

ARTICLE INFO

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Article history

Received: 13-05-2024
 Revised: 25-09-2024
 Accepted: 27-09-2024
 Available online: 30-09-2024

**Please cite this article in APA 7th
 edition style as:**

Hartanto, D.D., Mauliadan, Y. (2024).
 Complications in Pediatric Patient: A
 Case Report. *Jurnal Ilmiah Kedokteran
 Wijaya Kusuma*, 13(2), 179-187

<https://dx.doi.org/10.30742/jikw.v13i2.3654>

**Delayed Diagnosis of Volvulus without
 Complications in Pediatric Patient: A Case Report**

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Abstract

Introduction: Volvulus in children is rare occurrence, it's only about 3-5% cases in worldwide. Without abdominal radiological examination, it is difficult to make diagnosis of volvulus based on history and physical examination alone. The management procedures are also controversial, as some recommend a non-operative approach, while others recommend an operative approach in the form of Ladd's Procedure or laparoscopy. Sigmoidoscopy or a barium enema can be attempted as an initial treatment for sigmoid volvulus.

Objective: The purpose of this case report is to discuss why there was a delay in diagnosis of volvulus in this case and how to deal it. It also discusses the approach to diagnosis and management of volvulus in pediatric patients, both at the primary health center and the hospital, and why in this case.

Case presentation: In this case, volvulus occurred in a pediatric patient who had sought treatment at a primary health center with a complaint of abdominal pain for nine days without improvement. The complaint was accompanied with constipation and fever. Due to limited facilities in primary health center, the patient was referred to the hospital. **Result:** At the hospital, after taking the history, performing physical examination, and conducting radiological examination and laboratory tests, the patient was diagnosed with ileus obstruction due to volvulus. **Conclusion:** Although volvulus is a rare case, volvulus should still be included as a differential diagnosis of abdominal pain in pediatric patients to avoid delayed diagnosis. Delay in diagnosis and management of volvulus can lead to serious complications and even life-threatening conditions.

Keywords: Volvulus, Pediatric, Abdominal Pain

Case Report

INTRODUCTION

Volvulus is a rare and uncommon case in pediatrics, which may leads to missed and delayed diagnosis of the disease (Chang et al., 2017). The incidence of volvulus is often reported from the so-called volvulus belt region, with a range of 13-42% of cases. Whereas in areas with low incidence, only 3-5% of cases are reported. (Middle East, Africa, Indian subcontinent, Turkey, South America) (Haider et al., 2017). However, in the pediatric population, a higher incidence is also reported in the West continents, including North America (Bhandari & Shahi, 2019). Volvulus is the third leading cause of intestinal obstruction cases in North America and in Indonesia, there is no data on the incidence of

volvulus cases due to its rarity. (Haider et al., 2017). Only a few case reports have been reported regarding volvulus cases. (Chang et al., 2017). From 1941 to 2000, 63 cases of sigmoid volvulus in children were reported. Another report in 1990 mentioned 48 cases of children with sigmoid volvulus. In 1994, there were 10 cases of sigmoid volvulus in children out of 14 cases of colonic volvulus from 1955 to 1992. These reports give a rough idea of how rare this condition is in children (Bhandari & Shahi, 2019; Chang et al., 2017; Lofgran & Koury, 2022).

Volvulus as a differential diagnosis of acute abdomen in children, it can only be established in hospitals with radiology diagnostic facilities such as abdominal plain xray, the findings on abdominal imaging is a distension of the colon (Carmo et al., 2018). This is challenging for primary health care centers in rural areas, since they have limited diagnostic facilities and only rely on signs and symptoms found on physical examination. In fact, volvulus may only present as nonspecific abdominal pain that resemble other etiologies (Lofgran & Koury, 2022). In addition to its rarity, there is also very little literature on volvulus in pediatrics, hence our knowledge is largely based on studies and serial cases in adults (Destro et al., 2021). In this case, we present a case report of a delayed diagnosis of volvulus in a pediatric patient from a primary health center due to limited facilities. Delayed diagnosis in volvulus cases can result in complications and life-threatening conditions and unfortunately even death. However, in this case, the patient survived with good management in the hospital and had a good surgical outcome without complications.

CASE PRESENTATION

A 5-year-old boy was brought by his mother to the primary health center with complaints of abdominal pain for approximately 9 days. The patient had been treated at the same medical centre 2 days ago with the same complaint and was discharged for observation at home with oral medication. Currently, the complaint of abdominal pain is accompanied by fever, flatulence and inability to defecate or 2 days. The patient's vital signs upon examination shows pulse rate of 100x/min, respiratory rate of 20x/min, temperature of 39.1°C, and body weight of 17 kg. On physical examination, the abdomen appeared distended, with increased bowel noise, and defans muscular. Based on the results of history taking and physical examination, the patient was provisionally diagnosed with acute abdomen suspected paralytic ileus at the primary health center. The patient was given an intravenous infusion of Ringer Lactate with the rate of 15 drops/minute and an intravenous injection of 200 mg paracetamol. Nasogastric tube insertion for decompression could not be performed because it was not available at the primary health center. After intravenous infusion and antipyretic injection, the patient's vital signs were assessed again and shows pulse rate of 90x/min, respiratory rate of 20x/min, and temperature of 37.6°C.

The patient was scheduled to be referred to the hospital with adequate facilities for further examination and management. Upon the patient's arrival at the emergency room, a repeated history taking was performed on the parents. The history of the disease, the patient's complaints were the same as the previous complaints. The patient's vital signs were heart rate of 98x/min, respiratory rate of 20x/min, and temperature of 38.2. On physical examination, the abdomen appeared distended, with increased intestinal noise, and hypertympanic percussion sound. Laboratory examination in the form of a complete blood count performed on this patient showed normal results. Radiological examination with plain abdominal X-ray performed on the patient showed an enlarged intestine resembling the appearance of coffee beans or Coffee Bean Sign suggesting a volvulus.

Based on the results of history taking, physical examination, laboratory tests (complete blood count) which showed normal results, and radiological examination, the diagnosis in this patient is obstructive ileus due to volvulus. The initial treatment of the patient in the emergency room was the insertion of a nasogastric tube for decompression and Nile Per Os, and the placement of a urinary catheter. Intravenous fluid administration with kristaloid was continued at a rate of 20 drops/minute and paracetamol 200mg injections were given 3 times a day. The surgeon's definitive management in this patient was surgery with the Ladd's Procedure method.



Figure 1. "Coffee Bean Sign" in plain abdominal X-Ray



Figure 2. Patient's Appendix which undergo Mandatory Appendectomy



Figure 3. Ladd's Band found in the patient without malrotation.

During the postoperative period, the patient showed no symptoms of complications, worsening or infection of the surgical wound the patient was admitted for seven days to the surgical ward. During the treatment, the patient was given antibiotic ceftriaxon 2x850mg intravenously, painkiller paracetamol 3x200mg intravenously, and periodic postoperative wound care. On the second day, the patient was able to mobilize sitting, farting and defecating, and was given oral nutrition. On the third day, the wound looked good, there was no blood seepage on the dressing, no signs of infection such as pus-production, and pain had begun to decrease. The patient was also able to mobilize standing and walk to the bathroom by himself. Treatment was continued until day seven to ensure complete antibiotic administration and postoperative wound evaluation. Afterward, the patient was discharged with oral cefixime 2x1 and paracetamol 3x200mg. The patient was advised to visit the surgical clinic 1 week later. Unfortunately, the patient did not attend the surgical clinic for follow-up, possibly due to great distance between the house and the hospital, or due to the absence of complaints related to the surgical wound.

DISCUSSION

Colonic volvulus is a potentially life-threatening condition and emergency characterized by rotation of the colon in its mesentery axis, causing intestinal obstruction, ischemia and perforation if unrecognized (Bhandari & Shahi, 2019; Destro et al., 2021; Tannouri et al., 2017). In this case, the delayed diagnosis of volvulus may be due to a lack of knowledge and the rarity of this case, especially in Indonesia. The incidence of malrotation in the world varies widely. It has been reported that malrotation occurs in 3.9 per 10,000 live births, other studies state that the incidence of volvulus is 1 in 500 births, while other studies state that the incidence is 1 in 2500 live births and reaches 1% of the general population. This estimate may be an underestimate, as asymptomatic cases may be diagnosed late due to parents not visiting a doctor, so the complaint is just considered as bloating with normal abdominal pain. This is often the case in areas with inadequate access to health facilities and far from referral hospitals. Volvulus cases are also usually diagnosed during surgery. The reported incidence of symptomatic intestinal malrotation caused by volvulus or Ladd's band also varies. Some report incidence early in life, with 58.2% in the first year after birth and 75% before 5 years of age. There are also reports of 60% of cases occurring in the first 1 month of life, 20% of cases occurring at the age of

1 month to 1 year, and the rest appearing at the age of more than 1 year. Another report states that the average age of volvulus cases in children is 7-12 years old and the ratio between boys and girls is 3.5:1 (Haider et al., 2017; Jurnal et al., 2013; Nguyen et al., 2021; O'Keefe et al., 2016). Volvulus is reported to be more common in men, presumably because the large pelvic volume of women facilitates spontaneous twisting (Haider et al., 2017). There is no data on the incidence of pediatric volvulus in Indonesia. This has resulted in a lack of knowledge regarding the diagnosis of these cases among most general practitioners, especially at the primary care level as in this case. In addition, the limitations of diagnostic supportive examination tools that are not possible in primary health care facilities are also influential, especially in this case.

To date, the etiology of volvulus remains unclear. Certain risk factors and conditions that have an association with volvulus have been suggested, such as pregnancy, colitis, Hirschsprung Disease, prune belly syndrome, chronic constipation, laxative abuse, local anatomical differences (e.g. elongated mesentery with narrow attachments, excessive mobilization of colonic segments), redundant colon, omphalomesenteric abnormalities, intestinal malrotation, anal stenosis, surgical adhesions and children with developmental delay (Bhandari & Shahi, 2019; Destro et al., 2021). Other reports suggest that roundworm infestation and neurological disorders are also predisposing factors of volvulus (Carmo et al., 2018). In this case, no specific etiology was listed. The initial suspicion of roundworm infestation was inconsistent with the results of the history and was refuted by the results of the clinical examination and complete blood laboratory performed with results within normal limits.

Clinical symptoms of volvulus are abdominal pain, bloating, and vomiting with sudden or slow onset (Bhandari & Shahi, 2019; Lofgran & Koury, 2022). In children, sometimes the symptoms are not specific and may only present as abdominal pain that resembles other diseases, this may cause missed diagnosis of volvulus because it is not included as a differential diagnosis (Horvat et al., 2021; Nguyen et al., 2021). Volvulus is commonly found in an area called the "Volvulus Belt", where a high-fiber diet is common. Volvulus is very rare in children compared to adults. Volvulus may resolve spontaneously due to spontaneous intermittent detorsions. This is the reason for frequent missed or delayed diagnosis of volvulus in children. (Bhandari & Shahi, 2019; Chang et al., 2017; Lofgran & Koury, 2022). In this case, volvulus occurred in a 5-year-old child, with an initial complaint of nonspecific abdominal pain, so the patient was discharged with oral medication initially. The patient returned to the primary health center because the complaints persisted and even increased. The examination in primary health center founds no history of high-fiber diet and no risk factors and conditions associated with volvulus.

Laboratory tests are not beneficial in diagnosing volvulus, but the results of laboratory tests which show normal leukocyte counts and the absence of clinical signs of peritonitis predict the absence of gangrene due to volvulus (Hencke & Loff, 2023; Jurnal et al., 2013). In this patient, the laboratory tests performed showed normal results. Diagnosis often relies on radiologic supportive imaging, as clinical symptoms may be nonspecific or resemble benign childhood conditions such as constipation or gastroenteritis. Radiological examinations are adjusted to the availability of facilities and hospital affordability, because there is no consensus regarding the choice of optimal diagnostic imaging in volvulus cases (Emeka, 2022; Tannouri et al., 2017). Ultrasonography (USG) can also be performed to diagnose volvulus, but it has little diagnostic value due to visualization difficulties and interference caused by the presence of gas and other intestinal contents (Horvat et al., 2021).

Doppler ultrasound (US) examination can be the first choice of imaging modality that is non-invasive, radiation-free, mostly available, and inexpensive. Doppler US will show the abnormal position of the superior mesenteric artery and superior mesenteric vein in case of volvulus. The classic sonographic picture of volvulus on doppler ultrasound will appear as "whirlpool sign". Although the sensitivity and specificity of doppler US is quite high, it is not enough to replace Upper gastrointestinal examination (UGI) for a definitive diagnosis. UGI examination can confirm the diagnosis of volvulus with the pathognomonic sign of "corkscrew pattern" in the twisted bowel. But in children with peritonitis or suspected intestinal ischemia, surgery should not be delayed to wait for UGI examination (Castle et al., 2022; Hamidi et al., 2016; Langer, 2017; Nahle et al., 2023; Wong et al., 2020). In more

than 60% of adult cases, a plain abdominal imaging examination will identify the "Omega Sign" or "Coffee Bean Sign", but in children, the sensitivity and findings of the "Coffee bean sign" are only 16-30%, with the most common findings being colonic distension or fluid level at the sigmoid arch (Carmo et al., 2018; Haider et al., 2017; O'Keefe et al., 2016). The abdominal imaging examination performed at the hospital in this patient was a plain abdominal photograph, it shows "coffee bean sign", which is a classic radiologic sign in volvulus cases.

Computed tomography scan (CT) of the abdomen and surgical evaluation are actually recommended in volvulus cases if facilities are available, because the classic radiographic findings of "coffee bean sign" or "inner tube" on X-Ray examination are sometimes unreliable (Lofgran & Koury, 2022). Contrast-enhanced CT scan of the abdomen is also the second most commonly performed examination for the diagnosis of volvulus in children, with a success rate of 56%. A contrast-enhanced CT scan of the abdomen will identify a rotating mesentery or "beak sign". In addition, contrast-enhanced CT scan has the advantage of evaluating the presence of bowel wall necrosis, which is an absolute indication for surgery (Carmo et al., 2018). However, the limited diagnostic facilities at the primary health center make it impossible to do these examinations, and the patient must be referred to the hospital for further examinations and treatments.

In our patient, an abdominal CT scan was not performed due to financial considerations and the clinical examination and plain abdominal photographs were considered sufficient to establish the diagnosis of volvulus. Clinical knowledge and early diagnosis can increase the success of non-surgical detorsion (either by contrast enema or colonoscopy) and prevent ischemic/necrotic bowel complications (Carmo et al., 2018). Delayed or even untreated diagnosis and treatment of volvulus will result in life-threatening complications, such as intestinal obstruction, tissue ischemia, necrosis, gangrene/perforation, peritonitis, sepsis, and even death (Çakmak et al., 2017; Lofgran & Koury, 2022; O'Keefe et al., 2016). Volvulus-related morbidity and mortality are extremely high, often resulting from closed-arch obstruction, intestinal ischemia, and hypovolemic shock (Bhandari & Shahi, 2019). Fortunately, although the diagnosis in this patient was delayed, no complications and emergencies occurred during preoperative, intraoperative, and postoperative period.

Initial management of volvulus consists of adequate fluid resuscitation and stabilization, followed by decompression with nasogastric tube insertion. Resuscitation in volvulus patients in shock is best done with two large infusions with the dose of 20 cc/kg bolus of normal saline or Ringer lactate solution. Decompression with nasogastric tube insertion is intended to prevent gas accumulation that may occur in the patient's stomach (Irizarry & Justiniano, 2022; Lacher Shawn St Peter Augusto Zani, henckn.d.). The initial management of this patient at the primary health center was correct with the insertion of an IV line for fluid resuscitation, antipyretic injection for symptomatic treatment, and referral to the hospital for further examination and management. In the hospital, the treatment given was placement of a nasogastric tube for decompression and consultation to the surgeon for the surgery plans to treat the patient definitively.

The main goal of volvulus management is to prevent recurrent episodes. Definitive management depends on the presence or absence of complications, especially complications such as gangrene or perforation that have occurred, or are likely to occur (Hencke & Loff, 2023). The choice of volvulus management in children is also controversial, recent reports suggest non-surgical reduction (radiologic and/or endoscopic) in uncomplicated cases (without bowel necrosis, or perforation) followed by elective surgery to prevent recurrence. Some experts recommend endoscopy only in patients in whom definitive surgical therapy will not be performed, while others recommend surgery only in patients in whom sigmoidoscopic reduction has been performed unsuccessfully, because approximately only 40% to 50% of patients experience recurrence (Destro et al., 2021). The inability to detorize the volvulus endoscopically or the presence of ischemic bowel or peritonitis are indications for immediate surgery (Chang et al., 2017; Parolini & Alberti, 2017). The success rate of volvulus reduction with barium enema is reported to be 77% while also providing information for diagnosis, compared to sigmoidoscopy and

rectal reduction with success rate of 47% and a greater risk of perforation (Horvat et al., 2021; O'Keefe et al., 2016).

Management of volvulus requires prompt and precise diagnosis and surgical procedures as early as possible (Çakmak et al., 2017). The standard surgical procedure for volvulus management is Ladd's Procedure. This procedure was first described in 1936 by William Ladd, the first Chief of Surgery at Boston Children's Hospital. The procedure begins with a transverse incision in the upper abdomen, followed by detorsion of the volvulus if present. This was followed by separation of the abnormal peritoneal band attached to the cecum and duodenum (Ladd band), dilation of the mesenteric root to prevent further volvulus, placement of the bowel in a non-rotational configuration or stable position within the abdominal cavity, with the large bowel on the left and the small bowel on the right. In addition, some surgeons perform prophylactic appendectomy to prevent future diagnostic confusion and/or cecopexy, which was not in the original description. Postoperative complications with Ladd's procedure are rare if no bowel resection is performed (Arnaud et al., 2019; Lacher Shawn St Peter Augusto Zani, n.d.; Scalabre et al., 2020; Zhang et al., 2022) As our patient performed the Ladd's band procedure, no complications occurred postoperatively.

The second procedure is laparoscopy, which was first reported in 1995 in a 7-day-old neonate weighing 3.6 kg who had malrotation and volvulus. Compared to the Ladd's procedure, the laparoscopic procedure is reported to be superior in terms of faster operation time, shorter hospital stay and fewer postoperative complications. However, only experienced laparoscopic surgeons can perform this procedure (Arnaud et al., 2019; Zhang et al., 2022). In our patient, the operative method used was Ladd's procedure, as laparoscopic procedure was not possible due to limited facilities. The intraoperative findings in this patient were uncomplicated non-rotational volvulus. Non-rotational volvulus results from elongation of the midgut where no rotation occurs. In non-rotational volvulus, the colon is on the left side and the small bowel moves to the right of the midline. The mesentery will form a narrow base as the bowel extends over the superior mesentery artery without rotation. Midgut volvulus and duodenal obstruction are significant risks in this case (Jurnalis et al., 2013). Although the method performed in this case is fairly conventional, the results obtained are quite satisfactory for the operators and the patients. In our case, the patient survived despite the delayed diagnosis of volvulus due to good management from the beginning until surgical treatment. The patient's hospitalization period was not long, the patient's safety was maintained, and postoperative complications were not found. Complications due to delayed diagnosis also did not occur, possibly due to the absence of intestinal malrotation in this patient during the surgery. However, we acknowledge the shortcomings of this case report, such as the procedure performed was not a gold standard procedure, lack of data related to volvulus cases, especially in Indonesia, and the patient could not be followed up at the clinic due to not returning for control.

CONCLUSION

Volvulus remains a rare case in pediatric patients worldwide with limited literature. However, delay or misdiagnosis can result in life-threatening conditions, this should make physicians include volvulus as a differential diagnosis in cases of pediatric abdominal pain to avoid delay or misdiagnosis. Cases of abdominal pain in children with suspicion of volvulus should be immediately referred to a hospital with adequate facilities for diagnosis and further management. In this case, the approach to diagnosis and management of volvulus in children is still not in accordance with the recommended gold standard due to limited resources. Therefore, in this case, management is adjusted to the availability of facilities and resources in hospitals that are still limited and not possible to follow the gold standard. However, the selection of diagnostic approaches and management in volvulus patients must still consider and prioritize patient safety, including risks and complications that may occur, the effectiveness of examination and treatment, and the efficiency of treatment costs.

CONFLICT OF INTEREST

All authors declares no competing interest exists.

ACKNOWLEDGEMENTS

Alhamdulillah, the authors would like to thank the support of the Department of Surgery and Department of Emergency, Panglima Sebaya General Hospital, Paser.

REFERENCES

- Arnaud, A. P., Suply, E., Eaton, S., Blackburn, S. C., Giuliani, S., Curry, J. I., Cross, K. M., & De Coppi, P. (2019). Laparoscopic Ladd's procedure for malrotation in infants and children is still a controversial approach. *Journal of Pediatric Surgery*, *54*(9), 1843–1847. <https://doi.org/10.1016/j.jpedsurg.2018.09.023>
- Bhandari, T. R., & Shahi, S. (2019). Volvulus of sigmoid colon in a challenged adolescent: An unusual case report. *Annals of Medicine and Surgery*, *44*, 26–28. <https://doi.org/10.1016/j.amsu.2019.06.009>
- Çakmak, A. M., Boybeyi Türer, Ö., Göllü Bahadır, G., Türedi, B., Ateş, U., Yıldız, A. E., Küçük, G., Fitöz, Ö. S., Ulukol, B., Aslan, M. K., Soyer, T., & Dindar, H. (2017). Assessment of developmental and radiological long-term outcome of children with surgically treated midgut volvulus. *Turkish Journal of Medical Sciences*, *47*(2), 633–637. <https://doi.org/10.3906/sag-1512-89>
- Carmo, L., Amaral, M., Trindade, E., Henriques-Coelho, T., & Pinho-Sousa, J. (2018). Sigmoid Volvulus in Children: Diagnosis and Therapeutic Challenge. *GE Portuguese Journal of Gastroenterology*, *25*(5), 264–267. <https://doi.org/10.1159/000486242>
- Castle, C., Beasley, S. W., & Taghavi, K. (2022). Access to emergency paediatric surgery for testicular torsion or intestinal volvulus in New Zealand: A system perspective. *Journal of Paediatrics and Child Health*, *58*(1), 146–151. <https://doi.org/10.1111/jpc.15684>
- Chang, P. H., Jeng, C. M., Chen, D. F., & Lin, L. H. (2017). A case report and literature review of sigmoid volvulus in children. *Medicine (United States)*, *96*(52). <https://doi.org/10.1097/MD.00000000000009434>
- Destro, F., Maestri, L., Meroni, M., Campari, A., Pederiva, F., Costanzo, S., Re, G. Del, Roveri, M., Zuccotti, G., Calcaterra, V., & Pelizzo, G. (2021). Colonic volvulus in children: Surgical management of a challenging condition. *Children*, *8*(11). <https://doi.org/10.3390/children8110982>
- Emeka, C. K. (2022). Sigmoid volvulus in a teenager. *Journal of Pediatric Surgery Case Reports*, *76*. <https://doi.org/10.1016/j.epsc.2021.102119>
- Haider, F., Al Asheeri, N., Ayoub, B., Abrar, E., Khamis, J., Isa, H., Nasser, H., & Al Hashimi, F. (2017). Sigmoid volvulus in children: A case report. *Journal of Medical Case Reports*, *11*(1). <https://doi.org/10.1186/s13256-017-1440-y>
- Hamidi, H., Obaidy, Y., & Maroof, S. (2016). Intestinal malrotation and midgut volvulus. *Radiology Case Reports*, *11*(3), 271–274. <https://doi.org/10.1016/j.radcr.2016.05.012>
- Hencke, J., & Loff, S. (2023). Recurrent Sigmoid Volvulus in Children—Our Experience and Systematic Review of the Current Literature. In *Children* (Vol. 10, Issue 9). Multidisciplinary Digital Publishing Institute (MDPI). <https://doi.org/10.3390/children10091441>
- Horvat, M., Hazabent, M., Sekej, M., & Kljaić Dujić, M. (2021). Pediatric sigmoid volvulus of an extremely long sigmoid colon with hypoganglionosis: a case report. *Journal of International Medical Research*, *49*(7). <https://doi.org/10.1177/03000605211032429>
- Irizarry, L. A., & Justiniano, V. O. (2022). Sigmoid volvulus in a child with Autism Spectrum Disorder. *Journal of Pediatric Surgery Case Reports*, *76*. <https://doi.org/10.1016/j.epsc.2021.102065>
- Jurnal, Y. D., Sayoeti, Y., & Russelly, A. (2013). Malrotasi dan Volvulus pada Anak. In *Jurnal Kesehatan Andalas* (Vol. 2, Issue 2). <http://jurnal.fk.unand.ac.id>

- Lacher Shawn St Peter Augusto Zani, M. D. (n.d.). *Pearls and Tricks in Pediatric Surgery*.
- Langer, J. C. (2017). Intestinal Rotation Abnormalities and Midgut Volvulus. In *Surgical Clinics of North America* (Vol. 97, Issue 1, pp. 147–159). W.B. Saunders. <https://doi.org/10.1016/j.suc.2016.08.011>
- Lofgran, T., & Koury, R. (2022). A Twist on Adolescent Abdominal Pain in the Emergency Department. *Cureus*. <https://doi.org/10.7759/cureus.27371>
- Nahle, A. A., Hamdar, H., Essayli, D., Awada, R., Martini, N., Kanbar, M., & Dalati, H. (2023). Acute jaundice as a manifestation of midgut volvulus in a 6-year-old child: A case report. *Journal of Pediatric Surgery Case Reports*, 96. <https://doi.org/10.1016/j.epsc.2023.102697>
- Nguyen, H. T. N., Navarro, O. M., Guillerman, R. P., Silva, C. T., & Sammer, M. B. K. (2021). Untwisting the complexity of midgut malrotation and volvulus ultrasound. *Pediatric Radiology*, 51(4), 658–668. <https://doi.org/10.1007/s00247-020-04876-x>
- O’Keefe, L. M., Hu, Y. Y., Thaker, S., & Finck, C. (2016). Sigmoid volvulus: A pediatric case report and review of management. *Journal of Pediatric Surgery Case Reports*, 7, 4–7. <https://doi.org/10.1016/j.epsc.2016.02.003>
- Parolini, F., & Alberti, D. (2017). Sigmoid volvulus in children. *Surgery (United States)*, 161(2), 562–563. <https://doi.org/10.1016/j.surg.2016.01.020>
- Scalabre, A., Duquesne, I., Deheppe, J., Rossignol, G., Irtan, S., Arnaud, A., Ballouhey, Q., Abbo, O., Rabattu, P. Y., Binet, A., & Varlet, F. (2020). Outcomes of laparoscopic and open surgical treatment of intestinal malrotation in children. *Journal of Pediatric Surgery*, 55(12), 2777–2782. <https://doi.org/10.1016/j.jpedsurg.2020.08.014>
- Tannouri, S., Hendi, A., Gilje, E., Grissom, L., & Katz, D. (2017). Pediatric colonic volvulus: A single-institution experience and review. In *Journal of Pediatric Surgery* (Vol. 52, Issue 6, pp. 1062–1066). W.B. Saunders. <https://doi.org/10.1016/j.jpedsurg.2017.01.063>
- Wong, K., Van Tassel, D., Lee, J., Buchmann, R., Riemann, M., Egan, C., & Youssfi, M. (2020). Making the diagnosis of midgut volvulus: Limited abdominal ultrasound has changed our clinical practice. *Journal of Pediatric Surgery*, 55(12), 2614–2617. <https://doi.org/10.1016/j.jpedsurg.2020.04.012>
- Zhang, Z., Chen, Y., & Yan, J. (2022). Laparoscopic Versus Open Ladd’s Procedure for Intestinal Malrotation in Infants and Children: A Systematic Review and Meta-Analysis. *Journal of Laparoendoscopic and Advanced Surgical Techniques*, 32(2), 204–212. <https://doi.org/10.1089/lap.2021.0436>