A retrospective study on ruminant urethral obstruction in Debre Zeit area, Ethiopia

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SUMMARY

A retrospective study was carried out to determine the importance and causes of ruminant urethral obstruction, during the period from January 1989 to July 1991 and August 1998 to March 1999 in Debre Zeit area, Ethiopia. Of the total 104 ruminant surgical cases, the prevalence of urethral obstruction in sheep and cattle accounted for 37.14 % (13/35) and 44.93 % (31/69), respectively. The two common causes of urethral obstruction were external trauma and uroliths. In the sheep both external trauma and uroliths represent 46.15 % (6) each, while in cattle the rates of occurrence were 35.48 % (11) and 29.03 % (9), respectively. The causes of obstruction were not clearly identified in a significant proportion of cattle (35.48 %, n = 11), and in a single ram. In sheep, 53.85 % cases were with intact urethra, 15.38 % with ruptured urethra and 30.77 % with ruptured urinary bladder.

In cattle, 64.52 % cases were with ruptured urethra. Intact urethra and ruptured urinary bladder cases accounted for 25.81 % and 9.68 %, respectively. Shortage of drinking water during the long dry season, watering of animals on salty crater-lake water and low vitamin A level in feed are considered as some of the important contributing factors in urolith formation in cattle. An imbalance in calcium and phosphorus ratio and high level of magnesium in commercially available and traditionally used concentrate feeds, respectively, were anticipated to be the major contributory factors in ovine urolithiasis. Analysis of mineral composition of the urolith samples from cattle revealed the presence of calcium and oxalate as major constituents. Results were discussed by comparison with literature data from other countries. Recommendations on possible control options and future areas of research were made.

KEY-WORDS : urethral obstruction - causes - significance - Debre Zeit - Ethiopia - ruminant.

Introduction

Urethral obstruction, partial or complete blockage of the urethral lumen, is a serious condition, which often results in rupture of the bladder or extra-pelvic urethra in ruminants. It occurs almost exclusively in the male in which the structure is obliged to follow an extremely tortuous course [5]. Rupture of the urethra and bladder, in turn, results in infiltration of urine into the connective tissue of the ventral abdominal wall and the flow of urine into the peritoneal cavity, respectively [6]. The two most common causes of obstruction are trauma, as it occurs when the urethra is included in the jaws of burdizzo castrator during bloodless castration, and blockage by uroliths [5, 8].

Urethral obstruction is economically important in both cattle and sheep. It causes the condemnation of urinous carcass and death [5, 8]. According to HAY [6], the prevalence and the case fatality rate of the disease in intensively concentrate-fed sheep may reach up to 10 % and 100 %, respectively. Similarly, a 37 % death rate in flock of fattening lambs during winter housing was reported [10]. MALLY and BOMMAIAH [9], stated that a serious economic loss may be caused as a result of urine retention in male cattle due to uroliths in certain dry tracts of Mysore State.

In Ethiopia, no study has so far been conducted to evaluate the magnitude of the problem of urethral obstruction in ruminants. This study is, therefore, carried out to determine the
prevalence and relative importance of urethral obstruction and to assess the possible causes based on an analysis cases presented to the attention of the author at the Surgery Clinic, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.

Materials and methods

A retrospective study aiming at assessing the prevalence of urethral obstruction was conducted on 104 surgical cases, which were examined and treated at the Debre Zeit Veterinary Clinic of the Faculty of Veterinary Medicine during the period from January 1989 to July 1991 and August 1998 to March 1999. In addition, 44 ruminants (31 cattle and 13 sheep) were closely examined to determine the causes of urethral obstruction in the area, which is located at an altitude of 1850 m a.s.l. at the escarpment of the Great Rift Valley. The study area receives a bimodal annual rainfall pattern, which are identified as big rains (Kiremt) extending from June through August and small rains (Belg) during March and April. The topography of the area is marked by the presence of a number of crater lakes. Crop-livestock agriculture is the basic farming system in the area. The husbandry is predominantly traditional extensive type. Crop residues and hay are provided to animals during the long dry season when nutritional conditions are generally compromised.

Data concerning age, sex, type of feed and availability of drinking water, presenting signs, clinical and intra-operative findings, and the outcome of surgical interventions were compiled for each of the examined animals. On the basis of information gathered from the anamnesis and physical examination results, animals with symptoms of urethral obstruction were conventionally classified into three distinct stages revealing the severity of illness. Complaints of anuria were common in all these case categories. These categories are:

a) Early cases: are those cases with intact urethra. These animals were presented with symptoms of colic such as abdominal stretching, kicking at the abdomen and at times falling on the ground and stretching. Clinical examination further revealed distended bladder in cattle and encrustation of the preputial hair and occlusion of the urethral process with calculi in rams.

b) Advanced cases: are those animals with ruptured urethra, typically presented with oedematous ventral abdomen. On clinical examination, empty or partially full bladder was observed.

c) Severe cases: are those cases with ruptured urinary bladder. Owners’ complaints included abdominal enlargement and anorexia. Bloated appearance, dehydration, depression and empty bladder on rectal palpation were the common clinical findings.

As part of the attempt to assess the probable causes of urolithiasis in the study region, 3 cattle uroliths collected during surgical operations were determined at the Biochemistry Laboratory of the School of Veterinary Medicine, University of Glasgow. Quantitative analysis was carried out following the procedures described by VARLEY (1954) [16]. All these cattle were known to entirely depend on grazing and crop residues as feed sources.

Results

A total of 104 ruminants: 35 sheep (33.65 %) and 69 cattle (66.35 %) were presented for surgical treatment. Of these, 44 (42.31 %) were found to suffer from urethral obstruction, representing the highest surgical health problems of both sheep and cattle in the study area. The recorded prevalence rates of urethral obstruction in sheep and cattle were 37.14 % (13/35) and 44.93 % (31/69), respectively (Fig. 1).

All cattle presented with the problems of urethral obstruction were draught animals that depend on grazing, hay and crop residues, as feed sources. On the other hand, the sheep presented were kept for fattening and mainly fed on concentrates. Most cattle owners indicated that shortage of drinking water is a major constraint in the area and maximum possible dry season water provision is limited only to three times a week.

The age of examined animals ranged between two and eleven years for cattle and between three month and two years for sheep. No relation between the age of the animals and the stage of urethral obstruction was observed on examination of the case record. Both castrated and entire animals were presented. The presenting signs and clinical examination findings were variable depending up on the severity of the disease. The common presenting sign in early cases was colic. Advanced cases were mainly presented due to ventral abdominal swelling that resulted from subcutaneous infiltration of urine from ruptured urethra. Severe cases were often presented with complaints of bilateral abdominal enlargement, anuria, anorexia and depression, which were often preceded with symptoms of colic. Divers complaints of anuria were the common historical findings for all the three forms of urethral obstruction. Clinical examination findings in early cases included bladder distension, congested mucus membrane and increased respiration and heart rate. Advanced case revealed partially full or completely empty bladder and edematous ventral abdominal swelling. Laboured breathing, dehydration, variable body temperature, bloated appearance of the abdomen that reveal urineous fluid on abdominal paracentesis, collapsed empty bladder were the clinical examination findings observed in the severe cases.

The animals were treated surgically; the type of which varied with the specific cases presented. The surgical intervention used were those described in the standard textbook [8]. Penile amputation with urethral fistulization and multiple skin and subcutaneous tissue incision to drain urine from the ventral abdominal floor was used for those with ruptured urethra cases. For the early or obstructed urethra cases urethrotomy was used to remove calculi. Amputation of the obstructed urethral process was the usual procedure in sheep when digital pressure fails to remove the calculi. Ischial urethrotomy with placement of an indwelling catheter and draining urine from the abdominal cavity by abdominal paracentesis is the surgical procedure described for ruptured bladder cases. Due to the unavailability of an indwelling catheter, draining the urine from the abdominal cavity by abdominal paracentesis was the only intervention performed in ruptured urinary bladder cases in this study. In some of the ruptured bladder cattle cases ischial urethrotomy with placement of catheter
made from an intravenous infusion set into the urethra was attempted without success. The outcome of the surgical intervention was obtained only in 14 cases. The reluctance of most farmers to bring their animals for check-up was the main reason for lack of information in the remaining animals. The available data was examined for the survival rate based on the stage of urethral obstruction. Out of 7 cattle cases a survival rate of 3 (75 %) and zero was obtained in the ruptured urethra and ruptured urinary bladder cases, respectively. On the other hand, the seven sheep cases where the surgical outcome was obtained, showed a survival rate of 3 (75 %) and zero in the early and ruptured urinary bladder cases, respectively. Early cases of cattle and advanced cases of sheep were not presented for this analysis.

Results from the history and clinical examinations, and observations during operative procedures of individual animals revealed that the two most important causes of urethral obstruction were external trauma and urolithiasis. External traumas were due to faulty application of burdizzo castrators by untrained persons and mistreatments by animal attendants and trauma of unknown causes. In examined sheep, external trauma and urolithiasis represent 46.15 % each. The causes of urethral obstruction remained obscure in a significant proportions of cattle cases (35.48 %) while external trauma and urolithiasis accounted for 35.48 % and 29.03 %, respectively. Five cattle cases where the causes were not identified showed an extremely dilated urethra at the level of sigmoid flexure and accumulation of tissue debris inside the lumen of the urethra. As far as the overall scenario in both species is concerned, the highest cause was found to be external trauma (38.64 %) followed by urolithiasis (34.09 %) and unknown (27.27 %) (Fig. 2).

In sheep, early cases represent 53.38 % while advanced and severe case accounted for 15.38 % and 30.77 %, respectively. Most cattle cases (64.52 %) of urethral obstruction fall in the advanced category and only 25.81 % and 9.68 % accounted for early and severe cases, respectively. The overall picture revealed that early, advanced and severe cases represent 34.09 %, 50 %, 15.91 %, respectively, in all animals suffering from urethral obstruction (Fig. 3). The common site of urethral obstruction or rupture due to faulty application of burdizzo castrator and urolith in cattle was the distal sigmoid flexure, whereas in sheep, it often occurred at the level of the urethral process in those cases with urolithiasis (Fig. 4). Obstruction at the level of tuber ischi, sigmoid flexure, and the glans penis were also recorded in sheep. Abraded/haemorrhagic, sloughed and necrotic urethral mucosa, dilatation of urethral lumen and pouch formation were among the most prominent lesions encountered during operation. Pronounced lesions were observed at the sites of obstruction or rupture.

Results of biochemical analysis revealed that calcium and oxalate were the major constituents of the uroliths (Table I).

Discussion

The present study showed that urethral obstruction ranks first when compared with other ruminant surgical cases. In view of the fact that very few farmers in rural areas in Ethiopia bring diseased animals for modern veterinary care,
hence it is logical to imagine that the prevalence of urethral obstruction is higher than what is reported in this study. As in most parts of Ethiopia, in Debre Zeit area, oxen play an important role in the provision of energy for crop cultivation. Rams are raised as a source of cash income by smallholder farmers and also by low-income urban-dwellers to support the family lives. In this regard, there is no doubt that urethral obstruction represents one of the major surgical diseases of economic importance in the study area.

The common causes of urethral obstruction in male bovine, according to their order of importance, were external trauma, and urolithiasis. External trauma was due to faulty burdizzo castration, maltreatment by animal attendants and trauma of unknown causes through traumatization of the penis. These findings are in agreement with previous report [15]. In a significant number of bovine cases, the causes of urethral obstruction were not clearly identified. On the contrary, in rams the causes of obstruction were all identified with the exception of one case. Those cases with occlusion of the urethra with tissue debris might have been resulted from cystitis.

Ruptured urethra was the commonest form of urethral obstruction in examined cattle. This is attributed to the fact that affected animals were presented for modern medical care so late probably due to lack of observation of early cases by the owners or for their inability to reach the veterinary clinics due to far distance locations. The nature of the uroliths and the severity traumatic lesions could be responsible for the rupture of the urethra. Conversely, early cases are the commonest form of obstruction in rams. The possibility of early presentation of cases due to early detection, as rams were kept mostly in-door, could be one of the reason. Additionally, sand or grit like uroliths that lack concretion, which were mainly observed in these species, may not cause heavy pressure and necrosis to induce rupture of the urethra.

The commonest site of urethral obstruction by urolith is the distal sigmoid flexure and the urethral process in cattle and sheep, respectively [1]. Similar findings were obtained in the present study (Fig. 4). One possible explanation is anatomical, as diameters of lumens at these sites are the narrowest in the urethra canal, thus calculi could easily be trapped at these sites. In addition, untrained personnel can easily confuse the spermatic cord for sigmoid flexure during closed castrations using burdizzo castrators.

The surgical intervention described for ruptured urinary bladder cases by JENNINGS [8] is ischial urethrotomy with placement of an indwelling catheter and draining of urine.

<table>
<thead>
<tr>
<th>Constituents of calculi</th>
<th>Sample 1</th>
<th>Sample 2</th>
<th>Sample 3</th>
</tr>
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<tbody>
<tr>
<td>Calcium</td>
<td>15%</td>
<td>75%</td>
<td>40%</td>
</tr>
<tr>
<td>Oxalate</td>
<td>20%</td>
<td>10%</td>
<td>45%</td>
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<tr>
<td>Ammonia</td>
<td>0%</td>
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<tr>
<td>Phosphate</td>
<td>0%</td>
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<tr>
<td>Magnesium</td>
<td>0%</td>
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<tr>
<td>Uric acid</td>
<td>0%</td>
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<td>Cystein</td>
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Table 1.— Results of analysis of the mineral composition of the urolith samples.
from the abdominal cavity by paracentesis. On the other hand, BOHKRE and others [2] treated urinary bladder rupture cases by cystorrhaphy and placement of an indwelling catheter through bladder into the urethra to drain urine from the ventral portion of the bladder. In both surgical interventions, the purpose of placing an indwelling catheter is to drain urine that accumulated in the ventral portion of the bladder as tears are common in the dorsal aspect, and this prevent further spillage into the abdominal cavity and allows the bladder to heal. BOHKRE and others [2] reported a survival rate of 1 out of 5 ruptured bladder cases. This high mortality rate was mentioned to be as a result of toxaemic and peritonitis changes. Similarly, in this retrospective study a 100 % mortality rate was recorded in the ruptured urinary bladder cases in both sheep and cattle. Reasons ascribed, as the cause of death of these animals would be lack of draining of the urine from the bladder, which could aggravate the uraemia as well as the toxaemia already present and the associated dehydration.

MCINTOSH [11], in his review on the composition of urolith in domestic animals, has showed that nutritional and environmental factors can be involved in urolith formation. In grazing animals, large quantity of silica and oxalate in pasture were mentioned as major causes of urolith formation [12]. On the other hand, provision of highly concentrated rations with inadequate balance of calcium and phosphorus.
were stated as important factors in feedlot [6]. Vitamin A deficiency has also been considered as a contributory factor in calculus [14]. The same author indicated that straws are poor sources of vitamin A. It has also been indicated that there is an increase risk of urolithiasis when fluid intake drops resulting in urine concentration, which in return favours precipitation of solutes [6]. Similarly, RAO [14] affirmed that inadequate intake of water and the drinking of highly mineralised water are precipitating factors in calculi formation. In Debret Zeit region, as it is the case in most parts of the country, there is a heavy reliance on crop-residues and hay as animal feed during the long dry season. In some areas, animals entirely depend on salty crater-lake water for drinking throughout the year. In others, particularly in those sites far from lakes, there is shortage of drinking water for most months of the year. In such areas, farmers could manage to take animals to far distant watering point only twice a week. It is thus, concluded that high mineral content of lake-water and the prevailing scarcity of drinking water in the study area could be one of the most important factors in the calculi formation in bovines. Besides, lack of green feedstuff, which is a rich source of vitamin A, during the dry season, could be considered as a contributory factor in the process of calculogenesis. Analysis of the mineral composition of commercially available concentrate feeds used in the study area showed the presence of high level of phosphorus [13]. In addition, linseed and noug (Guizotia abyssinica) cakes together with wheat bran and mixed-grain flour obtained from mill houses are traditionally used as fattening ration for sheep in the study area. These concentrate diets contain high level of magnesium as their constituents (linseed cake = 4.6 g/kg, and noug cake = 5.3 g/kg). CUDDEFORD [3], showed the implication of high level of magnesium (> 2 g/kg dry matter) as a causal factor of urinary calculus in concentrate feed lambs. The recommended range of calcium : phosphorus ratio to prevent urolithiasis is 2:1 to 2.5:1 [6]. The imbalance in calcium and phosphorus ratio and high level of magnesium in the concentrate diets could, thus, be regarded as the main cause of urolith formation in rams in Debret Zeit area. This finding is in agreement with the reports of different authors [1, 4, 6].

Laboratory analysis of the few collected uroliths revealed that the major constituents are calcium and oxalate. A study conducted in Southern Australia showed that mixture of calcium, oxalate and silica are the main constituents of uroliths of grazing ruminants [12]. In this latter study, although the source of oxalate has not yet been defined, the higher silica content of feed and its subsequent excretion in the urine has been stated as a source of silicic urolith. In the present study, however, because of the limited number of urolith samples analysed and lack of information on mineral content of pasture plants and crater-lake water, it is not possible to precisely determine the sources of the recovered uroliths.

To sum up, the relatively high prevalence of urethral obstruction among other surgical problems in ruminants must be viewed in association with its economic repercussion in particular in the role of oxen in the Ethiopian farming system. The reliance on crop by-products as animal feed and shortage of drinking water during the long dry season are not without demerits pertaining to urolithiasis in cattle. Intensive use of high concentrate ration, particularly the oil-seed cakes, and traditionally obtained mixed-grain flours from mill houses as a fattening ration, are considered to be the most important precipitating factors in urolithiasis of rams. Thus, possible measures to alleviate these constraints should be envisaged. Besides, further studies emphasising on the chemical composition of urolith, mineral content of lake-water, pasture plants, crop by-products and mixed-grain flour in the study area are recommended. Farmers must also be informed as to the need of early presentation of cases for modern veterinary care in order to improve the prognosis of surgical interventions, and about the causes and management problems related to the disease.

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References

7. — HICKMAN J. and WALKER R. : An atlas of Veterinary Surgery, 244 pages, John Wright and Sons Ltd., Bristol, 1980.

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