

Health Risks to Veterinarians and Associated Personnel: Handling Pharmaceuticals and Biologicals

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Abstract

Veterinarians, livestock producers, and workers are at risk of illness from exposure to drugs intended for animal health or growth by inhalation, skin contact, and accidental needle sticks. Exposures to antibiotics, growth enhancers, immunization products, and needle sticks are all potential hazards to those handling these products. Special risks apply to women who handle oxytocin, prostaglandins, and live immunization products. These hazards can be unitized by training personnel, choosing safe products, instituting safe inoculation procedures, and utilizing safe sharps handling procedures.

Résumé

Les vétérinaires, les éleveurs de bétail et leurs employés s'exposent à des risques de maladies en manipulant les médicaments destinés aux soins des animaux d'élevage ou à leur croissance. Les voies d'intoxication possibles sont l'inhalation, le contact cutané et les blessures causées par une seringue. L'intoxication par les antibiotiques, les stimulateurs de croissance et les produits d'immunisation, ainsi que les blessures causées par des seringues sont des exemples des risques que courent ceux qui manipulent ces produits. Des risques particuliers concernent les femmes qui manipulent l'oxytocine, les prostaglandines et les produits d'immunisation vivants. On peut réduire ces risques en formant adéquatement le personnel, en choisissant des produits sécuritaires et en instaurant des procédures sûres d'inoculation et de manipulation des objets pointus.

Introduction

As production agriculture becomes more industrialized, work has become less varied, more repetitive, and more intense (greater production, with less labor). Livestock operations certainly conform to this picture. For example, some of the large swine operations may involve several hundred workers, producing a half million pigs per year. Cattle feeding operations may have 100,000 head in a single location. Care for these animals

requires prophylaxis and treatment with a vast array of injected pharmaceuticals. High numbers of animals, repeated tasks, and a large turnover in workers, all create increased risk for unintentional needle sticks (UNS) in workers. A general review of occupational UNS in livestock production has been previously described.¹ Women are of special risk, as unintentional injection with several different livestock pharmaceuticals may pose a risk to the health of an unborn fetus. Although there is no data available on UNS in women working livestock production generally, a survey of female veterinarians resulted in 64% of 2,531 women surveyed reporting an UNS over the duration of the survey. The annual risk rate was nearly 10/100 exposed.⁵ Surveys of Australian livestock farmers resulted in 80% reporting an UNS in last 12 months.

Iowa's Center for Agricultural Safety and Health (I-CASH) (<http://www.public-health.uiowa.edu/ICASH/>) serves as a resource center for information and service to the health care and producer communities of the state of Iowa. Further, we serve as the technical resource and education branch of the AgriSafe network (www.agresafe.org). As such, we receive frequent calls regarding illnesses and injuries that occur in our agricultural population in the state. Often follow-up investigations are made to determine the sequence of events, cause, and prevention. The following article is based on information and case investigations through this system.

Methods

I-CASH has received an increasing number of calls from producers and physicians and other providers about UNS cases over the past two years. Questions from health care providers include the pathogenesis of the needle sticks, the most offending agents, and how to properly treat and prevent these UNS.

Based on the calls we have received, the authors have chosen representative cases to investigate and report. The risks are summarized, and considerations for treatment and prevention are discussed. Further, two cases were selected from the literature to report here that exemplify certain classes of UNS and injury.

Case Reviews

A veterinarian was working with a producer to synchronize the estrous cycle of his sow herd. A series of injections were required, the last being an intravenous (ear vein) dose of follicle stimulating hormone. The veterinarian started to inject the hormone into an ear vein when the sow slipped her nose snare and the needle went into the palm of the veterinarian's hand. That veterinarian was the author (KJD) as a young swine veterinarian. The resulting swelling, pain, and disability made me suspect that UNS may be quite common. Our investigations at Iowa's Center for Agricultural Safety and Health have proven that UNS are common and they have considerable disability and cost associated with them. The following are examples of these events that we have investigated to provide insight on the cause and clinical outcome of these cases.

Case 1

A veterinarian was vaccinating swine with an erysipelas bacterin. He accidentally injected his index finger instead of the pig. The next day, the pain and swelling in that finger were so bad that he could not bend his finger. By the time he got to see his physician, he could not move his hand, and there were red spots surrounding the site of the needle stick. He was referred to an orthopedic surgeon who diagnosed tenosynovitis, an inflammation of the tendon and the sheath that surrounds the tendon. The surgeon operated on the hand allowing drainage. The patient was hospitalized for two days, and administered intravenous antibiotics. It was over 10 days more before he was able to return to work.

Case 2

A 24 year-old woman was working in the farrowing and nursery of a 900-sow, farrow-to-finish operation. She was vaccinating pigs for *Mycoplasma hyopneumoniae* and circovirus. She pinched the pigs between her knees to hold them while vaccinating them. However, as she went to vaccinate one of the pigs, it struggled just as the needle was to meet its target. Instead of the pig, the needle went into the quadriceps muscle group of her upper leg. The injection burned immediately, but she continued working. By evening, she had a swelling about the size of a very large marble. By the next morning, it was the size of a golf ball.

She went to see her local physician. To her credit, she brought with her the bottle with the insert label of the product that she had been using. She was referred to the University of Iowa Department of Surgery, where a portion of muscle from her upper leg was removed which measured 10 cm long, by 5 cm wide, by 5 cm deep. She was hospitalized for three days, and disabled from work for three months.

Case 3

A dairy farmer in Nebraska was treating his cattle for pneumonia with tilmicosin. He had given one cow a shot, put the syringe in his pocket, and walked down the alleyway to treat another cow. Suddenly without warning, a cow kicked out striking him in the thigh. He realized that the kick drove the needle into his thigh and injected some of the tilmicosin. In a few minutes, he was having a rapid heart rate and difficult breathing. He was transported to the local hospital emergency room. He died about two hours after the UNS.⁵

Case 4

A female veterinarian accidentally injected herself with prostaglandins in the process of her veterinary practice. The unintentional injection resulted in a spontaneous abortion in the woman.³

Discussion

Needle sticks in livestock production are common, painful, and costly in time off work, pain and suffering. Several variables need to be understood to estimate the potential seriousness of the inoculations and potential health threat. The following are important variables.

- Injury from the needle stick itself: Needles used in livestock production and treatment are often large (16-gauge up to 14-gauge) and can cause traumatic tissue damage just from the puncture wound itself. Further, the multiple use needles are often dull and barbed, resulting in increased trauma.
- Infections from a dirty needle: As needles are multiple use, they are therefore contaminated with bacteria from the environment. Inoculation of these bacteria through the skin can cause infections.
- Infections from bacteria on the skin of the producer driven under the skin: As our own skin has lots of bacteria that grow there, a needle can drive those bacteria under the skin, causing an infection.
- Injury from normal substances in the inoculum: There are substances as normal ingredients of commercial veterinary pharmaceuticals that may be harmful to people.
- Harmful substances as normal ingredients of vaccines:
 - Immunizing agents contain the infectious agent or parts thereof from which one is trying to protect the pig. These organisms are usually killed, and therefore will not cause infections. However, some of the agents are modified-live (attenuated) products, meaning that they will not cause disease in the animals. However, they may cause disease in people. For example, one erysipelas product is a modified-live product, and can cause an infection in a person.

- Adjuvants are added to most vaccines to increase the immune response of the animal. Adjuvants consist of one or more of the following products: mineral oils, aluminum salts, components of mycobacterial or other organisms. They usually do not cause a problem in the animal. However, if a person is accidentally inoculated, they may react severely to that product, resulting in a great deal of inflammation, pain, and swelling, with outcomes that have included finger amputation or severe loss of hand or wrist function.
- Hormones used for obstetrical or reproductive treatments in livestock: Oxytocin or PIT, and prostaglandins are commonly used hormones in cattle and swine production to assist with birthing, or to synchronize estrous. However, if a pregnant woman accidentally inoculates herself with one of these products, it can and has caused abortion of the fetus. Further, accidental inoculation of prostaglandins in either women or men may induce a severe type I hypersensitivity reaction which may cause low blood pressure, induce bronchiolar edema, and ventilatory obstruction.
- Antibiotics: Most antibiotics if accidentally inoculated will cause inflammation, possibly an allergic reaction, but usually not serious. However, there is one antibiotic that if accidentally inoculated can be fatal. Micotil (tilmicosin) is a macrolide antibiotic. This drug is not for use in swine, but for cattle, sheep and goats, and rabbits. However, an accidental inoculation with as little as 1.0 cc can be fatal in humans.⁴
- Location of the needle stick: A needle stick in the hand can be an emergency situation. The hand is a very complicated structure with many muscles, tendons, nerves, and vessels all in a small space. Swelling in the hand from an infection or inflammation can result in pressure on vital structures and cause permanent damage (compartmentalization) to the hand if immediate appropriate medical and surgical attention is not received. A needle stick in the hand that results in pain and considerable swelling is a medical and surgical emergency.
- Concentration of the product: Veterinary products for large animals are in much more concentrated forms than human products. This is so that a 1.0-5.0 cc dose will treat the animal rather than a much larger dose. Therefore, a small inoculation can often result in severe reactions in a person.

Prevention

Secondary prevention - what to do if you are accidentally stuck by a needle to minimize the injury

Pregnant women must contact their physician immediately if they are inoculated with either oxytocin or prostaglandins.

Contact your physician immediately if you inoculate yourself with tilmicosin.

Immediate first aid is to ice the region and apply a tourniquet between the inoculation site and the heart. The goal here is to slow the absorption of the drug into the circulation system with the goal of reducing the toxic load to the heart muscle.

For any accidental inoculation, wash the injection site immediately with soap and hot (for oil based adjuvants) water. Read the labeled directions on the bottle or package. Follow the label instructions if present. Keep the bottle and package insert available for possible future reference. If pain and swelling develop (especially in the hand), contact your physician. You may keep ice on the affected area. Take the bottle and package insert along with you to the doctor.

Primary prevention

Promote properly designed and maintained animal handling facilities, both those you may own and those of your clients. Assure there is adequate assistance to properly handle the animals. Most accidental inoculations occur when the handling facilities are inadequate, and you are trying to do a two-handed job while struggling by yourself to inoculate an animal that is much faster, bigger, stronger, and more frantic than you are.

Select immunization products that do not contain live organisms, assuming there are good alternatives.

Do not allow pregnant women to use oxytocin or prostaglandins.

Use alternatives for tilmicosin. If you dispense tilmicosin, make sure that you have thoroughly educated the client and that he/she understands the hazards of its use and procedures for safe handling.

Train employees on safe inoculation procedures and sharps handling and storage.²

- One dose in a syringe at a time (if possible), or use safe multiple dose devices
- Keep needle capped until use
- Do not carry a loaded syringe in your pocket or mouth
- Change needles frequently
- Wear safety glasses to prevent being sprayed in the eyes if needle slips off the hub when injecting.

Dr. David Rendell in Australia has developed a training program for sheep and cattle producers which indicates that the current popular two handed injection techniques where non preferred hand lifts skin prior to injecting substantially increases risk of UNS. Safer and effective one handed technique can be achieved in most scenarios with training and practice.

Investigate changing to needless inoculation. Several companies are marketing these high-pressure needless systems for livestock. Consider going to a

needless injection system in your own operation and for your clients.

Summary and Conclusions

Needle-stick injuries are more commonly reported as livestock production becomes more concentrated and industrialized. The health care community is relatively unaware of the nature of the pharmaceuticals that may be used in livestock production, and how to evaluate the risk, nature of the illness that may result, and how to clinically manage these conditions. Evaluation of the risk must include knowledge of the puncture wound itself, and the fact that infection might result from bacteria that are in the environment (may be antibiotic resistant organisms associated with livestock), or skin bacteria of the victim that has been punctured and introduced subdermally. Risk is also associated with the contents of the pharmaceutical. Some vaccines contain live-modified bacteria or viruses that may cause disease in humans. Vaccines may also contain adjuvants that may produce severe inflammation and tissue damage in the unintended inoculum. Aluminum salts, mineral oils, and cell products of mycobacterium and other bacteria are common components of adjuvants. Oxytocin and prostaglandins are commonly used in swine, beef cattle, and dairy production. At least one antibiotic (Micotil®) can be fatal if accidentally inoculated into a human.

Prevention is through establishing and maintaining excellent handling facilities, and developing and

training animal handling and inoculation practices that include assistance as needed. Substitute products without human health risks if there are more safe yet effective products available, and consider adopting needless injection systems.

Call I-CASH: Kelley Donham or LaMar Grafft at I-CASH 319-335-4190 or 319-335-4233; Kelley-Donham@uiowa.edu or LaMar-Grafft@uiowa.edu; <http://www.public-health.uiowa.edu/ICASH/>

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