

# Effect of distal splitting the scrotum when banding feedlot bulls on performance outcomes and healing time

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## Abstract

Castration of bulls using high tension banding techniques is a common practice in commercial feedlots. The objective of this study was to evaluate whether splitting the scrotum at time of banding would impact performance and healing times in feedlot bulls. A total of 32 bulls from a single breeding operation were blocked by initial body weight and then randomly assigned to intact ( $n = 16$ ) or split ( $n = 16$ ) treatment groups. A Newberry knife was used to make a 3-inch (7.6 cm) side-to-side incision through the distal scrotum immediately after banding bulls in the split treatment group. Bulls in the intact group were banded, but no incision was made in the scrotum. Individual weights were collected on days 14, 28, and 56, and the scrotum was visually assessed at each weigh point. More (37.5%) scrotums were absent on day 28 ( $P=0.03$ ), and ADG was improved at day 56 ( $P=0.06$ ) in the split treatment group compared to intact treatment group. Follow up studies evaluating the inflammatory response, health, and performance outcomes are warranted to further evaluate the process of splitting the scrotum at the time of band castration.

**Key words:** band, bovine, bulls, castration, feedlot

## Résumé

La castration des bovins mâles est une pratique courante au sein des parcs d'engraissement commerciaux. L'objectif de cette étude était d'évaluer si la séparation du scrotum au moment de l'utilisation des bandes élastiques avait un impact sur la performance et sur le temps de guérison chez les taureaux dans des parcs d'engraissement. Des taureaux de même origine ( $n = 32$ ) ont été bloqués par leur poids initial et ensuite alloués aléatoirement soit au groupe intact ( $n = 16$ ) ou soit au groupe avec séparation ( $n = 16$ ). Tous les taureaux ont ensuite été ramenés dans la zone de traitement pour l'application des bandes élastiques. Un

couteau Newberry a servi pour faire l'incision du scrotum au niveau du raphé médian pour le groupe avec séparation. Une incision unique localisée approximativement à trois pouces du sommet du scrotum servait pour le drainage. Le poids de chaque individu était mesuré aux jours 14, 28 et 56 et le scrotum était visuellement inspecté à chacune des pesées. Par rapport au groupe intact, une plus grande partie du scrotum avait disparu à 28 jours dans le groupe avec séparation ( $P = 0.03$ ) et le gain moyen quotidien était plus élevé au jour 56 ( $P = 0.06$ ). Des études de suivi portant sur la réponse inflammatoire sont justifiées afin d'évaluer plus à fond la procédure de séparation du scrotum au moment de la castration avec des bandes élastiques.

## Introduction

Castration of male cattle is common practice in feedlots to improve carcass traits and to reduce aggressive behavior.<sup>5,11</sup> Castrating male calves earlier in life results in improved health and performance outcomes in the feedlot.<sup>7,22</sup> Procedures to castrate bulls in the feedlot includes surgical, banding, and burdizzo methods.<sup>4,8,17</sup> Veterinarians tend to recommend banding more frequently as the body weight of bulls increases.<sup>11,23</sup> In 2011, 42.9% of all bulls placed in feedlots were banded, representing the most frequent castration method.<sup>25</sup>

Booker et al reported that band castration resulted in improved health and performance outcomes compared to surgical castration of feedlot bulls.<sup>1</sup> The band placed around the scrotum and testicles reduces arterial blood supply and venous drainage, resulting in ischemia.<sup>15</sup> The ischemia progresses with time, causing cellular damage and necrosis of the scrotum.<sup>15</sup> The anerobic environment caused by placement of the band puts the bull at high risk of tetanus.<sup>13,16</sup> Additional complications of band castration include increased swelling below the band and retention of the spermatic cord. The increased swelling below the band can occur if the band is not tight enough, resulting in incomplete ischemia. The objective of the current study was to evaluate if splitting the distal

scrotum at the time of banding would impact performance outcomes and healing times in bulls castrated at the time of feedlot entry.

### Materials and Methods

The study was performed at a commercial feedlot located near Montezuma, Kansas. All procedures were approved by the Fort Hays State University Institutional Animal Care and Use Committee (IACUC number 19-0020) prior to the study.

#### Study Bulls

A total of 32 bulls were utilized in the study. The bulls were culled from a single-source breeding program, and ranged in weight from 674 to 1218 lb (306 to 552 kg; average 961 lb [436 kg]). Bulls were allowed to rest for 1 day following arrival, and then were processed according to standard feedlot protocols. Bulls were provided a unique visual ear tag, a half-duplex electronic ID tag,<sup>a</sup> a modified-live viral vaccine,<sup>b</sup> moxidectin,<sup>c</sup> oxfendazole,<sup>d</sup> tildipirosin,<sup>e</sup> 8-way *Clostridium* spp bacterin-toxoid,<sup>f</sup> and a trenbolone acetate (200 mg)/estradiol (20 mg) growth promoting implant.<sup>g</sup>

#### Treatment Allocation

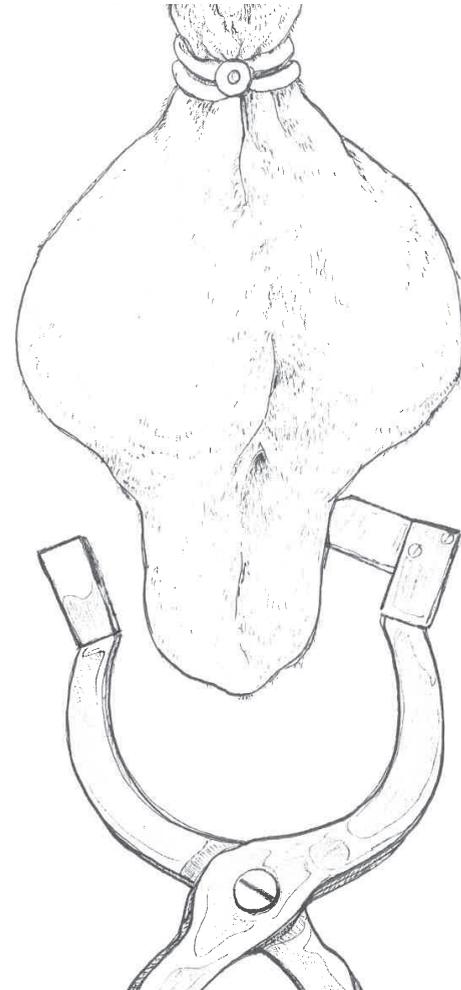
Due to the wide weight range of the bulls, individual animal weights were collected during initial processing. Bulls were then blocked by initial body weight, and randomly assigned to intact ( $n = 16$ ) or split ( $n = 16$ ) treatment groups. Following initial processing, the bulls were moved through the processing chute a second time and banded using a Callicrate Bander.<sup>h</sup> A Newberry knife was used to slice through the midline of the scrotum, side-to-side to the median raphe, in bulls in the split treatment group. The single 3-inch (7.6 cm) incision at the distal apex of the scrotum was made to allow for drainage (Figure 1). The testicles were not removed through the incision.

#### Body Weight and Scrotal Evaluation

All bulls were individually weighed on days 14, 28, and 56 prior to the morning feeding. Average daily gain (ADG) after the initial weight was calculated on each of the weigh days; no body weight shrink was applied for ADG calculations. The scrotum of each bull was visually assessed by a veterinarian (MET) on each weigh day while the bulls were in the chute. Each scrotum was subjectively classified as follows: absent – the scrotum was no longer present; shriveled – the scrotum was present, but shrunken due to ischemia and/or necrosis; and swollen – the scrotum was larger than when banded, and the median raphe was not as clearly defined. Binary outcomes (yes/no) were created for each of the scrotal evaluation classifications at each time point.

#### GrowSafe Feed Intake

The bulls were housed in a single dry-lot pen for 56



**Figure 1.** Visual diagram of distal splitting the scrotum with a Newberry knife side-to-side through the median raphe. Illustration courtesy of Sam Brown, student at Fort Hays State University, Hays, KS.

days. The pen was equipped with 4 GrowSafe<sup>i</sup> nodes through which ration was delivered. Each node was mounted onto 2 load cells which continuously weighed the node and assigned feed disappearance to an individual animal. Only 1 calf was allowed to eat at a node at a time. The bulls were also supplemented with free-choice grass hay in bunks next to the GrowSafe system for the first 5 days-on-feed (DOF). Hay intake was not captured at the individual animal level, therefore hay intake was not included in total feed intake or feed:gain (F:G) calculations. Feed intake for individual animals through 56 DOF was summed and divided by the pounds of body weight gained for F:G calculation. Total feed intake was divided by total DOF for average dry-matter intake for each calf.

#### Feeding from 56 DOF to Closeout and Harvest

After 56 DOF, steers (former bulls) were group housed together in a single, traditional dry-lot feedlot pen until closeout at 118 DOF. They were marketed based upon visual

appraisal of adequate finish and feed intake; all animals were marketed on the same day due to the small sample size. Individual animal carcass data was provided by the packing plant.

### Statistical Analysis

Data were imported to a commercial software program.<sup>1</sup> Individual animal was the experimental unit for all outcomes. Continuous outcomes (body weight, ADG, F:G, average dry-matter intake, carcass weight, ribeye area, and calculated yield grade) were evaluated with linear mixed models. Scrotal classification at 28 days, quality grade, and yield grade outcomes were evaluated using a generalized logistic regression model. All models included fixed effect of treatment group and random effect for block. Differences with a *P* value of  $\leq 0.10$  were considered statistically significant. Only descriptive analyses were performed on scrotal classification outcomes on days 14 and 56 due to complete separation of the data not allowing for model convergence. Descriptive analyses were performed evaluating dry-matter intake by treatment group and DOF; descriptive analysis was also performed evaluating ADG at 56 DOF by each of the blocks to explore any potential differences in effect by initial body weight.

### Results

Performance outcomes are displayed in Table 1. Average daily gain ( $P=0.06$ ) and body weight ( $P=0.10$ ) evaluated at 56 DOF were greater in the split treatment group compared to the intact treatment group (Table 1). There were no other performance differences ( $P\geq 0.10$ ) identified between treatment groups. More scrotums were absent at 28 DOF in the split treatment group compared to intact group ( $P=0.03$ ; Table 2). By 56 DOF, all the scrotums in both treatment groups were absent. There were minimal differences in dry-matter

intake by treatment group throughout the study (Figure 2). Average daily gain through day 56 was greater in 13 of the 16 blocks for the split treatment group compared to the intact treatment group (Figure 3). Ribeye area was increased for cattle in the split treatment group compared to the intact group ( $P=0.10$ ; Table 3).

### Discussion

Booker et al reported band castration was superior to surgical castration in feedlot bulls.<sup>1</sup> To the authors' knowledge, this is the first study evaluating splitting the scrotum at the time of banding, as well as the first study to visually assess the scrotum after banding at multiple time points to gauge healing response. The investigators were not blinded to treatment group when evaluating the scrotum after banding as the treatment was easily visualized; however, absent scrotum was the objective classification. Swollen and shriveled classifications were based on subjective assessments, but the authors do not believe the subjective classifications impacted the study. Both the intact and split treatment groups were assessed when the bulls were in the chute, and bulls were weighed based on the order brought through the processing facility.

The improvement in ADG in bulls which were split was surprising. Banding has been shown to increase systemic haptoglobin concentrations.<sup>18,26</sup> Haptoglobin is an acute phase protein produced by hepatocytes indicating a systemic response due to tissue damage, disease, or stress.<sup>5,17,24</sup> Our hypothesis was that the split in the scrotum allowed drainage of fluids containing proinflammatory responses, thereby allowing the bull to heal sooner. There were numerically fewer bulls which had a swollen scrotum in the split treatment group at 14 DOF compared to the intact group. At 28 DOF

**Table 1.** Model adjusted least square means of performance outcomes of bulls banded at feedyard processing and scrotum left intact or split open using a Newberry knife. Model included fixed effect of treatment group and random effect for block.

Outcome	Intact <sup>†</sup>	Split <sup>‡</sup>	SE	<i>P</i> value
Number bulls, n	16	16	-	-
Enrollment weight, lb	959.8	962.7	28.97	0.67
ADG* at 14 DOF <sup>§</sup> , lb	-0.36	0.18	0.367	0.31
Body weight at 14 DOF, lb	954.8	965.3	29.88	0.33
ADG at 28 DOF, lb	1.83	2.51	0.339	0.18
Body weight at 28 DOF, lb	1011.1	1033.0	30.98	0.20
ADG at 56 DOF, lb	3.35	3.87	0.19	0.06
Body weight at 56 DOF, lb	1147.5	1179.6	33.45	0.10
F:G <sup>#</sup> to 56 DOF	6.90	6.37	0.35	0.30
Average dry-matter intake to 56 DOF, lb	22.51	24.19	1.04	0.22

<sup>†</sup> Intact = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS

<sup>‡</sup> Split = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS, but the distal scrotum was split using a Newberry knife

\* ADG = average daily gain

<sup>§</sup> DOF = days-on-feed

<sup>#</sup> F:G = feed to gain ratio

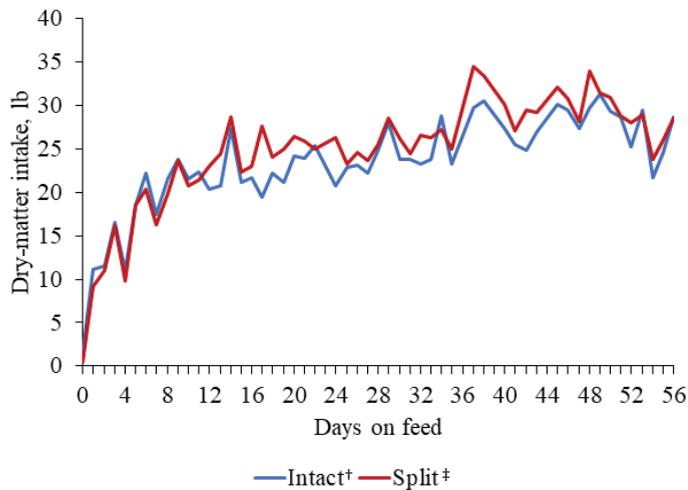
**Table 2.** Scrotal evaluation by treatment group and days-on-feed.

DOF	Classification	Intact <sup>†</sup>	Split <sup>‡</sup>	SE	P value
14*	Absent, %	0.00	18.75	-	-
	Shriveled, %	68.75	75.00	-	-
	Swollen, %	31.25	6.25	-	-
28	Absent, %	12.50	50.00	12.50	0.03
	Shriveled, %	87.50	50.00	12.50	0.03
56*	Absent, %	100.00	100.00	-	-

\* Only descriptive statistics provided for 14 and 56 DOF due to model convergence issues with complete separation of the data

<sup>†</sup> Intact = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS

<sup>‡</sup> Split = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS, but the distal scrotum was split using a Newberry knife



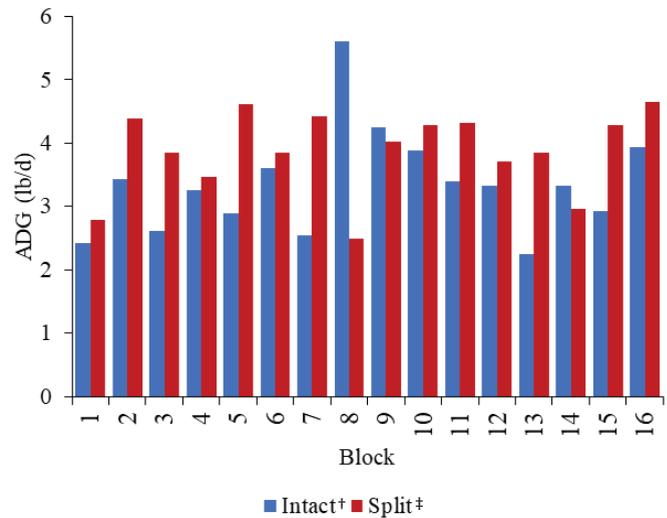
**Figure 2.** Descriptive average dry-matter intake by days-on-feed in feedlot bulls castrated by banding with the scrotum either split after banding or left intact.

<sup>†</sup> Intact = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS

<sup>‡</sup> Split = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS, but the distal scrotum was split using a Newberry knife

the scrotum was absent in a greater percentage of bulls in the split treatment group, indicating more rapid healing. Improvement in ADG with no difference in feed intake indicate more nutrients were used for gain rather than maintenance; however, a larger sample size is needed to validate this finding. Blood samples to measure acute phase proteins were not collected in the current study. Additional research is needed to identify potential physiological effects of splitting the scrotum at time of band castration; however, this study was designed to measure clinical outcomes under field conditions.

No systemic analgesic or local anesthetic products were administered to the bulls at time of banding, which is consistent with most feedlot protocols. According to a survey by Kansas State University researchers, only 21% of veterinarians administer analgesics at the time of castration.<sup>4</sup> Castration methods have been shown to produce



**Figure 3.** Average daily gain at 56 days-on-feed by treatment group and block (initial body weight) in feedlot bulls castrated by banding with the scrotum either split after banding or left intact. Block 1 was the lightest 2 bulls and block 16 was the heaviest 2 bulls in the study population.

<sup>†</sup> Intact = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS

<sup>‡</sup> Split = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS, but the distal scrotum was split using a Newberry knife

physiologic and behavioral changes indicative of pain,<sup>6,10,14,20</sup> and pharmaceutical agents such as flunixin meglumine,<sup>6,10</sup> meloxicam,<sup>3,18</sup> and lidocaine<sup>12,21</sup> have been shown to reduce some of these pain responses; however, this study was designed to mimic field conditions. Due to the limited number of bulls available, the sample size was not adequate to perform a factorial study evaluating pain mitigation strategies as well. Additional research is warranted to evaluate the effect of splitting the scrotum at time of banding in conjunction with pain management.

Evaluation of ADG by each of the blocks and treatment group provide an indication that the magnitude of results was similar and consistent across all initial weights of bulls. Additional research is needed to evaluate results in different

**Table 3.** Model adjusted least square means ( $\pm$  SE) of carcass outcomes of bulls banded at feedyard processing and scrotum left intact or split open using a Newberry knife. Model included fixed effect of treatment group and random effect for block.

Outcome		Intact <sup>†</sup>		Split <sup>‡</sup>		P value	
Carcass weight, lb	867.88	$\pm$	26.63	887.75	$\pm$	26.63	0.33
Ribeye area, in <sup>2</sup>	14.24	$\pm$	0.30	14.82	$\pm$	0.30	0.10
Calculated yield grade	2.87	$\pm$	0.13	2.57	$\pm$	0.13	0.13
USDA Choice, %	56.25	$\pm$	12.50	50.00	$\pm$	12.50	0.72
USDA Select, %	43.75	$\pm$	12.50	50.00	$\pm$	12.50	0.72
Yield grade 1, %	6.25	$\pm$	6.05	12.50	$\pm$	8.27	0.55
Yield grade 2, %	57.49	$\pm$	14.84	72.00	$\pm$	13.99	0.44
Yield grade 3, %	20.36	$\pm$	18.85	8.33	$\pm$	11.66	0.35
Yield grade 4, %	6.25	$\pm$	6.14	0.00	$\pm$	0.00	1.00

<sup>†</sup> Intact = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS

<sup>‡</sup> Split = bulls castrated using the Callicrate Smart Bander, No Bull Enterprises, St. Francis, KS, but the distal scrotum was split using a Newberry knife

breeds, age, and size of bulls; based on the evaluation of ADG by each of the blocks (Figure 3), we hypothesize the results could be extrapolated to a wide range in size and weight of feedlot bulls. The bulls with the lowest ADG at 56 DOF had either a swollen or shriveled scrotum at 14 DOF. Banding has been shown to impact feeding behavior and performance up to 4 weeks,<sup>10</sup> and the inflammatory response for 15 days after castration;<sup>26</sup> however, in both of these studies the scrotum was not split when the bulls were banded. More research is needed to identify if splitting the scrotum results in a more rapid return to baseline parameters.

Potential limitations of the current study includes housing bulls in both treatments together in the same pen, feeding the bulls through the GrowSafe system for the first 56 DOF, followed by feeding in a traditional feedlot pen-setting. Group housing may influence animal behavior or eating patterns. The GrowSafe system allowed a maximum of 4 animals to consume feed at one time, which differs from traditional feedlot feeding systems. A more complete description of the effect of distal splitting of the scrotum at time of banding could be performed by additional research with pen serving as the experimental unit instead of the individual animal, and feeding in a traditional feedlot environment with increased sample size.

### Conclusions

Distal splitting the scrotum at time of banding resulted in improved ADG ( $P=0.06$ ), healing time ( $P=0.03$ ), and increased ribeye area ( $P=0.10$ ) compared to leaving the scrotum intact. Splitting the scrotum was easily accomplished using a Newberry knife and slicing the scrotum from side-to-side through the median raphe. Distal splitting of the scrotum improved welfare and performance outcomes in the bulls. Follow up studies evaluating the inflammatory response, health, and performance outcomes with a larger sample size is warranted to further evaluate splitting the scrotum at the time of band castration.

### Endnotes

- <sup>a</sup> Half Duplex Technology (HDX) Ultra EID Tag, Allflex, Dallas, TX
- <sup>b</sup> Pyramid<sup>®</sup> 3, Boehringer Ingelheim Vetmedica, Duluth, GA
- <sup>c</sup> Cydectin<sup>®</sup>, Bayer Animal Health, Shawnee Mission, KS
- <sup>d</sup> Synanthic<sup>®</sup>, Boehringer Ingelheim Vetmedica, Duluth, GA
- <sup>e</sup> Zuprevo<sup>®</sup>, Merck Animal Health, Whitehouse Station, NJ
- <sup>f</sup> Covexin<sup>®</sup> 8, Merck Animal Health, Whitehouse Station, NJ
- <sup>g</sup> Component<sup>®</sup> TE-200 with Tylan, Elanco Animal Health, Greenfield, IN
- <sup>h</sup> Callicrate Smart Bander, No Bull Enterprises LLC, St. Francis, KS
- <sup>i</sup> GrowSafe Systems, Calgary, Alberta, Canada
- <sup>j</sup> R Studio Team<sup>®</sup> 2016, Boston, MA

### Acknowledgements

The authors would like to thank the entire staff at Hy-Plains Education and Research Center (Hy-Plains Feedyard, Montezuma, KS) for assisting in the study. There was no external funding provided for the study. The authors declare no conflicts of interest.

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