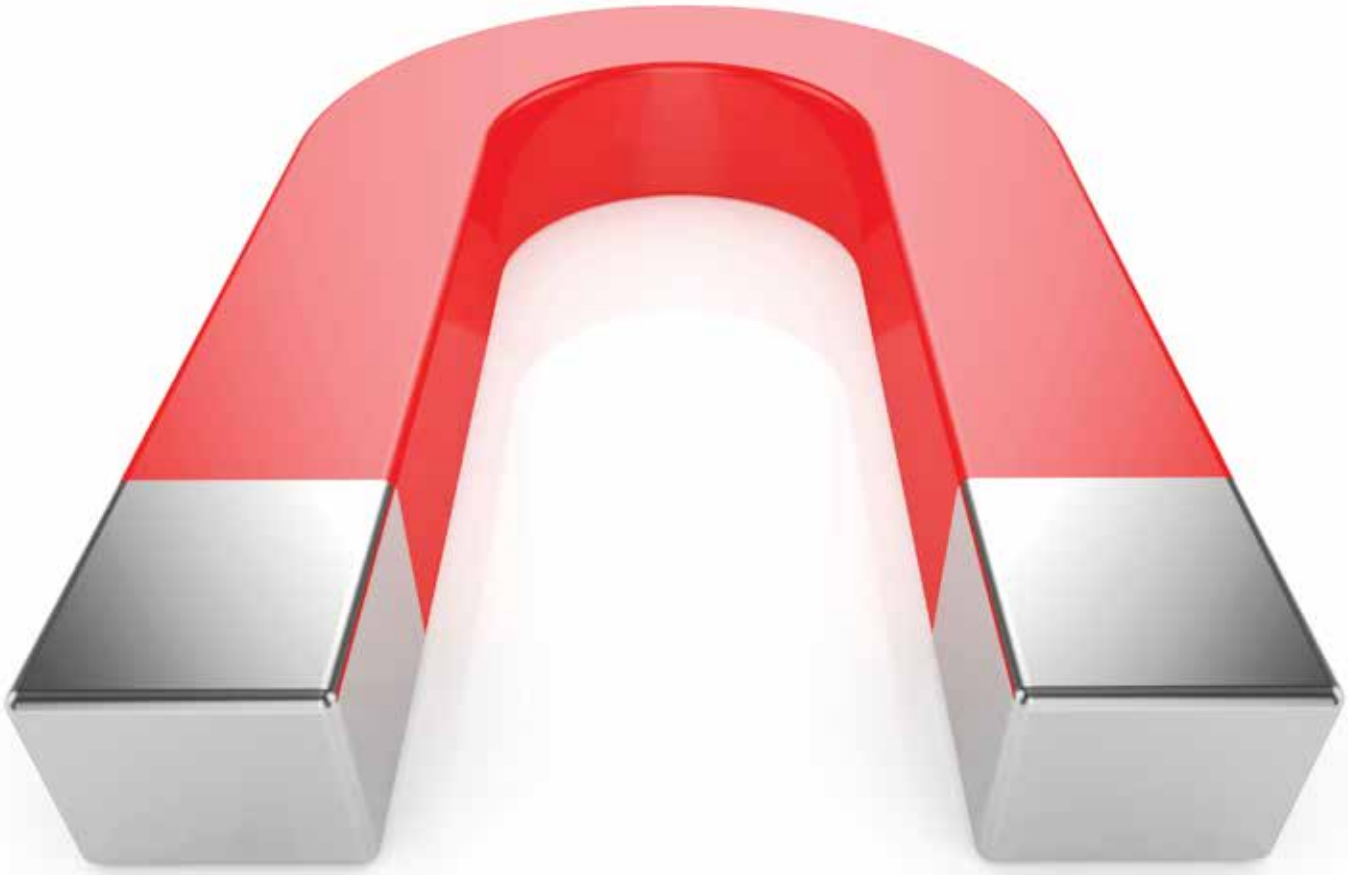

IMPACT OF MAGNETISM ON SURGICAL INSTRUMENT PROCESSING

Central Service (CS) department personnel must be knowledgeable about seemingly innumerable factors and procedures as they process reusable surgical instruments. Many of these concerns, such as the required procedures for cleaning, decontamination, inspection, and sterilization, are well-known and are routinely discussed during in-service training and other professional development activities. Other potential issues are less widely understood and are discussed less frequently. They represent, however, important background and contextual information that can be important as special processing conditions and situations are managed.

One of the less frequently-encountered issues that can have instrument processing implications is magnetism, the topic of this lesson.

CIS Self-Study Lesson Plan

Lesson No. CIS 237 (Instrument Continuing Education - ICE)

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LEARNING OBJECTIVES

1. Define the term "magnetism" and explain how it might impact the processing of surgical instruments
2. Review ways that magnets can be used in surgical procedures
3. Explain how instrument magnetization can occur
4. Discuss procedures to address magnetism during the inspection of surgical instruments
5. Discuss procedures to address magnetism during the sterilization of surgical instruments

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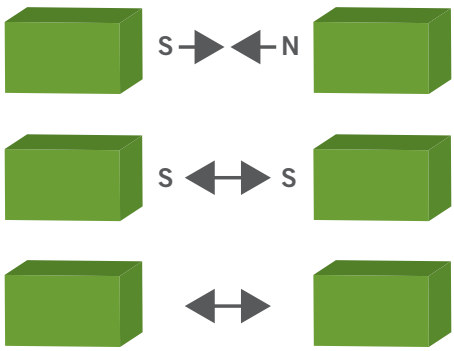
WHAT IS MAGNETISM?

Magnetism is an invisible force that can be produced by magnets, friction or electrical currents that can be visibly exerted on to specific metals and alloys. Magnetic forces can attract or repel each other depending on the direction of their magnetic fields, and they are also able to displace objects made from these metals and alloys. Magnetism can be temporary (example: electrical current), or it can be permanent (example: magnets).

One end of a freely-supported bar magnet will always point north (the magnet's north pole) and the other end will always point south (the magnet's south pole). Two magnets will attract or repel each other depending on which of their two poles face (are in contact with) each other. As shown in Figure 1, when the north and south poles of two magnets face (are in contact with) each other, they will be attracted to each other. However, when the north poles or south poles of two magnets face (are in contact with) each other, the magnets will repel each other.

Figure 1: Opposite Poles of Magnets Attract Each Other



MAGNETS IN SURGERY

Magnets have applications in non-invasive surgeries since they can attract and help to position magnetic devices inserted in the body through tissues and skin. One example is their use in treating hydrocephalus, a condition involving cerebrospinal fluid (CSF) in the brain. Ventricular-Peritoneal Shunts used in the procedure can be remotely adjusted with a magnetic dial to upgrade the valve setting.[1] This allows the physician to noninvasively adjust the CSF pressure/flow performance level without radiographic confirmation by using magnetic adjustment tools to address changing patient needs.[2]

Other examples include the use of magnets to prevent gastroesophageal reflux disease (GERD), a condition in which food or liquid mixed with gastric juice leak upwards from the stomach into the esophagus (the tube connecting the mouth with the stomach).[3]

Magnets have also been used to minimize the use of more extensive surgical procedures. In one case, magnets were used to break through an intestinal blockage in a baby by placing them on each side of the blockage.[4] Micro robots made from a magnetic nickel compound can be "navigated" with external magnets to "float' in the bloodstream.[5] For example, they can move through the blood stream to an intervention site deep inside a patient's brain to cauterize brain tissue which could be causing spasms or seizures.

Yet another surgically-related use of magnets involves a condition called pectus excavatum (commonly referred to

One of the quality control expectations when preparing a tray is to ensure that instruments are not magnetized, and CIS technicians must know how to determine if a surgical instrument has been magnetized.

as "sunken chest").[6] In the past, a patient's deformed chest required invasive surgery to be returned to a normal position, but a new method uses a magnetic implant and an external magnet to generate force sufficient to gradually reduce the deformity.[7]

As a final example, screwdrivers with magnetic tips are required for facial reconstructive surgery to hold small screws. In this instance, if the screwdriver's tip was not magnetized, the tray would be unusable since the screws are so small that only a magnet can pick them up properly and hold them securely while they are placed in the reconstruction plate being implanted. The rack holding the screws is also magnetized to hold the tiny screws in the small surgical tray during handling.

Note: our discussion of magnetization in surgery should also note some challenges created by it. One involves the use of magnetic resonance imaging (MRI), a wonderful tool used to diagnose disease processes. However, because this machine is really an extremely powerful magnet, surgeons had to make some changes in their surgical technique. For safety purposes, and to permit the use of MRI in the years following surgery, vascular and aneurysm clips and tumor markers had to be made of a metal, such as titanium, that would not be affected by the MRI magnet which could dislodge the older metal alloy clips and harm the patient.[8]

Another specific challenge relating to magnetism in surgery occurs when a magnet is created by a high electrical current.[15] For example, the "magnet used to disable cardiac pacemakers pulls a surgical instrument to itself, but this action is understood and anticipated."[9] In contrast, the accidental creation of magnets from friction is less understood and may be unanticipated.

This issue is addressed in the following section.

CAUSES OF INSTRUMENT MAGNETISM

Most surgical instruments, including forceps, clamps, scissors, and retractors, are made from combinations of metals such as iron, cobalt, nickel, and alloys based on these metals, such as steel. For this reason, metal-containing surgical instruments can become magnetized, and this may occur in three different ways.

The first way is if an instrument comes in contact with a magnet. For example, some CS personnel occasionally observe that surgical instruments, such as needle holders and forceps, have become magnetized, but it is not clear how and in what location these magnetization incidents occur.[10] It has been reported that instruments that are not magnetized in the CS department can later become magnetized in surgical suites. One possible explanation could be from friction caused by contact with a magnetized mat in surgery.[11] Note: magnetic mats are sometimes used to hold instruments in the sterile field during surgery, and these mats may possibly transfer some of their magnetic properties.

The second way occurs if an instrument becomes magnetized from metal-to-metal contact (friction) during processing.[12] One possibility may arise in the decontamination area if a nylon brush with a metal handle made of the same but, most likely, a different metal than the surgical instrument being cleaned creates electrical current and, hence, magnetism. Note: metal bristle brushes are NOT used on surgical instruments with the exception of on orthopedic rasps where bone chips are being removed. Other possibilities arise whenever there is metal-to-metal contact between surgical instruments.

The third way metal-containing instruments may become magnetized arises when an electric current is passed

through a metallic surgical instrument. One example is the use of electric current passing through a forceps or hemostat to seal a bleeding blood vessel: a common procedure in all surgical specialties.

What can be done to decrease the possibility of instrument magnetization? The tactics suggested by the above discussion are to (a) reduce the chances of instruments coming in contact with a magnet, (b) reduce friction caused by metal-containing instruments rubbing against each other, and (c) avoid instrument proximity to machinery using high electric currents.

MAGNETIZATION AND INSTRUMENT INSPECTION

The most difficult and important aspect of magnetized instruments relates to the detection of magnetization when not doing so creates a potential problem. For example, when a Certified Instrument Specialist (CIS) technician prepares a surgical tray, he or she should try to determine if magnetization has occurred because the scrub person who will next handle the instruments will be in the sterile surgical field. While he or she will notice any degree of magnetic force in the instruments before handing them to the surgeon, it is clearly better to have identified the problem before the instruments are transported to the operating suite area.

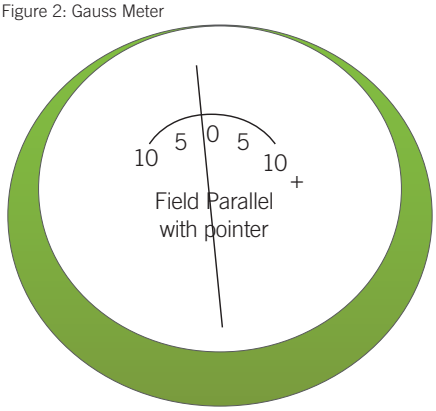
The magnetization of surgical instruments may occur more frequently than may be suspected. For example, a surgical instrument repair company representative indicated that the need for demagnetization of surgical trays occurs several times a year, on average, in the facilities serviced by his company.[13] If the tray magnetization rate is similar at all healthcare facilities, this represents a serious problem which should be addressed.

The inspection of instruments for magnetic properties should be a routine process since most surgical instruments are made of iron-based alloys. This is especially important since magnetic surgical mats transfer magnetic properties to instruments laid on these magnetic mats.[14]

One of the quality control expectations when preparing a tray is to ensure that instruments are not magnetized, and CIS technicians must know how to determine if a surgical instrument has been magnetized.

How can one determine if a surgical instrument has been magnetized? The simplest way is by bringing it close to another metal-containing surgical device such as a needleholder and observing if there is any interaction. If there is, the instrument must be demagnetized. Note: while inspecting surgical trays, the author of this lesson has witnessed the unmistakable magnetism effect that occurs when all of the surgical instruments attract each other like a stack of magnetized sewing pins.[10]

Figure 2: Gauss Meter



Another method of detecting magnetism involves the use of a Gauss meter (See Figure 2) which detects electro-magnetic fields. Hand-held units can be purchased for approximately $70 to $500, according to an internet search and may be affordable for many CS departments.

What should be done if a surgical instrument is found to be magnetized? One solution is to use one of a variety of tabletop units to demagnetize the instruments, and an example is shown in Figure 3. If this equipment is available in the CS department, the instrument can be demagnetized on-site. If the CS department does not own a demagnetizer, a repair company will be needed.

Figure 3: Tabletop Demagnetizer

INSTRUMENT MAGNETIZATION AND STERILIZATION

The sterilization process may be compromised by magnetized instruments. Steam sterilization is normally used for all instruments that can withstand steam heat, and this includes surgical tools made of metal. Although heat is transferred easily by metals, care is required to ensure that magnetized instruments that have been stuck to each other because of magnetization are not introduced in the autoclave. If this occurs, steam may not come in proper contact with all surfaces of the affected instruments, and sterility may be compromised.

An increasing number of battery-operated surgical equipment items can be steam sterilized. However, instruments running on batteries must be disassembled from these batteries before introduction

in the autoclave. Also, batteries can cause magnetism as they create electric currents so they should not come in contact with metal instruments. Some varieties (brands) of surgical batteries for saws and drills and robotic instruments (electrical transducers) can be steam sterilized in accordance with applicable Instructions for Use (IFU). Note: as with all instruments, the IFU must always be followed.

IN CONCLUSION

The properties of magnetism enable an increasing number of benefits in non-invasive surgeries. However, issues related to the processing and use of accidentally magnetized conventional instruments during surgical procedures must be addressed. One excellent example is the expansion of the instrument inspection process by CS personnel to help reduce the incidence of undesired magnetized instruments being unintentionally provided to surgical areas.

ABOUT THE AUTHOR

Nicolas M. Casati has written a Doctor of Business Administration dissertation on Productivity and Quality in Central Sterile Supply. He has served as Sterile Processing Technician and Safety Representative at an 897-bed Academic Medical Center since 2001.

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CIS SELF-STUDY LESSON PLANS

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