Testing the Feasibility of Injecting Joints in Sows for Therapy

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Summary and Implications

Lameness is one of the leading reasons for culling sows in many commercial swine production systems. Current research is being done on a chemically induced, transient lameness model in sows (Karriker et al, 2009). The lameness model allows comparisons to be made about gait and posture of the same sow; when a sow is sound versus when the same sow is lame. The lameness model has lacked the ability to study more than the distal interphalangeal joint. Therefore, the objective of this study was to (1) select proper needle size and estimate joint volume and (2) determine possible joint candidates for future incorporation into the lameness model and administration of future therapies. Fourteen clinically normal, mixed-parity crossbred sows were purchased from a commercial producer in Iowa and housed individual pens at Iowa State University. Fourteen front and fourteen rear sow legs were obtained post-mortem for injection of various joints.
Of the twenty eight post-mortem legs, one front and one back leg were used to examine anatomy, estimate joint volume, select proper needle size, and practice injecting. Results are expressed as a percentage of success.
The results conclude that the joints with greater success rates are potential candidates for incorporation into the lameness model. For that reason, the elbow and tarsocrural (hock) joints would not be good candidates for further research. Therefore it is beneficial to utilize the medial and lateral metacarpophalangeal/ metatarsophalangeal joints in the chemically induced, transient lameness model.

Introduction

Lameness is one of the leading reasons for culling sows in many commercial swine production systems. 2009). Research has been completed using a chemically induced, transient lameness model in the bovine (Coetzee et al., 2009). The ability to use the same animals as their own control group is statistically powerful, as it can account for animal to animal gait variation when sound and in stages of being lame and reduces the number of animals that need to be used. However, the feasibility of using this chemically induced model for lameness has yet to be explored in the sow. Therefore; the object of this study was (1) to determine the proper needle size and estimate joint volume and (2) to determine possible joint candidates for future incorporation into the sow chemically induced lameness model.

Materials and Methods

Animals and housing: This project leveraged sow carcasses from an unrelated trial that was approved by the IACUC. Fourteen clinically normal, mixed-parity crossbred sows were purchased from a commercial producer in Iowa, participated in another research trial and were humanely euthanized at the conclusion of that trial. These carcasses were then utilized in the study reported here.

Collection of limbs: Sows were euthanized by methods approved by both the American Veterinary Medical Association and the Institutional Animal Care and Use Committee. Fourteen front and fourteen rear sow legs (n = 28) were obtained post-mortem for injection of the following joints: medial and lateral metacarpophalangeal, carpus, elbow, medial and lateral metatarsophalangeal, and tarsocrural (hock).

Estimation of joint volume and proper needle size: One front and one back leg were used to examine anatomy, estimate joint volume, select proper needle size, and practice injecting. Joints were palpated to find the joint space (Figure 1).

Figure 1. Palpating the Metacarpophalangeal Joint.

After initial examination of the 14 sets of front and rear legs, it was determined that 23 gauge needles would be sufficient diameter for most of the joints and would provide minimal leak back. Needles 2.54 centimeters long were able to reach the joint space of all but two joints. Due to greater

amounts of soft tissue on the elbow and the tarsocrural joints, proper piercing required longer needles. Due to unavailability of 23 gauge by 3.81 centimeter needles, 20 gauge by 3.81 centimeter needles were used. Volumes to inject were determined by trial and error. Fluid was pushed into joints until there was consistent backpressure on the legs. Table 1 displays the determined proper needle sizes and volumes for joint injection.

Table 1. Needle sizes and volumes injected into joint spaces.

Joint	Needle Size	Volume of Dye
Medial Metacarpophalangeal	23 Gauge 2.54 cm	1 cc
Lateral Metacarpophalangeal	23 Gauge 2.54 cm	1 cc
Carpus	20 Gauge 2.54 cm	5 cc's
Elbow	20 Gauge 3.81 cm	7 cc's
Medial Metatarsophalangeal	23 Gauge 2.74 cm	1 cc
Lateral Metatarsophalangeal	23 Gauge 2.74 cm	1 cc
Tarsocrural (Hock)	20 Gauge 3.81 cm	10 cc's

Determination of possible future joint candidates:
After two sow legs were used for estimation of joint size and anatomy, the joints of the twenty six remaining sow legs were palpated and injected according to the estimated proper needle sizes and joint volumes mentioned above. For visualization of the joint space injections, a blue dye (Prima Tech: Spray on Concentrate Animal Marker) which was mixed according to manufacturer's directions, was used. Medial and lateral metacarpophalangeal / metatarsophalangeal joints were injected on the dorsal surface closer to the midline of the respective legs. The carpus joint was injected on the cranial, lateral portion of the front leg. To locate the elbow joint, the olecranon was palpated, and the injection site was moved approximately two inches cranial and one centimeter distal to that point. The tarsocrural joint was injected cranially, but slightly laterally. All injections were done by the same person to minimize bias. Following joint injections, legs were frozen for a minimum of 24 hours to facilitate the cutting of the legs with a band saw. Sagittal planes of the limbs were cut along the long axis to verify the presence or absence of dye in the joint space. If dye was present in the joint space it was considered a success. If dye was absent in the joint space it was considered a failure. Results will be presented descriptively.

Results and Discussion

Table 2 compares success rates of the various joints injected.

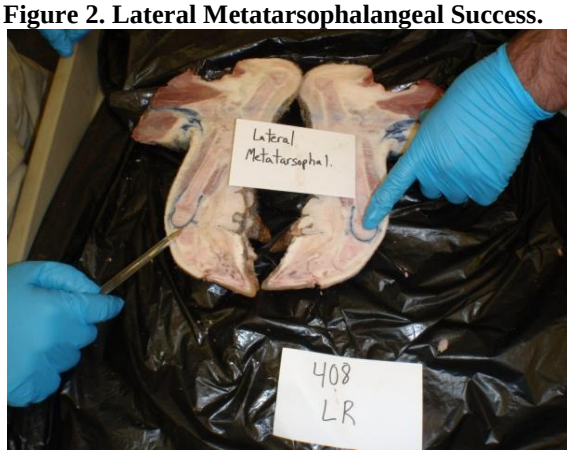
Table 2. Success rates of injecting joint spaces.

Joint	Success Rate
Medial Metacarpophalangeal	100%
Lateral Metacarpophalangeal	77%
Carpus *	
Distal 2 Joints Only	46%
Proximal Joint Only	23%
All 3 Joints	23%
Any of 3 Joints	92%
Elbow	15%
Medial Metatarsophalangeal	85%
Lateral Metatarsophalangeal	100%
Tarsocrural (Hock)	8%

*Includes antebrachiocarpal, intercarpal, and carpometacarpal joints.

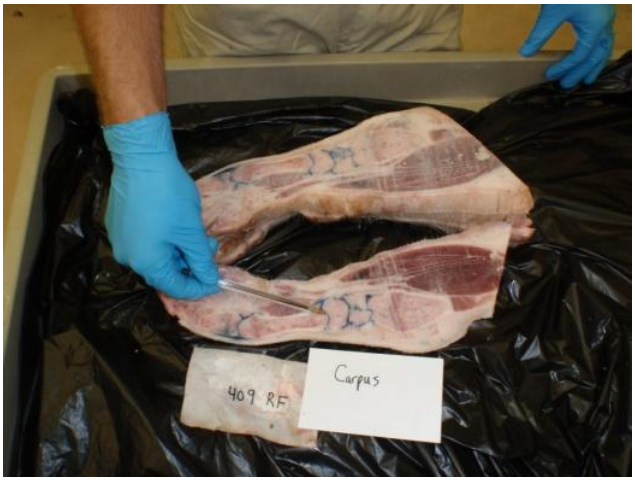
Based on results, the medial and lateral metacarpophalangeal / metatarsophalangeal joints have high success rates (100%, 77%, 85% and 100% respectively) (Figure 2).

Figure 2. Lateral Metatarsophalangeal Success.



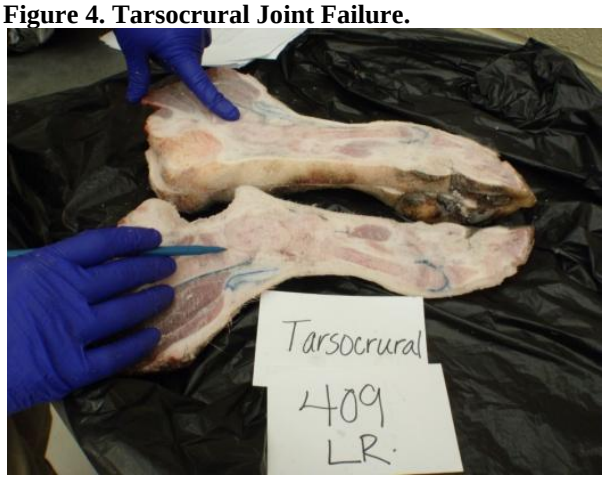
The carpus has a high success rate of hitting at least one joint space (92%), The presence of multiple joint spaces complicates the findings as there did not appear to be a consistent amount of communication between the three joint spaces of the carpus, antebrachiocarpal, intercarpal, and carpometacarpal, across sows(Figure 3).

Figure 3. Case where all 3 Joints in the Carpus appear to communicate.



The elbow and tarsocrural joints had low success rates.

Figure 4. Tarsocrural Joint Failure.



In conclusion, the joints with greater success rates are potential candidates for incorporation into the lameness model. For that reason, the elbow and tarsocrural joints would not be good candidates for further research. Therefore it is beneficial to utilize the medial and lateral metacarpophalangeal/ metatarsophalangeal joints in the chemically induced, transient lameness model.

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