ORIGINAL RESEARCH PEER REVIEWED

Effect of injection tool on incidence of head and neck abscesses at slaughter

Doug King, DVM; Tom Painter, DVM; Derald Holtkamp, DVM, MS; Paul DuBois, DVM, MS; Chong Wang, PhD

Summary

Objective: To test the effect of injection device (conventional syringe and needle versus needle-free injection device [NFID]) on the incidence of head and neck abscesses at slaughter.

Materials and methods: Pigs raised under antibiotic-free (ABF) conditions (n = 3424) were vaccinated first with combined Mycoflex and Circoflex (Boehringer Ingelheim Vetmedica Inc, St Joseph, Missouri) and second with ER Bac Plus (Pfizer Inc, Pfizer Animal Health, New York, New York), each via either conventional syringe and needle (Needle) or NFID. The first vaccination was given on the right side of the neck 1 day post weaning and the second on the left side of the neck 70 days post weaning. Four treatment groups were based on the vaccination injection methods: Needle-Needle; Needle-NFID; NFID-Needle; and NFID-NFID.

Results: At slaughter, 3134 carcasses were evaluated for head and neck abscesses. The incidence of abscesses among the treatment groups did not differ ($P > .05$). More abscesses occurred on the right side of the neck (0.45%; $P < .05$) than on the left (0.13%). Overall abscess incidence (0.57%) was less than that typically observed in similarly sourced ABF pigs (2.51%) produced under field conditions and harvested at the same processing facility.

Implications: Under the conditions of this study, incidence of head and neck abscesses at slaughter does not differ by injection device. Lower abscess incidence in study pigs than in ABF pigs under field conditions may be attributed to picking up small pigs for vaccination, frequent changing of needles, and not hurrying the vaccination process.

Keywords: swine, abscess, needle, injection device

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Resumen - Efectos del dispositivo de inyección en la incidencia de abscesos en la cabeza y el cuello en el matadero

Objetivo: Probar el efecto del dispositivo de inyección (aguja y jeringa convencional contra dispositivo de inyección sin aguja [NFID por sus siglas en inglés]) en la incidencia de abscesos en la cabeza y el cuello en la matanza.

Materiales y métodos: Los cerdos criados bajo condiciones libres de antibióticos (ABF por sus siglas en inglés) (n = 3424) fueron vacunados primero con la combinación de Mycoflex y Circoflex (Boehringer Ingelheim Vetmedica Inc, St Joseph, Missouri) y segundo con ER Bac Plus (Pfizer Inc, Pfizer Animal Health, New York, New York), cada uno vía aguja y jeringa convencional (Needle por su nombre en inglés) ó NFID. La primera vacunación se aplicó en el lado derecho del cuello el día1 después del destete y la segunda en el lado izquierdo del cuello 70 días después del destete. Cuatro grupos de tratamiento se basaron en métodos de inyección de vacunación: Needle-Needle; Needle-NFID; NFID-Needle; y NFID-NFID.

Resultados: En la matanza, se evaluaron los abscesos en la cabeza y cuello de 3134 canales. La incidencia de abscesos entre los grupos de tratamiento no difirió ($P > .05$). Se presentaron más abscesos en el lado derecho del cuello (0.45%; $P < .05$) que en el izquierdo (0.13%). La incidencia total de abscesos (0.57%) fue menor que la observada típicamente en cerdos ABF (2.51%) producidos bajo condiciones de campo y cosechados en las mismas instalaciones de procesamiento.

Implicaciones: Bajo las condiciones de este estudio, la incidencia de abscesos de cabeza y cuello en la matanza no difirieron debido al dispositivo de inyección. La menor incidencia de abscesos en los cerdos de estudio que en los cerdos ABF bajo condiciones de campo, puede ser atribuida a que se levantan los cerdos pequeños para la vacunación, el cambio frecuente de agujas, y a que no se apresura el proceso de vacunación.

Résumé - Effet de l'instrument à injection sur l'incidence d'abcès à la tête et au cou au moment de l'abattage

Objectif: Vérifier l'effet de l'instrument à injection (seringue conventionnelle et aiguille versus un mécanisme d'injection sans aiguille [NFID]) sur l'incidence d'abcès à la tête et au cou au moment de l'abattage.

Matériels et méthodes: Des porcs élevés dans des conditions sans antibiotique (ABF) (n = 3424) ont été vaccinés premièrement avec une combinaison Mycoflex et Circoflex (Boehringer Ingelheim Vetmedica Inc, St-Joseph, Missouri) et deuxièmement avec ER Bac Plus (Pfizer Inc,

DK: Pfizer Animal Health, Otley, Iowa.

TP: Cargill Pork, LLC, Wichita, Kansas.

DH, CW: Department of Diagnostic and Production Animal Medicine, Iowa State University, Ames, Iowa.

PDB: Cameron, Oklahoma.

Corresponding author: Dr Doug King (formerly with Cargill Pork, LLC), present address: Pfizer Animal Health, 1259 Dubuque Drive, Otley, IA 50214; Tel: 641-204-1475; E-mail: doug.king@pfizer.com.

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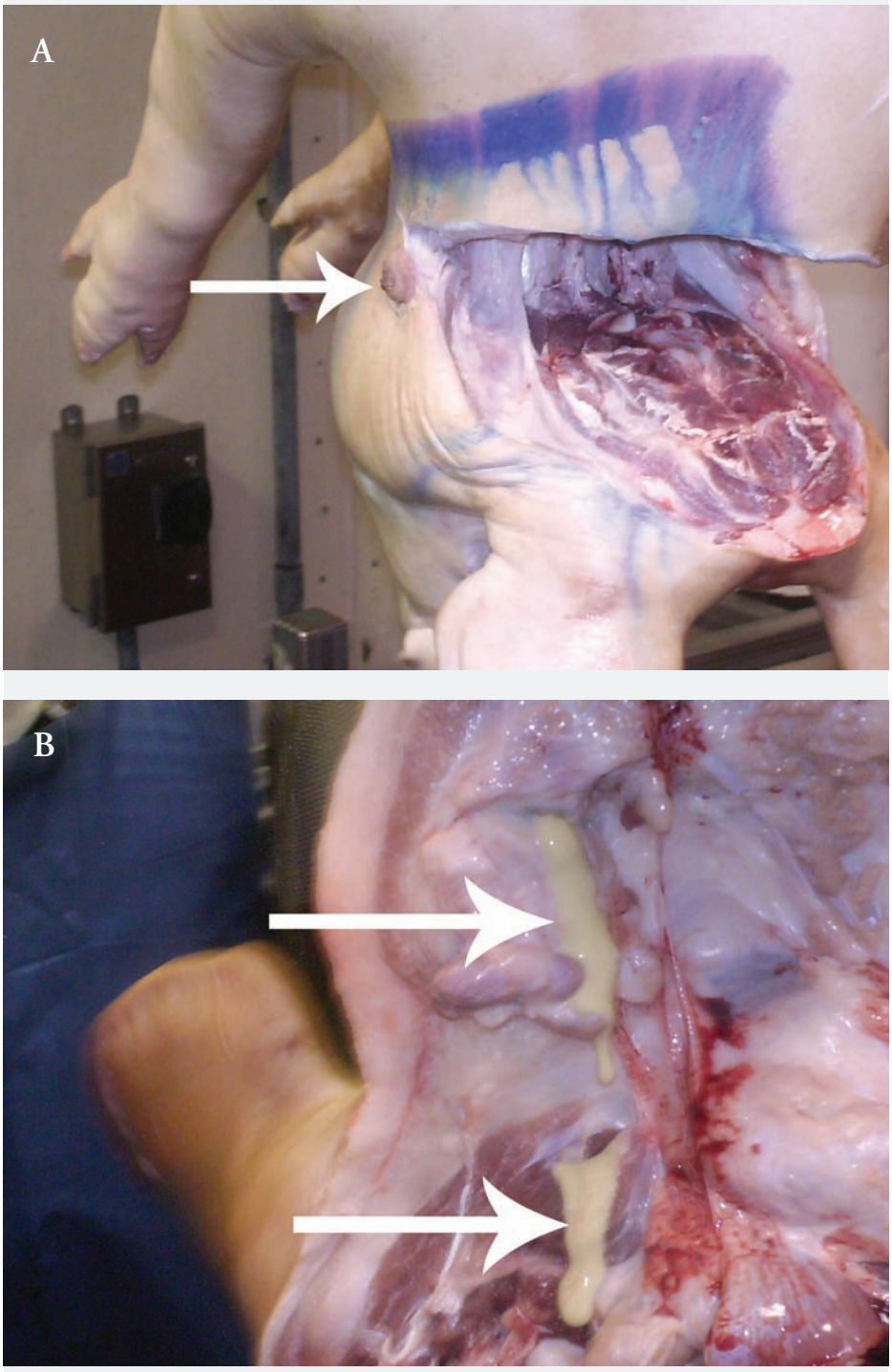
Pfizer Animal Health, New York, New York) chacun via une seringue conventionnelle et une aiguille (Aiguille) ou avec NFID. La première vaccination a été donnée du côté droit du cou 1 jour post-sevrage et la deuxième du côté gauche du cou 70 jours post-sevrage. Quatre groupes de traitement ont été constitués selon la méthode d'injection: Aiguille-Aiguille; Aiguille-NFID; NFID-Aiguille; NFID-NFID.

Résultats: Au moment de l'abattage, 3134 carcasses ont été évaluées pour la présence d'abcès à la tête et au cou. L'incidence des abcès parmi les groupes de traitement ne différait pas ($P > .05$). Plus d'abcès ont été retrouvés sur le côté droit du cou (0.45%; $P < .05$) que sur le côté gauche (0.13%). L'incidence globale des abcès (0.57%) était moindre que celle observée (2.51%) chez des porcs ABF élevés dans des conditions de champs et pris à la même usine.

Implications: Dans les conditions de réalisation de cette étude, l'incidence d'abcès de la tête et du cou au moment de l'abattage ne différait pas selon l'appareil à injection utilisé. Une incidence plus faible d'abcès chez les porcs de l'étude comparativement à des porcs en condition de champs pourrait être attribuable au fait que des porcs plus petits ont été pris pour la vaccination, le changement fréquent des aiguilles, et le fait de ne pas précipiter le processus de vaccination.

Abscesses found in the neck and head area of pigs result in trimming and condemnation of the entire head at slaughter. Since the head is commonly viewed as being of little value relative to the rest of the carcass, head losses are largely ignored. However, in economic terms, the head has a value that ranges from $2.27 to $4.81, with an average value of $3.49 (confidential Agristats data from 11 processing plants November 2009; all currency in $US). In 2008, commercial hog slaughter totaled 116.5 million head in the United States.[1] From these values, approximate cost of head and neck abscesses to the swine industry can be estimated. For every 1% of head loss or condemnation, the American swine industry experiences economic loss in excess of 3 million US dollars. These abscesses are often found in the area where injections or vaccinations are commonly given. Typical presentations of head and neck abscesses on carcasses at slaughter are shown in Figure 1.

Figure 1: Typical presentation of head and neck abscesses on market hog carcasses at slaughter. (A) Arrow indicates an externally visible neck lesion resulting in head condemnation. (B) Arrows indicate pus drainage from an abscess in the neck area.



Needle-free injection devices (NFIDs) have been promoted within the swine industry in the belief that such devices may allow use of lower antigen doses in vaccination,[2,3] minimize food-safety risk by eliminating broken needles in pork,[4] reduce transmission of disease agents, and reduce contamination of the injection site, compared to typical injection via a conventional needle.

The purpose of this study was to evaluate the effect of the injection device (conventional syringe and needle versus NFID) on the incidence of head and neck abscesses identified at slaughter. The hypothesis tested

was that the incidence of head and neck abscesses was different for the two devices.

Materials and methods

Pigs in this trial were cared for in accordance with the Cargill Pork LLC Swine Welfare Policy. All practices and protocols in this study were those followed within the Cargill Pork LLC production system.

Pigs in this study were managed under an antibiotic-free (ABF) program. Being ABF requires that pigs receive no antibiotics via injection or by feed or water medication. Pigs requiring individual treatment with injectable antibiotics were tagged and excluded from the ABF program and from this study. All pigs evaluated at slaughter had received no injections other than neonatal iron and two injectable vaccinations post weaning. Weaned pigs of both genders (N = 3424), sourced from 16 sow farms managed under the same ABF program, were placed in a single wean-to-finish barn. Wean age ranged from 17 to 24 days with a 19-day average. Pigs treated with antibiotics prior to weaning were tagged and excluded from this trial.

The wean-to-finish barn was a fully-slatted curtain-sided building with mechanical and tunnel ventilation capabilities. Approximately 40 pigs were placed in each pen, with each pen containing either gilts or barrows to allow for split-sex feeding.

At restraint for the first vaccination, pigs within each pen were assigned to four treatment groups and ear-tagged to designate study group by alternating treatments for pigs sequentially caught. The four treatment groups were approximately equally represented in each pen. Ear tags were color-coded to assure that the correct device was used for each injection, therefore it was not possible for the vaccine administrator to be blinded to treatment. All pigs in the trial were negative for porcine reproductive and respiratory syndrome (PRRS) virus (sourced from known PRRS-negative sow farms) and positive for *Mycoplasma hyopneumoniae* (sourced from known *M hyopneumoniae*-positive sow farms).

The first injection, given on the right side of the neck 1 day after weaning, contained a combination of 1 mL of *Mycoplasma hyopneumoniae* vaccine (Mycoflex; Boehringer Ingelheim Vetmedica Inc, St Joseph, Missouri) and 1 mL of porcine circovirus type 2 vaccine (Circoflex; Boehringer Ingelheim Vetmedica Inc), resulting in a 2 mL-total dose. A second vaccination, given on the left side of the neck approximately 70 days after weaning, contained 2 mL of *Erysipelothrix rhusiopathiae* vaccine (ER Bac Plus; Pfizer Inc, Pfizer Animal Health New York, New York). An AcuShot NFID (AcuShot Needle-Free Inc, Winnipeg, Manitoba, Canada) was used for all NFID vaccinations. Ideal D3 20-gauge, 1/2-inch needles (Neogen Corporation, Lexington, Kentucky) were used for the first needle vaccination, and Ideal D3 16-gauge, 1-inch needles (Neogen Corporation) for the second needle vaccination. The four treatment groups, Needle-Needle, Needle-NFID, NFID-Needle, and NFID-NFID, were based on vaccination injection methods (Table 1).

Trial investigators administered all vaccinations. For the first vaccination, pigs were individually picked up and vaccinated via needle or NFID. For the second vaccination, pigs were crowded in the pen and vaccinated via needle or NFID. For both first and second vaccinations, needles were changed after all pigs in each pen had been injected (approximately every 20 pigs).

At slaughter, USDA inspectors identified carcasses with head and neck abscesses via the inspection process used daily at the slaughter facility. A plant worker indicated which side of the neck the abscess was on prior to removing the condemned head. Trial investigators documented the number of abscesses and the side of the neck where the abscess was located.

Statistical analysis was performed using SAS software version 9.2 for Windows (SAS Institute Inc, Cary, North Carolina). Fisher's exact test was used to test for association between treatment groups. The incidence of abscesses was calculated as the percentage of carcasses in each group with abscesses. McNemar's test was used to test for a difference in percentage of abscesses between the left and right sides. For both tests, a P value < .05 was considered statistically significant.

Results

Table 1 shows numbers of pigs per treatment group at the beginning of the trial and the number of carcasses evaluated at the packing plant. Losses (< 10% of beginning inventory) were due to mortality, individual treatment with antibiotics, nonmarketable pigs (culls), or loss of identity prior to marketing. No outbreaks of clinical illness involving the entire group of pigs at the site occurred during the trial.

In total, 3134 pigs from this trial were evaluated for head and neck abscesses at a commercial processing facility in Ottumwa, Iowa, with 18 abscesses identified (0.57%). From June 1, 2009, through September 2, 2009, 40,866 head of ABF pigs were delivered from contract producers' sites to this processing plant, with an average incidence of head condemnation due to abscesses of 2.51% (personal communication, Process Improvement Department, Cargill Wapello County Plant; 2009). Results are presented in Table 2. There was no statistically significant difference in the abscess incidence among the four treatment groups (P > .05; Fisher's exact test). There was, however, a statistically significant difference between the proportions of abscesses on the right side (0.45%) and on the left side of the neck (0.13%) (P < .05; McNemar's test).

Table 1: Percentage of pigs per treatment group vaccinated using two injection methods* and evaluated for abscesses at slaughter

	Treatment groups				
1st vaccination† / 2nd vaccination‡	Needle / Needle	Needle / NFID	NFID / Needle	NFID / NFID	Totals
No. of study pigs	857	855	857	855	3424
No. of carcasses evaluated (%)	775 (90.43)	785 (91.81)	790 (92.18)	784 (91.70)	3134 (91.53)

* Vaccines were administered either by conventional needle and syringe (Needle) or by needle-free injection device (NFID).

† Mycoflex and Circoflex vaccines were combined (Boehringer Ingelheim Vetmedica Inc, St Joseph, Missouri; total 2 mL) and injected on the right side of the neck 1 day post weaning in pigs weaned at a mean of 19 days of age.

‡ ER Bac Plus (Pfizer Inc, Pfizer Animal Health New York, New York, total, 2 mL) was injected on the left side of the neck 70 days post weaning.

Table 2: Incidence of head and neck abscesses at slaughter in pigs vaccinated 1 and 70 days post weaning using two different injection devices*

	Treatment groups				
1st vaccination† / 2nd vaccination‡	Needle / Needle	Needle / NFID	NFID / Needle	NFID / NFID	Totals (%)
Pigs examined at slaughter	775	785	790	784	3134
Abscesses right side	3	4	2	5	14 (0.45)[a]
Abscesses left side	0	4	0	0	4 (0.13)[b]
Total (%)	3 (0.39)[c]	8 (1.02)[c]	2 (0.25)[c]	5 (0.64)[c]	18 (0.57)

* Vaccines were administered either by conventional needle and syringe (Needle) or by needle-free injection device (NFID).

† Mycoflex and Circoflex vaccines were combined (Boehringer Ingelheim Vetmedica Inc, St Joseph, Missouri; total 2 mL) and injected on the right side of the neck 1 day post weaning in pigs weaned at a mean of 19 days of age.

‡ ER Bac Plus (Pfizer Inc, Pfizer Animal Health New York, New York, total, 2 mL) was injected on the left side of the neck 70 days post weaning.

[ab] Proportions differ between sides of the neck ($P < .05$; McNemar's test).

[c] Proportions do not differ among treatment groups ($P > .05$; Fisher's exact test).

Discussion

Results of this study suggest that the incidence of head and neck abscesses was not different for the two devices tested (conventional needle or NFID). All pigs evaluated at slaughter, conforming with the ABF program, received neonatal iron injections and two vaccination injections via the methods identified. It must be kept in mind that the study pigs evaluated at slaughter received no other injections. This allowed determination of the effect of injection tool on incidence of head and neck abscesses. The incidence of abscesses on the right side (Mycoflex-Circoflex injection) was significantly greater than the incidence on the left side (ER Bac Plus injection). Identifying a root cause for this difference is speculation. Possible factors influencing the difference in abscess incidence on the right versus left side include needle size, age of pig, inherent difference in vaccines administered, and previous neonatal iron injection. For the groups injected with a needle and syringe, a 20-gauge needle was used for the injection on the right and a 16-gauge needle was used on the left. The pigs were younger when the vaccine was given on the right, and it was administered with each pig being held and restrained for either the conventional needle or NFID method. For the second vaccination, pigs were older and crowded in the pen when vaccinated via needle or NFID method. Finally, because most people are right-handed, it is likely that most pigs received a neonatal iron injection on the right side; however these data were not required or documented for this study. Prior tissue damage or lingering residue from the iron injection could contribute to an increased likelihood of abscess development. The overall incidence of abscesses for pigs in all treatment groups was 0.57%, which was less than the percentage commonly seen in ABF pigs processed in this packing facility (2.51% for the 3-month period from June 2009 to September 2009). Vaccination techniques, including picking up the younger pigs for injection, frequent changing of needles, and not hurrying the vaccination process, were all optimized in this trial.

Implications

- Under the conditions of this study, the incidence of head and neck abscesses at slaughter does not differ whether a conventional needle or NFID is used.
- The lower overall incidence of abscesses in this study, compared to that in non-study pigs raised under similar field conditions, may be attributed to picking up the younger pigs for injection, frequent changing of needles, and not hurrying the vaccination process.

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