

Surgery, such as Cannulation and Catheterization Procedures in the Pig for Biomedical Research

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Abstract. In surgery procedures, such as those of cannulations and catheterization, there are some fundamental actions that must be taken for surgery to be successful. For instances, the surgery area must be uncluttered for easy evacuating and scavenging anesthetic gases. Furthermore, it must be cleaned and well-lit for the surgeon and his/her team to have very clear view and access to the animal during surgery operations. These aid in avoiding putting the animal to risks. The instruments and other surgery-related materials must be used according to the laid down procedures. Surgery cannot occur until the patient (the animal) gets to appropriate anesthetic level. Accordingly, during surgery the animal must be seen not to be suffering or show any signs of discomfort, such as pain. Some of the means in ensuring this are pedal withdrawal reflex, ear pinch reflex and tail pinch reflex. These actions are what would culminate in a good or successful recovery surgery. Therefore, the objectives of this paper are to detail the procedures usually followed to carrying out successful recovery surgery in the pig as pig is the animal model mostly used in biomedical research.

Key words: Surgery, Anesthesia, Analgesia and Pig

Introduction

In conducting surgery on the pig for biomedical research there are some critical approaches that must be strictly followed for the surgery to be successful. The surgery area should be uncluttered, easy to clean, well-lit and should have facilities for evaluating and scavenging anesthetic gases when in use (Brown, Pearson & Tomson, 1993). These characteristics are important to avoid putting the animal at risk during surgery. The sketch (Figure 1) below sheds more light on where the surgery area should be located exclusively for surgery purpose.

Animal Preparation Area	Animal Recovery Area	Surgeon and Instrument Preparation	Surgery Area
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Figure 1. Surgery schematic

As all the pre-conditions for the surgery are met the animal is ready to be transported to the site of surgery. Animals may be transported in transport carts to the surgery site or area in a very humane manner without inflicting pain to the animal. On arrival at the site, the animal is humanely restrained to avoid aggression and put under anesthesia by masking. It is also important to note that animal is anesthetized in the preparation area separate from the core surgery area (Figure 1). To this extent, it has become very important for researchers to become very abreast with surgery procedures by critically explaining the step-by-step activities during surgery as to avoid putting the animal at risk during the surgery process (Schonholtz, 1976; Gwen, 1995). The objectives of this paper therefore are to uncover the principles and steps that need to be followed strictly for good and successful recovery surgery as demonstrated below.

Anesthesia Induction

Following induction of anesthesia the animal is carefully positioned to monitor the depth of anesthesia or the anesthesia effectiveness to enable surgery to be conducted on the animal

without compromising the functioning of the animal with due consideration to post-operative discomfort (Gwen, 1995). Therefore, no surgical activity can occur until the animal reaches an appropriate level of anesthesia. This can be effectively monitored by no withdrawal reflex to painful stimuli such as pedal withdrawal reflex, ear pinch reflex and tail pinch reflex. Other indicators that must be monitored are heart and respiration rate (there should be no gasping) and pulse must be steady (Conour, Chou & Anderson, 2008). These procedures must be strictly observed as to avoid pain and discomfort of the animal during surgery and even post-surgery complications.

Animal Positioning and Site of Surgery

Access to the table area (well prepared to meet the comfort and neatness of procedure) should be left to those involved in the surgery. The site for surgery on the animal should be identified and prepared for aseptic surgery in a standard fashion. The site is first shaved neatly to avoid contamination and then scrubbed with an antimicrobial agent followed by the application of an antimicrobial solution. The surgical site is swabbed in a circular fashion from the center to the periphery without returning the applicator to the center. The site is then rinsed with alcohol (Fitzgerald, 1979). Following these steps the surgical site should be protected from contamination by the use of sterile surgical drapes with the sole aim of avoiding the risk of contaminating the surgical site (Fitzgerald, 1979). It is very essential that the animal is positioned for surgery such that the surgical site is readily accessible and yet position does not interfere with the animal's ability to breathe. All surgical instruments and supplies must be well-sterilized before they are used (Hoyt, Clevenger & McGehee, 2001). This is highly required to prevent infections leading to complications that can have effect on the animal and complicate research data.

Handling of Surgery Instruments

Instruments must be well cared for. All foreign material must be removed prior to autoclaving; instruments must be cleaned using warm water and also well-rinsed with hot water (Hoyt, Clevenger & McGehee, 2001). All instruments must be placed on the instrument tray. All instruments of the same kind must be kept together. Pack must be tightly wrapped enough so that there is minimal room for instruments to shift when the pack is handled. Packs must be double wrapped. The outer wrap is usually sealed with indicator tape. Packs must also be well-labelled. When opening the wrap, the outer wrap can be opened by non-sterile personnel but the inner wrap must be opened by a sterile person (Hoyt, Clevenger & McGehee, 2001). However, if working alone the outer wrap must be opened prior to scrubbing and gloving (Hoyt, Clevenger & McGehee, 2001). All these protocols are observed to ensure contamination-free surgery.

Gown Wrapping

Gowns must be properly donned. Therefore, in ensuring that gowns are donned properly and ensure sterility when gowning they should be folded such that:

a. Gown must be clean and dry. b. the outside of the gown is the sterile area and should be folded inward. When the gown is lifted up and out, the inside of the gown (non-sterile area) will be facing the personnel. c. once the gown is folded, the neckties should lay loosely on top of the gown for easy access. d. the pack should be double wrapped and marked with indicator tape and e. the integrity of the package must be checked prior to opening. There should neither be tears nor holes in the fabric, nor show any signs of being wet at any time (Hoyt, Clevenger & McGehee, 2001).

The Surgeon and his/her Team

Suitable preparation of the surgeon and the team are very crucial to the success of the surgery. They must all be wearing a scrub suit, performing a surgical scrub, wearing cap, mask, sterile gown and sterile surgical gloves. The importance of wearing the disposable cap and mask are not farfetched. It is because they aid to minimize bacterial contamination (Conour, Chou & Anderson, 2008; Fitzgerald, 1979). All hair must be contained within the cap and mask tied over the cap. Coughing, sneezing and excessive talking must be avoided. However, all non-sterile personnel in the surgery suite must also wear a cap and mask but are exempted from gloving and gowning. Nevertheless, before entering the operating room they must wash their hands and put on a clean lab coat (Fitzgerald, 1979).

Animal Care and Surgery Activities

As surgery is to commence, care must be taken to avoid skin abrasions. Once the site of surgery is prepared the animal is moved to the surgery table that has already been prepared by placing some materials on to avoid the animal losing heat (Fitzgerald, 1979; Hoyt, Clevenger & McGehee, 2001). A sterile drape is then placed over the scrubbed area to create a sterile zone. Usually, a four corner drape method is used to secure by towel clamps to drape the animal leaving an opening to perform the surgery. Here, proper surgical technique must be adopted to prevent wound infection, promote wound healing and ensure satisfactory outcome of surgical procedure (Fitzgerald, 1979; Hoyt, Clevenger & McGehee, 2001). As stated previously, all instruments must be sterilized before being used in the procedure. Also, all personnel touching sterile items must be sterile. Non-sterile persons never reach across the sterile field. At this point, incision is made via the skin using the appropriate scalpel with one even stroke. At this point also, the skin on either side of the incision site should be placed under gentle tension using the thumb and finger (Hoyt, Clevenger & McGehee, 2001). Note that incision must be done using the anatomical knowledge to incise an area free of major blood vessels usually termed the midline after which the point of inserting catheter or cannula is located and fixed (Corletto, 2007). It is very crucial that surgery is done while animal is under anesthesia to avoid pain and discomfort; at this time the animal's physical responses, such as toe pinch reflex, signs for teeth grinding, blink reflex with the eye and breathing patterns are closely monitored to ensure that animal is not in pain during surgery (Corletto, 2007). Accordingly, anesthetics (isoflurane) and analgesics (Temgesic HCL-Buprenorphine-HCL) are effectively monitored to ensure that animals are not in pain or will not die as a result of over-dose of anesthesia, thereby providing quality anesthesia during the surgery (Hoyt, Clevenger & McGehee, 2001; Corletto, 2007). It is also important to provide the animal some fluid while undergoing surgery to avoid dehydration (Corletto, 2007). Also, noteworthy is the fact that as soon as surgery is complete anesthesia is stopped on the animal and quickly returned to its cage or pen in a humanely manner as it takes short time for the animal to regain consciousness (Corletto, 2007).

Conclusions

After the surgery, it is mandatory that biohazard containers be provided for professional disposal of biohazard items, such as needles used during the surgery to prevent injuries. In fact, though some research assistants may want to trivialize this, they should be made to understand that it is part of the safety regulation that is required to be covered in the use of biohazard materials in biological and biomedical studies.

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