

Prevalence of various presale radiographic findings and association of findings with sales price in Thoroughbred yearlings sold in Kentucky

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Objective—To estimate prevalences of various presale radiographic findings and of presale arthroscopy in horses offered for sale at the 2006 Keeneland September yearling sale and to compare sales prices between yearlings with and without various presale radiographic findings or a history of arthroscopy.

Animals—397 Thoroughbred yearlings.

Design—Cross-sectional study.

Procedures—Presale radiographs and health records were examined to estimate prevalences of various radiographic findings and presale arthroscopy. Sales price records were used to compare sales prices between yearlings with and without various presale radiographic findings or a history of arthroscopy.

Results—In the forelimbs, the most common radiographic findings were vascular channels in the proximal sesamoid bones (23%), enthesophytes or osteophytes in the radiocarpal joint (22%), and osteochondritis lesions involving the sagittal ridge of the third metacarpal bone (20%). In the hind limbs, the most common radiographic findings were enthesophytes or osteophytes involving the proximal sesamoid bones (39%), abnormalities of the distodorsal aspect of the third metatarsal bone (36%), enthesophytes or osteophytes involving the distal intertarsal joint (27%), and osteochondritis lesions involving the stifle joint (8%). Thirteen percent of horses had a history of presale arthroscopy. Median sales price was significantly lower in horses with fragments of the proximal phalanx than in horses without. Median sales price was significantly higher in horses with a history of presale arthroscopy than in horses without.

Conclusions and Clinical Relevance—Results revealed significant associations between a diagnosis of fragments of the proximal phalanx, presale arthroscopy, and sales price in Thoroughbred yearlings. (*J Am Vet Med Assoc* 2010;236:440–445)

The Keeneland September yearling sale is typically the largest sale in the yearling Thoroughbred market. In the past 12 years, the number of horses sold has increased from 2,949 in 1996 to 3,605 in 2008, while median value increased from \$22,000 to \$37,000.¹ For many years, the economic value of Thoroughbred yearlings offered for sale as future racehorses has been influenced by their pedigree and conformation. Recently, prospective buyers have paid increasing attention to the health status of yearlings, with emphasis on the results of presale radiographic examinations, a history of presale arthroscopic surgery, and the results of endoscopic evaluation of the upper airway.

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ABBREVIATIONS

CI	Confidence interval
MC3	Third metacarpal bone
MCP	Metacarpophalangeal
MT3	Third metatarsal bone
MTP	Metatarsophalangeal
OCD	Osteochondritis dissecans
P1	Proximal phalanx

In the Thoroughbred industry, there is a perception that results of presale radiographic examinations affect the sales price of yearlings. Objective data on the prevalence of presale radiographic findings and presale arthroscopy, and the association of these factors with the sales price of yearlings may help guide sales decisions and the subsequent management of yearlings in training.² Current knowledge of the prevalence of various radiographic findings in Thoroughbred yearlings offered for sale is limited. In a study³ of 1,162 horses offered for sale in Kentucky between 1993 and 1996, vascular channels in the proximal sesamoid bones of the forelimbs (98% of horses) and hind limbs (93% of horses) were the most common radiographic findings. However, study horses were not randomly selected. In

another study⁴ that evaluated 348 Thoroughbred yearlings offered for sale in Texas in 2002 and 2003, the most common radiographic finding (8% of horses) was an abnormal sagittal ridge of MC3 or MT3.

The relationship between the presence of specific radiographic findings and yearling sales price has been investigated. In the previous study of Thoroughbred yearlings in Texas,⁴ horses with lesions of the proximodorsal aspect of the sagittal ridge of MC3 or MT3 on presale radiographs had lower median sales prices, compared with horses that did not have such lesions. To our knowledge, relationships between the presence of various radiographic findings, presale arthroscopy, and sales price at the Keeneland September yearling sale have not been investigated. The objective of the study reported here was to estimate prevalences of various radiographic findings and presale arthroscopy in horses offered for sale at the 2006 Keeneland September yearling sale, and to compare sales price between yearlings with and without various presale radiographic findings or a history of arthroscopy.

Materials and Methods

Horses—Yearling Thoroughbreds offered for sale at the 2006 Keeneland September yearling sale ($n = 5,161$) were considered for inclusion in the study. This sale was selected because of the large number of horses offered, compared with other sales in the United States. The 2006 sale was conducted from September 11 through 25, 2006.

Design—The study was designed as a cross-sectional study. A sample size calculation performed with standard software^a indicated that given a population size of 5,161 horses, an assumed expected prevalence of P1 fragments in the MCP joint³ of $10 \pm 3\%$, and a desire to calculate 95% CIs with 80% power, 357 horses would be required in the study. To account for possible missing data in medical records at the time of sale, it was decided to include 40 (approx 10%) additional horses. Thus, 397 horses randomly selected by use of a computer software program^b from among all horses offered for sale were included in the study.

Evaluation of radiographs—For each horse offered for sale during the 2006 Keeneland September yearling sale, a repository consisting of digital radiographs (taken within 3 weeks prior to the horse selling date), veterinary certificates, and any other information that the seller wished to disclose, was established. For the present study, repository radiographs of horses selected for inclusion in the study were evaluated by an equine veterinarian with 26 years of professional experience in yearling prepurchase examinations (JCB). The veterinarian evaluating the radiographs was not employed by the sellers or prospective buyers, and was engaged to work exclusively for the purposes of the present study. A list of selected hip numbers for identification of study horses was provided to this individual for review of radiographs, which was performed prior to the sale of any horses. Therefore, the evaluator was not aware of the sales price of any horse at the time of evaluation of the radiographs. A radiographic finding was defined as any

congenital, developmental, or acquired bony lesion or abnormality, but may have included normal variations in the radiographic appearance or development of bone structures. Anatomic locations of all radiographic findings were recorded on standardized data collection forms classifying lesions as affecting the left, right, or both forelimbs or the left, right, or both hind limbs. Specific abnormalities that were recorded were selected on the basis of previous reports^{3,4} and the clinical experience of the evaluating veterinarian. A radiographic set for each horse was considered complete when it contained the standard 32 radiographic views recommended by a panel of veterinarians selected by Keeneland, based on guidelines provided by the American Association of Equine Practitioners (**Appendix**).

Data regarding presale surgery were listed by surgery site and date on the standardized data collection form. As set forth in the conditions of sale,⁵ surgical procedures designed to produce a permanent change in physical characteristics of the horse, including transphyseal bridging surgery and periosteal transection and elevation, were disclosed by sellers voluntarily. However, more invasive surgeries, such as arthroscopy, other invasive joint surgeries, and abdominal surgery of any type, were required disclosures according to the conditions of sale. All disclosed surgeries were recorded, but for the present study, only data on presale arthroscopy were analyzed.

Data collection—For each horse, the following data were recorded: hip number, sales day, whether the horse was sold (yes vs no), sales price, sire name, dam name, age (months), sex (colt vs filly), whether the stated reserve was attained (yes vs no), and whether the horse was withdrawn (yes vs no).

Categorization of radiographic findings—A standardized form was developed for collection of radiographic findings in each study horse. The classification system was based on that reported in a previous study³ of radiographic abnormalities in 1,162 Thoroughbred yearlings, with some modifications. For each study horse, each radiographic view of each limb was evaluated for specific abnormalities and data were recorded. Thus, multiple abnormalities may have been recorded for individual study horses.

For the MCP and MTP joints, radiographic findings that were recorded included proximodorsal and proximopalmar or proximoplantar fragments of P1. A distinction between articular and nonarticular fragments was not made because of the potential for misclassification. Cysts were identified and defined as any area of increased lucency that extended into subchondral bone. The presence of a well-defined semicircular lucency on the proximodorsal aspect of the sagittal ridge of MC3 or MT3 was recorded as osteochondritis. Other radiographic findings included bony fragments, lucencies, and supracondylar lysis involving the palmarodistal or plantarodistal aspect of MC3 or MT3.

The medial and lateral proximal sesamoid bones were categorized as elongated if they were > 2 mm longer than the other proximal sesamoid bone of the same limb. Abnormal shape of the sesamoid was defined as proximal, distal, or abaxial enlargement. Fracture of

the proximal sesamoid bone was classified as apical, abaxial, basilar, or other. Periarticular bone formation at the proximal or distal articulation of the MCP and MTP joints was recorded as an osteophyte, and bone production within the suspensory or distal sesamoid-equin ligaments was recorded as enthesophytes. Other radiographic findings included the presence and number of defined circular lucencies in the proximal sesamoid bones, and the presence of linear lucencies (ie, vascular channels) in the proximal sesamoid bones.

For the carpal joints, radiographic findings that were identified included abnormalities of the radial carpal bone, third carpal bone, or both (ie, thickened dorsal cortex, proliferative changes, enthesophytes, and bony fragments). The presence of circular lucencies involving the palmar region of the ulnar carpal bone, circular lucencies involving the accessory carpal bone, fragments, osteophytes, cysts, accessory carpal bone fractures, and wedging or collapse of the carpal bones was also recorded.

For the tarsal joints, radiographic findings that were identified included lucencies involving the medial malleolus, bone fragments, concavities of the distal intermediate ridge of the tibia, and abnormalities of the lateral and medial ridges of the talus (ie, flattened areas, lucencies, and fragments). Variations in the radiographic appearance of the distomedial aspect of the trochlear ridge were recorded, along with fragments, osteophytes, and enthesophytes involving the distal intertarsal or tarsometatarsal joint margins, and subchondral lucencies and wedging or collapse of the tarsal bones.

For the stifle joints, radiographic findings that were identified included flattened areas involving the lateral and medial trochlear ridges of the femur, subchondral defects with or without fragmentation, lucencies or fragmentation in the trochlear groove, and subchondral cysts involving the patella, femoral condyles, and proximal aspect of the tibia.

Statistical analysis—Prevalence of horses with various radiographic findings and prevalence of horses with presale arthroscopy were calculated by dividing the number of affected horses by the total number of study horses; 95% CIs were calculated as described.⁶ The correlation between median daily sales price of all horses offered at the sale ($n = 5,161$) and median daily sales price of study horses (397) was estimated by means of linear regression analysis.

The association between sales price and radiographic findings was examined by use of the Wilcoxon rank sum test. Multivariable ANOVA was applied to examine the relationship between sales price (rank data) and radiographic findings, controlling for sales day, presale arthroscopy, and other radiographic findings. Initially, variables that were associated (ie, $P \leq 0.20$) with the outcome of interest (ie, sales price) in univariable analyses were entered into the model, and a forward stepwise approach was used to identify variables associated with the outcome of interest, with a 2-sided P value of 0.05 used to include variables in the model and a 2-sided P value of 0.10 used to remove variables. In analyses of the association between sales price and radiographic findings, dorso- and palmaroproximal

fragments of P1 in either forelimb were grouped together into 1 variable (forelimb P1 fragments). Similarly, dorso- and plantaroproximal fragments of P1 in either hind limb were grouped into 1 variable (hind limb P1 fragments). Osteochondritis dissecans of the lateral or medial trochlear ridge of the femur and of the medial femoral condyle was grouped into 1 variable (OCD of the stifle joint).

Sales price was compared between horses with and without a history of presale arthroscopy, matched by sales day, by use of the Wilcoxon signed rank test. The overall median sales price was compared between horses with and without a history of presale arthroscopy by use of the Wilcoxon rank sum test. The association between sales price (ranked data) and presale arthroscopy (controlling for sales day and radiographic findings) was examined by use of multivariable ANOVA.

Analysis of the relationship between sales price and radiographic findings or a history of presale arthroscopy, matched by sales day and sire, was not possible because the number of horses with or without radiographic findings or a history of presale arthroscopy with the same sire was small. For all statistical analyses, values of $P \leq 0.05$ were considered significant.

Results

Of the 397 horses included in the study, 291 (73%) were sold, 95 (24%) were listed as reserve not attained, and 11 (3%) were withdrawn before entering the sales ring. In the forelimbs, the most common radiographic findings were vascular channels in the proximal sesamoid bones (23%; 95% CI, 19% to 27%), enthesophytes or osteophytes in the radiocarpal joints (22%; 95% CI, 18% to 26%), and OCD of the sagittal ridge of MC3 (20%; 95% CI, 16% to 24%). In addition, 12 of the 397 (3%; 95% CI, 1% to 5%) horses had forelimb P1 fragments, including 10 horses with fragments of the proximodorsal aspect of P1 and 2 horses with fragments of the proximopalmar aspect. In the hind limbs, the most common radiographic findings were enthesophytes or osteophytes involving the proximal sesamoids (39%; 95% CI, 34% to 44%), radiographic abnormalities of the distodorsal aspect of MT3 (36%; 95% CI, 31% to 40%), enthesophytes or osteophytes involving the distal intertarsal joint (27%; 95% CI, 22% to 31%), P1 fragments (9%; 95% CI, 6% to 11%), and OCD involving the stifle joints (8%; 95% CI, 6% to 11%). Prevalence estimates for specific radiographic findings in the forelimbs and hind limbs were not significantly different between horses sold during the first 4 days, compared with horses sold during the later days of the sale, except that vascular channels in the proximal sesamoid bones ($P = 0.03$) and OCD of the distal sagittal ridge of MC3 ($P = 0.05$) were significantly more common in horses sold during the later days of the sale.

Thirteen percent (95% CI, 10% to 16%) of horses had a history of presale arthroscopy (Table 1). The most common anatomic site of presale arthroscopy was the MTP joint (31/52). Horses having arthroscopy in multiple anatomic sites were also common (14/52), and all of those horses had surgery in the MTP joint.

For all horses offered for sale, median price the first day of the sale (ie, September 11) was \$310,000 and median price the fourth day of the sale (ie, September 14) was \$120,000. By comparison, median price the

Table 1—Frequency distribution of surgery site for horses offered for sale at the Keeneland September 2006 yearling sale that had a history of presale arthroscopy.

Surgery site	Left	Right	Bilateral	No. of horses
MCP joint	3	4	0	7
Carpal joint	1	1	0	2
MTP joint	7	8	2	17
Tarsal joint	1	4	2	7
Stifle joint	2	3	0	5
Multiple sites*	NA	NA	NA	14
Total	14	20	4	52

*Includes 1 horse each with arthroscopy of the right MCP and MTP joints, left MTP joint and left tarsal joint, left MTP joint and both stifle joints, left MTP joint and right tarsal joint, right MCP joint and right MTP joint, right MTP and right tarsal joint, both MTP joints and right tarsal joint, right MTP joint and left stifle joint, right MTP joint and right stifle joint, left MCP joint and right stifle joint, left MCP joint and left MTP joint, right tarsal joint and other joint, right MCP joint and left MTP joint, and right MCP joint and right MTP joint.
NA = Not applicable.

Table 2—Sales price of Thoroughbreds offered for sale at the Keeneland September 2006 yearling sale.

Day of the month	Median sales price of all yearlings (\$)	Study yearlings		
		Median sales price (\$)	IQR	No. of horses
11	310,000	277,000	145,000–352,500	18
12	300,000	437,000	170,000–743,000	18
13	150,000	132,000	91,000–200,000	30
14	120,000	75,000	37,000–170,000	31
16	80,000	70,000	47,000–135,000	31
17	72,000	57,000	37,000–100,000	30
18	55,000	45,000	27,000–75,000	31
19	40,000	33,000	13,000–50,000	30
20	30,000	21,000	12,000–30,000	31
21	20,000	19,000	7,000–37,000	31
22	13,000	10,000	6,000–35,000	31
23	11,000	14,000	9,000–21,000	30
24	6,500	3,000	2,000–13,000	28
25	4,600	3,000	2,500–7,000	27

IQR = Interquartile range (25th to 75th percentile).

fifth day of the sale (ie, September 16) was \$80,000 and median price the last day of the sale (ie, September 25) was \$4,600 (Table 2). Daily median prices of all horses offered for sale ($n = 5,161$) and of study horses (397) were highly correlated throughout the 14-day sales period ($R = 0.94$; $P < 0.01$).

In univariable analyses, the following forelimb radiographic findings were associated ($P \leq 0.20$) with sales price: P1 fragments ($P = 0.08$), vascular channels in the proximal sesamoid bones ($P = 0.12$), and enthesophytes or osteophytes involving the radiocarpal joint ($P = 0.16$). Similarly, in univariable analyses, the following hind limb radiographic findings were associated with sales price: P1 fragments ($P = 0.05$), vascular channels in the proximal sesamoid bones ($P = 0.17$), enthesophytes or osteophytes involving the distal intertarsal joint ($P = 0.11$), and OCD involving the stifle joints ($P = 0.07$). In the multivariable analysis, forelimb P1 fragments and hind limb P1 fragments were significantly ($P \leq 0.05$) associated with sales price. Mean sales price rank for horses with forelimb P1 fragments (mean \pm SE sales price rank, 170 ± 29) was significantly ($P = 0.01$) lower than mean sales price rank for horses without forelimb P1 fragments (238 ± 13), after controlling for sales day, history of arthroscopy, hind limb P1 fragments, and OCD involving the stifle joints (Table 3). Mean sales price rank for horses with hind limb P1 fragments (186 ± 22) was significantly ($P = 0.05$) lower than mean sales price rank for horses without hind limb P1 fragments (222 ± 18). Mean sales price rank was lower for horses with OCD involving the stifle joints (186 ± 24) than for horses without this radiographic finding (222 ± 15), but this difference was not significant ($P = 0.06$).

In the univariable analysis, median sales price was not significantly ($P = 0.46$) different when horses with (\$50,000) and without (\$35,000) a history of presale arthroscopy were compared (Table 3). However, multivariable ANOVA indicated that after controlling for sales day and the presence of P1 fragments and OCD involving the stifle joints, mean sales price rank was significantly ($P < 0.01$) lower in horses without a history of presale arthroscopy (180 ± 18), compared with horses with a history of presale arthroscopy (229 ± 20).

Table 3—Comparison of sales prices for Thoroughbred yearlings sold at the September 2006 Keeneland yearling sale with and without various presale radiographic findings or a history of presale arthroscopy.

Radiographic finding	No. of horses	Median sales price (\$)	Mean \pm SE sales price rank	P value
Forelimb P1 fragments				
No	280	38,000	238 ± 13	0.01
Yes	11	15,000	170 ± 29	
Hind limb P1 fragments				
No	263	40,000	222 ± 18	0.05
Yes	28	16,000	186 ± 22	
OCD of stifle joint				
No	266	38,500	222 ± 15	0.06
Yes	25	20,000	186 ± 24	
Presale arthroscopy				
No	253	35,000	180 ± 18	< 0.01
Yes	38	50,000	229 ± 20	
Sales day				
1–4	68	170,000	285 ± 20	< 0.01
5–14	223	150,000	123 ± 17	

Mean sales price rank was adjusted for sales day and a history of presale arthroscopy.

Discussion

In the present study, the most common radiographic findings in the forelimbs of Thoroughbred yearlings offered for sale at the 2006 Keeneland September yearling sale were vascular channels in the proximal sesamoid bones, enthesophytes or osteophytes in the radiocarpal joint, and OCD of the sagittal ridge of MC3. In the hind limbs, the most common radiographic findings were proximal sesamoid bone enthesophytes or osteophytes, abnormalities of the distodorsal aspect of MT3, and enthesophytes or osteophytes involving the distal intertarsal joint. There was a significant association between the presence of P1 fragments in forelimbs or hind limbs and sales price. Yearlings with P1 fragments in the forelimbs had lower sales prices than did yearlings without such fragments, after controlling for sales day, history of presale arthroscopy, and the presence of P1 fragments in the hind limbs, OCD in the stifle joints, or both. Similarly, yearlings with P1 fragments in the hind limbs had lower sales prices than did yearlings without such fragments, after controlling for sales day, history of presale arthroscopy, P1 fragments in the forelimbs, and OCD in the stifle joints. A random sampling approach was used to estimate the prevalence of various radiographic findings in horses offered for sale. Because median daily price of all horses offered for sale and median daily price of the study horses were highly correlated during the 14-day sales period, we suggest that this indicates that the random sample of horses in the present study was representative of the population of horses offered for sale.

A comparison of estimates of prevalence of radiographic findings in Thoroughbred yearlings from prior reports^{3,4} and the present study is difficult because the sampling methods differed between studies. In the previous study³ conducted in Kentucky, study horses were not randomly selected and the median sales price of study horses was significantly higher (\$40,000) than that for all yearlings offered for sale (\$22,000), suggesting that the study yearlings did not represent the sale population. In the study⁴ conducted in Texas, study horses were selected on the basis of whether health records were available for review. Therefore, it is possible that prevalence estimates for radiographic findings may have been under- or overestimated.

Current knowledge of the association between the presence of P1 fragments in Thoroughbred yearlings and future athletic performance is limited. In a study⁴ of Thoroughbred yearlings sold in Texas, the median sales price (\$6,500) was lower in yearlings with P1 fragments in the forelimbs or hind limbs, compared with the price for horses without P1 fragments (\$9,000). However, the analysis did not account for the potential confounding effects of additional radiographic findings on sales price, and no distinction was made between forelimbs and hind limbs. In a study⁷ conducted in Kentucky, the presence of P1 fragments in the forelimbs did not affect the ability of Thoroughbred yearlings to start a race as 2-year-olds, whereas the odds of starting a race were lower in Thoroughbred yearlings with P1 fragments in the hind limbs. However, in that study,⁷ any association between the presence of specific radiographic findings and future ability to start a race as a 2-year-old was diffi-

cult to assess because the occurrence of injuries during training prior to racing could not be measured.

In the present study, median sales price was lower in horses with OCD involving the stifle joints (\$20,000), compared with horses without this radiographic finding (\$38,500), after controlling for sales day, presale arthroscopy, and P1 fragments in the forelimbs or hind limbs. However, the difference in price was not significant. Because OCD of the stifle joint often causes lameness,⁸ it is possible that a small sample size was the reason that a significant difference was not observed in our study. If the observed difference was real, then the power of detecting this difference given the sample size used was < 50% at the 5% level of significance.

For horses in the present study, the prevalence of presale arthroscopy was 13%. However, compliance with surgery disclosure policies was not known, and if surgery disclosure was perceived to negatively affect sales price, then some surgeries may not have been disclosed. Therefore, it is possible that the prevalence of presale arthroscopy may have been underestimated in this study. Most horses had arthroscopy of the hind limb MTP joint. In yearlings, osteochondral fragments most frequently occur in the hind limbs and may develop early in life (eg, < 3 months of age).⁹ In addition, some yearlings undergoing sales preparation may kick objects (eg, stalls or exercisers) with their hind limbs, causing traumatic osteochondral P1 fragments. It is also possible that hind limb MTP joint arthroscopy may be perceived to mitigate potential detrimental effects of osteochondral P1 fragments on yearling sales price or future athletic performance. In a previous study,⁷ yearlings with proximodorsal P1 fragments in the hind limb MTP joint at the time of sale were less likely to start a race as 2- or 3-year-olds, compared with yearlings without this radiographic finding. Results from a study¹⁰ conducted at a training center in Florida revealed that arthroscopy (after sale but before training) may have a detrimental effect on athletic performance in Thoroughbred yearlings during training. The number of days lost during training was 28 days higher and financial returns were \$12,000 lower for Thoroughbred yearlings that had arthroscopy, compared with horses that did not have surgery.

In the present study, yearlings with a history of presale arthroscopy sold for a higher price than did yearlings without a history of surgery, after controlling for sales day, P1 fragments, and OCD of the stifle joints. Most often, surgery to remove fragments is performed before prepurchase radiographs are obtained. As a result, the radiographic findings that necessitated surgery are no longer evident on radiographs of these horses that are placed in the repository at the time of the yearling sale. Because yearlings with a history of presale arthroscopy sold for more money than did yearlings without a history of surgery in our study, we suggest that veterinarians advising buyers may assume that presale arthroscopy is unlikely to compromise future racing performance. However, a higher sales price in yearlings with a history of surgery could also be explained by pedigree-related factors, which were not assessed.

The present study had several limitations. All radiographs were evaluated by a single veterinarian, and the

sensitivity and specificity of the method of radiographic evaluation were not assessed. Misclassification of mild radiographic findings was possible, which may have biased the prevalence estimates for specific radiographic findings (eg, vascular channels in proximal sesamoid bones and the presence of enthesophytes and osteophytes in radiocarpal and intertarsal joints). In addition, it was difficult to assess the effect of pedigree (eg, sire) on the relationship between sales price and radiographic findings, and between sales price and presale arthroscopy because the number of horses presented for sale during the first 4 days with or without radiographic findings or a history of presale arthroscopy with the same sire was small. Therefore, the analyses of sales price included the variable of sales day (ie, the first 4 days vs subsequent days) because sales prices were higher during the first 4 days of the sales, when elite horses were offered for sale. Despite these limitations, the information provided by the present study may assist consignors, buyers, and veterinarians to more objectively evaluate Thoroughbred yearlings offered for sale.

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Appendix

Radiographic views (total = 32) required for horses sold at the Keeneland yearling sale.

- Right and left metacarpophalangeal (fetlock) joints
 Dorsoproximal-palmarodistal oblique (15° proximal to the supporting surface)
 Dorsomedial-palmarolateral oblique (30° medial to the dorsopalmar line)
 Dorsolateral-palmaromedial oblique (30° lateral to the dorsopalmar line)
 Lateromedial (obtained with the joint flexed)
- Right and left metatarsophalangeal (fetlock) joints
 Dorsoproximal-plantarodistal oblique (15° proximal to the supporting surface)
 Dorsoproximomedial-plantarodistolateral oblique (15° proximal to the supporting surface and 30° medial to the dorsoplantar line)
 Dorsoproximolateral-plantarodistomedial oblique (15° proximal to the supporting surface and 30° lateral to the dorsoplantar line)
 Lateromedial (obtained with the horse standing)
- Right and left carpal joints
 Dorsolateral-palmaromedial oblique (30° lateral to the dorsopalmar line)
 Dorsomedial-palmarolateral oblique (30° medial to the dorsopalmar line)
 Lateromedial (obtained with the joint flexed)
- Right and left tarsal (hock) joints
 Dorsomedial-plantarolateral oblique (65° medial to the dorsoplantar line)*
 Dorsolateral-plantaromedial oblique (10° lateral to the dorsoplantar line)
 Lateromedial
- Right and left stifle joints
 Lateromedial
 Caudolateral-craniomedial oblique (20° lateral to the craniocaudal line; must include medial femoral condyle in its entirety)

*Alternatively, the plantarolateral-dorsomedial oblique view (25° lateral to the dorsoplantar line) may be used.