Pathological study of the relation between the incidences of claws lesions and carpo-digital joint capsule lesions in front limbs of sheep slaughtered in Mosul

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For detecting a possible relation between claws lesions and the lesions of carpo-digital joint capsule, the nearest joint to the claws, with an importance in diagnosing the exact cause of lameness in sheep resulting to be brought for casualty slaughter. For that goal 128 front limb were collected from slaughtered sheep at Mosul abattoir for period from 5-25/2/2013, the gross examination was made for observing the claws lesions and the synovial capsule were harvested, preserved and prepared for histopathologic examination, then examined microscopically with recording lesions. the correlation coefficient values were estimated between claws affection and joint capsular lesions at the same limb. Results demonstrated affection of 83 limbs with claws lesions as foot rot and erosions at incidence ratio 64.84%. The histopathological examination revealed a chronic type of changes including Fibroplasia in both synovium and tunica densa at incidences 8.59% and 6.25% respectively, Foci of hyperplastic synovial lining at 4.68% of samples, adipose tissue marbleizing synovium at 7.03% of the examined sections. Mild degree of chronic synovitis was observed within 10.93% of total samples, connective tissue metaplasia was evident at 3.9% of sections at tunica densa layer, the arteriolar musculature showed vacuolation at 18.75% of samples. The correlation coefficient value was significantly positive between occurrence of foot rot disease and the incidence of chronic synovitis in carpo-digital joint capsule which can be considered as the most important conclusion in the study.

Keywords: Lesion, Joint capsule, Sheep

Introduction

The claws affection in sheep. Foot rot or so called infectious pododermatitis is one of the infectious diseases causes economic losses in small ruminants (1), the gram negative bacteria *Dichelobacter nodusus* is considered the main causative agent of it (2), other organisms as *Fusobacterium necrophorum* plays an important role in progression of pathogenesis and formation of lesions (3). The lesions include an exudative dermatitis with necrosis to the epidermal tissue in the interdigital skin, coronary bands and claw matrix and sometimes detachment of the claw from its underlying soft tissues (4), this affection negatively affect animal production through lameness, weight loss, fertility reduction and drop in wool quality (5). Lameness is the first and most noticeable clinical sign that vary from mild to severe with redness and swelling of the interdigital skin and spread apart toes (6). The disease known to be predisposed by moist soil and muddy ground in moist and rainy weather that provide suitable environment for the causative agents to stay viable (7). A similar well known affection to the foot is Dermatophilosis or strawberry foot rot, caused by the gram positive *Dermatophilus congolensis* and characterized by dermatitis, pustules and hyperkeratosis in coronary band, it was recorded and described by (8) in Diwanya province in Iraq. Although foot affections are the most observable cause...
of inducing lameness in sheep. Arthritis, the inflammation of joints appears to record high incidences in these animals through affecting one or two joints in the limb including knee joint, carpal or tarsal joints with swelling, the younger animals or lambs are the most susceptible than adults according to (9), he reported that the most common causative agent that can be isolated and cultured from the inflamed joint are Streptococcus, E.coli, Erysipelothrix rhusiopathiae and Fusobacterium necrophorum, describing the inflamed joint as swollen, hot and painful. Erysipelothrix rhusiopathiae was mentioned by (10) as the major cause of arthritis in Australian lambs. Mycoplasma agalactia reported to develop arthritis in sheep were monitored in Iran with in two studies, in Qom (11) and Khusestan province (12). In Mosul city in Iraq (13) Isolated Streptococcus dysagalactiae, Arkanobacterium pyogenes and Pseudomonas aerugenosa from synovial fluid aspirates from knee joint of sheep showing lameness and diagnosed as suppurative arthritis. Viruses less commonly induce arthritis in sheep but it is reported as Lentiviruses (14), Most of the viral diseases inducing lameness in sheep affect claws as Foot and Mouth disease and blue tongue (15). Lameness also can appear as a complicated case containing both foot lesions and arthritis on the same affected limb. It stated by (16) that Microorganisms can lodge in joints through hematogenous dissemination or by contiguous spread from osteomyelitis or a soft tissue abscess. The joint capsule is an important component of the joint and vital for its function that mainly composed from dense fibrous tissue, it is attached to the bone and forms sleeve around joint, the capsule may exposed to an injurious agent through rheumatoid arthritis or osteoarthritis or aging leaving variable changes on it (17).

For that purpose this study targeting to reveal lesions of synovial capsule of carpo-digital joint and their relation with foot affections in front limbs in sheep slaughtered in Mosul abattoir.

Materials and methods

Sample collection

The collection of 128 front limbs of slaughtered sheep were made at Mosul abattoir in the period from 5-25/2/2013, they directly packed, numbered and transformed to the laboratory of pathology were examined for gross foot-rot lesions, then the skin dissected over carpo-digital joint and the capsule were excised gently and preserved in 10% neutral buffered formalin.

Histological preparations and examination

Samples were trimmed, dehydrated, Cleared, impregnated and blocked in paraffin wax, then sectioned to 5 micrometer sections and stained with hematoxylin and eosin, dehydrated and mounted with DPX (18-22). The histopathological examination were done under light microscope with photographing using AMSCOPE digital camera.

Statistical analysis

Lesions detected by histopathological examinations, percentage of incidences were estimated, the 0 and 1 grading system were used to express lesion occurrence in each synovial capsule sample (19), also to express occurrence of foot-rot lesion or not. Data were analyzed using SPSS version 19 to determine the correlation coefficient values by 2-tailed Pearson correlation under significance at P≤0.01 (23).

Results

Gross examination revealed foot rot lesions at 83 limbs from total 128 limb examined at incidence ratio 64.84% (Figure 1). The histopathological examination of the carpo-digital joint capsule sections explored a pathological changes recognized from normal histological features of the joint capsule (Figure 2/A). Those changes were represented by mild chronic type of changes, these were included Fibroplasia in both synovium and tunica densa at incidences 8.59% and 6.25% respectively. (Figure 2/ B and C). Foci of hyperplastic synovial lining were observed at 4.68% of samples (Figure 2/D). Fat or adipose tissue marbleizing synovium was noticeable at 7.03% of the examined sections (Figure 3/A). Mild degree of chronic synovitis observed at 14 sections with an incidence rate 10.93% of total samples (Figure 3/B, C and D). Fibrocartilaginous connective tissue metaplasia were evident at 3.9% of capsule sections at tunica densa layer (Figure 4/A). The capsular arteriolar musculature showed vacuolation at 18.75% of samples to be the most noticeable change observed (Figure 4/B) (Table 1). The correlation coefficient value was significantly positive (r=0.235) between occurrence of foot rot disease and incidence of chronic synovitis (Table 1).
Figure 2: Sections in carpo-digital joint capsule showing: A- Normal morphology of synovial lining (Blue arrow). Synovial layer (Yellow arrow) and collagen bundles in tunica densa (Red arrow).40X. B- Focal hyperplasia of synovial lining (Blue arrow) and Fibroplasia of synovium and tunica densa (Yellow arrow).40X. C- Fibroplasia of the fibrous septa (Blue arrow) between collagen bundles (Yellow arrow) of tunica densa.100X D- Focal hyperplasia of synovial lining cells (Blue arrow).100X. Staining H&E for all images.

Table 1: Lesions of carpo-digital joint capsule, number of cases, Incidences and correlation coefficient values between lesions of capsule and foot-rot occurrence in the front limb

<table>
<thead>
<tr>
<th>Microscopic lesion</th>
<th>No. samples affected</th>
<th>% lesions incidence</th>
<th>CV with foot rot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibroplasia in synovium</td>
<td>11</td>
<td>8.59%</td>
<td>0.048</td>
</tr>
<tr>
<td>Fibroplasia of tunica densa</td>
<td>8</td>
<td>6.25%</td>
<td>0.095</td>
</tr>
<tr>
<td>Focal hyperplasia of synovial lining</td>
<td>6</td>
<td>4.68%</td>
<td>-0.002</td>
</tr>
<tr>
<td>Fat tissue marbleisation in synovium</td>
<td>9</td>
<td>7.03%</td>
<td>-0.107</td>
</tr>
<tr>
<td>Chronic synovitis</td>
<td>14</td>
<td>10.93%</td>
<td>0.235**</td>
</tr>
<tr>
<td>Connective tissue metaplasia</td>
<td>5</td>
<td>3.90%</td>
<td>0.141</td>
</tr>
<tr>
<td>Vacuolation of Arteriolar musculature</td>
<td>24</td>
<td>18.75%</td>
<td>0.037</td>
</tr>
</tbody>
</table>

Total number of samples=128, samples affected with Foot-rot=83, significant correlation (*) between lesion of capsule and Foot-rot at P≤0.01.

Figure 3: Sections in carpo-digital joint capsule showing A- Fat tissue marbling synovium (Blue arrows).40X. B- Fibrotic focus of chronic inflammation with lymphocyte, fibroblast and collagen under synovial lining (Blue arrows).100X. C- infiltrations of lymphocyte and plasma cells with in synovium (Blue arrows). 100X. D- Mild chronic inflammatory reaction with infiltration of lymphocyte and plasma cells from capillaries of synovium (Blue arrows).100X. Staining H&E for all images.

Discussion

As a general analytical view to the results, a few types of lesions have been found in the wall of synovial capsule. The presence of fibroplasias as foci in both synovium and tunica densa layers mostly reflects previous traumatic lesions and previous inflammatory affections (24), also the abnormal motion of the limb may be related to lameness stretches the fibrous joint capsule and laxity of the joint resulting in developing fibroplasias in the joint capsule and formation of osteophytes, the fibroplasia of joint capsule also mentioned in the pathogenesis of frozen shoulder which confirmed by histological staining of collagen I and II and the immunohistochemical detection of vimentin and conclusion were made that an incidence of fibroplasia at the anterior and
The normal synovial membrane mostly appeared as acellular structure composed of one or two cell thickness intestinal layer and synovial sublining layer containing the blood and lymphatic vessels, fat cells, fibroblasts with few lymphocytes and macrophages. Those membranes anatomically classified according to the composition of the subintimal layer and content of fibrous, areolar and adipose tissues, this may be variable according to the position of the joint in the body. The subintima may contain hyaline or fibrocartilage tissues and even osteoblasts. Based to those information’s and microscopic examination the marbleisation with fat tissue within subintimal synovium at 7.03% of samples reflects an intense presence of adipocytes that may convey general obesity of the animal or related to the age progression that younger animals contain much more fat in their synovium. The same explanation manages observation of metaplastic changes to chondroblasts with in subintimal synovium at 3.09% of samples that increases with senility or age progression. The significant correlation link 0.235 between presence of chronic inflammatory foci insynovium and incidence of foot rot lesions in claws can be managed under two explanations. Either extension of the infection from the claw to the adjacent joints through venous drainage and lymphatics as mentioned by (13) who isolated multiple pathogenic microorganisms from synovial fluid of knee joints of lamed sheep, or the most probable examination that the abnormal motion of the affected limb may induce the physical damage and stretching the synovium of the joint (25), causing inflammatory response that involve cellular infiltrates, cytokine production, enzymes and relevant proteins secretion, increase synovial lining layer thickness, vascular and lymphatic changes and the production of metalloproteinases that stimulates osteoclast formation (30).

Conclusion

The study demonstrated presence of multiple mild to moderate changes in the capsule of the carpo-digital joint with a positive correlation link between the occurrence of foot rot and the development of chronic synovitis in the carpo-digital joint capsule in sheep.

References

لتحري عن احتمال وجود ارتباط بين أفات الظلف وآفات المحافظة الزلالية في المفصل المشطي الديم، المفصل الأقرب للظلف، في الأغنام، أجريت هذه الدراسة لما لها من أهمية في تطوري اكتشاف حدوث الارتجح في هذه الحيوانات مؤديًا إلى الأشخاص المصابين، إن أطلق هذا الهدف تم جمع 188 قائمة أمامية من الأعشاب المحرومة في مجزرة الموصل لل فترة من 2012/2015 واجري عليها الفحص العيان لمحاولة أفات الفحص وتم استنساخ المحافظة الزلالية للمفصل المشطي الديم، وأجريت عليها التحصيات السيقية والفحص الديم وسيجري وسجلت الأفات المرضية وتم إجراء معامل الارتباط بين أصابة الظلف وآفات المحافظة الزلالية في نفس القائمة. أظهرت النتائج إصابة 34.68% قائمة بأفات الظلف مطلقة بتكلفة وعناية الظلف بنسبة إصابة 24.68% في حين أظهر الفحص الديم الجسم الخاص للمحافظة الزلالية ووجد تغيرات مزمنة تتمثل في التبكس في العبيدة والقيمة السياقية واللسطيني المحافظة على السيبتين 8.35% و8.65% على التوالي، بور من فرض النتائج لخلايا البطانة المصلية في الحالة وتخليل الأنسجة المهنة في الطب البشري في 38% من العينات، أظهرت المحافظة المصلية المزمنة للظلف لوحظ عند 15% من أجمالي العينات عناية عن الحويل للدجاج المضمن بنسبة 34.68% وتفاوت خلايا الطبقة المصلي في شرينات المحافظة عند 18.9% لفحص العينات المحفوظة. سجلت النتائج وجود علاقة ارتباط إيجابية بين حالات افت击败الظلف في القدم وظهور التهاب المحافظة المصلية المزمنة للظلف في المفصل المشطي الديم والذي يمكن اعتباره الاستنتاج الأهم في هذه الدراسة.