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Sawdust-induced rumen impaction with concurrent rumen tympany in a Balami ram

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Abstract

Rumen impaction and tympany represent significant gastrointestinal disorders in ruminants, frequently associated with the ingestion of indigestible materials and low-quality feed materials. This case report describes the clinical presentation, diagnosis, and successful surgical management of the first reported case of sawdust-induced rumen impaction with concurrent rumen tympany in a Balami ram. A 3-year-old Balami ram weighing 37kg was presented to the Veterinary Teaching Hospital, University of Jos, Nigeria, with a history of abdominal distention and inappetence. The owner had lost three rams two days prior, following ingestion of sawdust that was spread to insulate the cold floor where the rams were housed. Clinical findings included ventrally distended and doughy abdomen on palpation, bilaterally bloated abdomen with tympanic sound on percussion, polypnea, bruxism and reduced rumen motility. Rumen impaction associated with tympany was suspected based on the ram's history and observed clinical findings. Ultrasonography (hyperechoic and hypoechoic areas) indicated foreign material and gas buildup in the rumen, which facilitated a definitive diagnosis of rumen impaction with concurrent rumen tympany. The impacted ram subsequently underwent an emergency rumenotomy to relieve the tympany and evacuate the impacted sawdust. A ruminal incision relieved the bloat, and approximately 7kg of the ingested sawdust was evacuated. The impacted ram showed stability following rumenotomy with notable improvement in respiratory rate and recovered uneventfully. This first case report of sawdust-induced rumen impaction with concurrent rumen tympany adds sawdust to the list of known causes of rumen impaction and highlights the need for prompt surgical intervention in similar cases.

Keywords: Impaction; Rumen; Rumenotomy; Sawdust; Tympany

1. Introduction

Rumen foreign body impaction and tympany are significant gastrointestinal disorders in ruminants worldwide,

often linked to the ingestion of indigestible materials such as polythene bags, plastic, clothing items, mosquito nets, ropes, metal, hair, hide, nails, wood strips, and low-quality or indigestible feed materials, which accumulate in the rumen

Case Study

and disrupt normal digestive processes. These conditions can severely impact animal health, productivity, and farm profitability, particularly in regions where high-fiber, low-digestibility forages are prevalent [1-7]. Feeds with high fiber content and low digestibility can increase the risk of impaction due to slow rumenal passage and reduced microbial degradation [8, 9]. This risk can be further compounded by poor feeding management, abrupt dietary changes, and inadequate adaptation periods, which may destabilize rumen microflora [3, 10]. Rumen tympany (bloat) can be classified into two types: primary (frothy) and secondary (free-gas) bloat. Primary bloat is often caused by the rapid fermentation of high-protein forages or finely ground grains, resulting in a stable foam that traps gas. In contrast, secondary bloat occurs due to physical or functional blockages that prevent eructation of gas and can be worsened by rumen atony associated with low-quality diets [11, 12]. Rumen impaction and tympany in ruminants can be managed through surgical or non-surgical strategies, with the choice of treatment depending on the severity and underlying cause. Rumenotomy is often the most effective approach for severe cases caused by indigestible foreign bodies, with high success rates when performed promptly [13-16]. Non-surgical strategies, such as fluid and antibiotic therapy, purgatives, supportive care, and dietary adjustments, may be effective for mild to moderate cases of impaction and tympany, especially when caused by fibrous, low-digestibility feed rather than foreign bodies [6, 17, 18]. Notably, despite documentation of various indigestible foreign materials implicated in rumen foreign bodies, sawdust has not been previously reported as a rumen-impacting foreign body, to our knowledge. This article reports the first case of sawdust-induced rumen impaction with concurrent rumen tympany and highlights the importance of considering unusual causes of rumen impaction and tympany in small ruminants. This study describes the clinical presentation, diagnosis, and successful surgical management of rumen impaction with concurrent rumen tympany in a Balami ram resulting from sawdust ingestion.

2. Materials and methods

2.1. Case history

A 3-year-old Balami ram weighing 37 kg was presented to the Large Animal Clinic Unit of the Veterinary Teaching

Hospital, University of Jos (VTHUJ), Nigeria, with a history of inappetence, rapid respiration and bilaterally distended abdomen (Figure 1A). According to the owner, he had lost three rams two days prior, after manifesting similar clinical signs of rapid respiration and abdominal distention, following ingestion of sawdust used to insulate the cold floor where the rams were housed under an intensive management system.

2.2. Clinical and laboratory examinations

Upon presentation of the ram to the clinic, a thorough clinical examination was conducted and all the clinical findings were recorded. The ram's vital parameters, including respiratory rate, rectal temperature, and pulse rate, were evaluated and also recorded. After a comprehensive clinical examination, a 5 mL whole-blood sample was obtained from the jugular vein into an ethylenediaminetetraacetic acid (EDTA) tube and sent for hematological analysis. Abdominal ultrasonography was recommended to facilitate the diagnosis. The abdominal flanks of the ram were shaved and prepared, after which the ultrasonography was performed using a 3.5 MHz convex probe and a DAWAI MU10 Ultrasound Scanner. Based on the impacted ram's history, its critical state on presentation, the clinical findings and the ultrasonography findings (Figure 1B), a definitive diagnosis of sawdust-induced rumen impaction with concurrent rumen tympany was made, necessitating emergency rumenotomy to relieve the ram's condition.

2.3. Anaesthesia, surgical management and post-operative care

The surgical site (shaved left flank region) of the impacted ram was scrubbed and disinfected with povidone iodine (Kattle Care Ltd, Nigeria). The ram was then physically restrained in right lateral position on the surgical table, and a laparotomy drape was applied over the proposed surgical site. Local anesthesia was achieved by infiltrating 1% Lidocaine (Pharma X India Pvt. Ltd., Mumbai, India) at 2 mg/kg via an inverted L pattern to desensitize the region and abolish pain during the surgical procedure. A 5cm vertical skin incision was made into the subcutaneous tissue at the left flank region (Figure 2A), and the abdominal muscles were separated along the direction of their fibers. A stab incision was made into the peritoneum and carefully extended along the incision line to approximately 7 cm, sufficient to allow exteriorization of the

Case Study

rumen. The peritoneum was explored, and part of the bloated rumen was carefully exteriorized (Figure 2B). A stab incision was made on a relatively less vascularized area of the dorsal ruminal wall to decompress the distended rumen. The incision was then extended to approximately 5 cm to access the ruminal contents (Figure 2C), allowing careful evacuation of the impacted material (sawdust) from the rumen. The ruminal incision was closed in two layers using Cushing suture pattern (Figure 2D), using size 1 chromic catgut (Huaian Angel Med. Inc. Co., Ltd., Jiangsu, China), after which the rumen was returned to the peritoneal cavity. The peritoneum and abdominal muscles were apposed together with size 2 Polyglactin 910 suture (Agaracryl, Angel Med. Ins. Co., Ltd, China) in a continuous suture pattern, followed by subcutaneous tissue closure using a subcuticular suture pattern. Routine skin closure with size 2 silk suture (Kangning Ind., Co., Ltd, Tianchang, China) was then performed in an interlocking pattern [19]. Postoperative care was composed of alternate-day wound dressing. Postoperative medications included intramuscular administration of 20% Amoxicillin (five-Amox.20@ LA, Central Vet. Med. No. 5, Hanoi-Vietnam) at 20mg/kg, repeated after 48 hours, and 2.5% Diclofenac (Jiangxi Kangtai Pharmaceutical Co., China) at 1.5 mg/kg for three consecutive days [20].

3. Results

3.1. Clinical findings and laboratory results

Upon thorough clinical examination, the ram exhibited bilaterally bloated abdomen (Figure 1A) with tympanic sound on percussion, a ventrally distended and doughy abdomen on

palpation, reduced rumen motility, polypnea, and bruxism (teeth grinding), indicative of abdominal pain. The ram's rectal temperature and pulse rate were 38.2°C and 140 beats/min, respectively.

Comprehensive hematological analysis revealed that the hematological parameters were within the reference ranges reported in Schalm's Veterinary Haematology (Table 1) [21], except for moderate leukocytosis attributed to moderate eosinophilia. The abdominal ultrasonographic findings revealed hypoechoic and hyperechoic areas (Figure 1B), indicative of indigestible material (foreign body) and gas buildup in the rumen. These findings, combined with the clinical findings and the impacted ram's history, facilitated a definitive diagnosis of rumen impaction with concurrent rumen tympany, prompting an emergency rumenotomy to relieve the tympany and evacuate the indigestible material causing the impaction.

3.2. Postoperative outcome

Following a successful surgical intervention, the ram was stabilized with a notable relieved from the rumen tympany (Figure 2E). A notable improvement in respiratory rate (28 cycle/min) was recorded, which underscores the significant role of the rumenotomy. About 7 kg of indigestible impacted sawdust was evacuated from the rumen during the surgical procedure (Figure 2F). The ram recovered remarkably with the return of normal rumen motility following the surgical management. The skin suture was removed on day 10 postoperatively.

Table 1. Haemogram results of a 3-year-old Balami ram with rumen impaction associated with rumen tympany with history of sawdust ingestion.

Parameters/Units	Patient Values	Reference Values*
Packed cell volume (%)	35	27–45
Total white blood count ($\times 10^3/\mu\text{l}$)	8700	4000-8000
Segmented neutrophils ($\times 10^3/\mu\text{l}$)	4524	700-6000
Band neutrophils ($\times 10^3/\mu\text{l}$)	00	00
Lymphocytes ($\times 10^3/\mu\text{l}$)	2349	2000-9000
Monocytes ($\times 10^3/\mu\text{l}$)	174	0-750
Eosinophils ($\times 10^3/\mu\text{l}$)	1653	0-1000
Basophils ($\times 10^3/\mu\text{l}$)	00	0-300

*Reference Values [21]

Case Study

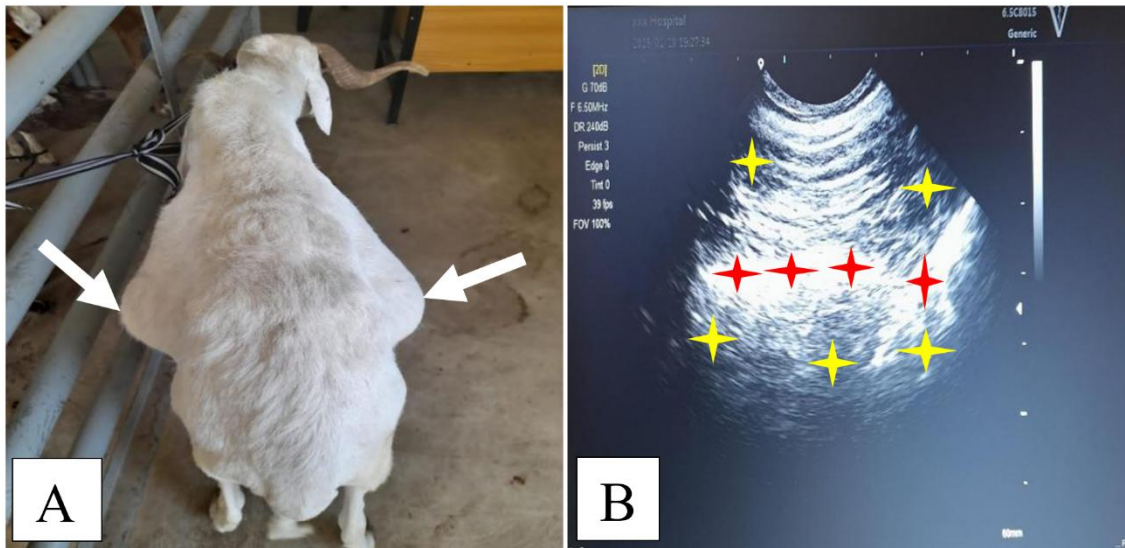


Figure 1. Case presentation and abdominal ultrasonography of a 3-year-old Balami ram with history of sawdust ingestion. **A.** Bilaterally bloated abdomen (white arrows), **B.** Hyperechoic areas (red stars), indicative of gas build and hypoechoic areas (yellow arrows), indicative of indigestible material most likely sawdust.

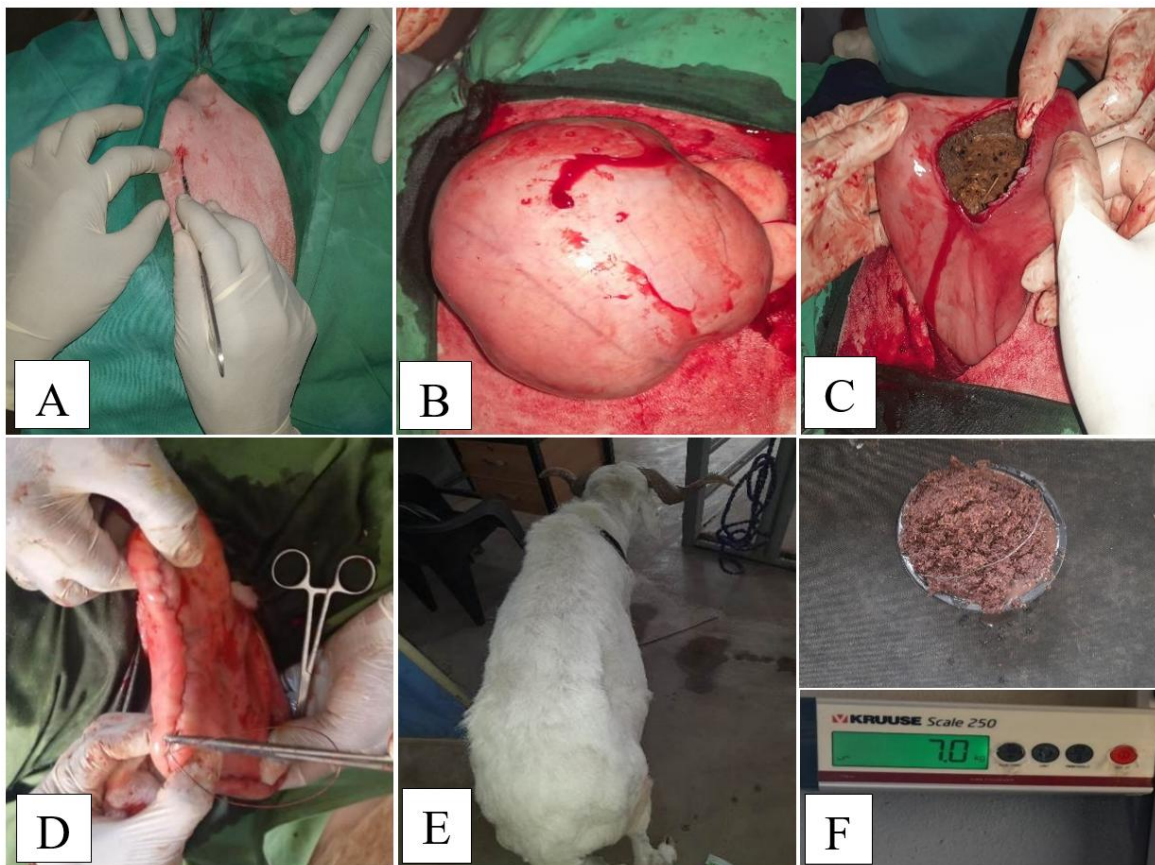


Figure 2. Rumenotomy and outcome in a 3-year-old Balami ram with sawdust-induced rumen impaction and concurrent rumen tympany. **A.** Vertical skin incision, **B.** The exteriorized bloated rumen, **C.** Ruminal incision at the dorsal wall, **D.** Closure of the ruminal incision with Cushing suture pattern, **E.** The ram's condition after the surgical intervention, **F.** The evacuated impacting material (sawdust) weighed 7 kg.

Case Study

4. Discussion

This study documents the first instance in which sawdust was identified as the cause (impacting material) of rumen impaction with concurrent rumen tympany. Previous studies have associated rumen impaction with the ingestion of various indigestible materials, including polythene bags, plastic, clothing items, mosquito nets, ropes, metal, hair, hide, nails, wood strips, and low-quality or indigestible feed materials [1-6]. Notably, the finding of sawdust as the impacting material adds to the list of known causes of rumen impaction and highlights the importance of selecting appropriate bedding materials in ruminant husbandry. The clinical presentation of the impacted ram, characterized by a bilaterally bloated abdomen with a tympanic sound on percussion, bruxism, rapid respiratory rate, a ventrally distended abdomen, and reduced rumen motility, is consistent with rumen impaction and tympany, as reported in previous studies that documented similar clinical findings [6, 7]. Although a tentative diagnosis of rumen impaction with associated tympany was made based on the ram's history and clinical findings, the abdominal ultrasonography facilitated a definitive diagnosis of rumen impaction with concurrent rumen tympany, and guided an informed decision for a prompt surgical intervention. The ingested sawdust in this study likely caused a physical and functional blockage in the rumen due to its poor digestibility and slow passage rate, preventing gas release and leading to secondary (free-gas) bloat. This is consistent with previous reports [8, 9, 11, 12], that associated secondary bloat with physical or functional obstructions in the rumen that prevent the release of gas, mostly exacerbated by rumen atony associated with low-quality diets. The bloated abdomen in the present case could be directly related to the physical presence of the sawdust, highlighting the importance of considering foreign bodies and indigestible materials in the diagnosis of rumen tympany. The impacted ram's history, its critical state on presentation, and the ultrasonographic findings prompted an emergency rumenotomy to relieve the tympany and evacuate the indigestible material causing the impaction. The procedure was performed on the left abdominal flank after local anesthesia of the proposed surgical site was achieved with 1% of lidocaine. A markedly bloated rumen was encountered during surgery and was carefully exteriorized to avoid rupture. An incision into the rumen relieved the bloat,

and approximately 7 kg of the ingested sawdust was evacuated from the rumen. The ruminal incision was closed with size 1 chromic catgut using Cushing suture pattern and afterwards returned into the peritoneal cavity. The peritoneum and abdominal muscles were apposed together in a continuous suture pattern using polyglactin 910, followed by routine subcutaneous layer and skin closures using subcuticular suture and interlocking suture patterns, respectively. The notable improvement of the ram's post-operative respiratory rate indicated a relatively stabilized condition. The successful outcome of the surgical procedure, followed by the ram's remarkable recovery underscores the significance of surgical management of rumen impaction with concurrent secondary rumen tympany via rumenotomy.

5. Conclusion

This case report highlights the importance of considering unusual causes of rumen impaction like sawdust ingestion in ruminants, and underscores the significance of selecting appropriate bedding materials in ruminant husbandry. Furthermore, timely presentation, accurate diagnosis, and prompt surgical intervention via rumenotomy can lead to successful outcomes in cases of sawdust-induced rumen impaction with concurrent tympany and similarly related cases in ruminants. The loss of three rams due to the ingestion of sawdust that led to rumen impaction and concurrent rumen tympany underscored the importance of proper bedding material selection. The owner was advised to avoid using sawdust as bedding material for his farm animals, instead, safer alternatives like straw or hay should be utilized. Additionally, regular monitoring of animal behavior and feed intake was recommended to facilitate early detection and prompt intervention, ultimately reducing the risk of rumen impaction and tympany. By adopting these preventive measures, farmers can promote animal welfare and minimize economic losses.

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Authors' contributions

Case Study

Iliya Paul Sambo conceptualized the study, wrote the manuscript and performed the surgery. **Idris Ayodeji Azeez** contributed to writing and revising the manuscript. **Andrew Ababa James** conducted diagnostic imaging and interpretation. **Japheth Joel Kalang** was involved in case management and organizing the manuscript. **Danbwarang Dennis Sunday** was involved in the post-operative care. **Charibu Hurdison Dishon** collected and organized the data, and **Blessing Mosco** was involved with the postoperative care. All authors read and approved the final version of the manuscript prior to publication.

Conflict of interest statement

The authors declare that there was no conflict of interest

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Ethical approval

Consent from the owner of the ram was obtained before collecting information about the case history, and also prior to the case management when the animal was presented to VTHUJ.

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Data availability

All data supporting the findings of the present study are available within the article and from the corresponding author upon reasonable request.

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Case Study

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