

Chapter 3: Agricultural Animal Health Care

Adequate agricultural health care involves a written and implemented program for disease prevention, surveillance, diagnosis, treatment, and end point resolution. The agricultural animal health care program is the responsibility of the attending veterinarian. The objectives of such a program are to minimize pain and suffering and to maintain animal health and production. Secondary objectives include the prevention of zoonoses and the avoidance of contaminants and residues in animal products. The program should include provisions for training animal users regarding humane restraint, anesthesia, analgesia, surgical and postsurgical care, and euthanasia.

The institution should provide investigators and teachers with access to a veterinarian who has experience in agricultural animal medicine. The veterinarian can be full-time or part-time and should have appropriate authority to ensure that the provisions of the program are sustained.

A mechanism of direct, frequent, and regular communication should be established among the personnel who are responsible for daily animal care and observation, the principal scientist, and the veterinarian. This mechanism will help to ensure that timely and accurate information on animal health problems is communicated among those concerned.

An important component of an agricultural animal health program is keeping records that can be used to monitor animal health events, levels of production, and the signs of injury and disease. The record system should include summaries of animal health and performance. The fundamental requirements include the following (Radostits et al., 1994b):

- Positive identification of individual animals or groups of animals.
- Suitable animal records for recording preventive medicine processes, signs, diagnoses, prognosis, treatments, major surgical procedures, and resolution of events, including necropsy observations and laboratory results.
- Maintenance of records that include treatment medications, dates of administration, medication names, dosage, route of administration, name of caretaker, and withdrawal times for any agents administered to the animals. Prescriptions should be attached to the records. It is advisable to retain a record of all medications purchased that documents the vendor supplying the products, date of purchase, production lot serial numbers, and expiration dates. This information is useful when it is necessary to appraise the cause of adverse reactions or product failure.
- Record of euthanasia, including the method and agent used.

The record system must be structured so that the information is easily collected, gathered, analyzed, summarized, and available to the principal scientist, the veterinarian, and the ACUC.

SIGNS OF PAIN AND DISTRESS

Pain is a sensation of discomfort that may lead to distress and feelings of urgency resulting from the stimulation of specialized nerve endings. In animals, pain is a condition that can often be measured by an observer with a knowledge of signs evidenced by the animal, although animals can experience pain without it being apparent to observers.

Pain is one of the earliest signs of disease or distress. The sensation depends on receptors located in the skin and deeper structures. The skin is sensitive to pricking, cutting, and heat or cold, whereas visceral pain is caused by local trauma or an engorged or inflamed mucosa, distention or spasm of smooth muscle, and traction upon mesenteric attachments. Local ischemia and prolonged contraction of muscles may also cause pain (Breazile and Kitchell, 1969).

Animals in pain may become listless, move constantly, continually get up and lie down, refuse to stay in one place, go off feed, grind their teeth, or vocalize in a particular manner. Some animals show a sluggish temperament, and others have a frightened expression, resist handling, and favor the painful area. Acute abdominal pain may cause an animal to assume an abnormal stance in an attempt to alleviate the pain.

Pain may not be noticed until a normal physiological act is induced, such as swallowing, coughing, chewing, defecating, or any bodily movement. The attendant should determine whether the pain is associated with a normal physiological act or is constant, even in the absence of a provoking act. Sudden acute pain is usually associated with fractures, rupture or torsion of visceral organs, acute inflammation, or the abrupt loss of blood (Sodeman and Sodeman, 1984).

There are a number of aspects to the problem of relieving pain in agricultural animals. Relief of the causative factor is important, and the attending veterinarian should institute remedial medical treatment when the causative factor can be accurately identified. Relief of pain should be one of the first tasks of the attending veterinarian, adhering to the following principles (Radostits et al., 1994a):

- Relief of pain is a humane act.
- Analgesia should not be used if it will obscure clinical signs that may be necessary to observe, to properly diagnose, or to maintain surveillance of a case. Relief

of pain must be initiated promptly following an accurate diagnosis.

- It may be necessary to protect the animal from massive self-injury.
- A major problem in the clinical management of pain is for cases of severe, slowly healing, infected traumatic wounds of the musculoskeletal system, especially in cattle and horses.

Tolerance of and response to pain vary widely, and the severity of a disease process, or of trauma, should not be judged only by the pain response of the animal. Detecting pain and monitoring the animal's attempts to alleviate the pain are ways of following the course of a disease process. The cause of pain should be determined, and the pain must be ameliorated. When possible, the animal care program should be altered to prevent or minimize the inciting cause of pain in agricultural animals used in research and teaching.

ANESTHESIA AND ANALGESIA

The proper provision of anesthetics and analgesics to research animals is necessary for both humane and scientific reasons. A veterinarian with extensive experience in the care of agricultural animals should advise research and teaching scientists concerning the choice and use of these drugs, including recommendations as to times for withholding food and water to minimize anesthetic risk. After being trained and subsequently supervised by a qualified scientist or veterinarian, qualified technical personnel may administer anesthetics and analgesics as part of a research or teaching protocol. If a painful experimental procedure must be conducted without the use of an anesthetic or analgesic because such use would defeat the purpose of the experiment, the procedure must be outlined and justified in the use protocol and approved by the ACUC.

Paralytic drugs (e.g., succinylcholine or other curariform drugs) are not anesthetics. They must not be used unless animals are under deep anesthesia and entirely unconscious. The use of paralytics must be justified in the research protocol and reviewed and approved by the ACUC.

Tranquilizers are psychotropic substances that alter mental processes or behavior but do not produce anesthesia (Upson, 1985). These medications should only be used to allay fear, anxiety, and nervous tension. Their application may render restraint less stressful and irritating and enable animals to adapt more easily to different or novel situations.

Tables of pre-anesthetics, anesthetics, analgesics, and antiinflammatory substances that are appropriate for use in agricultural animals are provided in Appendix 2 Table A-2.

Certain animal husbandry procedures may be conducted without anesthetization of animals. (These standard agricultural practices are discussed in Chapters 1 and 2.) When conducted by trained and experienced personnel, those pro-

cedures are usually less stressful and painful than the trauma and risk of injury from restraint and anesthetization. All of these procedures should be conducted early in the life of the animals. These procedures should only be performed after the careful consideration and approval of the ACUC. When such procedures are to be performed on older animals, appropriate anesthesia should be induced, trauma minimized, and hemorrhage controlled. It is important that the husbandry guidelines be established to minimize stress, to prevent infection, and to ensure the comfort of the animals during the recovery period. Specific recommendations for each species are provided in Chapters 5 through 11.

SURGERY PERSONNEL

Inappropriate or inadequately performed surgical techniques or postoperative care constitutes unnecessary pain. Experimental surgery on agricultural animals should be performed or supervised by an experienced veterinary surgeon or animal scientist. Institutions must provide basic training and practice before experimental surgery is conducted. Training opportunities should be available to research assistants and animal care personnel to facilitate the upgrading of surgical skills and techniques. The training program should be under the direction of the experienced attending veterinarian or animal scientist, and documentation of the training provided must be maintained.

SURGICAL FACILITIES AND ASEPTIC TECHNIQUE

Major surgeries are those that penetrate and expose a body cavity or produce substantial impairment of physical or physiologic function. Major survival surgeries should be performed in facilities designed and prepared to accommodate surgery, and standard aseptic surgical procedures should be employed. Good surgical practice includes the use of surgical caps, masks, gowns, and gloves as well as appropriate site preparation and draping. Sterile instruments should be used. For nonsurvival surgeries, during which the animal is euthanatized before recovery from anesthesia, it may not be necessary to follow all of these techniques, but the instruments and surrounding area should be clean.

Minor surgical procedures that do not penetrate a body cavity or produce substantial impairment (e.g., wound suturing and peripheral vessel cannulation) may be performed under less stringent conditions if performed in accordance with standard veterinary practices (Brown et al., 1993).

Therapeutic and emergency surgeries (e.g., Caesarean sections, bloat treatment, and repair of displaced abomasum) are sometimes necessary in agricultural situations that are not conducive to rigid asepsis. However, every effort should be made to conduct minor and emergency sur-

geries in a sanitary and aseptic manner, and appropriate anesthetics, analgesics, and sedatives should be used commensurate with risks to the animal's well-being. Research and teaching protocols that carry a high likelihood of the need for emergency surgery should contain provisions for handling anticipated cases. Surgical packs and equipment for such events should be prepared and be readily available for emergency use.

POSTSURGICAL CARE

Appropriate facilities and equipment should be available for animals that are recovering from general anesthesia and major surgery. The following are required:

- Segregation from other animals.
- Clean and sanitary recovery area.
- Adequate space, with consideration for physical comfort and well-being of the animal in a place suitable for recovery from anesthesia without injury, including protective flooring.
- Environmental control sufficient to provide environmental temperature within the thermoneutral zone during postsurgical recovery.
- Trained personnel for postsurgical observation to help to ensure an uneventful recovery.

MULTIPLE MAJOR SURGICAL PROCEDURES

Performance of more than one major survival surgical procedure on a single animal is discouraged. Multiple survival surgical procedures might be justified when they are related components of the same project (e.g., cannulation of the digestive tract at several locations). Multiple procedures on an animal should be allowed only when scientifically necessary, justified in the protocol, and approved by the ACUC.

ANIMAL PROCUREMENT, QUARANTINE, AND STABILIZATION

When animals are acquired, particular attention must be paid to applicable regulations, especially those dealing with transportation and health. It is advisable to assess the health status of a vendor herd or flock prior to acquiring animals. Animals of unknown origin or from stockyards may pose special health risks and should be handled accordingly.

Quarantine is the separation of newly received animals from those already in the facility until the health of the new animals has been evaluated and found to be acceptable. Effective quarantine minimizes the introduction of disease agents into established animal flocks or herds. The principal scientist and attending veterinarian should formulate written policies to evaluate the health status of newly received animals under quarantine in accordance with acceptable veterinary practices and applicable regulations. Skilled personnel should perform the initial visual examination and subsequent daily observations.

Quality control by the vendor and knowledge of the history of the animals are part of an institutional quarantine program. Some experiments, such as studies of shipping fever, may require newly received animals. Other newly received animals, however, should be given a stabilization period prior to their use to permit physiological and behavioral adaptation.

When feasible or appropriate, animals should be observed in an isolated facility or a separate area or room for a quarantine period before being introduced into a herd or facility. Exceptions to this practice should be reviewed and approved by the attending or facility veterinarian. The quarantine period should be long enough to permit the appearance of disease signs or serologic titer in animals that may have been recently infected with a disease agent. The quarantine period should also allow time for treatment of potential diseases and parasites. Quarantine and testing of animals before introduction is particularly important for herds or flocks that have attained specific pathogen-free status. Attempts should be made to minimize the risk of introducing disease agents.

If the history of newly received animals is incomplete, the quarantine should be more comprehensive and of sufficient duration to allow expression of diseases present in the incubation stage.

BIOSECURITY

Research facilities should consider instituting rigorous biosecurity measures. Such measures will vary in rigor depending on the status of the animals housed (e.g., more rigor will be required for animals known to be free of specific infectious disease), but might include the following (Radostits et al., 1994b):

- Security fences and (or) entry alarm systems.
- Appropriate signs posted indicating restricted entry.
- No visitors allowed unless absolutely necessary.
- A shower-in and shower-out facility, with work clothing furnished by the institution.
- Rodent and bird abatement programs.
- Stray and wild animal trapping and relocation.
- A requirement that personnel coming into contact with the animals or facilities do not own or come into contact with animals that may harbor infectious disease agents that may be transferred to the research animals.
- A requirement that personnel who have delivered animals to markets or slaughterhouses must not enter the research facility for at least 24 hr.

SEPARATION BY SPECIES, SOURCE, AGE, AND HEALTH STATUS

Animals should ordinarily be separated into different pens according to species to reduce anxiety from interspecies conflict and to meet experimental and instructional requirements. In extensive production situations, mixing of

compatible species (e.g., sheep and cattle) may be appropriate. Some species carry subclinical or latent infections that, when transmitted to other species, can cause clinical disease and sometimes death.

Separation of individuals or groups of the same species from one another is advisable when animals are obtained from multiple sources because those animals often differ in microbiological status.

Separation of groups of animals of different ages may be advisable for disease control or control of social interactions, particularly when there is a large difference in the size of the animals. Groups of the same age or same size may allow more uniform access to feed and may also reduce injuries. All-in, all-out schemes are examples of age group separation and are designed to minimize disease risks. However, group housing and mixed age groups are acceptable if disease risk is low or disease is being controlled by other means and if social interaction is acceptable or desirable.

RESIDUE AVOIDANCE

Drug administration to experimental animals destined to enter the food chain requires special consideration. Before animals may be slaughtered for human food purposes, time must be allowed for medicaments, drugs approved by the FDA, or substances allowed by the FDA for experimental testing under the INAD exemption to be depleted from the tissues. Such use is only permitted when it adheres to the regulations in the Animal Medicine Drug Use Clarification Act of 1994 (Federal Register, 1996). A record of the product used, dose, route of administration, duration of treatment, name of caretaker, and period of withdrawal must be maintained, and the proper withdrawal time must be ensured, before the animals are transported to the auction market or the abattoir. In addition, records of all potentially harmful products used in the facility, their storage, their use, and their disposal must be maintained. Such record keeping should be similar to the quality assurance programs used by responsible farmers and ranchers in the food animal industries. Records should be maintained for 3 mo.

Food animal industries have developed quality assurance programs (e.g., the Milk and Dairy Beef Quality Assurance Program, the Beef Quality Assurance Program, the United Egg Producers Five Star Quality Assurance Program, the Pork Quality Assurance Program, and the Veal Producer Quality Assurance Program). Agricultural researchers and teachers using animals that may be slaughtered for human consumption should institute quality assurance programs that are equivalent or superior to those used in the food animal industries.

Residues of three groups of chemicals must be prevented from occurring in research animals if those animals or their products are going into the human food chain. They are (1) approved drugs used according to directions on the label, (2) drugs used in an extralabel fashion, and (3) other chemi-

cals such as some drugs, herbicides, pesticides, and wood preservatives.

The FARAD is a project sponsored by the USDA and Extension Service that originated with the Residue Avoidance Program in 1982 (Crosier et al., 1996). The FARAD Compendium of FDA Approved Drugs provides information about drugs that are available for treating animal diseases and the withholding times for milk and eggs and preslaughter withdrawal times for meat. Information about the drugs approved for use in food animals in the US is included in this on-line database. The Compendium allows the selection of over-the-counter products that satisfy particular needs or alerts to the need for veterinary assistance with prescription drugs.

If used in accordance with the label and with allowance for the correct withdrawal time, approved drugs should not leave violative residues beyond the stated withdrawal time. Record keeping and management should confirm on audit that the drugs are not outdated and that the directions on the label have been followed.

In the event that animals are given a new animal drug for investigational purposes, no meat, eggs, or milk from those animals may be processed for human food unless authorization has been granted by FDA or USDA and an appropriate INAD exemption from FDA has been obtained for use of the investigational drug. In such cases, the investigator must follow specifications outlined in the INAD. The authorization to process meat, eggs, or milk from such animals for human food will depend on the development of data to show that the consumption of food from animals so treated is consistent with public health considerations and that the food does not contain the residues of harmful drugs or their metabolites. In the event that animals are given a new animal drug (21CFR 511 and 514; CFR, 1987), no meat, eggs, or milk from those animals may be processed for human food consumption under any circumstances. Proper methods of disposal of such meat, eggs, and milk may include incineration, burial, or other procedures ensuring safety, sanitation, and avoidance of the human food supply.

The use of different dosages, formulations, or routes of administration, or the treatment of animals for conditions not specifically mentioned on the product label, constitutes extralabel use. Such use may be considered by licensed veterinarians when the health of animals is immediately threatened and when suffering or death would result from failure to treat the affected animals. Such use is only permitted when it adheres to the regulations promulgated by the FDA under the Animal Medicinal Drug Use Clarification Act of 1994. The major principles guiding such use are that (1) there must be a valid relationship between veterinarian, client, and patient, and (2) there must be an adequate safety margin in the withdrawal time that is based on the most complete pharmacokinetic data available.

Additional criteria that need to be met and precautions to be observed are detailed in FDA Compliance Policy Guide 7125.06 *Extra-Label Use of New Animal Drugs in Food Producing Animals* (1992; regulations to be issued as part of the Animal Medicine Drug Use Clarification Act of 1994).

There are many chemicals used on farms and in agricultural research establishments that could potentially result in residues in the meat, milk, or eggs of animals exposed to these chemicals. Examples are pesticides for insect control, herbicides, poisons for rodent control, wood preservatives, disinfectants, and many other compounds. Harmful products should be properly labeled and stored, a record of their purchase and expiration dates should be kept, and personnel should be informed of potential hazards and wear appropriate protective equipment. Chemicals should be stored, used, and disposed of in a manner to prevent contamination of animals and residues in milk, meat, or eggs.

PHYSICAL RESTRAINT

Brief physical restraint of agricultural animals for examination, collection of samples, and a variety of other experimental and clinical manipulations can be accomplished manually or with devices such as restraint stocks, head gates, stanchions, or squeeze chutes. It is important that such devices be suitable in size and design for the animal being held and be operated properly so as to minimize stress and to avoid pain and injury (Battaglia and Mayrose, 1981; Ensminger, 1983; Grandin, 1983). Refer to Chapter 2 for additional information.

EUTHANASIA AND SLAUGHTER

Euthanasia is the procedure of killing an animal rapidly, painlessly, and without distress. Euthanasia should be carried out by trained personnel using acceptable techniques in accordance with applicable regulations and policies. The method used should not interfere with post-mortem evaluations. Proper euthanasia involves skilled personnel to help ensure that the technique is performed humanely and effectively and to minimize risk of injury to people. Personnel who perform euthanasia must have training and experience with the techniques to be used. This training and experience must include familiarity with normal behavior of agricultural animals and how handling and restraint affect their behavior. The equipment and (or) materials required to perform euthanasia should be readily at hand, and the attending veterinarian or a qualified animal scientist should ensure that all personnel performing euthanasia have demonstrated proficiency in the use of the techniques selected.

The techniques for euthanasia should follow current guidelines established by the AVMA (1993), and these guidelines should be made available to all personnel who euthanize animals. The agents and methods of euthanasia appropriate for agricultural animals are listed in Appendix 2 Table A-3 and are also detailed in Chapters 5 through 11.

Acceptable methods of euthanasia are those that initially depress the central nervous system to ensure insensitivity to pain (Canadian Council on Animal Care, 1980).

Euthanasia techniques should result in rapid unconsciousness followed by cardiac or respiratory arrest and the ultimate loss of brain function. In addition, the technique used should minimize any stress and anxiety experienced by the animal prior to unconsciousness (AVMA, 1993). For this reason, anesthetic agents are generally acceptable, and animals of most species can be quickly and humanely subjected to euthanasia with the appropriate injection of an overdose of a barbiturate. Certain other methods may be used for euthanasia of anesthetized animals because the major criterion (humane treatment) has been fulfilled (Lucke, 1979).

Physical methods of euthanasia (e.g., penetrating captive-bolt devices for large animals) may be used. Every attempt should be made to minimize stress to the animal prior to euthanasia.

Electrocution is an acceptable means of euthanasia if the electrodes are placed so that the current travels through the brain and through the heart. Methods in which the current is directed through the heart only are not acceptable. It is important to ensure that the animal is indeed dead (i.e., no heartbeat and no possibility of recovery).

Agents that result in tissue residues cannot be used for euthanasia of animals intended for human or animal food unless those agents are approved by the FDA. Carbon dioxide is the only chemical currently used for euthanasia of food animals (primarily swine) that does not lead to tissue residues. The carcasses of animals euthanized by barbiturates may contain potentially harmful residues and should be disposed of in a manner that prevents them from being consumed by human beings or animals.

Slaughter of animals entering the human food chain must be accomplished in compliance with regulations promulgated under the Federal Humane Slaughter Act (CFR, 1987).

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