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Radiographic, ultrasonographic and surgical treatment of rectovaginal fistula disease associated with atresia ani in ruminants

Tratamiento radiográfica, ultrasonográfica y quirúrgica de la fístula rectovaginal asociada a atresia anal en rumiantes

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ABSTRACT

Recto-vaginal fistula (RVF) associated with atresia ani (AA) are congenital anomalies in which fecal and urinary output occurs through the vulvar region. In this study, 17 ruminants (lamb n=9, calf n=8) constituting type II AA-associated RVF cases were included. The cases were evaluated clinically, radiographically and ultrasonographically. Clinical findings included tenesmus, feces in the perivulval area, abdominal distension, partial perineal swelling and hematochezia. The abdomen and pelvis were evaluated by direct radiography and gaseous distension, dilated colon, moderate or severe megacolon were diagnosed. Using radiographic assessment of the distance between the rectum blind pouch and perineum, AA was typed and all cases were diagnosed as Type II AA. Ultrasonography was used to classify RVF and recto-lower fistula was diagnosed in all cases evaluated. All operations were performed by anoplasty using the rectal-pull through technique. No complications were encountered during the postoperative follow-up period. The aim of this study was to provide information about the diagnosis, treatment and use of radiography and ultrasonography in Type II AA with RVF in lambs and calves.

Key words: Atresia ani; rectovaginal fistula**;** ruminants; radiography; ultrasonography

RESUMEN

Las fístulas rectovaginales (FRV) asociadas a atresia anal (AA) son anomalías congénitas, en la cual, la salida fecal y urinaria se realiza a través de la región vulvar. En este estudio se incluyeron 17 rumiantes (cordero n=9, ternero n=8) que presentaban FVR asociada a AA de tipo II. Los casos fueron evaluados clínica, radiográfica y ecográficamente. Los hallazgos clínicos fueron tenesmo, heces en la zona perivulvar, distensión abdominal, irritación perineal parcial y hematoquecia. El abdomen y la pelvis se evaluaron mediante radiografía directa y se diagnosticó distensión gaseosa, colon dilatado y megacolon moderado o grave. Mediante la evaluación radiográfica, se evaluó la distancia entre el saco ciego del recto y el periné, se tipificó la AA y todos los casos se diagnosticaron como AA de tipo II. Se utilizó la ecografía para clasificar la FRV y se diagnosticó una fístula rectoinferior en todos los casos evaluados. Todas las intervenciones se realizaron mediante anoplastia utilizando la técnica de extracción a través del recto. No se produjeron complicaciones durante el periodo de seguimiento postoperatorio. El objetivo de este estudio fue aportar información sobre el diagnóstico, el tratamiento y el uso de la radiografía y la ecografía en la AA de tipo II con FRV en corderos y terneros.

Palabras clave: Atresia anal; fístula rectovaginal; rumiantes; radiografía; ultrasonografía

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INTRODUCTION

Congenital anomalies involving the rectum and anus in the gastrointestinal tract are common in all animal species, with an approximate incidence of 4.3% [1]. Genetic and environmental factors are thought to be effective in the etiology of congenital anomalies, but the exact causes are unknown [1, 2].

Atresia ani (AA) is a congenital anomaly of the rectum and anus characterized by the inability to pass feces due to the closure of the anal canal (anus) [3]. In the etiology of AA, teratogens found in plants and viral diseases during pregnancy have been reported for cattle, while it has been reported to be the result of an autosomal recessive gene for sheep [4, 5]. Clinical signs in affected animals include progressive abdominal distension, tenesmus and prominence of the anal/perineal region [6]. AA is divided into four classes in all animals: Type I AA is a congenital stenosis of the anus. In type II AA, the membrane of the anus persists and the rectum ends as a blind pouch just cranial to the anus without a hole. In type III, the anus is closed and the blind end of the rectum is more cranial. In type IV atresia ani, the anus and terminal rectum develop normally, but the cranial rectum ends as a blind pouch in the pelvic canal [7]. Surgical correction is the most indicated treatment for this disease and therapeutic success has been reported to depend on the degree of rectal development [6]. Given the importance of this disease in ruminant species, low therapeutic success has been reported [3, 6, 8]. AA can be associated with congenital diseases such as rectovaginal fistula (RVF), rectocystic fistula, vagino–urethral agenesis, taillessness, hypospadias and diphallus [8]. These congenital anomalies of the external genital organs are of special importance due to their repercussions on future generations [5].

RVF is another congenital problem in female ruminants that causes a direct connection between the rectum and vagina and is responsible for urofecal mixing, and if the vulva is formed, it serves as a common opening for both the digestive and urogenital tracts [5, 9]. Studies have reported that most cases of RVF are associated with type II AA, and type III AA is encountered in fewer cases [10]. In most of the affected animals described in the veterinary literature, various degrees of fecal impaction and colonic distension are evident on radiographic examination in RVF associated with AA [9]. Common clinical signs include defecation from the vulva, vulvar irritation, abdominal distension, absence of anus orifice, megacolon, and cystitis most commonly associated with *E. coli* and *Proteus* spp. [11]. In the veterinary literature, AA–associated RVF have been reported in calves (*Bos taurus*) and lambs (*Ovis aries*), but there is insufficient data, especially radiographic and ultrasonographic evaluations [12].

Anoplasty is the most common surgical procedure performed in RVF associated with AA. Anoplasty aims to restore anorectal continuity, preserve the external anal sphincter, restore colonic function and eliminate rectovaginal fistula. The perineal approach is used for all surgical correction of atresia types I, II and III [6, 11]. When not treated surgically, animals with atresia ani type II and III have been reported to have fatal outcomes due to intestinal obstruction [10].

This study aims to contribute to clinician veterinarians by evaluating the clinical, surgical, radiographic and ultrasonographic findings of AA–related RvF cases observed in calves and sheep.

MATERIALS AND METHODS

A total of 17 female ruminants consisting of lambs (n:9) (53%) and calves (n:8) (47%) brought to Harran University, Faculty of Veterinary Medicine, Animal Hospital, Turkey, with the complaint of fecal and urinary output from the female genital organs due to absence of the anus region constituted the material of this study. Species, age, breed, AA–RVF type, treatment and 6 months postoperative follow–up information were recorded. RVF disease associated with AA was evaluated with clinical, radiographic and ultrasonographic examinations and surgical procedure was decided. The data included in the study were AA type and RVF localization, surgical procedure, postoperative follow–up, hematology, serum biochemical and blood gas results, radiographic and ultrasonographic diagnostic imaging findings and postoperative follow–up processes. Cases in which information could not be obtained because the patient owner could not be reached during the postoperative period were not included in the study.

This study protocol was approved by the Local Ethics Committee on Animal Experiments, Harran University (session and permit number: 2024/001/04).

Clinical and laboratory examinations

Within the scope of clinical examinations, body temperature, pulse rate and respiratory rate were evaluated with Mindray UMEC12VET (Mindray UMEC12VET, Shenzhen Mindray Bio–Medical Electronics Co, Shenzhen, China) device before the surgical procedure. Hemogram, serum biochemistry and blood gas analysis were performed. For hemogram, white blood cell (WBC), lymphocyte, monocyte, red blood cell (RBC), mean corpuscular volume (MCV), hematocrit, mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC) and hemoglobin levels were measured using a hematology auto analyzer (pocH–100i®, Sysmex, Kobe, Japan). For biochemical evaluation, serum glucose, creatinine, cholesterol, alanine aminotransferase (ALT), aspartate transaminase (AST), total bilirubin, albumin, C–reactive protein (CRP) levels were determined using an automated biochemistry analyzer (Spotchem EZ SP 4430®, Arkray Inc. , Kyoto, Japan). Hydrogen ion concentration (pH), partial pressure of oxygen (pO_2) and partial pressure of carbon dioxide (pCO_2) analyses of heparinized blood samples were performed with GEM Premier Plus 3000 (74351, Blood Gas/Electrolyte Analyzer, Model 5700, Instrumentation Laboratories, USA) autoanalyzer.

Radiographic and ultrasonographic evaluation

The initial diagnosis of RVF associated with AA was based on the results of physical examination and observations of perivulvar fecal contamination. In addition, considering the presence of feces in the vulva, a probe or forceps was inserted gently into the vulva and advanced towards the vagina to confirm the relationship with the rectum. Radiographic (838 HF50, Hasvet, China) and ultrasonographic (Z60 VET, Mindray, China) examinations were performed for detailed diagnosis. Radiographs were taken in lateral and ventrodorsal positions including the abdomen and pelvis to determine the degree of colonic dilatation, caudal width of the rectum and type of AA and to evaluate any sacrococcygeal anomaly. Radiographs were taken with a Hasvet 838 HF50 70KV – 50mA veterinary por table DR x–ray machine and digitally evaluated. Ultrasonographic examinations of the anorectal region were performed similar to the technique described by Kleinübing *et al.* [13]. In ultrasonographic examinations, all images were obtained

using an ultrasound machine (Z60 VET, Mindray, China) with a 7.2 to 11 MHz microconvex probe. Animals were placed in the sterno-abdominal position and transperineal ultrasonography was used to examine the presence, length, location and positioning of the RVF in relation to the rectum. Furthermore, according to the proximity and distance of the connection of the fistula to the rectum to the perianal region, the type classification of recto- upper vaginal fistula and recto- lower vaginal fistula were assessed [14]. All assessments were recorded.

Treatment and surgical technique

All surgical procedures were performed under sedation and local anesthesia in the sterno-abdominal position with a perineal approach. Initially, the animal was anesthetized and then placed on the operation table. After the tail was wrapped with a bandage, it was fixed to the back and removed from the operation area and the perineal area was prepared for the surgical procedure.

In the anesthesia protocol applied to the animals, 2% Xylazine (Rompun® 0.02- 0.34 mg·kg^{-1}, intramuscular) was used as a preanesthetic agent. Induction and maintenance of anesthesia was achieved by administration of Propofol (Propofol-PF 1% 3 mg·kg^{-1} intravenously). Subsequently, lower epidural anesthesia was performed in the lumbosacral region using the local anesthetic 2% Lidocaine (Jetocaine® – 0.1 mL·kg^{-1}, epidural).

The subjects were placed on the operation table in the sterno-abdominal position with their hind legs stretched posteriorly and shaving and antisepsis of the operation area was performed by brushing with 10% Povidone Iodine and rinsing with 70% ethyl alcohol. After the operation area was delimited with sterile cervical cloths, a "+" shaped skin incision was made in the perineal region. The incision lines varied according to the size of the patient, but were 2×3 cm in diameter in lambs and 5×8 cm in calves. The vertical incision was bordered dorsally and ventrally by the base of the tail and the dorsal commissure of the vulva, respectively. Following careful blunt dissection of the connective tissue in the area and the medial line of the external anal sphincter muscle, the path of the rectovaginal fistula was traced. The fistula area in the rectum was identified with the help of a hemostatic clamp inserted from the vulva, two ligatures were applied with 2-USP PGA absorbable thread and the fistula area was reversed to the ventral wall of the rectum and the dorsal wall of the vagina with the "rectal pull through" technique. The fistula area was then closed by applying simple separate sutures with 2-USP PGA absorbable thread (FIGS. 1, 2).

This area was further defined by meticulous division of the subcutaneous tissue around the blind fundus pouch of the rectum, which is located more dorsal to the fistula area. Anoplasty was continued to reconstruct the anal canal and anus. Accordingly, before transection of the distal part of the blind inferior pouch, a circular skin opening was created by cutting the apexes of the skin incisions, and the rectal mucosa and submucosa layers were fixed to the skin with a separate single layer of 2-USP non-absorbable silk thread. Thus, the anus tract was opened to the outside and fecal output was observed in most of the cases (FIGS. 1, 2).

Postoperatively, Meloxicam (2.2 mg·kg^{-1}, Metacam®, Terrassa, Barcelona Spain) and Vetimycin 8mg·kg^{-1} (Vetas, DEVA Holding) were administered intramuscularly once a day for a week. Paraffin liquid (Sokol liquid, 200 mL, Biofarma) was recommended to be administered orally 15 mL twice daily until normal defecation begins. Since it was challenging to keep the surgical area clean due to feces, the area was cleaned with povidone iodine (Baticonol 10%, DERMOSEPT) three times a day. Soapy water enemas have also been recommended if necessary.

Postoperative follow-ups were conducted via telephone with the patient owners. During the 6-month follow-up, questions were asked whether any complications occurred and the owners stated

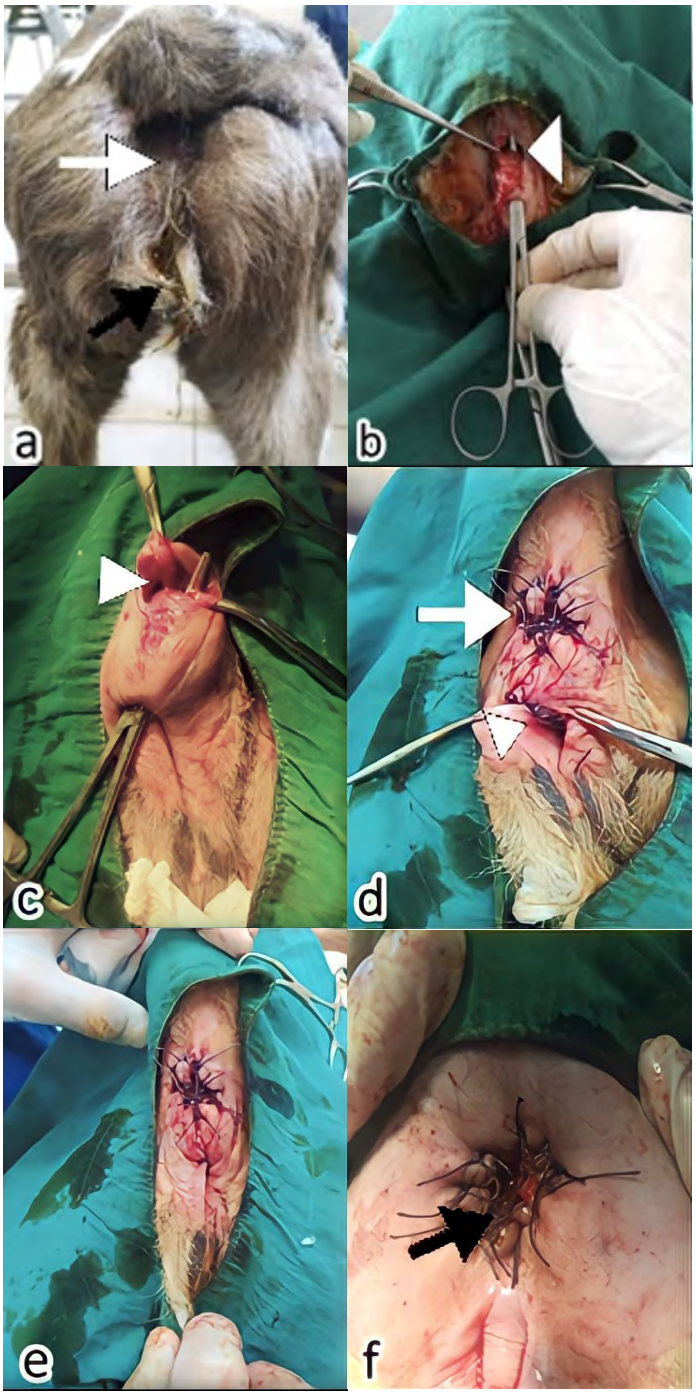

FIGURE 1. Case 11 a) Closed anal area (white arrow), feces in perivulvar area (black arrow). b) Detection of fistula in closed anal area with guiding forceps from vulva (white arrow). c) Fistula in anoplasty area (arrowhead). d) Postoperative rectal suture (white arrow), suture of fistula canal (arrowhead). e) Postoperative area. f) Fecal output (black arrow)

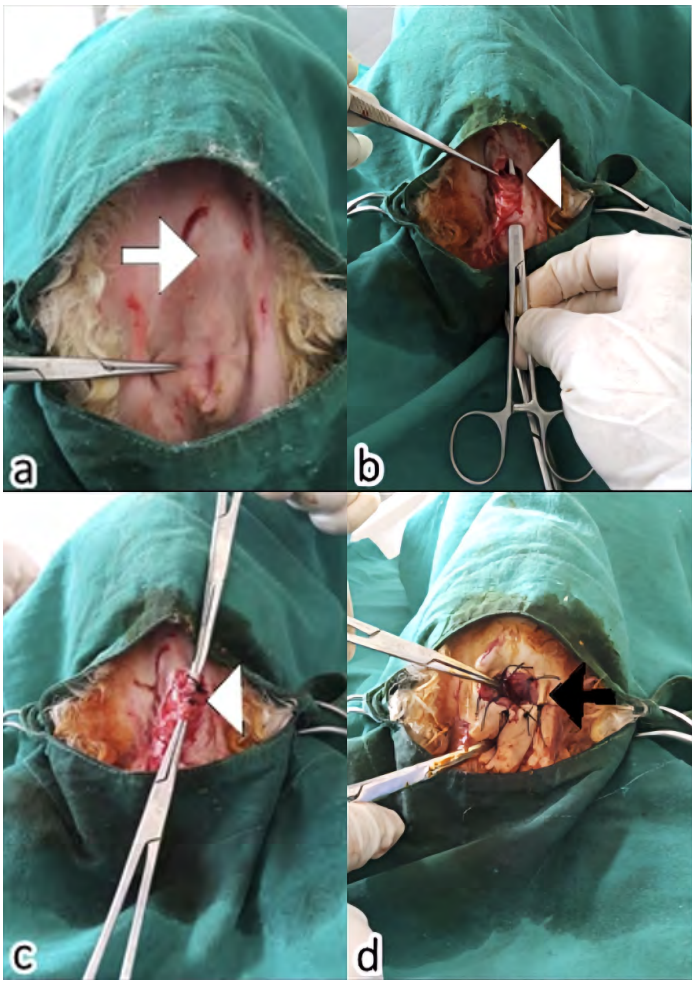

FIGURE 2. Case 1 a) Closed anal area (white arrow). b) Fistula in the anoplasty area (arrowhead). c) Suture of the fistula canal (arrowhead). d) Postoperative area (black arrow)

that the patients experienced constipation for 3–5 days (d) in the postoperative period, but no other complications were observed. Especially in the calf cases, at the end of the 6th month, the owners asked if they could have calves from the patients in the future and relevant recommendations were presented.

Statistical analysis

SPSS statistical package program was utilized for all calculations and statistical analyses in the study and descriptive statistical analysis software was applied. The data sets were evaluated for normality using the Shapiro–Wilk normality test and the data sets displayed a normal distribution. In addition, ODDS Ratio and 95% confidence intervals were calculated and comments were provided accordingly.

RESULTS AND DISCUSSION

In the study, a total of 17 female ruminants, 9 lambs and 8 calves, were diagnosed with RVF associated with Type– II AA. Based on the anamnesis information obtained from the owners and clinical examinations, it was confirmed that all lambs and calves had congenital RVF. In lambs, RVF associated with congenital Type–II AA was observed between 3 and 540 d of age. In patient number 4 (1 of 9, frequency 11%), the owner reported that the animal defecated from the female organ until the age of 1.5 years and it did not affect its life, but it was brought for treatment due to severe constipation and enlargement of the fistula. This was observed in calves between 1 and 32 d old (Mean ± SD 13.5 ± 13.4). All lambs were of ivesi breed, 6 calves were simmental (6 of 8, 75%) and 2 were Hollstein (2 of 8, frequency 25%). The species, breed, age, diagnosis, radiographic and ultrasonographic findings and prognosis of all cases are presented in TABLE I.

In the light of clinical examination findings, tenesmus and feces in the perivulval area, abdominal distension, partial perineal swelling and hematochezia in cases 4, 9 and 13 (3 of 17, frequency 17%) were encountered in the majority of cases. Preoperative hemogram, serum biochemistry and blood gas analyses were within the normal reference range in all cases and no intraoperative or postoperative complications were encountered. Laboratory values are shown in TABLE II.

TABLE I
Summary of diagnosis, disease and treatment information of cases (n=17)

Case	Animal	Diagnosis	RG	USG	Prognosis
1	Lamb, 4–day, Female, Awassi	Atresia ani type II with RVF	Abdominal distension, dilated colon, severe megacolon	Recto– lower vaginal fistula	After 6 months, no complications
2	Lamb, 1.5–month, Female, Awassi	Atresia ani type II with RVF	Dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
3	Lamb, 2–month, Female, Awassi	Atresia ani type II with RVF	Abdominal distension, dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
4	Sheep, 1.5–year, Female, Awassi	Atresia ani type II with RVF	Abdominal distension, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
5	Lamb, 3–day, Female, Awassi	Atresia ani type II with RVF	Abdominal distension, dilated colon, severe megacolon	Recto– lower vaginal fistula	After 6 months, no complications
6	Lamb, 15–day, Female, Awassi	Atresia ani type II with RVF	Abdominal distension, dilated colon	Recto– lower vaginal fistula	After 6 months, no complications
7	Lamb, 10–day, Female, Awassi	Atresia ani type II with RVF	Abdominal distension, dilated colon	Recto– lower vaginal fistula	After 6 months, no complications
8	Lamb, 3–day, Female, Awassi	Atresi ani et vulvi type II with RVF, Lack of tail	Abdominal distension, dilated colon	Recto– lower vaginal fistula	After 6 months, no complications
9	Lamb, 2–month, Female, Awassi	Atresia ani type I with RVF	Dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
10	Calf, 1–day, Female Simmental	Atresia ani type II with RVF	Abdominal distension, dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
11	Calf, 7–day, Female Simmental	Atresia ani type II with RVF	Abdominal distension, dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
12	Calf, 32–day, Female, Simmental	Atresia ani type II with RVF	Dilated colon, severe megacolon	Recto– lower vaginal fistula	After 6 months, no complications

TABLE I
Summary of diagnosis, disease and treatment information of cases (n=17) cont...

13	Calf, 7–day, Female, Simmental	Atresia ani type II with RVF	Abdominal distension, dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
14	Calf, 2–day, Female, Hollstein	Atresia ani type II with RVF	Abdominal distension, dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
15	Calf, 3–day, Female, Simmental	Atresia ani type II with RVF	Dilated colon, mid megacolon	Recto– lower vaginal fistula	After 6 months, no complications
16	Calf, 30–day, Female, Simmental	Atresia ani type II with RVF	Abdominal distension, dilated colon, severe megacolon	No assessment	After 6 months, no complications
17	Calf, 26–day, Female, Hollstein	Atresia ani type II with RVF	Abdominal distension, dilated colon, severe megacolon	No assessment	After 6 months, no complications

RG: radiographic imaging, USG: ultrasonographic imaging

TABLE II
Haematological, biochemical and blood gases results. Mean ± SD

Parameter Test Results	Lambs	Calves
WBC	9.82±0.59	13.69±2.50
Lymphocyte	55.66±0.08	16.06±9.83
Monocyte	2.55±0.02	0.88±1.12
RBC	9.55±2.55	8.79±3.40
MCV	35.11±4.31	38.20±3.35
Hematocrit	29.48±1.22	37.55±3.56
MCH	9.12±2.77	14.47±3.49
MCHC	31.34±0.65	31.55±1.81
Haemoglobin	12.11±2.30	11.86±1.19
Glucose (mmol·L^{-1})	3.60±1.23	4.22±0.50
Creatinin (µmol·L^{-1})	129±5.7	142±5.9
ALT (U·L^{-1})	29.62±3.26	31.21±1.18
AST (U·L^{-1})	118.10±9.21	123.8±2.50
Total–Bilirubin(mg·dL^{-1})	0.36±0.50	0.23±0.68
Albumin (g·dL^{-1})	2.33±0.45	2.40±0.97
CRP (mg·dL^{-1})	0.69±0.31	0.54±0.58
pH	7.43±0.01	7.41±0.32
pCO_2	40.66±3.53	44.60±2.65
pO_2	39.15±1.85	30.44±2.46

In all animals, direct radiographs taken before treatment demonstrated gaseous distension of the intestinal segments and a dilated colon. The cases were classified as moderate to severe megacolon. Furthermore, no other congenital anomalies were detected in the radiographic evaluation of the pelvis and abdominal region. In radiographic imaging, using a common classification scheme with other literatures [15], type II AA (Mean±SD 0.68±0.17) was observed in all cases based on the distance between the closed rectum and perineum on lateral radiographs. In this classification scheme, the radiographic evaluation of type II AA was expressed as the distance between the anus (<1 cm) where the imperforate rectum terminated close to the closed anus (FIG. 3).

In 15 of 17 cases (15 of 17, 88%), the fistula could be visualized completely on ultrasonographic evaluation. In Case 16 and 17 (2 of 17, 11%), ultrasonographic evaluation was not possible due to closed rectum and fecal density in the fistula canal. For ultrasonographic evaluation, the chart of various internal fistulas including recto–vaginal fistulas associated with imperforate anus as presented by Choi *et al*. [14]. According to the scatter plot of perineum–pouch (P–P) distances versus AA type of RVF cases, using the classification of recto–upper vaginal fistula and recto–lower vaginal fistula type, the mean P–P distances for Upper and Lower type AA with RVFs were established as 6–30 mm and 0–14 mm, respectively. [14, 16]. Type II

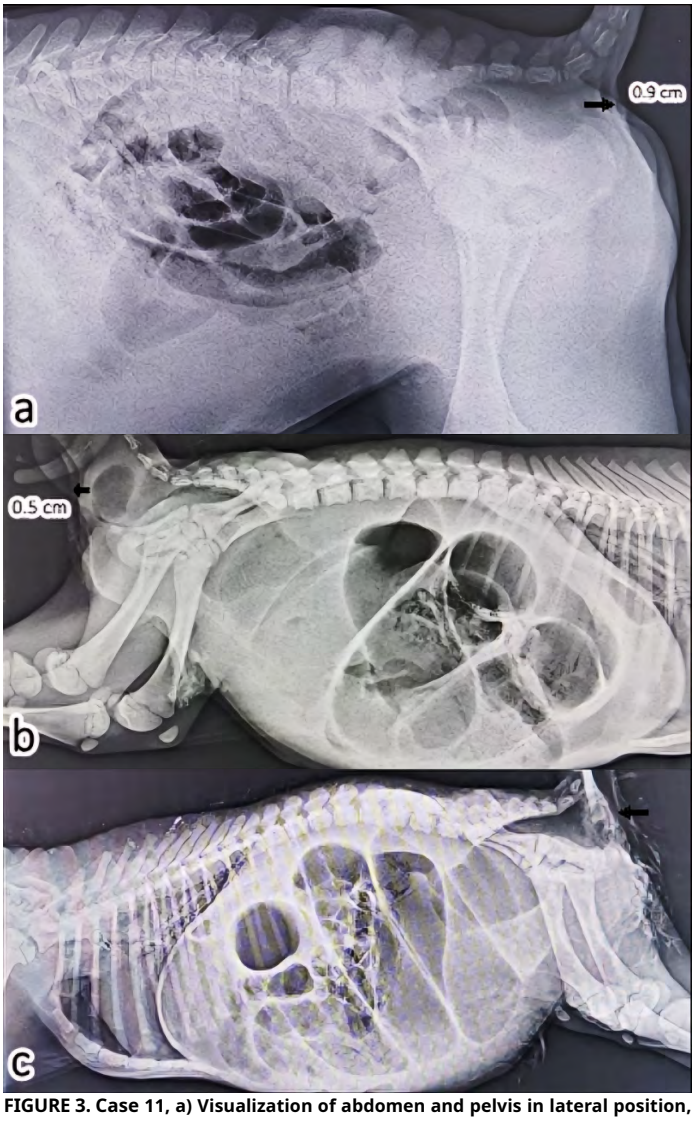

FIGURE 3. Case 11, a) Visualization of abdomen and pelvis in lateral position, dilated colon and moderate megacolon, (0.9 cm=Type II). Case 1, b) Preoperative visualization of abdomen and pelvis in lateral position, clear detection of closed sac, dilated colon and severe megacolon, (0.5 cm= Type II). Case 1, c) Postoperative anoplasty procedure resulting in an opened anal canal (black arrow)

AA type overlapped with the Lower type reference interval and recto–lower vaginal type (Mean±SD 10.8 ± 3.52 mm) was detected (P<0.005) in the patients who could undergo ultrasonographic evaluation (n:15). It was noted that all cases evaluated had recto–lower vaginal fistula. Findings such as the cranial location of the fistula during the surgical procedure and radiographic observation of recto–lower vaginal fistula in AA type II cases supported the ultrasonographic findings (Mean±SD 10.8 ± 3.52 mm). In all cases evaluated on transperineal ultrasonography, fistulas were mostly in the form of longitudinal hypoechoic areas between the rectum and urethra. Especially in cases 2, 6 and 11 (3 of 17, 17%), color Doppler study (Z60 VET, Mindray, China) of the vaginal fistula area showed marked hypervascularity (FIG. 4).

Although the presence of infection in these areas was considered, it did not pose a risk for later periods considering the hematologic values and the operation process. Considering both imaging modalities, it was concluded that radiographic identification was more useful in the typing of atresia and ultrasonography was more useful in the detection of rectovaginal fistula. However, the definitive diagnosis and typing should be supported by the findings observed during the surgical procedure.

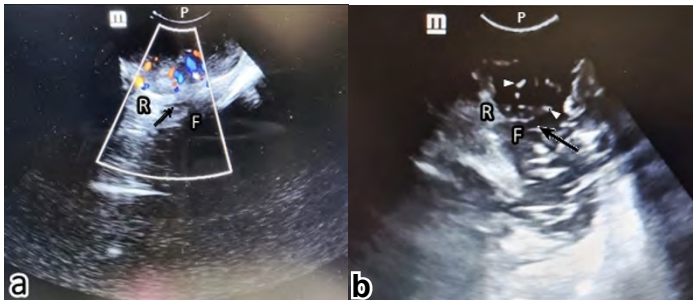

FIGURE 4. Case 11, a) Transperineal USG, Grayscale image shows a hypoechoic fistula (black arrow) on the right side of the anal canal. Marked hypervascularity on color Doppler study near the perianal region of this fistula. Case 1, b) Transperineal USG, air bubbles in the closed perianal region (arrowhead), wider fistula channel to the right of the rectum (black arrow). R = Rectum, F = Fistula, P = Probe

Anoplasty was performed in all cases (n:17) and RVF was surgically closed when available. Sutures were removed 10–12 d after the procedure. Animals were able to defecate normally 7–10 d after the surgical procedure. Six months after the surgical procedure, the animals were re-evaluated and no complications were detected.

In the statistical evaluation, TABLE III shows whether the disease is associated with species and race. As a result, when TABLE III was analyzed, the predisposition of breed and species was found to be statistically significant (P<0.05). Awassi breed lambs were determined as the most disadvantaged breed in terms of this anomaly. Within-group evaluation revealed that lambs had a 2-fold more disadvantageous predisposition to this anomaly than calves and this predisposition was significant (P<0.05).

AA is a congenital deformity caused by a genetic defect in the perianal region in which the dorsal part of the anus opening to the outside is not formed. RVF is a congenital disease characterized by the failure of the urorectal septum to close due to an embryologic defect. These two diseases occur together, especially in ruminants, and when left untreated, they lead to poor prognosis and economic losses such

TABLE III
Analysis results and odds ratio values for the orientation of AA with RVF disease by species and breeds.

Anomaly	Races	Total	Odds Ratio*	95% Wald' Confidence Interface	X^2 (P-value)
Type II AA with RVF	Awassi	9	2,000	1,418– 57,117	13,432[a] (P=0,000)
	Simmental Holstein	8	0,111	0,018– 0,705	

*: Simmental or Holstein groups were combined under the same group and the risks were calculated based on the group including Awassi breed. [a]: 4 cells (100,0%) have expected count less than 5. The minimum expected count is 3.76

as megacolon, chronic renal damage, cystitis, vaginitis, cervicitis, endometritis, failure to conceive and reproductive failure [6, 17, 18]. In this clinical study, 9 lambs and 8 calves with AA-associated RVF cases had a better prognosis postoperatively than preoperatively with correct diagnosis and diagnosis.

In ruminants, RVF cases with AA may be associated with other congenital anomalies such as vulvar agenesis, atresia coli, atresia ani et vulvi and partial tail agenesis [6, 19, 20, 21, 22]. Among the cases analyzed in this study, tail agenesis was observed in only one lamb (case 8) and no other congenital anomalies were observed in the other cases.

In the literature, the incidence of AA-associated RVF cases in ruminants is low and has been reported in approximately 22 lambs and calves [1, 2, 22]. Among the reported cases, it is noteworthy that the number of calves is higher and especially buffalo and native calf India breeds are more common [23]. In lambs, mostly crossbreds have been reported [8]. In this study, awassi lambs (n:9) and simmental (n:6) and holstein (n:2) calves were included. In addition, odds ratio evaluation revealed that lambs were 2 times more likely to be observed (P<0.005).

AA is classified into one of four types based on assessments such as anal stenosis, distance between rectum and bladder [7]. In all data, RVF has been reported to be mostly associated with type II AA and very few with type III AA in both lambs and calves and other animals such as cats and dogs [23, 24]. Based on the findings obtained with imaging diagnostic methods and surgical procedure, all cases in the present study were found to be RVF associated with type II AA.

Although clinical and physical findings are effective in the diagnosis of congenital diseases such as AA and RVF, different diagnostic tools such as radiography, ultrasonography, computed tomography (CT) and magnetic resonance imaging (MRI) are required in cases such as the differentiation of fistula position and atresia ani types, detection of anomalies in the pelvic region, determination of the exact size of the colon to rule out possible megacolon, diagnosis of urinary tract infections, detection of anomalies in other organs in the abdomen, and prognosis of the disease and acceleration of the surgical procedure [1, 4, 10, 25]. In the study of Fernandes *et al.* [26], involving Type II AA with RVF cases reported in 2 calves, it was emphasized that examinations such as radiography and ultrasound should be used as they help to determine the position of the colon and rectum relative to the perianal region [26]. In another study presented by Bae *et al.* [24], radiography was used for diagnosis in a case of urethrorectal fistula with atresia, but it was reported that it should be supported by methods such as ultrasonography and computed tomography (CT) [24]. Ryu *et al.* reported that contrast radiography was useful in determining the type of AA and the position of the fistula in a calf with type II AA

with RVF [23]. In the present study, all cases were evaluated both radiographically and ultrasonographically. Consequently, radiography was utilized in AA typing and ultrasonography was utilized in the position and classification of the fistula.

In the radiographic evaluation of AA cases, type I (0 cm) = imperforate anus, type II (<1 cm) = imperforate anus, type III (>1 cm) = imperforate anus can be classified according to the distance between the blind sac and the perineal region [15]. In the case study presented by Choi CK *et al*, RVF with Type III AA was diagnosed as RVF with Type III AA as a result of the observation of an imperforate anus in a cat (*Felis catus*) in which the perineal skin of the rectum terminated with a blind pouch approximately 1.26 cm in radiologic findings [27]. Kurt and Turan, observed that the blind rectal pouch was 1.07 cm away from the anal pouch with lateral plain positive contrast radiography in a cat and defined it as Type III AA with RvF [7]. Kim *et al*. also reported that the distance between the blind rectal pouch and the perineal sac on radiographic imaging was 1.2 cm, indicating a type III AA with RVF [16]. Ellison and Papazoglou, measured the distance between the blind rectal sac and perineal skin as 1.5 cm in the right lateral radiographic imaging of a 7-week-old female French Bulldog and reported Type III AA [9]. In the present study, when lambs and calves were radiographically categorized, the diagnosis of Type II AA (Mean±SD 0.68 ± 0.17 cm) was confirmed (P<0.005).

In a retrospective study of pediatric patients with atresia presented by Haber *et al*. [28], recto- upper vaginal fistula (Mean±SD 24 ± 6 mm) was diagnosed in 4 patients. It was emphasized that in patients who underwent transperineal ultrasonographic approach, a complete decision was made together with radiographic and surgical findings in the typing of the fistula. Moreover, this noninvasive imaging method has been reported to prevent unnecessary colostomy in some pediatric patients by correlating with the surgeon's identification of atresia ani, especially when a fistula cannot be detected on clinical examination [28]. Hwang *et al*. performed ultrasonographic evaluation of perianal fistulas in pediatric patients. In this evaluation, they defined fistulas as long, tubular and hypoechoic areas. In the Doppler evaluation of some cases, the presence of hyperemia in the areas where the fistula was observed in 2D grayscale and the presence of air bubbles, fluid collection or abscess in colored areas were assumed. In line with these findings, the surgical procedure was approached cautiously and the final diagnosis was decided by subjective evaluation [29]. In the study conducted in lambs and calves, transperineal ultrasonography was utilized in the evaluation of the disease. Recto-lower vaginal fistula (Mean±SD 10.8 ± 3.52 mm) was diagnosed in the evaluable cases (n=15) supported by radiography and surgical procedure. Additionally, the visualized fistulas consisted of longitudinal tubular hypoeocic areas similar to other studies. Although infection was considered in the colored areas in Doppler evaluation, hematological values and operation findings were not detected. Since there is not enough data on ultrasonographic evaluation of recto-vaginal fistula cases associated with atresia ani in the veterinary literature, it is believed that more studies are required.

Two surgical techniques are commonly used in cases of recto-vaginal fistula associated with AA. The first of these techniques is based on anoplasty, in which the area is accessed by incising the rectum cranial to the fistula opening, the fistula area is exposed and sutured, and then the ends of the rectum are sutured to the anus and fixed. In the second technique, similar to the epistotomy method, the fistula is first exposed and then the anal opening is reconstructed by closing the rectum and vulvar defects separately [23, 26]. This technique has also been reported by Ziaullah and Shahzad, in a case of type II atresia ani with RVF in a dog (*Canis lupus familiaris*) by applying an alternative method such as semitendinosus muscle flap technique [30]. Similar to the first method, the operative procedures in the study were performed on the basis of modified anoplasty by entering the vulva with forceps or catheter and opening the rectum with a " +" incision from the closed skin caudal part of the rectum under the guidance of a fistula, first closing the fistula and then fixing the rectum around the anus with sutures. In addition, similar to Jardel *et al*. [31], the "rectal pull through" technique was used in the surgical procedure and the fistula area was exposed more easily. Thus, suturing was easily performed without the need for another incision. This technique is thought to be less invasive with minimal tissue damage.

In some studies, a syringe cut chamber of various sizes was placed into the rectum after the operative procedure. It has been reported that this material reduces the pressure on the sutures in the fistula mouth and anal sphincter and keeps the sutures clean [8, 12, 27, 32]. This material was not used in the present study. Postoperative wound care was performed 3 times a day and no complications were encountered.

Possible complications following surgical treatment include tenesmus, depression, abdominal distension, megacolon due to constipation, fecal incontinence and rectal prolapse due to surgical trauma [4, 25, 26]. In our study, constipation was observed in the postoperative period and resolved with treatment. Besides, no complications related to surgical trauma were encountered.

CONCLUSION

It is considered that the prognosis of AA with RVF disease, which can lead to serious complications and economic losses when left untreated in lambs and calves, could be improved with a modified anoplasty procedure using the rectal pull through technique. In addition, it is concluded that not only clinical and physical evaluation but also radiographic and ultrasonographic evaluations are very crucial for the diagnosis and treatment of this disease.

Conflicts of Interest

The authors declare no conflict of interest.

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