Radiographic Assessment of Bone Cortex to Bone Diameter Ratio of Manus and Pes in Camel

Sarang Sorouri\textsuperscript{1} DVSc
Abbas Veshkini\textsuperscript{*1} PhD
Mohammad Mehdi Dehghan\textsuperscript{1} DVSc
Omid Farhadian\textsuperscript{2} DVM

\textsuperscript{1}Department of Clinical Sciences, Faculty of Veterinary Medicine, University of Tehran, Iran.
\textsuperscript{2}Graduated from the Faculty of Veterinary Medicine, University of Tehran, Iran.

Abstract

Objective- To measure statistically bone cortex to diameter (C/D) ratio in metacarpal/metatarsal and proximal phalanges in camel. This ratio may be used in diagnosing possible metabolic and nutritional diseases in camel.
Design- Experimental study.
Animals- Twelve camel limbs (6 fore limbs & 6 hind limbs)
Procedures- This study was conducted on dorsopalmar/dorsoplantar radiographs of twelve fore and hind limbs of camel. Cortical thickness, bone diameter and C/D ratio of mid metacarpal/metatarsal regions, C/D ratio of metacarpal/metatarsal regions just proximal to its bifurcation and C/D ratio of proximal phalanges were measured on all radiographs. Available data were analyzed statistically and the average, P-values, and standard deviations are given. Important characteristic of measurements are discussed.
Results- C/D ratios of mid metacarpal region and just proximal to its bifurcation were 0.18 and 0.13 respectively. C/D ratios of mid metatarsal region and just proximal to its bifurcation were 0.21 and 0.14 respectively. C/D ratios of mid lateral and medial proximal phalanx of forelimb were 0.21 and 0.22 respectively. C/D ratios of mid lateral and medial proximal phalanx of hind limb were 0.22 and 0.24 respectively.
Conclusion and Clinical Relevance- This study showed that there were significant differences between C/D ratios of manus and pes measured in all locations except between metacarpal to metatarsal region just proximal to its bifurcation. No acceptable reason was found for this result so it can be attributed to measurement inaccuracy in this site.
Key words: Radiography, Bone Cortex to Diameter Ratio, Camel

* Corresponding Author:
Abbas Veshkini,
Department of Clinical Sciences, Faculty of Veterinary Medicine, University of Tehran, Iran.
e-mail: veshkiniabbas@yahoo.com
Introduction

Cortical thinning and subsequent pathologic fractures due to metabolic, nutritional, malignancy, aging and disusing can occur most often in human and animals. Bone densitometry is most accurate and sensitive assessment of bone health especially in human. Bone densitometry can detect the changes in bone volume as little as one percent. Although bone densitometry is used in veterinary research and practice but it has not become routine in veterinary medicine due to the price of unit and variety in the size of animals. Plain radiography can detect decrease in density when at least 30% of the normal bone density is decreased. Although radiographic diagnosis is very accurate in advanced cases but it is very subjective in early cases. C/D ratios are a radiographic and computed tomography parameter that is used in human to assess the amount of bone health. These ratios are very easy to obtain on the radiographs\(^1,2\). These ratios are not routinely used for assessing bone health in animals like dog and cat as well as in camel. This study was conducted to have some normal values of C/D ratios in fore and hind limb in camel.

Materials and Methods

Twelve fore and hind limbs of slaughtered one humped camel (Dormdrain dromedaries) were radiographed in dorsopalmar/dorsoplantar view using 60 kVp and 5 mAs with FFD of 80 cm (Fig1). C/D ratio of mid metacarpo/metatarsal region (Fig 2), and C/D ratio of metacarpo/metatarsal region were measured on the dorsopalmar region just proximal to its bifurcation (Fig 2), middle of lateral phalanges and middle of medial phalanges of fore and hind limb (Fig 3). An independent student’s t-test and paired sample t-test were used to detect significant differences between data collected from fore and hind limbs. A nonparametric Mann-Whitney U test was used where data did not follow a normal distribution. The significance level was set at P<0.05.
Results

The mean ± SE of C/D ratios of mid metacarpal region and metacarpal region just proximal to its bifurcation were 0.18±0.006 and 0.13±0.005 respectively. The mean ± SE of C/D ratios of mid metatarsal region and metatarsal region just proximal to its bifurcation were 0.21±0.004 and 0.14±0.004 respectively. The mean ± SE of C/D ratios of mid lateral and medial proximal phalanges of forelimb were 0.21±0.003 and 0.22±0.006 respectively. The mean ± SE of C/D ratios of mid lateral and medial proximal phalanx of hind limb were 0.22±0.006 and 0.24±0.006 respectively.

There was significant difference between mean value of C/D ratios of mid metacarpal region to metacarpal region just proximal to its bifurcation (P<0.05) and also between mid metatarsal region and metatarsal region just proximal to its bifurcation. There was no significant difference between mean value of C/D ratios of middle of lateral and medial proximal phalanges of fore limb (P=0.25). Unlike forelimb, there was significant difference between mean value of C/D ratios of middle of lateral and medial proximal phalanges of hind limb (P-value = 0.017). There was significant difference between C/D ratio of mid metacarpal and mid metatarsal region (P-value = 0.017) but there was no significant difference between metacarpal and metatarsal region just proximal to its bifurcation (P=0.50). There was significant difference between lateral proximal phalanges of fore and hind limb (P-value = 0.037) and between medial proximal phalanges of fore and hind limb (P-value =0.045). (Table 1 & 2)
Table 1: Mean of cortex, bone diameter and C/D index of metacarpal/metatarsal region

<table>
<thead>
<tr>
<th>Anatomical region</th>
<th>Mid metacarpal/metatarsal region</th>
<th>Metacarpal/metatarsal region just to its bifurcation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean±SE of CT (mm)</td>
<td>Mean±SE of BD (mm)</td>
</tr>
<tr>
<td>Manus</td>
<td>8.08±0.41</td>
<td>44.50±1.43</td>
</tr>
<tr>
<td>Pes</td>
<td>7.07±0.37</td>
<td>36.60±1.30</td>
</tr>
</tbody>
</table>

* CT = Cortical thickness ** BD = Bone diameter
Means with the same superscripts are significantly differed at P<0.05

Table 2: Mean of cortex, bone diameter and C/D index of lateral and Medial proximal phalanx

<table>
<thead>
<tr>
<th>Anatomical region</th>
<th>Mid medial proximal phalanx</th>
<th>Mid lateral proximal phalanx</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean±SE of CT (mm)</td>
<td>Mean±SE of BD (mm)</td>
</tr>
<tr>
<td>Manus</td>
<td>5.40±0.19</td>
<td>24.5±0.27</td>
</tr>
<tr>
<td>Pes</td>
<td>5.30±0.19</td>
<td>21.9±0.52</td>
</tr>
</tbody>
</table>

* CT = Cortical thickness ** BD = Bone diameter
Means with the same superscripts are significantly differed at P<0.05

Discussion

Bone densitometry is one of the main pillars in assessment of osteoporosis in human\(^1\). The most important modalities are dual x-ray absorptiometry (DXA), quantitative computed tomography (QCT), and quantitative ultrasound (QUS)\(^1\). Although the DXA or QUS are more accurate measurement in assessment of osteoporosis but these techniques are not practically available in assessment of osteoporosis/osteopenia in animals generally and specially in camel. C/D ratios are very important and practical index that can be used to assess bone health\(^1\). C/D ratio has been used in human to assess bone changes\(^1,2\). Bone diseases causing decrease in bone density can be detected in early stages by knowing normal C/D ratios of bones in different animals\(^3\). C/D ratio has got merit to cortical thickness measurement alone because this index exclude related factors such as age, sex, weight, height and breed. This study showed that, there is significant differences between C/D ratios of manus and pes measured in all sites mentioned in Table 1 and 2 except between metacarpal to metatarsal region just proximal to its bifurcation. No explanation was found for this result so it can be attributed to measurement inaccuracy in this site. This study showed that, there was no significant difference between C/D ratio of lateral and medial proximal phalanges of fore
limb, whereas the C/D ratio of lateral and medial proximal phalanges of hind limb was different significantly. Although cortical thickness in manus is greater than pes in all areas, which have been measured but the C/D ratio in pes is higher than manus. This is due to the smaller bone diameter in all areas measured in pes. In this study the C/D index was obtained on the basis of the cortical thickness measurement only, because this index is not affected by disturbing factors such as age, sex, weight, height and breed.

References

چکیده
ارزیابی رادیوگرافی نسبت کورتکس به قطر استخوانهای دست و یا در شتر

دکتر سارنگ سروری، دکتر عباس وشکنی، دکتر محمد مهدی دهقان، دکتر امید فرهادیان

گروه آموزش علوم درمانگاهی، دانشکده دامپزشکی دانشگاه تهران، تهران، ایران.

کاشاند، دانشکده دامپزشکی دانشگاه تهران، تهران.

هدف: محاسبه نسبت ضخامت کورتکس به قطر استخوان (C/D) در استخوانهای قلم و بند اول انگشتان دست و یا در شتر به منظور تشخیص بیماری‌های احتمالی تغذیهای آنها و منابعی که از آنها بهره می‌برند.

روش کار: این مطالعه بر روی رادیوگرافی‌های تنه شده از تعداد 32 رادیوگرافی قلم و خلفی شتر در دو حالت کم و بالا پشتی- کف دست و پشتی- کف پاپی انجام شد. این رادیوگرافی‌ها ضخامت کورتکس و قطر استخوان و نسبت (C/D) در ناحیه میانی و ناحیه بالا‌الصفاء قابل تنظیم، محل دو صفحه شدن بالا استخوان قلم و بند اول انگشتان در دست و یا اندازه‌گیری کورتکس و محاسبه شدند. یافته‌های بوده مورد بررسی و تحلیل آماری قرار گرفت و نتایج آن‌ها با محاسبات ممکن اندازه‌گیری کشیده شد.

نتایج: نسبت C/D در ناحیه بالا و ناحیه بالا با استخوان قلم در دست به ترتیب 0.18 و 0.14 و نسبت C/D در ناحیه بالا و ناحیه بالا با استخوان بالا در دست به ترتیب 0.21 و 0.22 محاسبه گردیدند. همچنین نسبت C/D ناحیه میانی بند اول انگشتان 0.21 و 0.22، نسبت C/D ناحیه میانی بند اول انگشتان 0.24 به دست آمد.

نتایج گیری: این مطالعه نشان داد که اختلاف میانی داری بین نسبت استخوانهای تمام ناحیه دست به جز ناحیه بلافاصله قبل از محل دو صفحه شدن بالا استخوان قلم با استخوانهای مشابه در پا وجود دارد. هنگام قابل توجهی برای این عدم وجود اختلاف میانی دار بین C/D استخوانهای بالا با استخوانهای قلم دست با پا به دست آمد و این ممکن است این مورد به دوی اگر

کلید واژگان: رادیوگرافی، استخوان، کورتکس، شتر

IJVS Vol.: 2 No.: 2 Year: 2007