

## Ultrasonographic Appearance of the Urinary Organs in Native Korean Cattle

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### 한우에서 尿器官의 초음파상

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충남대학교 수의과대학, \*충북대학교 수의과대학, \*\*생명공학연구소

**요 약 :** 한우 성우 및 송아지에서 신장 및 방광의 정상적인 초음파영상에 관한 연구를 하기 위하여 본 연구를 수행하였다. 초음파검사법에 의하여 19두의 한우 성우의 우측 신장 및 방광과 16두의 한우 송아지의 양측 신장 및 방광의 위치, 면적 및 구조를 관찰하였다. 3.5 또는 5.0-MHz convex transducer 및 5.0-MHz sector transducer를 사용하여, 신장은 요추측와 및 최후 늑간강에서 관찰하였으며, 방광은 하복부 정중선에서 관찰하였다. 송아지의 우측 신장은 6.9-9.9 cm의 길이, 4.2-6.6 cm의 폭, 그리고 2.5-3.3 cm의 깊이를 나타내었다. 우측 신장의 실질 및 신동의 직경은 각각 0.77-1.26 cm 및 0.67-0.94 cm를 나타내었다. 송아지의 좌측 신장에서도 유사한 결과를 나타내었다. 성우의 우측 신장은 10.6-11.7 cm의 폭, 그리고 5.0-8.4 cm의 깊이를 나타내었다. 우측 신장의 실질 및 신동의 직경은 각각 1.9-3.1 및 1.6-2.7 cm를 나타내었다. 송아지에서 방광의 직경, 원주 및 면적은 각각 52.3 mm, 162.8 mm 및 22.3 cm<sup>2</sup>이었으며, 성우에서의 방광의 직경, 원주 및 면적은 각각 94.3 mm, 293.8 mm 및 69.4 cm<sup>2</sup>이었다. 본 연구에서의 초음파검사 결과는 한우 성우 및 한우 송아지의 신장 및 방광의 형태학적 변화의 진단을 위한 참고자료로서 사용될 수 있다는 결론을 얻었다.

**Key words :** ultrasonography, native Korean cattle, urinary organs, kidney, urinary bladder

### Introduction

Ultrasonography provides us morphological and physiological information of internal organs. Nowadays the importance of ultrasonographic diagnosis is recognized also in veterinary medicine but fundamental data is not many for using as diagnostic materials, especially in bovine.

In clinical medicine, the ultrasonographic imaging

of the kidney is of major importance in the diagnosis of renal disease. Ultrasonography has been used to diagnose renal calculi, cysts, renal neoplasia, hydronephrosis, cystitis, bladder diverticula, and obstruction of the urinary tract<sup>10</sup>. Ultrasonographically determined anatomic features of the kidney have been described in horses<sup>8</sup>, dogs<sup>7,10,16</sup>, cats<sup>14</sup>, goat<sup>17</sup>, sheep<sup>4</sup> and cows<sup>2</sup>. But it is not many, especially in cows.

Ultrasonographic examinations of the size, shape, and position of normal liver<sup>1,15</sup>, kidney<sup>2</sup>, duodenum<sup>3</sup>, limb<sup>9</sup>, eyes<sup>6</sup> and genital organs<sup>5,11-13</sup> were reported in adult cows. But to our knowledge, they have not

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been done yet in calf. Also in native Korean cattle, there was no report of ultrasonography for urinary organs in both the cattle and calves.

Native Korean cattle has been adapted for climate and natural features in Korea. Nowadays native Korean cattle usually reared in groups. The incidence of diseases of urinary organs have been increased with overfeeding of concentrated feed and unbalance of mineral intake. However, there was no report for the ultrasonography of native Korean cattle yet. The present study aims to make fundamental data for the ultrasonographic diagnosis of abdominal disease, genital disease and early pregnancy diagnosis in native Korean cattle.

## Materials and Methods

The position, dimensions, and structure of both kidneys and urinary bladder in 16 calves and the right kidney and urinary bladder in 19 cattle were determined by use of ultrasonography. All examinations were performed in standing position. The kidneys were determined in the paralumbar fossa, and in the last intercostal space. The urinary bladder was examined in the lower belly on midline. Ultrasonograms were obtained with 3.5 or 5.0-MHz convex and 5.0-MHz sector transducers.

Ultrasonographic measurements of the kidney included length of the kidney (the distance between the cranial and caudal renal poles), depth of the kidney (the distance between the ventral and dorsal faces), width of the kidney (the distance between the lateral and medial margins), diameter of the renal parenchyma and renal sinus (measured from dorsal to ventral in the transverse plane at the level of the renal hilus). The diameter, circumference and area of the urinary bladder were determined.

## Results

The ultrasonographic examination of the kidney of native Korean calf is shown in Table 1. The right kidney in calves was 6.9 to 9.9 cm long, 4.2 to 6.6 cm wide, and 2.5 to 3.3 cm deep. Diameter of the parenchyma and renal sinus of the right kidney rang-

**Table 1.** Results of ultrasonographic examination of the kidney in 16 native Korean calves

Variables	Mean	SD	Normal range	
<b>Right kidney</b>				
Length	9.3	1.3	6.9	to 9.9
Width	5.4	0.6	4.2	to 6.6
Depth	2.8	0.4	2.5	to 3.3
Diameter of renal parenchyma	1.0	0.3	0.77	to 1.26
Diameter of renal sinus	0.8	0.2	0.67	to 0.94
<b>Left kidney</b>				
Length	9.5	1.4	8.8	to 10.1
Width	5.5	0.7	4.2	to 8.7
Depth	2.8	0.5	2.5	to 3.4
Diameter of renal parenchyma	1.1	0.3	0.76	to 1.25
Diameter of renal sinus	0.8	0.3	0.89	to 0.97

Data are expressed in centimeters.

ed between 0.77 to 1.26 cm and 0.67 to 0.94 cm, respectively.

The left kidney in calves was 8.8 to 10.1 cm long, 4.2 to 8.7 cm wide, and 2.5 to 3.4 cm deep. Diameter of the parenchyma and renal sinus of the right kidney ranged between 0.76 to 1.25 cm and 0.89 to 0.97 cm, respectively.

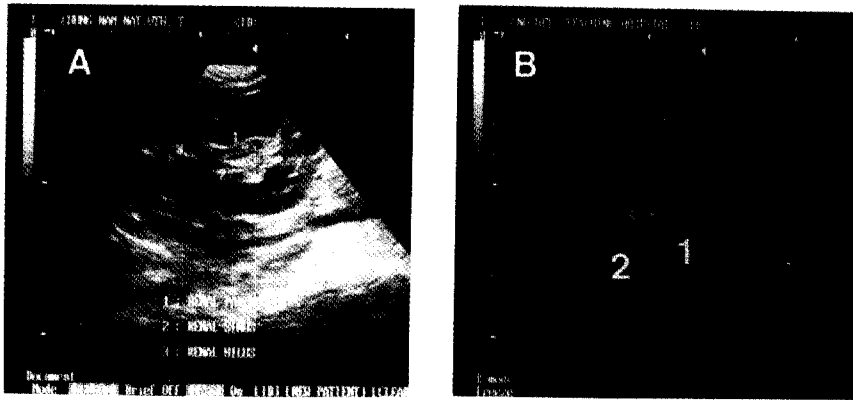
As shown in Fig 1, hyperechoic renal sinus was easily distinguished from the surrounding hypoechoic renal cortex and medulla.

The ultrasonographic examination of the kidney of native Korean cattle is shown in Table 2. The right kidney in cattle was 10.6 to 11.7 cm wide, and 5.0 to 8.4 cm deep. Diameter of the parenchyma and renal sinus of the right kidney ranged between 1.9 to 3.1 cm and 1.6 to 2.7 cm, respectively.

As shown in Fig 1, hyperechoic renal sinus was easily distinguished from the surrounding hypoechoic renal cortex and medulla. Kidney revealed grape figure and irregular shape.

The diameter, circumference and area of the bladder in calves was 52.3 mm, 162.8 mm and 22.3 cm<sup>2</sup>, respectively. The diameter, circumference and area of the bladder in cattle were 94.3 mm, 293.8 mm and 69.4 cm<sup>2</sup>, respectively.

As shown in Fig 2, low echoed bladder in the central whole area was elliptical, and acoustic enhancement was revealed under the urinary bladder.



**Fig 1.** Ultrasonogram of kidney. Kidney reveals grape figure and irregular shape. High echoed renal sinus is in the middle area. (A) Ultrasonogram of kidney in 5 months old, 120 kg weighed female native Korean calf. The transducer was placed in the 12th intercostal space about 16 cm distal to the midline of the back. 1=renal parenchyma, 2=renal sinus, 3=renal hilus. (B) Ultrasonogram of kidney in 12 months old, 300 kg weighed native Korean cow. The transducer was placed in the 12th intercostal space about 25 cm distal to the midline of the back. 1=renal parenchyma, 2=renal sinus.

**Table 2.** Results of ultrasonographic examination of the kidney in 19 native Korean cattle

Variables	Mean	SD	Normal range
Right kidney			
Width	11.2	1.5	10.6 to 11.7
Depth	6.7	1.3	5.0 to 8.4
Diameter of renal parenchyma	2.3	0.6	1.9 to 3.1
Diameter of renal sinus	2.1	0.4	1.6 to 2.7

Data are expressed in centimeters.

**Table 3.** Results of the ultrasonographic examination of the urinary bladder in native Korean calves and cattle (Mean ± SD)

Variables	No of animals	Diameter (mm)	Circumference (mm)	Area (cm <sup>2</sup> )
Calves	16	52.3 ± 11.2	162.8 ± 35.6	22.3 ± 10.9
Cattle	19	94.3 ± 17.5*	293.8 ± 52.5*	69.4 ± 23.1*

\*; p<0.01

### Discussion

Diagnostic gray-scale ultrasonography is a non-invasive method of imaging soft tissue structures. It defines normal base-line anatomic organ determinants and also facilitates recognition and evaluation of disease. Nowadays the importance of ultrasonographic diagnosis is recognized also in vet-

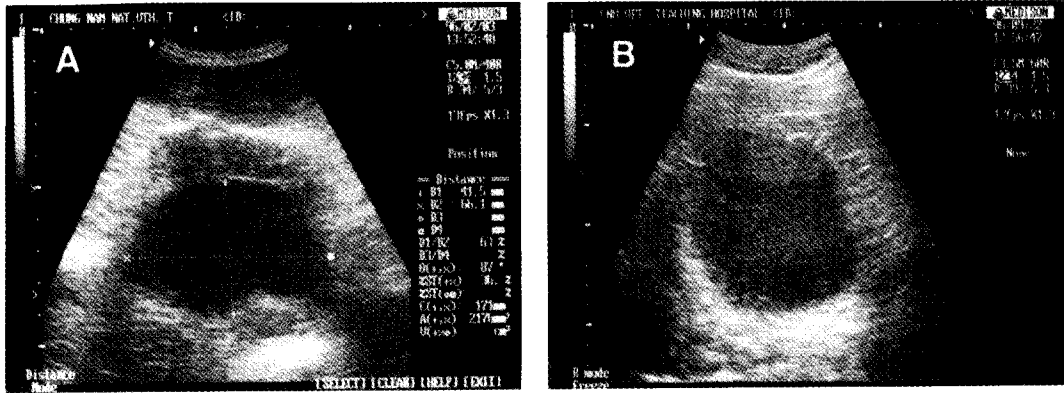
erinary medicine but fundamental data is not many for using as diagnostic materials, especially in bovine.

Also, urinary disease is increasing in cattle because of group raising, overfeeding of concentrated feed and deficit of vitamin A. Diagnostic ultrasonography enables the clinician to get an accurate assessment of liver and kidney.

Ultrasonographically determined anatomic features of the kidney have been described in horses<sup>8</sup>, dogs<sup>7,10,16</sup>, cats<sup>14</sup>, goat<sup>17</sup>, sheep<sup>4</sup> and cows<sup>2</sup>. But it is not many, especially in cows.

Braun *et al*<sup>1</sup> reported that the diameter of the bladder of sheep could not be determined in 32% of the sheep because it was > 10 cm, and, therefore, was beyond the penetration depth of the scanner. But, authors could determine the diameter of the bladder of cattle using 3.5-MHz convex scanner because it could penetrate 18 cm.

Both kidneys of calf were easily accessible to ultrasonography from the body surface, but only right kidney was easily accessible in cattle. It is supposed that the reason why the left kidney of cattle was not visualized, is interception of rumen. In the calf, the ratio of rumen capacity in ruminant stomach is increased according to growth. So, it was considered that after yearling, ultrasonographic image of the left



**Fig 2.** Ultrasonogram of urinary bladder. These were observed in the midline of lower abdomen. Low echoed bladder in the central whole area is elliptical. (A) Ultrasonogram of urinary bladder in 4 months old, 110 kg weighed female native Korean calf. The length and width of bladder are 66.1 mm and 41.5 mm, and 171 mm of circumference and 2, 176 mm<sup>2</sup> of area are seen. (B) Ultrasonogram of urinary bladder in 13 months old, 320 kg weighed native Korean cow. Acoustic enhancement is revealed under the urinary bladder.

kidney should be obtained rectally, using a special transducer. As shown in Fig 1, renal sinus is appeared hyperechoic because it includes renal calyx, renal pelvis, vessels and lymphatics.

It was considered that the ultrasonographic values of urinary organs in this study can be used as references for the diagnosis of changes in urinary organs of native Korean cattle and calves.

### Conclusion

The purpose of this study is to make fundamental information about the ultrasonogram of the kidney. The kidney and urinary bladder of 19 native Korean cattle and 16 calves were determined. The kidney were examined in the paralumbar fossa, and in the last intercostal space. The urinary bladder was examined in the lower belly on midline. All examinations were performed in standing position. Ultrasonograms were obtained with 3.5 or 5.0-MHz convex and 5.0-MHz sector transducers.

The right kidney in calves was 6.9 to 9.9 cm long, 4.2 to 6.6 cm wide, and 2.5 to 3.3 cm deep. Diameter of the parenchyma and renal sinus of the right kidney ranged between 0.77 to 1.26 cm and 0.67 to 0.94 cm, respectively. The ultrasonographic measurements of the left kidney in calves were sim-

ilar. The right kidney in cattle was 10.6 to 11.7 cm wide, and 5.0 to 8.4 cm deep. Diameter of the parenchyma and renal sinus of the right kidney ranged between 1.9 to 3.1 cm and 1.6 to 2.7 cm, respectively.

The diameter, circumference and area of the urinary bladder were determined. The diameter, circumference and area of the bladder in calves was 52.3 mm, 162.8 mm and 22.3 cm<sup>2</sup>, respectively. The diameter, circumference and area of the bladder in cattle were 94.3 mm, 293.8 mm and 69.4 cm<sup>2</sup>, respectively.

It was concluded that the ultrasonographic values determined in this study can be used as references for the diagnosis of morphologic changes in the urinary organs in native Korean cattle.

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