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Original Research Article

Rumen impaction in cattle due to plastic materials

Akraiem A.^a, Abd Al-Galil A. S. A.^{b,*}

^a Department of Veterinary Medicine and Surgery, Faculty of Veterinary Medicine, Omar Al-Mukhtar University, Elbeida, Libya

^b Department of Veterinary Surgery, Faculty of Veterinary Medicine, Benha University, Egypt

ABSTRACT

The present study was carried out on 22 cows suffering from ruminal impaction with plastic materials as foreign bodies and ten apparently healthy cows as a control group. Clinical examination included clinical signs, temperature, pulse, respiratory rate and ruminal motility were recorded prior to treatment. Hematological parameters such as hemoglobin (Hb), packed cell volume (PCV), erythrocyte count (RBCs), total leucocytes (WBCs) count and the glutaraldehyde test were performed. Ruminal fluid was evaluated for pH and the methylene blue reduction time (MBRT). The mean pH of rumen fluid, MBRT, total leucocytes count, and PCV were increased significantly ($P<0.05$). Rumen motility was significantly reduced ($P<0.05$) preoperative in the animals suffering from rumen impaction, but the mean value of pulse rate, respiration rate, temperature, glutaraldehyde test, haemoglobin and total erythrocyte count were non-significantly changed. On the 5th postoperative day the clinical and the laboratory parameters in the study group had largely become normalized. Six months after the procedure, 18 (81.9%) cows showed complete recovery and 4 (18.9%) animals were slaughtered within 3 months following surgery. This study concluded that the clinical and laboratory findings might be of diagnostic importance. Rumen impaction with plastic materials should be differentiated from anorexia, emaciation, ruminal hypomotility, tympany and dehydration in cows. The surgical removal of foreign body demonstrated positive effects on animal health.

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* Corresponding author: ATEF.ABDELGALIL@fvtm.bu.edu.eg, Tel. (+2) 0123649989 (Dr. Abd Al-Galil ASA)

1. Introduction

Rumen impaction due to metallic or non-metallic foreign bodies is among the most common cause of gastrointestinal disorders in ruminants (Mohammed et al., 2006; Ismael et al., 2007; Bakhiet, 2008). The absence of garbage recycling industries, especially the plastic materials are usually not disposed in a correct manner, and hence they were eaten by the grazing animals (Bakhiet, 2008; Ramaswamy and Sharma, 2011; Desiye and Mersha, 2012). The incidence of non-metallic foreign bodies (mostly polythene material) was explored by previous literature mostly in cows (Hailat et al., 1996; Kahn et al., 1999; Igbokwe et al., 2003; Mohammed et al., 2006; Boodur et al., 2010; Desiye and Mersha, 2012).

Rumen impaction with a foreign body is a disease that is highly correlated to the specific way of cows' eating and to the special anatomic conditions of the fore stomachs. Ingestion of non-metallic foreign bodies hinder the process of fermentation and mixing of contents leading to indigestion (Radostits et al., 2000; Braun et al., 2007). The polythene and other plastic materials do not degrade in the rumen/reticulum and remain causing hindrance in its orifice (Ramaswamy and Sharma, 2011). Moreover, it affects the rumen microflora leading to indigestion (Athar, 2010a).

Clinically, rumen impaction with a non-metallic foreign body is characterized by clear signs of emaciation, dehydration, abdominal distension and asymmetry of the abdomen. Affected animals showed a lack of feces in the rectum, foamy salivation, recumbency and inappetence (Blood and Radostits, 1994; Ismael et al., 2007; Athar, 2010b). The objective of this study was to evaluate some clinical, laboratorial, surgical parameters and their outcome in cows suffering from rumen impaction due to a non-metallic foreign body.

2. Materials and methods

2.1. Animals

The study included 22 cows suffering from rumen impaction due to a non-metallic foreign body and ten healthy cows (control group) aged 2-11 years during

the period from 2008 to 2015. The presence of the foreign body was diagnosed by external abdominal palpation, rectal examination and rumenotomy. Cows were clinically examined according to Resenbeger (1990), revealing respiratory rate, heart rate, rectal temperature, rumen motility. Filling of the rumen and feces (quantity and consistency) was daily determined. Approximately 100-200 ml of rumen fluid was collected using rumen fluid extractor and was immediately examined for colour, odour, consistency, pH and MBRT (Dirksen, 1969).

Blood samples were taken from each animal prior to the operation and on the 5th day post surgically. Five ml of blood was collected from each cow by venipuncture of jugular vein on EDTA for haematological examination including determination WBCs and RBCs (Schalm et al., 1975), PCV % (Coles, 1986), and Hb content (Wintrobe et al., 1976). In order to carry out glutaraldehyde test (Aslan and OK, 1991), 5 ml blood with EDTA was taken from the jugular vein of animals. Blood samples were centrifuged at 3000 rpm. Two ml of collected plasma was put in a 10 ml plastic injector, mixed with 2 ml of glutaraldehyde solution and was checked every 30 seconds to assess coagulation. The time of coagulation was recoded. A dose of procaine penicillin 30,000 IU /kg b.wt was intramuscularly administered to all affected animals. Foreign bodies were surgically removed by rumenotomy according to Götze technique, immediately weighed and their components were determined. Clinical, laboratory and surgical parameters were recorded and analyzed. Continuous follow up of animals for six months after discharging from the clinic were performed by questionnaire.

2.2. Statistical analysis

Data of various parameters was presented as means with standard deviations. Results were analyzed by using one-way analysis of variance (ANOVA). $P < 0.05$ were considered statistically significant.

3. Results

3.1. Surgical findings

Rumenotomy revealed the presence of large amounts of non-metallic foreign bodies consisting of plastic materials and ropes. The mean weight of removed foreign bodies was 28 ± 10.5 kg (10-45 kg). Adhesions between reticulum and body wall/diaphragm was recorded in 2 (9.1%) cows. However, rumenotomy revealed no metallic foreign bodies in the reticulorumen. Ruminal contents in affected cows were sticky and foamy. Outcome: Twenty two animals were discharged to home 5 days after the surgical interference. Six months post operation, 18 (81.9%) cows were completely recovered and the other four cows (18.9%) were slaughtered within 3 months following the operation. Two animals culled due to disorders not related to the surgical interference (fertility disorders, mastitis).

3.2. Clinical and laboratory findings

Depression, anorexia, restlessness, tympany, ruminal atony, decline in milk production, off feed, reduced dung quantity evacuation, rumen doughy in consistency, suspended rumination, dehydration, distended left para lumbar fossa, impacted rumen, constipated feces in rectum were the most common clinical signs recorded among affected animals (Tables 1-3). The rectal body temperature of affected animals varied from 37.5°C to 40°C . Hyperthermia was recorded in 5 (22.7%) cows. The heart rate varied from 56 to 132 beats per minute. Four (18.2%) cows showed tachycardia and one (5%) cow had bradycardia.

The respiratory rate was recorded within the normal range in 18 (81.8%) affected cows while, 4 (12.2%) animals showed an increased respiratory rate. Mean values of rectal temperature, heart rate and the respiratory rate were within the normal range.

Ruminal motility and the amount of feces were reduced preoperative in all affected cows and return normal on the 5th day postoperative. Ruminal motility was absent in 12 (54.5%) examined cows, while 8 (36.4 %) cows showed rumen hypomotility with reduced strength of ruminal contraction. Fecal quantity in rectum was scanty in affected animals preoperatively. Mild tympany with inapparent respiratory distresses was found in 13 (59.1%) affected cows and in 2 (9.1%) of affected cows. Tympany was moderate to severe with varying degrees of respiratory distress. Pain test was negative in all affected cows. A significant decrease in ruminal motility and fecal quantity in the affected compared to healthy animals. The MBRT of 17.4 ± 2.45 minutes before treatment of affected animals was improved to 7.2 ± 1.25 minutes after 5 days. The pH of ruminal fluid before treatment was 8.0 ± 0.28 and reduced towards normal gradually after 5 days post-surgery. A significant increase of MBR and pH of ruminal fluid in affected cows compared to the control group. The PCV and WBCs were significantly increased in affected cows while, there was no significant difference of Hb and RBCs compared to the control group. Dehydration was observed in all affected animals before the operation and disappeared within 5 days post-surgery and animals had largely become normal ($P < 0.001$). Glutaraldehyde coagulation test showed reduced clotting time (3-6 minutes) in 4 (20%) affected cows. There was no significant difference in the mean value of glutaraldehyde test between of both groups was recorded. On the 5th day postoperative, clinical and laboratory parameters of affected animals were considerably normal ($P < 0.01$).

Table 1. Body temperature, respiratory rate, pulse rate, ruminal movement and pain test in both apparent healthy and those with ruminal impaction cows.

Parameters	Healthy cows (Control group)	Affected cows	
		Preoperative	Postoperative
Rectal temperature ($^{\circ}\text{C}$)	38.4 ± 0.17	38.6 ± 0.55	38.7 ± 0.55
Heart rate/min	69.00 ± 7	72.9 ± 8	73.7 ± 6
Respiratory rate /min	24.80 ± 1.68	28.5 ± 0.9	28.7 ± 0.5
Ruminal movement/min	6.30 ± 0.45	$1.3 \pm 1.25^{**}$	$3.7 \pm 0.5^{**}$
Pain test	Negative	Negative	-

*Significant different from control at $P < 0.05$, **Significant different from control at $P < 0.01$

Table 2. Ruminal fluid pH and MBRT (minutes) in both apparent healthy and those with ruminal impaction cows.

Parameters	Healthy cows (Control group)	Affected cows	
		Preoperative	Postoperative
Ruminal Fluid pH	7.1 ±0.3	8.0 ±0.28**	7.4±0.6*
MBRT	4.8±0.3	17.4±2.45**	7.2±1.25*

* Significant different from control at $P < 0.05$. **Significant different from control at $P < 0.01$

Table 3. Red blood cell count (RBC), packed cell volume (PCV), hemoglobin (Hb) and glutaraldehyde est (min) in both apparent healthy and those with ruminal impaction cows.

Parameters	Healthy cows (Control group)	Affected cows	
		Preoperative	Postoperative
PCV (%)	29.4±0.5	38.7±3.5**	33.4±0.4*
Hb (g/dL)	9.5 ± 0.51	8.7 ± 0.6	8.9±0.5
WBCs ($10^3/\mu\text{L}$)	7.6±0.5	13.4±0.5**	8.7±0.5**
Glutaraldehyde test	Negative (above of 15 minute)	Negative (above of 15 minute)	-

* Significant different from control at $P < 0.05$. **Significant different from control at $P < 0.01$

4. Discussion

In the present study, clinical, laboratory findings, diagnostic procedures, treatment, and outcome were investigated in a series of cases of rumen impaction with plastic materials-foreign bodies. Rumenotomy was performed in 22 affected cows; 6 month follow up indicated that 18 (81.9%) cows were at their home farm and utilized as normal and the other four (18.9%) cows were slaughtered within 3 months following surgery. Two of the other 4 animals were culled because of disorders not related to the previous treatment (fertility disorders, mastitis).

Regarding findings of the respiratory rate and heart rate, body temperature, it seemed that the presence of the foreign body did not alter clinical findings, although hyperthermia and increased respiratory rate were noticed in some clinical cases. Increased temperature values might be attributed to peritonitis or septicemia accompanying concurrent parturition diseases, such as metritis, mastitis (Dirksen 1994; Braun et al., 2007; Athar et al., 2010 a, b). The increased respiratory rate is probably due to the increased pressure of the dilated rumen on the diaphragm (Kuiper and Breukink, 1986; Garry, 1996;

Bakhiet, 2008). In the present study, the most clinically observed findings such as complete anorexia, weakness, decreased milk production, scanty feces and recurrent rumen tympany were in accordance with those obtained by Reddy et al. (2004) and Ramaswamy and Sharma (2011). The absence of rumination and reduced ruminal motility were observed in all impaction- affected animals. However, non-metallic foreign body was found and the foreign materials were mostly plastic, ropes and pieces belonged to old clothes. Such materials were heavy (10-45 kg) and in some cases concreted and settled in the ventral aspect of the rumen and reticulum. The presence of impacted material may cause, partially or completely, block of the rumino-reticular orifices. The ingested polythene hinders the process of fermentation and mixing of contents might lead to indigestion (Lafi and Barakat, 1998; Radostits et al., 2007; Vanitha et al., 2010). Rumen contents were stinky, partially foamy, with decreased activity. Similarly, examination of the ruminal fluid showed alkaline pH and an increased reduction time of methylene blue (Boodur et al., 2010). The pH ruminal fluid and the MBRT reduced towards normal in

affected cows. The reduction time of methylene blue (RTMB) and pH ruminal fluid were significantly increased in affected animals, compared to the control group. The expected MBRT under normal conditions of ruminal function is often three minutes (Braun et al., 2007). An increase of pH ruminal fluid and MBRT are important diagnostic tool in field condition for the early detection of plastic indigestion in bovine (Boodur et al., 2010). The glutaraldehyde test is still an important diagnostic tool because the clotting time is shorter than normal in 90% of cattle (Braun et al., 2007). In the glutaraldehyde coagulation test, positive results were obtained only from those animals having adhesion (Dirksen, 1994). In the hematological profile, a significant increase of PCV and WBCs were reported in affected cows compared to healthy ones. Such values indicate a slight degree of dehydration in animals with rumen impaction (Jain, 1986; Reddy et al., 2004; Ismael et al., 2007). On the other hand, increased WBCs may be due to the stress reaction in some cases of the present study (Blood and Radostits, 1994). There was no significant difference in mean and standard deviation values of erythrocytic count and hemoglobin obtained in both groups in the current study. Erythrocytic count and hemoglobin concentrations were decreased in many affected cows. Haematological findings might be attributed to the penetration of the reticulum or chronic inflammatory process (Reddy et al., 2004; Braun et al., 2007).

5. Conclusions and Clinical Relevance

It has been found that clinical and laboratory findings might be of some diagnostic assistance. Rumen impaction with non-metallic foreign body should be considered as a differential diagnosis for anorexia, emaciation, tympany and poor milk production in cows. Good prognosis with elimination of foreign bodies was observed.

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