

INCIDENCE OF INJECTION-SITE BLEMISHES IN BEEF TOP SIRLOIN BUTTS

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Summary

The occurrence of damaged muscle tissue resulting from intramuscular injections of animal-health products represents a “quality control” problem and an economic loss to the beef industry. Ten individual and sequential national audits of injection-site blemishes in beef top sirloin butts have been conducted at the steak-cutter level. The national incidence of injection-site lesions in top sirloin butts (n = 154,010) has decreased (P < .05) between November 1995 (12.0%) and November 1998 (4.4%). However, between November 1995 and July 1997 the mean weight of injection-site lesions increased (P < .05) from 153.04 g to 396.86 g, respectively, and then decreased (P < .05) to 159.26 g in November 1998 which is not different from the mean injection-site lesion weight found in November 1995. A 5-point classification system used to partition the blemishes into chronological stages of the healing process suggested that the majority of the blemishes originated either at the cow-calf or stocker levels, or early in the finishing period. Evaluation of blemish data by geographic location of plant-of-origin suggests that the injection-site lesion problem occurs throughout the beef production sector.

Key Words: Injection, Lesions, Top Sirloin Butts, Tissue, Damage, Incidence

Introduction

Face-to-face interviews with representatives of each sector of the beef industry revealed that concerns regarding injection-site lesions ranked second for purveyors, third for retailers, second for restaurateurs, and second for packers (Smith *et al.*, 1992). When beef cattle are given injections, these injections, are often given intramuscularly, between the hooks and the pins, and cause tissue damage (Dexter *et al.*, 1992); approximately 70% of such damage occurs in the *biceps femoris* and 30% occurs in the *gluteus medius*. Detection of injection-site lesions in top sirloin butts in intact carcasses is not possible because the damage is in the muscles and concealed by subcutaneous fat. Injection-site damage is normally only exposed at meat-market and steak-cutting establishments during portioning of the top sirloin butt.

Activities of the National Cattlemen’s Beef Association (formerly National Cattlemen’s Association), Beef Quality Assurance Task Force led to a reduction in the incidence of injection-site lesions from 21.27% to 10.87%, from July 1991 to March 1993 (Dexter *et al.*, 1994) but no change in incidence (George *et al.*, 1996) from July 1993 (10.91%) to July 1995 (10.19%). This report describes changes in injection-site lesion incidence from November 1995 to November 1998.

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Experimental Procedures

To obtain ongoing assessments of the incidence/severity of injection-site blemishes in top sirloin butts on a national scale, data were collected from individual steak-cutting plants located nationwide. Ten individual audits were conducted in November 1995 and in March, July and November of 1996, 1997 and 1998. Facilities audited were selected according to (1) U.S. geographic location and (2) quantities of top sirloin butts processed. Two or three 8 to 9-h shifts were audited at each plant during each audit period. Audit procedures were identical to those described by Dexter *et al.* (1994). All top sirloin butts evaluated were identified by USDA slaughter plant establishment number to facilitate evaluation of injection-site blemish data by geographic location.

At each of the audited facilities, all steak cutters as well as immediate supervisor(s) were given instructions concerning the audit process and were shown how the affected tissue (injection-site blemish) appeared in top sirloin butts/steaks. Instructions were also given regarding actions to take when questionable tissue was discovered, with the proper course of action being to hold the product for evaluation by the investigator prior to excision. As each individual top sirloin butt was portioned into individual steaks, injection-site damage that was exposed was excised from all affected steaks. The excised damaged tissue was then subsequently classified using a 5-point classification system (Dexter *et al.*, 1994) and weighed to the nearest g.

Statistical Analysis. Data representing percentage incidence of injection-site blemishes were analyzed using frequency procedure (SAS, 1991). Significance differences between incidence values associated with the ten audit time periods were determined by normal approximation of binomial data. Means for blemish weights were computed and analyses of variance determined using the GLM procedures of SAS (1991). Least significant differences were used to identify statistical differences among lesion weights.

Results and Discussion

The average incidence of injection-site lesions during the audit period of November 1995 was 12.0% which is higher numerically than the 10.19% incidence reported by George *et al.* (1996) for the audit period of July 1995. The average weight of injection-site lesions excised from affected top sirloin butts for the November 1995 and July 1995 (George *et al.*, 1996) audits were 153.04 g and 152.81 g, respectively.

Over the ten audit periods, the incidence of injection-site lesions decreased (Table 1) from a high of 12.0% in the first audit period (November 1995) to a low of 4.4% in the last audit period (November 1998). The decline in injection-site incidence percentage was continuous over the ten audit periods with the exception of, (a) the July 1996 to November 1996 audit periods where the incidence did not change, (b) the July 1997 to November 1997 audit periods where the incidence did not change, and (c) the March 1998 to July 1998 to November 1998 audit periods where incidence of injection-site lesions peaked ($P < .05$) for one audit period and then returned to previous levels in the following audit period. The decrease in injection-site lesion incidence agrees with the findings of Dexter *et al.* (1994) who found a decrease in lesion incidence over the six audit periods from July 1991 to March 1993 but disagrees with the findings of George *et*

al. (1996) who found no decrease in injection-site lesion incidence over seven audit periods from July 1993 to July 1995. On balance though, the decrease in injection-site incidence suggests that the ongoing efforts of the Beef Quality Assurance Task Force of the National Cattlemen's Beef Association, have been effective.

The average weight of injection-site lesion trim did not change from the beginning to the end of the 10-audit period (Table 1); however, the average weight of injection-site lesion trim increased ($P < .05$) from November 1995 (153.04 g) to a peak in July 1997 (396.86 g), and then decreased ($P < .05$) to 159.26 g in November 1998. Dexter *et al.* (1994) reported a decrease in average weight per injection-site lesion from July 1991 to March 1993, while George *et al.* (1996) reported an increase in average weight per injection-site lesion from July 1993 to July 1995. It appears when George *et al.* (1996) reported that injection-sites can significantly toughen the gluteal muscles up to 7.62 cm from the core of the lesion, a short-term change in the excision procedures for lesions was initiated by purveyors but this procedural change was short-lived. Questioning of some of the purveyors as to excision procedures supported this reasoning.

Top sirloin butts produced by packing plants in ten different states were examined during the ten audit periods in the current study. Incidence rates of injection-site lesions in top sirloin butts by packing plant location (state) and audit period (Table 2) show no definitive patterns with regard to any geographic area having consistently higher or lower incidence of injection-site lesions, and show that all geographic areas of origin demonstrate injection-site lesion problems. Data regarding cattle origin as defined by packing plant location may not be highly definitive in describing injection-site lesion incidence differences by geographic location because cattle, especially calves, may be transported great distances to be fed and/or harvested.

Over the entire ten-audit period (November 1995 to November 1998), the percentage of lesions (Table 3) classified as cystic (fluid filled), did not change ($P > .05$); however, the percentage of lesions classified as scar with nodules (lesions containing a central foci of necrosis, surrounded by granulomatous inflammation) decreased ($P < .05$), and the percentages of lesions classified as mineralized scars (scar containing mineralized remnants of muscle cells), clear scars (scars containing primarily clear connective tissue) and woody calluses (lesions infiltrated by organized connective tissue and fat) increased ($P < .05$). Overall, 79% of the lesions examined during the audit period were classified as "older" lesions (either woody calluses or clear scars).

Lesion weight average by lesion type and audit date is presented in Table 4. The weight of injection-site lesions excised by purveyors during portioning did not increase ($P > .05$) from November 1995 to November 1998, with the exception of mineralized scars which did show a net increase in weight for this time period. Although the weights of most types of lesions did not increase over the entire audit period, scars with nodules, clear scars and woody calluses did show an increase ($P < .05$) in weight that peaked during the July 1997 audit and then decreased to the November 1998 audit.

Implications

Injection-site lesions have caused and continue to present, enormous economic losses to the U.S. beef industry as well as creating a serious quality assurance problem. An injection-site lesion requiring removal of 159.26 g of tissue accounts for a monetary

loss (using December 1998 values) of approximately \$5.72 per top sirloin butt affected. The reduction in injection-site lesion incidence for the period of November 1995 to November 1998 from 12.0% to 4.4%, respectively, results in a net savings of \$.87 on average, for every steer or heifer slaughtered in the United States in 1998. This savings for every steer or heifer slaughtered equates to an industrywide savings of \$25,264,800, based on 29.04 million steers and heifers harvested in 1997 (USDA, 1998).

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Table 1. Summary of injection-site damage (incidence and weight of lesions) in beef top sirloin butts

Time period ^a	Packer locations ^b	Steak cutter locations ^c	Total primal cuts ^d	Incidence of lesions, % ^e	Average weight per lesion, g \pm SE ^f
November 1995	IA, IL, KS, NE, TX, UT	AR, CO, IL, TN, WA	18,800	12.0 ^y	153.04 \pm 3.01 ^u
March 1996	CO, IL, KS, NE, TX, UT	AR, CA, CO, IL, TN	19,935	10.3 ^x	174.74 \pm 3.74 ^{vw}
July 1996	AZ, CO, KS, NE, TX, WI	AR, CA, IL, TN	19,197	8.5 ^w	175.80 \pm 3.68 ^{vw}
November 1996	KS, NE, TX, UT	AR, CA, IL, TN	21,617	9.0 ^w	193.39 \pm 4.21 ^x
March 1997	CO, KS, NE, TX	AR, CA, IL, TN	19,065	7.5 ^v	186.52 \pm 4.62 ^{wx}
July 1997	KS, NE	CA, IL, TN	11,088	5.6 ^u	396.86 \pm 12.90 ^z
November 1997	AZ, CO, IL, KS, NE, TX, UT, WI	CA, IL, TN, TX	14,644	5.6 ^u	251.28 \pm 7.22 ^y
March 1998	CO, KS, NE, UT	CA, IL, TX	12,927	4.7 ^t	125.66 \pm 6.10 ^t
July 1998	AZ, KS, NE, PA, TX	CA, TN, TX	8,693	6.1 ^u	195.86 \pm 6.24 ^x
November 1998	KS, NE, TX	CA, IL, TN, TX	8,044	4.4 ^t	159.26 \pm 6.84 ^{uv}

^aPeriod of time in which injection-site lesion audits were conducted.

^bPacker-location origin of top sirloin butts.

^cSteak-cutting facilities at which top sirloin butts were examined.

^dNumber of top sirloin butts examined.

^ePercentage of top sirloin butts that had injection-site lesions.

^fAverage weight per lesion after excision.

^{u-vwxyz}Mean values within a column lacking a common superscript letter differ ($P < .05$).

Table 2. Percentage incidence of injection-site lesions stratified by packer location (state) for 10 audits

Packer location	November 1995	March 1996	July 1996	November 1996	March 1997	July 1997	November 1997	March 1998	July 1998	November 1998
Arizona	- ^a	-	14.1	-	-	-	7.1	-	7.7	-
Colorado	-	8.9	13.2	-	19.7	-	12.6	5.8	-	-
Iowa	10.0	-	-	-	-	-	-	-	-	-
Illinois	8.2	6.0	-	-	-	-	11.7	-	-	-
Kansas	16.0	9.4	5.5	9.8	9.5	6.9	4.1	2.1	3.6	4.6
Nebraska	4.9	9.9	6.5	7.1	6.2	4.2	7.9	6.9	3.8	5.0
Pennsylvania	-	-	-	-	-	-	-	-	12.6	-
Texas	24.2	13.9	14.3	10.7	8.0	-	1.3	-	7.3	3.2
Utah	32.2	-	-	12.8	-	-	7.8	7.2	-	-
Wisconsin	-	-	6.1	-	-	-	7.3	-	-	-

^aDashes indicate that no data were obtained for cuts from this geographic packer location during this specific time period.

Table 3. Percentage incidence (of lesions excised) of injection-site lesions in each of five classifications

	November	March	July	November	March	July	November	March	July	November
Classification	1995	1996	1996	1996	1997	1997	1997	1998	1998	1998
Cystic ^a	.75 ^{xy}	.59 ^{xy}	.31 ^x	.56 ^{xy}	.35 ^x	1.13 ^{yz}	.73 ^{xy}	2.61 ^z	.57 ^{xy}	1.40 ^{yz}
Scar with nodules ^b	28.34 ^z	17.02 ^x	25.95 ^z	25.87 ^z	19.20 ^{xy}	21.86 ^y	16.85 ^x	12.87 ^w	11.17 ^w	14.89 ^{wx}
Mineralized scar ^c	.13 ^{xy}	.00 ^x	.00 ^x	.51 ^z	.49 ^z	.48 ^{yz}	.85 ^z	.65 ^z	.76 ^z	.84 ^z
Clear scar ^d	46.06 ^{uv}	49.39 ^{wx}	43.64 ^u	45.44 ^{uv}	53.33 ^{yz}	49.84 ^{vwx}	45.79 ^{uvw}	52.77 ^{xyz}	49.62 ^{vwx}	57.58 ^z
Woody callus ^e	24.71 ^u	33.01 ^{xy}	30.11 ^{wx}	27.61 ^{vw}	26.63 ^{uv}	26.69 ^{uvw}	35.78 ^{yz}	31.11 ^{wxy}	37.88 ^z	25.28 ^{uvw}

^aCystic = encapsulated lesion containing fluid.

^bScar with nodules = central foci of necrosis, surrounded by granulomatous inflammation.

^cMineralized scar = lesion (scar) containing mineralized remnants of muscle cells.

^dClear scar = older lesion primarily containing clear connective tissue.

^eWoody callus = older lesion that is characterized by infiltration with organized connective tissue and fat.

^{uvwxyz}Means within a row lacking a common superscript letter differ (P < .05).

Table 4. Mean (\pm SE) weight (g) per injection-site lesion in each of five classifications

Classification	November	March	July	November	March	July	November	March	July	November
	1995	1996	1996	1996	1997	1997	1997	1998	1998	1998
Cystic ^a	346.35 \pm 55.58 ^z	358.67 \pm 76.58 ^z	266.60 \pm 106.56 ^z	291.18 \pm 77.49 ^z	218.20 \pm 47.98 ^z	291.86 \pm 65.80 ^z	310.50 \pm 84.24 ^z	293.63 \pm 83.34 ^z	256.67 \pm 91.55 ^z	439.00 \pm 166.81 ^z
Scar with nodules ^b	146.42 \pm 3.77 ^u	177.04 \pm 5.62 ^{vwx}	168.55 \pm 5.50 ^v	189.56 \pm 6.64 ^x	186.79 \pm 8.01 ^{vwx}	470.52 \pm 28.61 ^z	216.58 \pm 15.16 ^y	94.20 \pm 13.87 ^t	180.08 \pm 16.58 ^{uvwx}	158.17 \pm 14.66 ^{uvwx}
Mineralized scar ^c	94.67 \pm 25.01 ^{wx}	-	-	81.3 \pm 24.53 ^w	188.43 \pm 27.29 ^{wxy}	311.33 \pm 105.83 ^{wxyz}	356.86 \pm 91.84 ^{yz}	352.75 \pm 90.30 ^{xyz}	316.75 \pm 82.78 ^{xyz}	482.33 \pm 246.31 ^z
Clear scar ^d	116.19 \pm 3.48 ^t	143.65 \pm 3.22 ^{uv}	147.70 \pm 4.41 ^{uvw}	150.52 \pm 5.04 ^{vw}	159.28 \pm 4.58 ^{wx}	299.12 \pm 15.79 ^z	240.41 \pm 11.12 ^y	108.45 \pm 6.76 ^t	175.28 \pm 7.27 ^x	127.18 \pm 6.05 ^{tu}
Woody callus ^e	223.74 \pm 8.34 ^w	216.81 \pm 9.46 ^w	221.84 \pm 8.86 ^w	267.62 \pm 10.29 ^{xy}	240.43 \pm 13.10 ^{wx}	525.01 \pm 26.07 ^z	277.81 \pm 11.91 ^y	149.05 \pm 12.11 ^v	224.14 \pm 12.07 ^w	206.66 \pm 14.74 ^w

^aCystic = encapsulated lesion containing fluid.

^bScar with nodules = central foci of necrosis, surrounded by granulomatous inflammation.

^cMineralized scar = lesion (scar) containing mineralized remnants of muscle cells.

^dClear scar = older lesion primarily containing clear connective tissue.

^eWoody callus = older lesion that is characterized by infiltration with organized connective tissue and fat.

^{tuvwxyz}Means within a row lacking a common superscript letter differ (P < .05).