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Effects of injecting electronic transponders into the auricle of pigs

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Veterinary Record (1995) 136, 606-609

Electronic transponders (3 × 18 mm) were injected into the base of the auricle of 69 10-day-old pigs, 111 four-week-old pigs and 24 six-month-old pigs, to examine the procedure of injection in the auricle, the tissue reaction and the ease of removal from the carcass. The injection was difficult in the 10-day-old pigs, but was easier at four weeks. One of the 204 transponders were lost and five of them appeared to be broken. Only one gilt showed some exudate around the transponder. The transponders could easily be removed when the pigs were slaughtered by cutting off the ear. The position of the transponder was significantly ($P < 0.05$) more ventral in the animals injected at 10 days old than in those injected at four weeks. The mean thickness of the connective tissue capsule around the transponders increased at first ($P < 0.1$) and then decreased when they were injected into 10-day-old pigs but decreased ($P < 0.1$) from shortly after injection in the pigs injected at four weeks old. After five months, the capsule in the animals injected at 10 days old was on average significantly ($P < 0.01$) thinner than in those injected at four weeks.

IN the Netherlands the current identification and registration regulation for pigs has been established to help to control the spread of infectious diseases, but its objective is not fully achieved owing to the loss of the eartags used, and the lack of effective methods of control. The introduction of an injectable electronic transponder

for the identification of pigs might be an improved method for the implementation of the regulation and also for other purposes such as breeding information, and management and process control in slaughterhouses. An injectable electronic identification transponder consists of a microchip with a receiver/transmitter housed within a biologically acceptable material. It can be read during the lifetime of the pigs and in their carcasses (Wee and Aarts 1991). The minimum requirements for the use of transponders in the Netherlands have been defined as first that they should be easy to inject by the farmer, secondly, that there should be no more than a 1 per cent rate of loss, thirdly, that they should not induce an inflammatory reaction and, lastly, that they should be removable within four seconds when the pigs are slaughtered (Langeveld and others 1992).

The recommended injection sites for transponders in pigs are lateral to the anus, in the auricle or in the base of the ear (Dorn 1987, Lambooj and Merks 1989, Lambooj 1992). After injection into the base of the ear the results have been variable. On experimental and commercial farms the injection of transponders (3.6 × 30 mm) resulted in losses of 5.8 to 11.5 per cent and 6.3 per cent, respectively, and 1.2 to 3.1 per cent and 1.3 per cent of inflammatory reactions by 21 days after injection. It was also difficult to remove the transponders quickly enough at slaughter because they appeared not to be located precisely in the base of the ear. The introduction of mechanical head-cutters which cut the head at the transponder-position was an additional problem (Langeveld and others 1992).

The auricle is considered to be the best position in animals used for meat production, because it can be removed easily and rapidly from the carcass at slaughter. However, it has been difficult to use the auricle because the read-out distance of small transponders was inadequate and too many larger ones were lost (Dorn 1987, Lambooj and Merks 1989). Recently, medium-sized transponders (3 × 18 mm) with a minimum read-out distance of about 25 cm have become available for commercial use, and these are more acceptable for injection in the auricle. Preliminary results have shown that losses were minimised when these medium-sized

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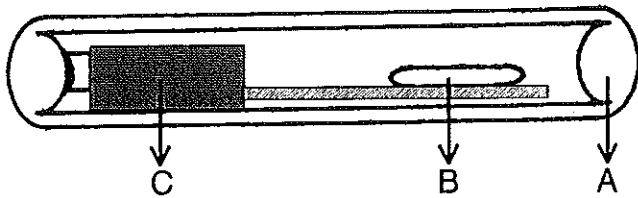


FIG 1: The passive electronic identification transponder, which consisted of a receiver/transmitter (C) with a microchip (B) covered with ceramic bioglass (A)

TABLE 1: Numbers of pigs that lost the identification transponders after they were injected 10 days, four weeks or six months of age

Time after injection (days)	10 days		Injection age 4 weeks		6 months	
	Lost	Number of pigs	Lost	Number of pigs	Lost	Number of pigs
1	1	69	0	111	0	24
7	0	69	0	111	1	24
21	1	64*	0	106*	1	24
During fattening	1	57†	1	98‡	—	—
At slaughter	0	57	0	98	0	24
Total loss	3	69	1	111	2	24

* Seven and 21 days after injection, five piglets were slaughtered for histological examination, † Two pigs died, ‡ Three pigs died

transponders were injected into the base of the auricle (Lambooij and others 1992).

The aims of this study were to examine the tissue reactions and rates of loss of these medium-sized transponders after they had been injected into the auricles of pigs of different ages.

Materials and methods

Transponders and other devices

The transponder had a diameter of 3.0 mm and a length of 18 ± 1 mm (Fig 1); it consisted of a microchip with a passive receiver/transmitter covered with ceramic bioglass (Type TX 1409L; SIS/Destron-ID). The transponders were placed in a cartridge and embedded in Savlon suspension (ICI). The cartridge was fitted in a specially designed injection pistol with a needle about 4.5 mm in diameter and 45 mm in length (SIS/Destron-ID).

Animals and experimental design

Sixty-nine 10-day-old piglets, 111 four-week-old piglets and 24 six-month-old gilts were injected (Table 1).

At seven and 21 days after injection, five of the animals injected at 10 days old and five of those injected at four weeks old (20 in all) were slaughtered for dissection (Table 2); the other piglets were slaughtered at the end of the fattening period, at a liveweight of 90 to 110 kg. They were slaughtered in two groups, three weeks apart, in a commercial slaughterhouse. After slaughter, five of the animals injected at 10 days old and five of those injected at four weeks old, were selected at random for histological examination of the tissue reactions to the transponders (Table 2).

TABLE 2: Numbers of animals with exudate (ex) and cellular proliferation (pr) at different times after the injection of the transponders

Time after injection	10 days		Age at injection 4 weeks				6 months		
	Number examined	Ex	Pr	Number examined	Ex	Pr	Number examined	Ex	Pr
7 days	4*	2	4	5	2	5	—	—	—
21 days	5	4	3	5	2	4	—	—	—
1 month	—	—	—	—	—	—	5	0	2
5 months	5	0	2	5	1	0	—	—	—

* One transponder with surrounding tissue was lost

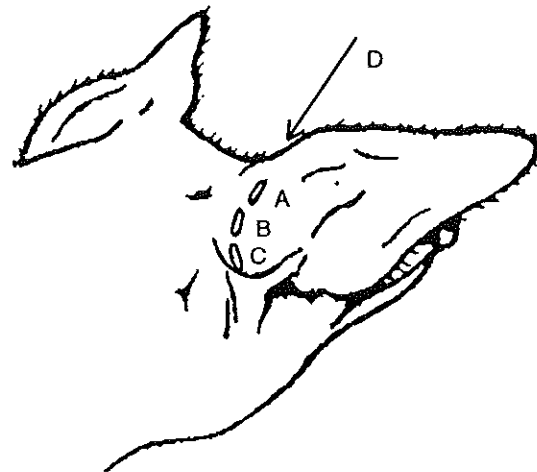


FIG 2: The positions of the transponders found when they were removed at slaughter: dorsocranial (A), middle (B) (correct position), ventral (C) (Table 3) and the injection site in piglets (D)

Twelve of the gilts were slaughtered one month and 12 were slaughtered two months after injection, in a commercial slaughterhouse. Five of the gilts in the first group were selected at random for histological examination (Table 2).

Injection procedure

The transponders were injected by a skilled operator while an assistant restrained the pigs. They were injected subcutaneously in the base of the auricle (Fig 2). In the piglets injected at 10 days or four weeks old, the needle of the injection pistol was placed in the auricle about 1 cm lateral to the join between the ear and the head, near the dorsocranial part of the auricle (injection site D in Fig 2). At the convex part of the ear (approximately at position A in Fig 2), the needle was turned through 90°, while inserted as far as the middle of the auricle. In the gilts, the needle was put in about 1 cm lateral of the join between the ear and the head, in the middle of the auricle. The transponder was placed about 3 cm in the ventral direction, 1 cm lateral of the join between the ear and the head (position B in Fig 2). After the insertion of the needle, the transponder was pushed into the desired position by a pin, and during the extraction of the needle the pin kept the transponder in place.

Measurements

The injected transponders were read out daily during the first week, after 21 days, monthly during fattening, before the pigs were transported to the slaughterhouse, in the slaughterhouse before and after scalding and when the transponder was removed from the carcass. In cases of the apparent loss of the transponder the auricle was palpated to try to find it.

The injection site was inspected and palpated daily during the first week, on day 21 and when the transponder was removed. The onset and disappearance of inflammatory hyperaemia, oedematous swelling and cellular exudate were recorded. The gilts were slaughtered in a commercial slaughterhouse in which the auricular canal, containing the transponder, was cut off in the slaughterline.

The auricle was cut off the carcass of the animals injected at 10 days or four weeks old at the end of the slaughterline. The exact position of the transponder – dorsocranial, middle or ventral and its distance lateral to the join between the ear and the head was determined (Fig 2). The transponder was then removed from the auricle.

For histological examination, the transponders were removed with the surrounding tissues and preserved in 4 per cent buffered formaldehyde. After fixation, the tissues were cut transversely to the longitudinal axis of the transponder, after the transponder had been removed. After embedding in paraffin wax, 5 µm sections



TABLE 3: Numbers of transponders that were found after slaughter in the dorsocranial, middle or ventral position (Fig 2) and the distance in cm lateral to the join between the ear and the head of the pigs

	Age at injection									
	10 days					4 weeks				
	Distance (cm)					Distance (cm)				
	0	1	2	3	Total	0	1	2	3	Total
Dorsocranial	0	0	0	0	0	0	0	1	0	1
Middle	2	18	3	1	24 ^a	15	38	12	1	66 ^b
Ventral	12	13	7	0	32 ^a	6	19	6	0	31 ^b
Total	14	31	10	1	56	21	57	19	1	98

Within positions the data with different superscripts differ significantly ($P < 0.05$)

TABLE 4: Mean (\pm se) thickness (mm) of the connective tissue capsule at different times after the injection of the transponders

Time after injection	Age at injection		
	10 days	4 weeks	6 months
7 days	0.19 (0.04) ^x	0.37 (0.11) ^q	-
21 days	0.37 (0.15) ^{x,y}	0.15 (0.02) ^q	-
1 month	-	-	0.06 (0.01)
5 months	0.07 (0.01) ^{a,y}	0.10 (0.01) ^{b,r}	-

Within day/month, data with different superscripts differ significantly for ^{a,b}: $P < 0.01$. Within age, data with different superscripts differ significantly for ^{x,y}: $P < 0.1$; ^{q,r}: $P < 0.1$

were stained with haematoxylin and eosin, after van Gieson, and with Azan. Two sections per animal were examined and the exudate and cellular proliferation were graded semiquantitatively. The thickness of the connective tissue reaction was measured with an ocular micrometer at the north, south, east and west orientation of the section.

Statistics

The ventral and middle positions of the transponder and also its distance lateral from the join between the ear and the head were analysed by using a log linear model (Bishop and others 1975).

The thickness of the connective tissue capsule around the transponder at seven days, 21 days and five months after its injection into 10-day-old and four-week-old piglets was analysed by using comparisons based on a *t* test for populations with unequal variances (Nie 1975).

Results

Injection technique

It was difficult to inject the transponders into the auricle of 10-day-old piglets because the auricle was thin and the tissue was weak, while the needle had to follow the convex aspect of the auricle. The auricle was perforated in one of the pigs in this group. It was less difficult to inject the transponders into the auricle of four-week-old piglets, but concentration was necessary during the injecting to achieve accuracy. It was easy to inject the transponders into the gilts after they had been restrained with a nose twitch.

Loss of transponders

The transponder was lost from the auricle which was perforated, on the following day. In all the other cases in which the transponder had apparently been lost (Table 1), it was still present after slaughter, but appeared to be broken.

The total loss of means of identification at the end of the slaughterline was two out of 69 pigs injected at 10 days old, one of 111 injected at four weeks old and two of the 24 gilts injected at six months (Table 1). All the transponders that could be read

out before transport, could also be read out at the different reading positions in the slaughterline.

Clinical observations

Only one gilt had some purulent exudate around the transponder when it was removed from the carcass. No other signs of inflammation were recorded.

Removal from the carcass

The transponders in the gilts could be removed from the carcass by cutting off the auricular canal.

When the auricles of the two other groups of pigs were cut off, two of the transponders of the animals injected at 10 days old and two of those injected into piglets at four weeks old remained in the carcass. These transponders were observed on the cutting sheet. Eighty-eight of 154 transponders were found in the auricle about 1 cm from the join between the ear and the head (Fig 2, Table 3). The position of the transponder lateral to the join between ear and head was not significantly different between the two groups (Table 3). In the animals injected at 10 days old, significantly ($P < 0.05$) more of the transponders were found in a ventral position than in the animals injected at four weeks.

Histological examination

Exudate was observed in 11 of the 34 animals, mostly in those slaughtered seven or 21 days after injection (Table 2). In a few animals slaughtered seven and 21 days after injection, hairs and fragments of skin were observed in the exudate.

The degree of cellular proliferation varied between sections within an animal. Cellular proliferation was observed in 20 of the 34 animals, mostly in the animals slaughtered seven or 21 days after injection (Table 2).

The variation in the thickness of the connective tissue capsule around the transponder between sections and between the four measurements of one section was large. The mean thickness of the connective tissue capsule 21 days after injection tended to be greater than the mean thickness after seven days and had decreased significantly ($P < 0.1$) after five months in the piglets injected at 10 days old (Table 4). The mean thickness of the connective tissue capsule in the pigs injected at four weeks old tended to decrease from seven days after injection and was significantly ($P < 0.1$) thinner after five months than after seven days. After five months the connective tissue capsule in the animals injected at 10 days old was significantly ($P < 0.01$) thinner than in the animals injected at four weeks old. The thinnest capsule was observed in the gilts, one month after injection (Table 4).

Discussion

The advantage of an electronic identification system is that each animal has a unique number that can be read automatically and used for various purposes (Lambooy and Merks 1989). An electronic transponder can be injected at many positions in the body of an animal. Recommended sites for pigs are in the auricle or the base of the ear, depending on the size of the transponder (Dorn 1987, Lambooy 1992). It is simple to inject the transponder in the base of the ear. However, in high speed slaughterlines the transponder can only be removed easily when it has been injected in the right position (Langeveld and others 1992). In the present study the transponder was positioned 1 cm lateral to the join between the ear and the head. Although this site is more difficult to inject, it is easy to remove the transponder by cutting off the ear. For records of breeding the data for the sow should be related to the data of its piglets, and it is therefore necessary to identify the piglets as soon as possible after birth. It was difficult to inject the transponders into piglets aged 10 days,



because the tissue was weak and the auricle was easily perforated. It was easier and is to be recommended that the piglets should be injected at four weeks old, when they are weaned. However, this relatively late injection may be a disadvantage for breeding records.

Six of the 204 transponders injected were either lost or failed to work by the time the pigs were slaughtered. The transponder injected into the auricle which was perforated during the injection of a 10-day-old piglet was lost the day after it was injected. The other transponders, that could not be read out, appeared to have been broken, possibly as a result of a mechanical disturbance due to physical forces such as fighting between the animals. Only four of the transponders remained in the carcass after the slaughter procedure, but they could be observed and removed at the same time. It is therefore necessary to ensure that the transponder is injected at the right place in the auricle (Fig 2). Significantly ($P < 0.05$), more of the transponders were found in the ventral position of the auricle (Fig 2) in the pigs injected at 10 days old than in those injected at four weeks (Table 2). This difference could have been caused by differences in the technique of the operator at the different times, or it might have been due to the migration of the transponder after its implantation owing to the weaker tissues of the younger pigs.

In the encapsulation process three patterns of reaction to the transponders have been described: simple encapsulation, encapsulation with inflammatory reactions and abscess formation (Lambooij and others 1992). In the present study, clinical signs of an inflammatory reaction were observed in only one gilt. Cellular proliferation and an exudate were mostly observed at seven and 21 days after the injection. In experiments at commercial farms, when transponders were injected in the base of the ear, signs of inflammation were observed 21 days later in 0.6 per cent of cases and abscesses were found at slaughter in 1.3 per cent; there was wide variation in the results between different farmers and suppliers of transponders (Langeveld and others 1992). The changes in the mean thickness of the connective tissue capsule between seven days and five months after implantation differed between the animals injected at 10 days and four weeks old. The mean thicknesses of the capsule in the two groups were significantly different ($P < 0.01$) at five months after injection. These differences in the tissue reaction suggest that the age at which the transponder is injected may have an effect on the encapsulation reaction, although the variance was large at seven and 21 days after injection and the difference could have been due to the different technique of the operator at the different times. Lambooij and others (1992) injected polyethylene terephthalate-covered transponders into the base of the ears of piglets aged four weeks. In this study the mean thickness of the connective tissue capsule was 0.32 mm after five months, much thicker than in the present experiments. Gruys and others (1993) injected ceramic bioglass transponders into the base of the ears of piglets aged three weeks; the mean thickness of the tissue capsule was 0.14 to 0.17 mm after five months, a value which lies between the values of Lambooij and others (1992) and the present results. These results may be explained by a more severe tissue reaction to polyethylene terephthalate-covered transponders than to bioglass transponders, and a more severe tissue reaction to implants in the base of the ear than in the auricle.

The results of this study suggest that the injection of a medium-sized transponder into the auricle of four-week-old pigs could be a useful method of identification, because no signs of inflammation were observed, very few of the transponders were lost or failed, and they could easily be removed at slaughter without damage to the carcass. However, the injection procedure is more difficult than an injection into the base of the ear. It may be expected that injection into the auricle may result in more variation and more cases of inflammation when the method is applied on commercial farms.

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Abstracts

Heritability of spondylosis deformans in boxers

THE heritability of spondylosis deformans in the boxer was estimated from a study of 353 offspring of 24 randomly selected sires, each with at least three offspring which had been investigated radiographically. The mean \pm se estimated heritability (h^2) for the maximum degree of osteophyte formation was high, both when estimated by paternal half-sib correlation (0.42 ± 0.24) and by the regression of offspring on the parents (0.62 ± 0.57). The heritability of the number of affected discs estimated by paternal half-sib correlation was also high (0.47 ± 0.25) but it was much lower when estimated by the regression of offspring on the parents (0.13 ± 0.18). There was a positive phenotypic correlation between spondylosis deformans and hip dysplasia, which, providing that a significant proportion of the correlation is genetic, should make it possible to select against spondylosis deformans without increasing the incidence of hip dysplasia.

LANGELAND, M. & LINGAAS, F. (1995) *Journal of Small Animal Practice* 36, 166

Antihistamines in the control of canine pruritus

THIRTY dogs with atopy were treated orally with six different antihistamine drugs for 10 weeks. During the first six weeks the dogs received in successive weeks, in random order, one to three daily doses of hydroxyzine, trimeprazine, chlorpheniramine, clemastine, promethazine and cyproheptadine. The drug which on clinical grounds had achieved the best control of the pruritus was then administered for another four weeks; if several drugs performed equally well, one was chosen on the basis of low cost, ease of administration and lack of side effects. Over 60 per cent of the dogs benefited from the treatment and few side effects were observed. Hydroxyzine was the most effective of the antihistamines, but all of them controlled the pruritus in some of the dogs.

PATERSON, S. (1994) *Journal of Small Animal Practice* 35, 415

Inheritance of histiocytosis in Bernese mountain dogs

FAMILY relationships among 127 Bernese mountain dogs with histiocytosis ruled out autosomal recessive, autosomal dominant and sex-linked modes of inheritance for this tumour. The trait was determined to be inherited by a polygenic mode of inheritance with a heritability of 0.298.

PADGETT, G. A., MADEWELL, B. R., KELLER, E. T., JODAR, L. & PACKARD, M. (1994) *Journal of Small Animal Practice* 36, 93

