Studies on the normal synovial fluid from the carpal joints of Iranian water buffaloes: physical and biochemical parameters

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Summary

Reports on the physical and biochemical parameters of synovial fluid in buffaloes are limited. This study was conducted to evaluate the normal parameters of synovial fluid on buffaloes that can be very helpful in diagnosis of arthropathy. Synovial fluid of carpal joints was collected by arthrocentesis of the right and left forelimbs in 21 water buffaloes immediately after slaughtering of animals in abattoir. The quality of mucin clot and viscosity were normal in 100% of animals. The synovial fluid was colorless in 50% of cases and the other 50% had a yellowish color. Only 77.5% of samples were transparent and 22.5% were semitransparent. The range of values for different measured parameters were: AST: (27.65 ± 5.9) IU/L, ALT: (15.08 ± 2.75) IU/L, LDH: (36.55 ± 13.28) IU/L, glucose: (59.25 ± 3.39) mg/dL, total protein: (0.89 ± 0.055) g/dL, urea nitrogen: (7.96 ± 1) mg/dL. There was no significant difference between groups according to age, sex and side (left and right forelimbs) for all parameters except ALT and LDH which differed according to sex, ALT and LDH were significantly (P<0.05) greater in females.

Key words: Buffalo, Synovial fluid, Carp

Introduction

Examination of the synovial fluid can be a routine procedure in the evaluation of arthritic conditions, as it can provide valuable information in addition to that gained by clinical and radiological examination. Although a synovial fluid examination will not provide a specific diagnosis, it does give an indication of the degree of synovitis and metabolic derangement within the joint (Tyagi and Krishnamurthy, 1974; Jani et al., 1994; Pal et al., 1994; Barvalia et al., 1995).

Although some information is available on the cytological and biochemical parameters of synovial fluid of tibiotalar and stifle joints in buffalo, the level of enzymes in synovial fluid has not been determined (Tyagi and Krishnamurthy, 1972; Krishnamurthy and Tyagi, 1973; Soliman et al., 1975). Because of limited information, this study was conducted to obtain some basic information about the composition of carpal synovial fluid in Iranian water buffalo.

Materials and Methods

Synovial fluid of carpal joints were collected by arthrocentesis of the right and left forelimbs in 11 female and 10 male water buffaloes immediately after slaughtering of animals in Ahvaz (southwest province in Iran) abattoir. Animals were examined for any signs of lameness before slaughtering. Samples were obtained from healthy animals without any sign and history of lameness. The site of arthrocentesis was located in the depression either lateral or medial to the extensor carpi radialis muscle. Samples were obtained from the carpus held in a flexed position using a 20 ml syring attached to a 1-inch 18-gauge needle.

Samples were transferred to the clinical pathology laboratory of veterinary teaching hospital in Shahid Chamran University of
Ahvaz. After recording the physical parameters of synovial fluid, fluids were preserved in the refrigerator for biochemical tests. All measurements were performed with utmost 18 hours. Physical parameters included the quality of mucin clot, color, viscosity and transparency. The quality of mucin clot was evaluated by adding 0.5 ml of synovial fluid to 2 ml of 2% acetic acid and mixed it rapidly by a glass rod. For evaluating viscosity, a drop of synovial fluid was placed on the thumb and then touched with the index finger. If the separation of the fingers produced a string 2.5 to 5 cm long before breaking, viscosity was graded as normal. The activities of alanine aminotransferasase (ALT; Reitman-Frankel method), aspartate aminotransferase (AST; Reitman-Frankel method), lactate dehydrogenase (LDH) (Cabaud and Wroblewlski method) and the level of glucose (Glucose oxidase method), total protein (Biuret method) and urea nitrogen (Di Acetylmonooxinium method) were also measured (Pesce and Kaplan, 1987).

Samples were divided according to sex (10 male and 11 female buffaloes) and maturity (12 mature and 9 immature). Analysis of variances was used for determination of significant difference between groups. The test was also used for showing significant difference in measured parameters between right and left forelimbs (21 right carpal joint and 19 left carpal joint).

**Results**

A tight rosy mass formed in all samples, therefore the mucinous precipitate quality was graded as good (normal) in all samples. Separating the fingers produced a string 2.5 to 5 cm long of synovial fluid in all samples before breaking, therefore viscosity were normal in 100% of animals. Fifty percent of specimens were colorless and 50% have a yellowish color. Only 77.5% of samples were transparent and 22.5% were semitransparent.

The range of values for different measured parameters were: AST: (27.65 ± 5.9)IU/L, ALT: (15.08 ± 2.75) IU/L, LDH: (36.55 ± 13.28) IU/L, glucose: (59.25 ± 3.39) mg/dL, total protein: (0.89 ± 0.055) g/dL, urea nitrogen( 7.96 ± 1) mg/dL. There was no significant difference between groups according to age, sex and side (left and right forelimbs) for all parameters except ALT and LDH according to sex. ALT and LDH were significantly (P<0.05) greater in females (ALT: 16.48 ± 2.34 in females and 13.53 ± 2.34 in males; LDH: 41.71 ± 13.55 in females and 30.84 ± 10.61 in males). Table 1 shows the mean and standard deviation of different measured parameters.

**Table 1: The mean and standard deviation of measured parameters of the synovial fluid in different groups according to sex, age and side (left and right forelimbs)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AST (IU/L)</th>
<th>ALT (IU/L)</th>
<th>LDH (IU/L)</th>
<th>Glucose (mg/dL)</th>
<th>Total Protein (g/dL)</th>
<th>Urea Nitrogen (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (10)*</td>
<td>26.42 ± 6.67</td>
<td>13.53 ± 2.3</td>
<td>30.84 ± 10.6</td>
<td>59.11 ± 4.21</td>
<td>0.89 ± 0.058</td>
<td>8.15 ± 1.11</td>
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<tr>
<td>Female (11)</td>
<td>28.67 ± 5.01</td>
<td>16.48 ± 2.3</td>
<td>41.71 ± 13.5</td>
<td>59.38 ± 2.25</td>
<td>0.89 ± 0.052</td>
<td>7.79 ± 0.88</td>
</tr>
<tr>
<td>Right (21)</td>
<td>28.24 ± 6.62</td>
<td>14.65 ± 3.11</td>
<td>37.9 ± 14.35</td>
<td>59.71 ± 3.51</td>
<td>0.89 ± 0.057</td>
<td>7.93 ± 1.00</td>
</tr>
<tr>
<td>Left (19)</td>
<td>27 ± 5.09</td>
<td>15.21 ± 2.37</td>
<td>35.05 ± 12.2</td>
<td>58.74 ± 3.26</td>
<td>0.89 ± 0.053</td>
<td>7.99 ± 1.02</td>
</tr>
<tr>
<td>Mature (12)</td>
<td>26.87 ± 4.35</td>
<td>14.7 ± 2.9</td>
<td>39.25 ± 11.95</td>
<td>59.25 ± 2.5</td>
<td>0.9 ± 0.057</td>
<td>7.7 ± 1.09</td>
</tr>
<tr>
<td>Immature (9)</td>
<td>28.71 ± 7.53</td>
<td>15.59 ± 2.53</td>
<td>33.53 ± 14.28</td>
<td>58.88 ± 4.37</td>
<td>0.88 ± 0.049</td>
<td>8.32 ± 0.75</td>
</tr>
<tr>
<td>Total (21)</td>
<td>27.65 ± 5.9</td>
<td>15.8 ± 2.75</td>
<td>36.55 ± 13.28</td>
<td>59.25 ± 3.39</td>
<td>0.89 ± 0.055</td>
<td>7.96 ± 1.00</td>
</tr>
</tbody>
</table>

*Number of samples
a, b; Significant difference between groups according to sex (P<0.05)
Discussion

A significant decrease in relative viscosity, mucin precipitate quality and glucose concentration and a significant increase in total proteins have been observed following induced arthritis in buffalo calves (Jani et al., 1994). Also, there is a close correlation between the activities of alkaline phosphatase (ALP), aspartate aminotransferase (AST) and lactate dehydrogenase (LDH) in synovial fluid and the clinical severity of joint disease (Stashak, 1987). The data of physical parameters of synovial fluid in Iranian buffalo obtained in this study can be used as a reference value for evaluating the arthritis in buffaloes. The quality of mucin clot was good and the viscosity was normal in all samples. Samples were colorless or had a yellowish color.

Significant difference (P<0.05) was observed in ALT and LDH in females in comparison with males. Activity of these enzymes was higher in females. In a study on Holstein and mixed breed cows, the statistical analysis showed a significant increase in activity of AST of synovial fluid in calves and heifers. Also a significant increase in activity of ALT was observed in female calves. (Mojabi et al., 1991)

Some of the authors reported the significant difference of blood level of LDH and ALT between males and females in lambs, horses and calves (Beatty and Doxey, 1984; Richard et al., 1995; Sharma et al., 1994; Wu and Wu, 1996). Because of close relation between synovial fluid and blood, the difference at the level of these enzymes in synovial fluid between males and females could be explained.

In this study, glucose, total protein and urea nitrogen of carpal synovial fluid were 59.25 ± 3.39 mg/dL, 0.89 ± 0.055 g/dL and 7.96 ± 1 mg/dL, respectively. Total protein of synovial fluid of the tibiotalaral and stifle joint in buffalo has been reported 0.882-0.9g/dL and 1.02 g/dL, respectively (Krishnamurthy and Tyagi, 1973; Soliman et al., 1975). The value of glucose, total protein and urea nitrogen in cattle has been reported 61.59 ± 6.06 mg/dL, 0.91 ± 0.17 g/dL and 8.69 ± 1.9 respectively (Mojabi et al., 1370). Also the mean value of total protein in synovial fluid for 15 horses was 1.088 mg/dL (Korenevik et al, 1992).

It was concluded that these values in healthy animals could be used for determination of joint diseases when compared with those obtained from arthritic cases.

References


