become slippery. Do not pass sharp objects such as scalpels or scissors to another person. Place them on the table for another person to pick up, if this is necessary. Carefully place used disposable needles, syringes, scalpels, blades, pipettes, and similar objects into properly labeled leak- and puncture-resistant containers made for disposal.

As well as accidents when attempting to inject them, animals are also a potential source of percutaneous injury when they scratch and bite, as they unavoidably will. For this reason following good practice that reduces the chance that animals become stressed or startled is also important for risk reduction. If animals appear agitated try to identify the cause and resolve it before proceeding. Always try to handle animals in a calm, confident and deliberate way. Be gentle but firm as far as possible. Avoid sudden movements and noises, and if, for reasons outside of your control, something disturbs them, give the animals time to calm down before proceeding.

In some contexts sharps may be used in a visually busy environment with a lot of other items present, where line of sight may be blocked. This can mean that a sharp is present, but it is easy to overlook it. One example is the use of blade edges on optical tables to determine the power profile of a laser source. If this is the

case steps should be taken to avoid accidental contact and cut wounds, for example by protecting all but a small portion of the blade edge that is illuminated.

Figure 1: Typical Optical Table Optical Knife



Example of a crowded environment increasing the risk of inadvertent injury from a sharp

8. Personal Protective Equipment

For much work with sharps manual dexterity is important, so any procedures to increase safety must not make the task more difficult to perform, as new risks can be created. It is rare that the same amount of dexterity is required in both hands, and most injuries are suffered by the opposite hand to the one holding the sharp. If one handed operation cannot be achieved eg. because it is necessary to hold an animal to scruff it for injection, consider whether a cut and puncture resistant glove can be used. Kevlar gloves which give a reasonable level of dexterity can be obtained. If resistance to microbial or chemical penetration is required it may be necessary to combine use of cut and puncture resistant gloves with an inner disposable glove.

Example of a glove providing cut and puncture protection but also a level of dexterity.

9. Action After Skin Penetrating Injury

If you suffer a skin penetrating injury after which the wound may be contaminated:

- Encourage the wound to gently bleed, ideally holding it under running water
- Wash the wound using running water and plenty of soap
- Don't scrub the wound whilst you are washing it
- Don't suck the wound
- Antiseptics and skin washes should not be used - there is no evidence of their efficacy, and their effect on local defenses is unknown. Disinfectant may be used.
- Dry the wound and cover it with a waterproof plaster or dressing
- Seek urgent medical advice as effective prophylaxis (medicines to help fight infection) are available

Further information is available here

10. Concluding Remarks

There will always be increased risk from use of sharps, particularly in environments where they are contaminated. For this reason the first step is to consider whether use of a sharp can be avoided. If it cannot a range of different approaches are available to reduce the risk, not all of which will be applicable in a particular context. However, because sharps and other forms of penetrating injury present a frequent ongoing source of injury in University environments, it is important to adopt a range of measures to manage this well-known risk, starting with those that will be most effective. In this advice note suggested controls are presented in order of potential effectiveness. Even if a sharp is used in an environment without contamination hazards, eg. in a design workshop or to determine the power profile of a laser on an optical table, the ubiquitous risk of tetanus infection means that at all costs the use of rusty sharps should be avoided.

11. References

Pallen. (2018). *The Last Days of Smallpox*. Amazon.