Case Report

One-year-old Boy with Gallbladder Stone: A Case Report and Literature Review

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Abstract

Gallstone is a rare disease in children. It might cause complications such as cholecystitis, cholangitis, and gallstone pancreatitis due to obstruction of biliary duct or secondary infection. We report a case of a 1-year, 7-month-old boy with incidental finding of gallbladder stone, who received ceftriaxone treatment after diagnosing with *Salmonella* enterocolitis. Herein, we review the incidence, etiology, risk factors, and management of ceftriaxone-related gallstones in children. In conclusion, these patients are suggested to receive expectant management with close follow-up instead of surgical intervention.

Keywords: Ceftriaxone, children, gallstone, risk factors, treatment

Introduction

Gallstones are highly prevalent in the age of 50–60 years. Middle-aged, obese women are more prone to gallstone disease. The composition of gallstones includes a mixture of cholesterol, calcium salts of bilirubinate or palmitate, proteins, and mucin. The most common type of gallstone is called a cholesterol gallstone. If the patient has liver diseases or hemolysis, the type of gallstones one has usually are pigmented stones. Biliary tract infections often lead to mixed stones.[1] Gallstones are relatively rare among children, with a reported prevalence rate of around 0.13%–1.9%. Its risk factors include family history, total parenteral nutrition, obesity, premature birth, dehydration, infections, hemolytic diseases, biliary dyskinesia, or medication-related causes such as diuretics, and clofibrate, etc.[2] More than 70% of gallbladder stones in children are pigmented stones and only 15%–20% are cholesterol stones.

Case Report

A 1-year, 7-month-old boy was admitted to the hospital with high fever, vomiting, and diarrhea which have not improved for 2 days. According to the description of the patient's father, the patient started having nausea and vomiting after eating 2 days ago, and then, he got a high fever of 39.9°C. After receiving treatment in the clinic, the patient's vomiting improved, but his fever did not, and he started having frequent watery diarrhea, followed by blood-tinged mucus in stool. Later, the patient was admitted to the hospital because of dehydration.

The patient was given fluid supplement therapy through intravenous (IV) drip infusion after hospitalization. He was also provided with antibiotics (ceftriaxone 100 mg/kg/day IV Q12H) for 5 days due to blood test that showed leukocytosis and high C-reactive protein level [Table 1]. As the patient was crying of intermittent periumbilical abdominal pain, an abdominal sonogram was performed on the 3rd day of hospitalization. The result showed intestinal dilation and bowel wall thickening caused by inflammation [Figure 1] and also incidentally found a 1.3 cm × 0.6 cm gallbladder stone [Figures 2-4]. However, the examination showed neither thickening of the gallbladder wall caused by inflammation nor any dilated bile duct.

Received: 13-12-2019 **Revised:** 16-02-2020 **Accepted:** 20-02-2020 **Available Online:** 12-05-2020

Access this article online

Quick Response Code:

Website: www.jmuonline.org

DOI: 10.4103/JMU.JMU_28_20

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How to cite this article: Koh KJ, Lin LH. One-year-old boy with gallbladder stone: A case report and literature review. J Med Ultrasound 2020;28:260-3.

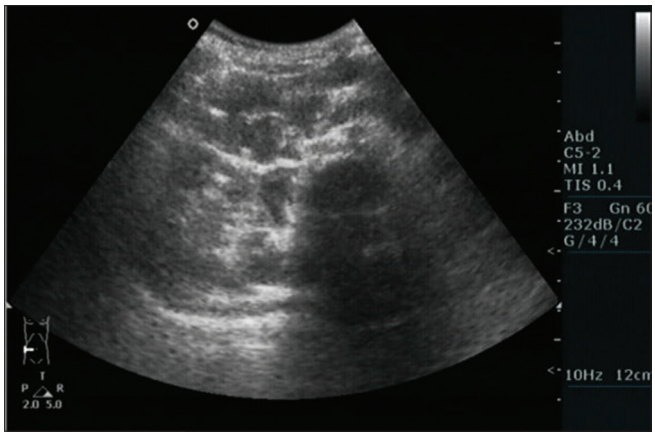

Figure 1: Intestinal dilation and thickening of bowel wall

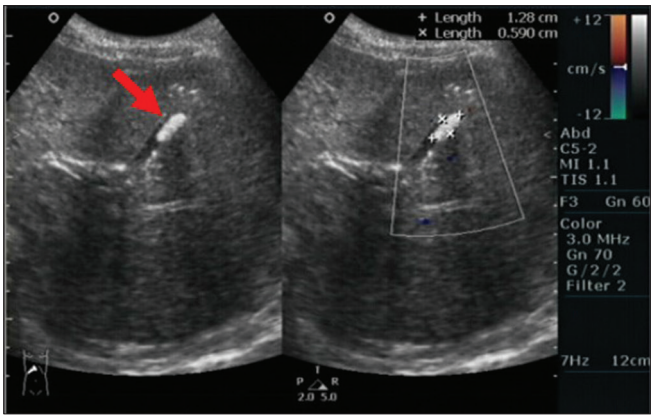

Figure 2: There was a high echogenicity 1.3 cm × 0.6 cm lesion in the gallbladder (arrow) with posterior acoustic shadow

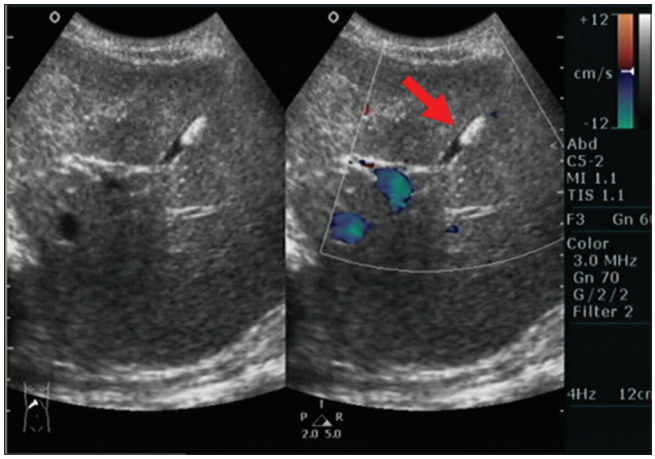

Figure 3: The Doppler ultrasound image showed no internal blood flow in the lesion (arrow)

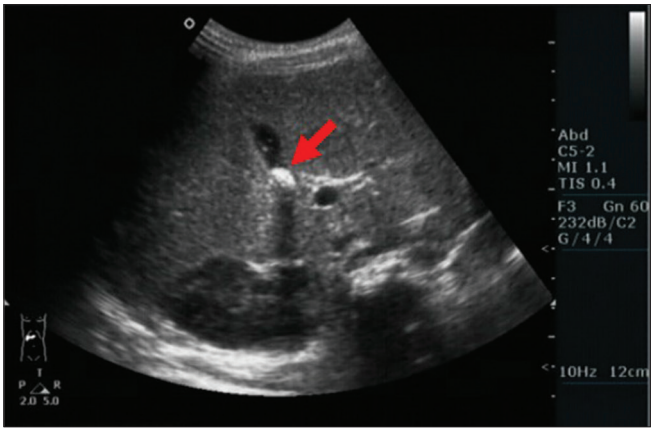

Figure 4: The high echogenic lesion (arrow) descended to the dependent area as the patient changed his body posture

The patient showed no clinical symptom of scleral jaundice and reported no right upper abdominal tenderness during his physical examination (murphy sign negative). His father had a family history of gallbladder stones, so he paid to have the patient to get an abdominal sonogram examination at birth, and the result showed no abnormality. After 5 days of hospitalization, the patient's fever was brought down. The stool culture confirmed that the patient had *Salmonella* enterocolitis (*Salmonella* Group D).

An abdominal sonogram was followed up 15 days after the patient discharged from the hospital. The test showed dissolution of gallstone with only some hyperechogenic lesions at the gallbladder orifice and main bile duct, believed to be residual biliary mud or sands [Figures 5 and 6].

Discussion

Gallstones caused by the use of cephalosporin antibiotics, especially the third-generation ceftriaxone, are not uncommon. The incidence rate is around 15%–57%. Most of them are asymptomatic gallstones and would alleviate by oneself.[3] Ceftriaxone is a semi-synthetic, β-lactamase resistant antibiotic for IV administration.[2]

Table 1: Blood test results

Item	Value	Unit
Hemoglobin	12.4	g/dL
WBC	12.65×10^3	/uL
Band	10	Percentage
Segment	28	Percentage
Lymphocyte	49	Percentage
Monocyte	6	Percentage
Atypical lymphocyte	7	Percentage
Platelet	340×10^3	/uL
Sodium	136	mmol/L
Potassium	3.4	mmol/L
Glucose	94	mg/dL
ALT	20	IU/L
Creatinine	0.45	mg/dL
CRP	11.952	mg/dL

WBC: White blood cell count, ALT: Alanine aminotransferase, CRP: C-reactive protein

In a prospective, observational, and descriptive research, 73 children aged between 4 months and 17 years were treated with ceftriaxone and 31 of them (42.5%) were diagnosed with gallstones. Most of the stones were found after patients

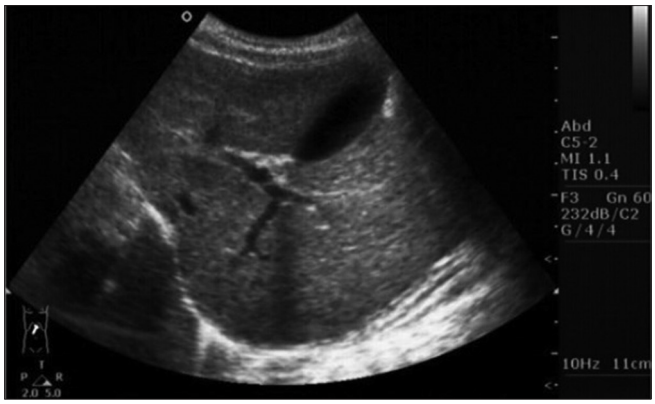

Figure 5: Followed up sonogram 15 days later showed dissolution of gallstone

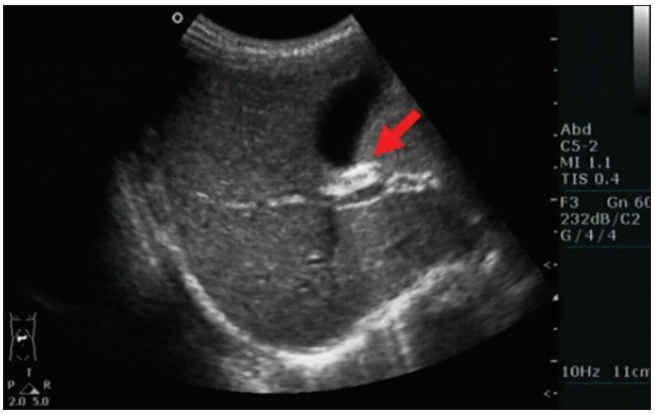

Figure 6: Hyperechogenic biliary mud (arrow) at the gallbladder orifice and main bile duct

have used the antibiotic for 5 days (96.8%). The sizes of those gallstones ranged from 4 mm to 14 mm (average 8.1 mm). These gallstones dissolved within about 9–55 days (24.1 days on average). Seven of the patients (22.6%) showed symptoms. The study also found that patients using lactated Ringer's solution as a dilution were at a higher risk of developing gallbladder stones (1.86 times, $P = 0.019$). Age, duration and dosage of antibiotics, fasting, calcium supplements, IV nutrition, and co-treatment with other antibiotics have no effect on the incidence of gallstones.[3]

Another randomized, single-blind, case–control prospective study found that among 108 Chinese children aged 9 months to 11 years with hepatobiliary disease or pneumonia, the incidence rate of gallstones after ceftriaxone treatment was 43.1% (25 out of 58). The rate reduced to only 2.0% (1 out of 50) when compared to treatment with another third-generation cephalosporin, ceftazidime. Sediments appeared in the patient's gallbladder about 2–7 days after antibiotic therapy. Most stones dissolved 7–14 days after the discontinuation of antibiotics (only 1 patient had the stone dissolve until day 54).[2]

In a single-center retrospective study, it was found that 43.8% of ceftriaxone-associated gallstones in children dissolve on their own. Using or not using ursodeoxycholic acid for treatment did not affect the dissolution rate of stones. In addition, the younger the patient is, the more likely the gallstones are going to dissolve. If the patient is diagnosed with gallstones at the age of 2 years or even younger, 50.0% (9/18) of them would have the stones dissolve. In contrast, only 19.8% (21/106) of patients older than 2 years of age would eventually found their gallstones disappear (odds ratio: 3.1).[4]

Gallstones caused by ceftriaxone often show high-density images due to their high calcium content. About 33%–67% of the drug would be excreted as urine prototypes, while the rest are metabolized through the biliary tract. The concentration of ceftriaxone in the gallbladder may exceed in the serum by 20–150 times. The high-concentration ceftriaxone combines with calcium ions and becomes an insoluble complex that accumulates in the biliary tract. Such combinations also cause stones in the urinary system.[2] In animal studies, ceftriaxone also inhibits gallbladder contractions, which, in turn, induces the formation of stones.[1]

Compared to adults, children have a thin and long biliary system, which prevents them from effectively excreting biliary mud. In addition, children have a lower concentration of cholecystokinin, which is the major hormone responsible for gallbladder contraction. Last but not least, as children are prone to dehydration when getting sick, biliary muds are more likely to accumulate as sediments and form stones in their gallbladder.[2]

Nontyphoidal *Salmonella* spp. infection has been associated with the cause of cholecystitis in very few case reports.[5] However, no current study has discovered that acute infection with *Salmonella enterica* might induce gallstone formation.

Conclusion

According to current studies, as asymptomatic stones rarely occur as a complication in children, it is advisable to carry out regular follow-up instead of performing the gallbladder removal surgery.[4]

Declaration of patient consent

The authors certify that they have obtained appropriate patient's parents consent form. In the form, the parents has given the consent for their child's images and other clinical information to be reported in the journal. The parents understand that their child's name and initial will not be published and due efforts will be made to conceal the identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Nayak A, Slivka A. Ceftriaxone-induced gallstones: Case report and literature review. ACG Case Rep J 2014;1:170-2.
2. Meng D, Cao Y, Fu J, Chen R, Lu L, Tu Y. Sonographic assessment of ceftriaxone-associated biliary pseudolithiasis in Chinese children. J Int Med Res 2010;38:2004-10.
3. Rodríguez Rangel DA, Pinilla Orejarena AP, Bustacara Diaz M, Henao García L, López Cadena A, Montoya Camargo R, *et al*. Gallstones in association with the use of ceftriaxone in children. An Pediatr (Barc) 2014;80:77-80.
4. Gökçe S, Yıldırım M, Erdoğan D. A retrospective review of children with gallstone: Single-center experience from Central Anatolia. Turk J Gastroenterol 2014;25:46-53.
5. Beiler HA, Kuntz C, Eckstein TM, Daum R. Cholecystolithiasis and infection of the biliary tract with *Salmonella* Virchow – A very rare case in early childhood. Eur J Pediatr Surg 1995;5:369-71.