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.

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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.[1] 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 | /μL     |
| Band              | 10    | Percentage |
| Segment           | 28    | Percentage |
| Lymphocyte        | 49    | Percentage |
| Monocyte          | 6     | Percentage |
| Atypical lymphocyte | 7    | Percentage |
| Platelet          | 340×10^3 | /μL    |
| 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...
accumulates in the biliary tract. Such combinations also cause stones in the urinary system. In animal studies, ceftriaxone also inhibits gallbladder contractions, which, in turn, induces the formation of stones.

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.

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).

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 find their gallstones disappear (odds ratio: 3.1).

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

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

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.

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.

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Conflicts of interest
There are no conflicts of interest.
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