

New classification of Amyand's hernia, our experience: a retrospective observational study with a literature review

Cem Kaya, Alparslan Kapisiz, Ramazan Karabulut, Zafer Turkeyilmaz, Sibel Eryilmaz, Merve Altin Gulburun, Kaan Sonmez

Department of Pediatric Surgery, Faculty of Medicine, Gazi University, Ankara, Turkiye

Purpose: Amyand's hernia (AH) is the name given to the type of hernia in which the appendix is found in a hernial sac. We aimed to share our clinical experience with a literature review for AH.

Methods: A total of 1,774 inguinal hernias and 13 AH cases were repaired in our clinic between 2009 and 2020. In addition, detailed clinical features about AH were extracted by including unpublished data of 165 cases, which were gathered from the extensive literature on childhood AHs using PubMed, Web of Science, and Cochrane databases.

Results: The rate of AH was 0.73% in all inguinal hernias; this rate was 8.6% for incarcerated hernias. The average age was 5.74 ± 7.27 months for AH. Our AH cases were seen in males and on the right side. AH is seen in 97.3% of males according to a review of 69 articles. The average age was 16.78 ± 30.46 months. One hundred sixty-five of the AH cases were on the right (88.7%). The main symptoms were swelling or redness in the inguinal region, pain, fever, and vomiting, along with patients presenting septic or with stercoral fistula.

Conclusion: If the appendix is normal and easily reduced, high ligation is sufficient. In cases where reduction is difficult and/or the appendix is inflamed, appendectomy and hospitalization should be performed.

[Ann Surg Treat Res 2024;107(4):237-244]

Key Words: Amyand's hernia, Child, Incarcerated hernia, Inguinal hernia, Treatment

INTRODUCTION

Amyand's hernia (AH) is the name given to the type of hernia in which the appendix is found in a hernial sac and was first described by Claudius Amyand in 1735 with a case involving a perforated appendix included in the hernial sac. AH cases make up 1% of groin hernias, while appendicitis developing in the hernial sac makes up 0.1% of appendicitis cases [1,2]. In AH cases, patients may present with findings such as swelling in the inguinal region, acute scrotum, and strangulated hernia, and preoperative diagnosis is generally impossible. The sliding

of the appendix within the hernial sac may feel like a thickened cord or a second cord during physical examinations or produce testicle-like findings. Also, in delayed inflammation cases, the patient may present with redness, swelling, or pain in the groin and scrotum. Extremely delayed cases may present with stercoral fistula in the scrotal or inguinal region [1,3-5].

Most of the publications in the literature are presentations of single cases. There are a limited number of publications that give information about AH which are original publications from clinics or literature reviews that include multiple patients. This study aims to compile all the information on AH by collecting

Received September 25, 2023, Revised May 20, 2024,
Accepted July 2, 2024

Corresponding Author: Ramazan Karabulut

Department of Pediatric Surgery, Faculty of Medicine, Gazi University,
Mevlana Bulvari, No: 29, Ankara 06530, Turkiye

Tel: +90-312-2026210, Fax: +90-312-2230528

E-mail: karabulut@yahoo.com, ramazank@gazi.edu.tr

ORCID: <https://orcid.org/0000-0001-9624-3258>

Copyright © 2024, the Korean Surgical Society

© Annals of Surgical Treatment and Research is an Open Access Journal. All articles are distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

our clinical AH experience and all the cases in the literature that relate to childhood.

METHODS

The study protocol was approved by the Institutional Ethics Committee of Our University (No. 21/3/2022; 216). This study was performed in accordance with the Declaration of Helsinki and written informed consent was waived due to its retrospective nature.

All inguinal hernia cases admitted to our clinic between January 2009 and March 2020 were retrospectively scanned. Of the total 1,774 inguinal hernias repaired in our clinic within the given timeframe, 151 of them were incarcerated, and AH was identified in 13. All patients were diagnosed with AH intraoperatively. Preoperative ultrasonography (USG) was performed in only 1 patient, and it was determined that there was a bowel loop in the inguinal canal, but the appendix could not be evaluated. In addition, detailed clinical features about AH were extracted by including unpublished data of 165 cases, which searched the extensive literature for childhood AHs using PubMed, Web of Science, and Cochrane databases [6].

RESULTS

The appendix was found in the sac in 13 of the 1,774 patients who were operated on for inguinal hernias between 2009 and 2020. While the AH rate in our clinic was 0.73%, the AH rate in strangulated hernias was 8.6%. All patients were male and the hernias were on the right side. The average age was 5.74 ± 7.27 months (range, 48 days–2.5 years). While all cases were done with the open method, an appendectomy was performed on 4 patients because the appendix was hyperemic in 2 patients and dissection of the appendix from the sac was difficult in 2 patients. The appendix was pushed into the abdomen in 9 cases. Two cases were reported as lymphoid hyperplasia while 2 were evaluated as normal (Table 1).

Sixty-nine publications presenting AH were screened. In these publications, the rate of incarceration was similar for boys and girls. However, of the cases where sex was disclosed 180 were male (97.3%) while 5 were female (2.7%). Sex was not stated in 13 cases. The average age of the cases was 16.78 ± 30.46 months (range, 4 days–16 years). Of the 137 cases where age was disclosed, 91 were younger than 1 year (66.4%), 43 were 1–10 years-old, and 3 were older than 10 years. Of the 198 AH

Table 1. Our Amyand's hernia patients (all of male sex) and characteristics

Patient No.	Presenting symptom	Age	Appendectomy	Pathology	Hernial sac contents
1	Swelling of the inguinal region and elective surgery	51 days	–	Normal	Appendix
2	Swelling of the inguinal region and elective surgery	48 days	+		Appendix
3	Swelling of the bilateral inguinal region and elective surgery	2 yr 3 mo	–		Cecum + appendix
4	Swelling of the inguinal region and elective surgery	8 mo (29-wk gestation)	–	Lymphoid hyperplasia	Appendix
5	Swelling of the inguinal region and elective surgery	3 mo	–		Ileum in the sac with appendix
6	Reducible swelling extending to the scrotum and elective surgery	3.5 mo	–		Cecum in the sac with appendix
7	Swelling of the inguinal region and elective surgery	2.5 mo	–		Appendix
8	Swelling of the inguinal region and elective surgery	3 mo	–		Appendix
9	Bilateral inguinal swelling, unable to reduce right side, emergency surgical intervention	54 days	–		Appendix
10	Swelling of the inguinal region and elective surgery	10 mo (28-wk gestation)	+	Serosal congestion and lymphoid hyperplasia	Sliding hernia + appendix
11	Swelling present for 1 day, unable to reduce, redness of the skin, ultrasonography, bowel loop in the inguinal canal, emergency surgical intervention	48 days	+		Perforated cecum in the sac with appendix
12	Reducible hernia since birth, patient presented with an incarcerated hernia on the 43rd day and the hernia was reduced Elective surgery 2 weeks later	2 mo (32-wk gestation)	–		Appendix
13	Swelling of the inguinal region and elective surgery (congenital hypothyroidism, cow milk protein allergy)	8 mo (24-wk gestation)	+	Normal	Appendix

cases, 165 cases were on the right (88.7%), 21 on the left (11.3%), and in 12 cases the side was not stated. An appendectomy was performed in 103 cases, 2 of which were inverted. Out of the 51 cases sent to pathology, 13 were normal, 33 were acute, and 5 were reported as perforated. Of the 39 appendectomy cases not sent to pathology, perioperative findings showed 2 normal, 16 acute, and 7 gangrenous cases. Clinical and histopathological appendicitis was observed in 83.3% of cases where appendectomy was performed, while this rate was 37.8% for all cases [6] (Table 2).

Not all publications included postoperative follow-up, and in the publications that did include this information, 4 reported wound infection; and in general, there were no complications [7-10].

In 1 case where the appendix was pushed back into the abdomen, the patient was operated on a second time 2 days after the first operation due to fever and distension, and ischemia of the appendix was found in the patient [11].

In 19 out of 20 cases where the patient had previously been confirmed to have an inguinal hernia by family or doctors but had not undergone surgery, the patient underwent emergency interventions due to incarceration during follow-up. The average age of these patients was 22.10 ± 22.22 months and follow-up time was 20.18 ± 22.37 months. The other patient underwent elective surgery and an AH was found on the left, and a right Littre hernia was identified. The hernia was reported as extending into the scrotum in 36 patients. The cecum was also found in the hernia sac next to the appendix in 33 patients (16.6%), and in 10 of these cases, the ileum was also in the sac. Thirteen patients were reported as having a sliding hernia [6] (Table 2).

In addition to the main symptoms of AH such as swelling or redness in the groin area, pain, fever, and vomiting, there were also patients who presented with septic conditions or stercoral fistula. In the screening, epididymo-orchitis was considered before AH in 6 patients (3.0%) aged 5–42 days [12-17]. Four patients (2.0%) aged 10 days, 26 days, 28 days, and 10 months were first considered for a diagnosis of testicular torsion [8,18-20].

Of the 21 AH cases on the left, all were found in males. The cecum was in the sac in 12 cases, of which 4 also had the ileum in the sac, and no information was reported for 9 of these cases. Ninety-five patients underwent open surgery, and 11 underwent laparoscopic surgery, while no information was provided about the operation procedure for 92 patients [6] (Table 2).

DISCUSSION

Inguinal hernia, the incidence of which varies between 0.8% and 4.4% in the pediatric age group, is the disease that most frequently requires surgery in this age group [21,22]. AH make

up 1% of all hernias, and appendicitis in AH makes up 0.1% of all appendicitis cases [2]. According to this screening, AH is found in males 97.3% of the time and on the right in 88.7% of cases. This is in line with our clinical experiences in which all cases were on the right side and in male patients. This may be due to low numbers.

While the reason for appendicitis developing in AH is not entirely known, some authors have stated possible reasons such as circulation problems due to incarceration, the appendix being open to trauma when it settles in the inguinal region, especially during reduction, contraction of the abdominal muscles, and circulatory abnormalities due to increased intraabdominal pressure [1,23]. Since AH is an incarcerated inguinal hernia and most AH cases (66.4%) are seen in patients under the age of 1 year, and when we consider that the average age in our batch is 5.74 months, the operation should be performed at an earlier stage because these cases are more prone to incarceration. This is why when swelling or a cord-like structure is identified in the inguinal region of a patient under the age of 1 year, even though the number of patients receiving preoperative diagnoses using USG and exhibiting findings similar to the acute scrotum is 2, at least a differential diagnosis should be performed with USG and elective surgery should be performed to lower the risk of incarceration and emergency surgical intervention [12,15]. The 3 late cases presenting with fistula in the scrotum and inguinal region should also be kept in mind clinically [3-5].

Generally, cases are taken into surgery without a preoperative diagnosis (91.4%) and receive a diagnosis of AH during surgery. Today, the use of ultrasound makes it at least more likely to diagnose AH preoperatively. In 1 patient in our batch, preoperative USG detected the intestinal contents but could not visualize the appendix. In the cases in the literature where appendicitis diagnoses were delivered preoperatively using USG, the appendix was seen preoperatively, and an incompressible lumen was observed for diagnosing appendicitis [9,12,15,24-28].

In classic AH, the appendix is included in the hernial sac. In the literature, it has been stated that in the presence of patent processus vaginalis, the persistent fibrous band between the appendix and the testicle may cause the appendix to be directed to the inguinal canal and cause this type of hernia [2]. In our opinion, the openness of the inner ring or processus vaginalis and the 30% of the appendix being pelvic and mobile in premature and young children explain why the appendix moves into the hernia sac and develops into AH. The fact that the inner ring or processus vaginalis was open in premature and young children and the majority of patients were premature or young children both in the literature and in our batch supports this view [29].

Even though there are no left-sided AH cases in our batch due to the low number of cases, left-sided AH makes up 11.3% of cases in the literature. The relation between the testicle and

Table 2. Literature review for Amyand's hernia

Study	Presenting symptom	Sex	Age	Side	Appendectomy	Pathology/perioperative diagnosis	Hernial sac contents
Köseoglu et al. [3]	A lesion with fecal drainage on the right inguinal region. A tender swelling and redness on the same region appeared 3 weeks before. Two weeks later, spontaneous purulent drainage discharged from the lesion and then it turned into a stercoral fistula. Treated by antibiotics. His abdomen was soft and non-tender bowel sounds were normal not vomiting	Male	3 mo	Right	+	-/Perforated	
Jain et al. [4]	Intermittent spontaneous abscess discharge since 3 months of age + thick cord tender, unable to catheterize sinus, USG intestinal herniation	Male	1 yr	Right	+	Acute/-	Cecum
Panagidis et al. [5]	Fever distention septic scrotum and penis edematous on the table right scrotum ulcerated fecal matter coming from the floor X-ray gas in scrotum	Male	25 days	Right	+	-/Perforated	
Sulu and İşler [7]	1. Hernia since birth + painful swelling fever peritoneal irritation for 2 days + incarcerated 2. Hernia since birth + painful swelling fever vomiting peritoneal irritation for 3 days + incarcerated 3. Painful swelling vomiting peritoneal irritation for 2 days + incarcerated 4. Painful swelling for 1.5 days incarcerated	Male	2, 3, 6, and 14 yr	Right	3	All inflamed/-	
Khan et al. [8]	Scrotal swelling, redness, localized temperature increase, thickened inguinal canal, tachycardia + no abdominal findings, unable to clearly palpate left testicle (operation performed under the assumption of testicular torsion)	Male	10 mo	Left	+	-/Inflamed	Cecum
Okur et al. [9]	Irreducible painful swelling tenderness in the right side of the groin in all, fever in 4 patients + vomiting, findings indicating intestinal obstruction in 1 patient (12 patients had preoperative USG, appendix visible in the sac in 9)	Male, 20 Female, 1	Average age 20.3 mo (2 mo–10 yr)	Right	9	5 Inflamed, 1 perforated, and 3 normal/-	
Khattoon et al. [10]	Swelling extending into scrotum since birth, incarcerated for 4 days non-bilious vomiting + fever + inguinoscrotal redness Localized temperature increase + X-ray air in scrotum+	Male	4 mo	Right	+	-/Perforated gangrenous	Cecum
Esposito et al. [11]	Surgery due to a left irreducible hernia, appendix observed in sac on the right and pushed into the abdomen. Two days later fever swollen abdomen readmitted taken into surgery again	Male	1 mo	Right	+	-/Ischemic appendix	

Table 2. Continued 1

Study	Presenting symptom	Sex	Age	Side	Appendectomy	Pathology/perioperative diagnosis	Hernial sac contents
Park et al. [12]	Bilateral hernia and history of UTI, swelling and redness in the right scrotum +, left reducible right irreducible scrotal mass+, redness on the right spread to the perineum, leg, and abdomen, no fever, respiratory distress requiring intubation +, USG epididymo-orchitis query. CT showed air in the scrotum and canal, but no findings of obstruction. Abdominal examination comfortable, patient was circumcised which made Fournier gangrene a possibility. Started antibiotics, redness decreased. Two days later control USG showed a decrease in epididymo-orchitis and showed structure extending from the cecum to the sac. Treatment with antibiotics continued for 10 days	Male	33 days (premature)	Right	+	Upon review of the pathologic data, the appendix was 5 cm in length and 0.4–0.6 cm in diameter. The serosal surface was grey-tan and smooth, with pinpoint areas of hemorrhage, but no gross defects. No fecaliths were identified on gross examination/–	
Piedade et al. [13]	Incarcerated hernia reduced 17 days prior, 3 days later scrotal inflammation edema, USG increased blood build up in the cord, epididymitis. Start on antibiotic treatment, 2 days later fever vomiting increase in swelling in the groin USG hernia + inflammation of testis and epididymis + heterogeneous fluid + abscess formation, patient operated on for preliminary diagnosis of intestinal perforation or epididymo-orchitis complication	Male	6 wk (premature)	Right	+	Gangrenous perforated appendix/–	
Sun et al. [14]	Scrotal pain for 4 days hard swelling no fever no vomiting no distention redness + USG thickened colon-like structure in the canal, the patient started antibiotics due to suspicion of epididymitis. Two days later similar images on USG	Male	24 days	Right	+	Fibrous tissue hyperplasia in the interstitium, with acute-chronic inflammatory cell infiltration, vasodilatation, and congestion/–	
Mandhan et al. [15]	Swelling extending into the scrotum for 1 day, irritable for 12 hours but feeding bowel movements normal. No fever no vomiting (cleft palate lip polydactyly clenched fist [mosaic trisomy 13]). Hard irreducible inguinoscrotal swelling, slight redness + unable to clearly differentiate testicle during examination. USG increased vascularity in both testicles+. Though to be epididymo-orchitis started on antibiotics. Two days later the child is clinically stable, laboratory results improved however redness of the skin and swelling are increasing. USG repeat shows tubular structure in sac	Male	5 days	Right	+	Acute inflammation with focal suppuration/–	Cecum and terminal ileum
Yodoshi and Hurt [16]	Subfebrile fever slight erythema in groin X-ray natural first USG does not indicate testicular torsion or incarceration, referred with a diagnosis of acute epididymitis. 6 hours later fever, extreme redness in the scrotum, repeat X-ray gas in scrotum	Male	10 days (premature)	Right	+	Inflamed/–	

Table 2. Continued 2

Study	Presenting symptom	Sex	Age	Side	Appendectomy	Pathology/perioperative diagnosis	Hemial sac contents
Mohamed and Fagelhor [17]	Inguinoscrotal erythema for 1 day, no vomiting, distended soft abdomen no tenderness, bilateral scrotal edema inguinoscrotal erythema tenderness, X-ray dilated bowel loops but no indication of obstruction, no air in scrotum, USG no indication of incarceration or torsion, increased blood build up in right testicle and echogenicity, epididymo-orchitis was considered and the patient was started on antibiotics. 12 hours later bilious vomiting, worsening of inguinoscrotal edema, abdominal examination "diffuse guarding," no indication of incarceration testicular torsion ruled out through USG, operated with incision due to acute abdominal pain on the upper right quadrant	Male	19 days	Right	+	-/Inflamed	
Milburn and Youngson [18]	Scrotal swelling for 2 days + good clinic, normal feeding, no fever (preliminary diagnosis testicular torsion)	Male	10 days	Right	+	Acute inflammatory changes with infarction/gangrenous perforated appendix -/Perforated	
Kumar et al. [19]	Undescended right testicle, increasing swelling and redness in the right groin for 2 days + no vomiting, no fever, normal feeding (preliminary diagnosis testicular torsion)	Male	26 days	Right	+	-/Perforated	Cecum
Omran et al. [20]	USG infected right hydrocele at 14 days and spermatic cord edema, 5 days ago increased swelling and became erythematous, fever + no vomiting, hard irreducible swelling extending into the scrotum, edematous red skin, X-ray normal, unable to examine testicles separately, USG testicular torsion with fluid and gas around it	Male	28 days	Right	+	-/Perforated	
Sarsu [23]	Reducible hernia for 2 wk + elective surgery	Male	5 yr	Right	-		
Akfiyat et al. [24]	Swelling	Male	2 mo	Right	+	Not reported	
Giannattasio et al. [25]	Right lower quadrant pain + fever + hard tender irreducible hernia + (neonatal diabetes due to pancreatic agnesia, ASD + CMV +, medicated for 2 years due to hypothyroidism)	Male	4 yr, 5 yr	Right	+	Not reported	Cecum
Cankorkmaz et al. [26]	While all 12 AH patients were incarcerated, only 1 was diagnosed with preoperative USG, 4 of them (1 of them was located on the left) had signs of peritoneal irritation accompanied by fever and vomiting	Male	46 days, 40 days, 40 days, 14 mo, 1 mo, 4 mo, 15 days, 8 mo, 30 days, 22 days, 2 mo, and 35 days	Right, 10 Left, 2	10	4 Acute, 6 normal/-	
Dange and Gireboinwad [27]	Swelling in the right groin for 3 weeks, pain on touch for 1 week, no findings of obstruction USG tubular structure with blind ending in groin	Male	3 yr	Right	+	Inflamed/-	
Guler et al. [28]	First patient: groin pain for 2 days incarcerated USG: inflamed appendix in the hernia sac Second patient: scrotal swelling USG: colon and appendix vermiformis in the hernia sac	Male	16 yr and 1 mo	Right	Not reported		Second patient: colon

USG, ultrasonography; UTI, urinary tract infection; ASD, atrial septal defect; CMV, cytomegalovirus.

Table 3. Classification of Amyand's hernia for children with Gazi modification

Type of hernia	Appendix features	Surgical procedure
1	Normal appendix with easy reduction	High ligation without appendectomy and hospital stays
2	Normal appendix difficult reduction due to adhesion	If dissection is simple: high ligation without appendectomy and 1-day observation at the hospital If dissection is difficult: appendectomy is done through the hernia sac and high ligation and 1 day observation at the hospital
3	Acute appendicitis (easy or difficult reduction)	Dissection of the appendix from the sac and appendectomy is performed through the hernia sac and high ligation and 1-day observation at the hospital
4	Acute appendicitis with peritonitis and other abdominal pathology	Appendectomy and exploration are performed through laparotomy and the hernia is repaired

the appendix is not as obvious in left AH. The fact that 60% of hernias are typically on the right explains the right-sided involvement of AH [30].

Considering cases where the appendix is retrocecal or subserosal, in 4 cases in our batch (30.8%) and in 16.6% of cases in the literature, the cecum and ileum were included in the hernial sac. This is why cases in which intestinal organs such as the cecum are included in the hernial sac in AH cases disprove this hypothesis. Also, in 57.1% of cases in the literature, the cecum was included in the hernial sac in left-sided AH cases, which also excludes AH occurrence related to this band. In almost all these cases where left AH was diagnosed, pathologies such as mobile cecum, malrotation, or situs inversus were also found. Thus, AH cases that include intestines apart from the appendix should typically be classified as incarcerated inguinal hernias. The appendix is in the inguinal sac because the cecum is in the sac. The cecum is not in the sac because the appendix is in the inguinal sac. The clinical findings described by Lossonaf and Basson with a 1–4 grading do not explain the symptoms of these patients. Also, the hernia described by Amyand that would later be named after him only included the appendix in the hernial sac [31]. Thus, in the classification of AH in children, we are of the opinion that a modified Gazi classification would be more appropriate (Table 3).

In cases where the appendix is normal and easily reduced, only high ligation is sufficient, whereas in cases where reduction is difficult and/or the appendix is inflamed, appendectomy, reduction, and hospitalization should be

performed for patient safety.

ACKNOWLEDGEMENTS

Fund/Grant Support

None.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

ORCID iD

Cem Kaya: <https://orcid.org/0000-0003-4265-4013>

Alparslan Kapisiz: <https://orcid.org/0000-0002-4803-8900>

Ramazan Karabulut: <https://orcid.org/0000-0001-9624-3258>

Zafer Turkyilmaz: <https://orcid.org/0000-0003-3464-9628>

Sibel Eryilmaz: <https://orcid.org/0000-0002-3433-7301>

Merve Altın Gulburun: <https://orcid.org/0000-0003-3272-9974>

Kaan Sonmez: <https://orcid.org/0000-0002-3914-7128>

Author Contribution

Conceptualization, Methodology: All authors

Formal Analysis: CK, AK, MAG, RK, SE

Investigation: CK, AK, MAG, RK, SE

Supervision: KS

Writing – Original Draft: CK, RK, ZT

Writing – Review & Editing: All authors

REFERENCES

1. Patoulis D, Kalogirou M, Patoulis I. Amyand's hernia: an up-to-date review of the literature. *Acta Medica (Hradec Kralove)* 2017;60:131-4.
2. Michalinos A, Moris D, Vernadakis S. Amyand's hernia: a review. *Am J Surg* 2014;207:989-95.
3. Köseoglu B, Bakan V, öNem O, Bilici S, Demirtaş I. A patient with an unusual complication of sliding inguinal hernia: stercoral appendiceal fistula. *J Pediatr Surg* 2002;37:E13.

4. Jain P, Mishra A. Amyand's hernia presenting as chronic scrotal sinus. *J Indian Assoc Pediatr Surg* 2012;17:128-9.
5. Panagidis A, Sinopidis X, Zachos K, Alexopoulos V, Vareli A, Varvarigou A, et al. Neonatal perforated Amyand's hernia presenting as an enterocutaneous scrotal fistula. *Asian J Surg* 2015;38:177-9.
6. Kapisiz A, Kaya C, Karabulut R, Turkyilmaz Z, Sonmez K. Our experience of pediatric Amyand's hernia and literature review. In: Abstract Book of the 9th Croatian Congress of Pediatric Surgery with International Participation; 2022 Sep 21-24; Pula, Istria, Croatia. European Paediatric Surgeons Association; 2022. p. 43.
7. Sulu B, İşler S. Using the properties of Amyand's hernia in children in the preoperative diagnosis: our experience and review of the literature. *Ulus Travma Acil Cerrahi Derg* 2010;16:253-9.
8. Khan RA, Wahab S, Ghani I. Left-sided strangulated Amyand's hernia presenting as testicular torsion in an infant. *Hernia* 2011;15:83-4.
9. Okur MH, Karaçay S, Uygün I, Topçu K, Öztürk H. Amyand's hernias in childhood (a report on 21 patients): a single-centre experience. *Pediatr Surg Int* 2013;29:571-4.
10. Khatoon R, Khan YA, Saddal NS. Perforated appendicitis with peri-appendicular abscess in an Amyand's hernia. *APSP J Case Rep* 2013;4:37.
11. Esposito C, Iaquinto M, Escolino M, Settini A. Laparoscopic management of a newborn with a right Amyand's hernia and a left incarcerated inguinal hernia. *Afr J Paediatr Surg* 2013;10:35-7.
12. Park J, Hemani M, Milla SS, Rivera R, Nadler E, Alukal JP. Incarcerated Amyand's hernia in a premature infant associated with circumcision: a case report and literature review. *Hernia* 2010;14:639-42.
13. Piedade C, Reis Alves J. Amyand's hernia in a 6-week-old infant: a delayed diagnosis. *Case Rep Pediatr* 2013;2013:758171.
14. Sun XF, Cao DB, Zhang T, Zhu YQ. Amyand's hernia in a neonate: a case report. *J Res Med Sci* 2014;19:193-5.
15. Mandhan P, Al Rayes T, J Ali M, Aldhaheer M. Complicated Amyand's hernia in a neonate. *J Neonatal Surg* 2014;3:38.
16. Yodoshi T, Hurt TL. Gas in the right hemiscrotum?: Amyand's hernia in a neonate. *BMJ Case Rep* 2018;2018:bcr2018224598.
17. Mohamed A, Fagelnor A. Amyand's hernia in a neonate presenting with inguino-scrotal erythema: a difficult diagnosis. *European J Pediatr Surg Rep* 2019;7:e69-71.
18. Milburn JA, Youngson GG. Amyand's hernia presenting as neonatal testicular ischaemia. *Pediatr Surg Int* 2006;22:390-2.
19. Kumar R, Mahajan JK, Rao KL. Perforated appendix in hernial sac mimicking torsion of undescended testis in a neonate. *J Pediatr Surg* 2008;43:e9-10.
20. Omran A, Gawrieh BS, Abdo A, Ali Deeb M, Khalil MA, Shater W. Amyand hernia: scrotal pyocele, associated with perforated vermiform appendix and complicated by testicular ischemia in neonate. *J Surg Case Rep* 2019;2019:rjz265.
21. Karabulut B. One surgeon experiences in childhood inguinal hernias. *J Korean Surg Soc* 2011;81:50-3.
22. Cho YJ, Kwon H, Ha S, Kim SC, Kim DY, Namgoong JM, et al. Optimal timing for inguinal hernia repair in premature infants: surgical issues for inguinal hernia in premature infants. *Ann Surg Treat Res* 2023;104:296-301.
23. Sarsu SB. Is appendectomy necessary in children with amyand hernia?. *J Pediatr Res* 2016;3:50-2.
24. Akfırat M, Kazez A, Serhatlıoğlu S. Preoperative sonographic diagnosis of sliding appendiceal inguinal hernia. *J Clin Ultrasound* 1999;27:156-8.
25. Giannattasio A, Campus R, Muraca M, Lucigrai G, Michelazzi A, Eljerbi EM, et al. Amyand's hernia in a child with permanent neonatal diabetes due to pancreatic agenesis. *Pediatr Rep* 2009;1:e6.
26. Cankorkmaz L, Ozer H, Guney C, Atalar MH, Arslan MS, Koyluoglu G. Amyand's hernia in the children: a single center experience. *Surgery* 2010;147:140-3.
27. Dange A, Gireboinwad S. Case report: a rare case of Amyand's hernia presenting in a 3-year-old male child. *Indian J Surg* 2013;75:332-3.
28. Guler I, Alkan E, Nayman A, Tolu I. Amyand's hernia: ultrasonography findings. *J Emerg Med* 2016;50:e15-7.
29. Dunn JC. Appendicitis. In: Coran AG, Adzick NS, Krummel TM, Laberge JM, Caldamone A, Shamberger R, editors. *Pediatric surgery*. 7th ed. Elsevier; 2012. p. 1255-63.
30. Glick PL, Boulanger SC. Inguinal hernias and hydroceles In: Coran AG, Adzick NS, Krummel TM, Laberge JM, Caldamone A, Shamberger R, editors. *Pediatric surgery*. 7th ed. Elsevier; 2012. p. 985-1001.
31. Losanoff JE, Basson MD. Amyand hernia: a classification to improve management. *Hernia* 2008;12:325-6.