The prevalence of blood and serous cysts in the atrioventricular valves of the heart of cattle

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SUMMARY

The hearts of 1100 cattle slaughtered during six months in a local slaughterhouse were inspected for the prevalence of blood and serous cysts of the atrioventricular (A-V) valves. Out of 1100 hearts examined, 540 had valvular cysts (49.1%). Blood and serous cysts were observed on both valves, different age groups, both sexes and in different breeds. Although clinical examination of clinically healthy cattle revealed cardiac murmurs but it is not known whether there is any relationship between murmurs and valvular cysts. The results of this study showed that the prevalence of the A-V valvular cysts is not related to sex, but Holstein breed demonstrated more cysts than either cross or native breeds.

Keywords: blood cyst, serous cyst, atrioventricular valve, cardiac valve

Introduction

Congenital and acquired disorders of the heart valves have been observed in large animals [3, 8, 10]. Some of the abnormalities cause no clinical signs and they may be picked up incidentally for some other reasons. Heart valves in normal situation are functioning unidirectionally, allowing blood flow in one direction. Of the four valves of the heart, those on the left side have a particularly important role in this high pressure pump, and any congenital or acquired lesions on the cusps, chordae tendinae and the papillary muscles can have an effect on the function of the valvular apparatus and consequently on blood circulation.

Clinicopathological study carried out by HOLMES and ELSE [10] on horses revealed that 45% of cases with systolic murmur had some kind of lesions on the valvular apparatus. As far as we are aware no such a study has been done on cattle. However, clinical studies in cattle revealed that cardiac murmurs arising from the heart valves are as common as has been reported in the horse [21]. A preliminary pathological survey on slaughtered cattle indicated that some valvular lesions or abnormalities can occur in cattle [16]. However, there has been no comprehensive study which documents the incidence of such lesions.

In this study a survey was carried out in a local slaughterhouse in order to find out the prevalence of blood and serous cysts on the atrioventricular (A-V) valves of cattle.

Materials and methods

During a six months period 1100 cattle slaughtered in a local slaughterhouse were used for this study. Before slaughter, breed, sex and age of animals were recorded and then the carcass was marked with a predefined number. The heart was removed and after opening, the cusps, chordae tendinae and the papillary muscles of the A-V valves (mitral and tricuspid valves) were examined carefully for the presence of cyst. The characterization of the cysts including the shape, anatomical positions (mitral and tricuspid), number of cysts and the size of them were recorded. If there were more than one cyst then the mean of the sizes of the cysts was taken as the size of the cyst. The cysts were classified according to their content (blood and serous) and the relationship between the occurrence of cyst and age, sex (male and female) and breeds (Holstein, cross breed and native) were also taken into consideration. Eleven hundred cattle were divided in 5 age groups, that is, <1.5, 1.5 to 2, 2 to 2.5, 3 and > 3.5. There were
885 females and 215 males and 445 Holstein, 88 cross breed and 569 native breeds.

The prevalence of valvular cysts was analyzed by Chi-square test and the number of cysts and cyst diameter were compared by one way ANOVA and Schefe’s tests. The level of significance was set at P<0.01. The SPSS statistical software (version 11.5) was used for data analysis.

Results

Out of 1100 hearts inspected, 540 samples (49.1%) had valvular cysts. The result of this study showed that there was no significant difference between the incidence of blood cysts on the mitral valve (26.7%) and the tricuspid valve (29.5%). However, the incidence of serous cysts on the mitral valve (18.3%) was significantly higher than that on the tricuspid valve (9.2%) (table I). In general, the prevalence of blood cysts on the A-V valves was higher than the serous cysts on these valves. The frequency of the cysts on the A-V valves was significantly higher in Holstein (68.3%), cross breed (33.9%) and native breed (36.5%), respectively, but there was no difference between males (48.6%) and females (51.2%).

There was no relationship between the prevalence of the serous cysts and different age groups. However, the incidence of blood cysts in age group of less than 1.5 year-old was higher than the other groups (table II).

The mean number of blood cysts on the tricuspid valve was higher than that on the mitral valve and also more than that of serous cysts on both A-V valves (3.06 vs 2.02, 1.8 and 1.68, respectively). There was no significant difference in the mean number of blood cysts on the mitral valve of all three breeds (2.25 vs 1.60 and 1.73). However, the mean number of blood cysts on the tricuspid valve was higher in Holstein (3.56) in comparing with the native breed (1.88) but there was no difference when the latter was compared with the cross breed (2.0). There was no significant difference between the number of serous cysts of the mitral and tricuspid valves of three breeds (P=0.23). This study also revealed that there was no significant difference between the number of cysts in male and female cases (P>0.05) and neither in different ages.

The mean size of serous cysts on both A-V valves was 3.5 mm and significantly larger than blood cysts (2.02 mm) and there was no difference in three breeds studied. However, the mean size of blood cysts in female (2.26mm) was significantly larger than male (1.71mm). The mean size of blood cysts of both valves was significantly larger in > 3.5 year-old age group compared to other groups.

Discussion

Congenital small blood cysts on the A-V valves of the infants, was first reported by ELSASSER [5]. Since then there have been many reports on the incidence of blood cysts in the cardiac valves in the range of 25 up to 100% in children with no clinical signs or rarely in children and adults with signs of cardiac involvement [1, 2, 6, 13, 15, 17, 22]. It is believed that these cysts do not interfere with blood circulation so no clinical sign will be observed and most of them have been diagnosed at autopsy [1, 22]. The presence of valvular cysts has also been reported in domestic animals such as horses [4], cattle [9, 14, 18], swine [9, 12] and dogs [20] either at autopsy or in slaughterhouse at the time of meat inspection [14]. There is no information in animals whether these cysts can produce any valvular abnormalities and consequently cardiac insufficiency, although a recent study has shown that cardiac murmurs are common in apparently healthy cattle [21]. Whether these cysts can partly be the cause of the murmurs is not known at this stage.

A review of the literature reveals that serous cysts are not common in human beings and blood cysts are seen mostly in infants and not common in adults. It seems that this is not the case at least in cattle as both types of cysts are common even in adult [14, 18].

This study showed that both blood and serous cysts occur in the A-V valves of cattle. Serous cysts are larger and mostly single (Figure 1) and blood cysts are smaller and multiple (Figure 2). The former occurs on the base of the valves and the latter on the closing edge of the valves. The prevalence of valvular cysts in this study was 49.1% which is much higher than other reports [14, 18]. Both types of cysts were observed in all age groups, they were commoner in Holstein than other breeds, and the size of blood cysts increased with age.

In a study on 120 hearts of cattle of 2-4 year- old and on 132 hearts of 2-8 day- old calves, SMITH and TAYLOR [18] found both types of cysts. JONES [12] studying on the endocardial lesions of 1000 samples of valvular and endocardial lesions of 1-6 year- old pigs and on 500 samples of six months old pigs found no cyst in the younger group but reported an incidence of 1.8% in those in the 1-6 year- old group. In a retrospective study on 255 beagle dogs, Takada et al [20] found 11 cases of blood cysts in the tricuspid valve. More recently, MARCATO et al [14] in a survey on 30907 cattle in a slaughterhouse (5984 calves, 15937 young adult and 8986 cows) found both blood and serous cysts in the A-V valves. In their study the incidence of cysts was higher in older cows (16.2%) than young animals (11.5% in calves, 7.9% in steers and 6.4% in heifers). In total, they reported 10.90% of cases with blood or serous cysts.

In the present study the incidence of blood cysts in the mitral (26.7%) and the tricuspid (29.5%) and serous cysts in the mitral (18.3%) and in the tricuspid valve (9.2%) was much higher than the values reported by others for cattle [8, 14, 18]. In Holstein the incidence of both cysts on both A-V valves was significantly higher than cross breed and native breed. This could be due to the fact that Holstein grows faster and produces more milk as compared with the other two breeds. This may put more pressure on the cardiovascular system and higher blood pressure. The incidence of both blood and serous cysts in the mitral was higher (45%) than the tricuspid valve (38.7%). This may also be due to higher blood pressure on the left side of the heart.
Whether the method of slaughtering has any effect on the production of these cysts is not known at this stage. It has been stated that the electrical stunning, which was used in this study, may raise the vascular pressure. For example, it may raise the normal blood pressure of sheep from 120-145 mmHg to 260mmHg [7] which may be a contributing factor in production of the A-V valves cysts. A high blood pressure and higher heart rate facilitate immediate bleeding.

Several views have been presented regarding the origin of these valvular cysts. Some researchers consider them as hematomas, while other accept them as angiomas. It has been stated that there is a small connection between the cyst lumen and the ventricles so blood pushes through these connections [22]. However, these connections have not been observed in studies on cattle [14]. The last hypothesis suggests that blood and lymphatic vessels of the A-V valves dilate and produce blood and serous cyst, respectively. The presence of blood and lymphatic vessels has been shown in the A-V valves as well as the chordae tendinae, papillary muscles and in the ventricular walls [11, 19, 20]. In this study one blood cyst was observed on the chordae tendinae.

**TABLE I.- The prevalence of blood and serous cysts of the A-V valves in different breeds of cattle.**

<table>
<thead>
<tr>
<th>Breed</th>
<th>No Blood cyst</th>
<th>% Blood cyst</th>
<th>No Serous cyst</th>
<th>% Serous cyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein</td>
<td>445</td>
<td>180</td>
<td>40.4</td>
<td>111</td>
</tr>
<tr>
<td>Cross breed</td>
<td>88</td>
<td>15</td>
<td>17.0</td>
<td>11</td>
</tr>
<tr>
<td>Native breed</td>
<td>567</td>
<td>99</td>
<td>17.5</td>
<td>79</td>
</tr>
<tr>
<td>Total</td>
<td>1100</td>
<td>294</td>
<td>26.7</td>
<td>201</td>
</tr>
</tbody>
</table>

**TABLE II.- Number of valvular cysts in different age groups.**

<table>
<thead>
<tr>
<th>Age Year old</th>
<th>Blood cysts</th>
<th>Serous cyst</th>
<th>Blood cysts</th>
<th>Serous cyst</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ±SD</td>
<td>No</td>
<td>Mean ±SD</td>
<td>No</td>
</tr>
<tr>
<td>&lt; 1.5</td>
<td>2.09 ± 0.18</td>
<td>1-8</td>
<td>1.69 ± 0.14</td>
<td>1-6</td>
</tr>
<tr>
<td>1.5-2</td>
<td>1.88 ± 0.13</td>
<td>1-7</td>
<td>1.85 ± 0.15</td>
<td>1-9</td>
</tr>
<tr>
<td>2-2.5</td>
<td>1.95 ± 0.18</td>
<td>1-6</td>
<td>1.69 ± 0.16</td>
<td>1-4</td>
</tr>
<tr>
<td>3</td>
<td>2.91 ± 0.71</td>
<td>1-9</td>
<td>2.17 ± 0.64</td>
<td>1-9</td>
</tr>
<tr>
<td>&gt; 3.5</td>
<td>1.97 ± 0.25</td>
<td>1-6</td>
<td>1.94 ± 0.35</td>
<td>1-5</td>
</tr>
</tbody>
</table>

**FIGURE 1.- A serous cyst about 19 mm on the tricuspid valve of a cow. A blood cyst also visible in this valve.**

**FIGURE 2.- Multiple blood cysts with different sizes on the mitral valve.**

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In conclusion the results of this survey showed that blood and serous cysts are common even in adult cattle and it is not related to the sex of animal. They do not regress with age in contrast to what has been reported in human beings, and they were more common in Holstein.

References