Turkish Archives of Pediatrics

ORIGINAL ARTICLE
DOI: 10.5152/TurkArchPediatr.2024.23316

Are Medical Students and Primary Health-care Professionals Aware of Neonatal Cholestasis and Acholic Stool

Neslihan Gürcan Kaya[1], Sinan Sarı[2], Buket Dalgıç[2]

[1]Department of Pediatric Gastroenterology, Ankara Training and Research Hospital, Ankara, Türkiye
[2]Department of Pediatric Gastroenterology, Gazi University School of Medicine, Ankara, Türkiye

What is already known on this topic?

- *Timely diagnosis of biliary atresia (BA) and the timing of Kasai hepatic portoenterostomy are important.*
- *Studies have shown that Kasai operations were performed after 60 days for most of the patients.*
- *Acholic stool is a significant sign of BA.*
- *The rates for the Kasai operation performed before 60 days of age have improved since the implementation of the national screening program in Taiwan.*

What this study adds on this topic?

- *The participants were unaware that infants with BA are timely delivered, healthy-looking, and have well-growing jaundiced babies, which contributes to the confusion in diagnosing cholestasis versus physiological jaundice or breast milk-associated jaundice.*
- *Awareness of acholic stools among the participants was found to be quite low.*
- *The stool colors which could be defined as mild yellowish pale stool (4-5-8-9) were not recognized well by physicians.*
- *Stool color cards can be used to diagnose infants with biliary earlier.*

Corresponding author:
Neslihan Gürcan Kaya
✉ nesligurcan@hotmail.com
Received: December 22, 2023
Revision Requested: January 16, 2024
Last Revision Received: March 21, 2024
Accepted: March 26, 2024
Publication Date: May 2, 2024

ABSTRACT

Objective: Early diagnosis of biliary atresia (BA) and the timing of Kasai hepatic portoenterostomy are associated with improved survival rates of the native liver. Acholic stool is a major and earliest sign of BA. We evaluated the awareness and recognition of medical students and primary health care professionals (PHCPs) about neonatal cholestasis and acholic stool as a marker of BA.

Materials and Methods: The knowledge of students and PHCP about prolonged jaundice and acholic stool was evaluated through a questionnaire. In the first step, 5 questions evaluating the knowledge of prolonged jaundice were asked. The sixth question was "Have you ever seen acholic stool before?" Following this question, stool color cards with 9 colors were shown, and participants were asked "Which of the following stool pictures would you define as acholic?"

Results: A total 724 students and 88 PHCPs were included in the study. In both groups, about half of the participants could not answer the first 4questions related to prolonged jaundice and cholestasis correctly. Twenty-four percent of the students and 11.4% of PHCP answered correctly to all of the stool colors. The rate of correct answers to acholic stool colors were approximately 43.9%–87.6% and 23.9%–86.4% for students and PHCP, respectively. Whitish acholic stool colors were better known than mild yellowish pale stool colors. The percentages of recognition were less than about 50% for these stool colors.

Conclusion: This study showed that recognition and awareness of prolonged jaundice are low, and acholic stool is not well known. This may lead to delay in diagnosis. Considering the international success of stool color cards, using stool color cards will improve the outcomes of biliary atresia in our country as well.

Keywords: Biliary atresia, cholestasis, infant, early diagnosis, stool color card

INTRODUCTION

Prolonged jaundice is defined as ongoing jaundice after 14 days in term infants and after 21 days in preterm infants.[1] Conjugated bilirubin level is the most important measure in an infant with prolonged jaundice because increased conjugated bilirubin levels are the most common presenting feature of liver or biliary tract disease in the neonate.[2] The most common causes of cholestatic jaundice in the first months of life are biliary atresia (BA) (25%–40%) and a variety of uncommon genetic disorders (25%).[3,4] Timely diagnosis of BA and the timing of Kasai hepatic portoenterostomy are important for successful surgical drainage and are associated with improved survival rates of the native liver.[5] If Kasai is performed within the first 60 days of life, approximately 70% of patients will establish bile flow, if it is performed beyond 90 days of life, only <25% of patients will have effective bile flow.[6] Early diagnosis is important because liver transplantation is usually required within a year of a later referral

Cite this article as: Gürcan Kaya N, Sarı S, Dalgıç B. Are medical students and primary health-care professionals aware of neonatal cholestasis and acholic stool. *Turk Arch Pediatr.* 2024;59(3):283-288.

due to problems resulting from cirrhosis.[7] The delayed diagnosis of BA is a global problem for several reasons, there is visual overlap with physiological jaundice, and there is no readily applicable newborn screening.[8] For the solution of this global problem, diagnostic stool cards were improved in Taiwan for timely diagnosis of BA patients, and the timing for Kasai operation improved.[9]

In our country, the diagnosis and treatment of BA patients are usually delayed, and the stool card screening program is not used for BA. We think that the delayed diagnosis of BA may be due to low awareness of prolonged jaundice and cholestasis in infants, and incorrect evaluation of stool color. The aim of this study is to evaluate awareness and recognition of medical students and primary health-care professionals (PHCPs) about neonatal cholestasis and acholic stool as a marker of BA.

MATERIALS AND METHODS

Study Population

The cross-sectional study was conducted with medical students in at Gazi University School of Medicine and PHCPs in Ankara between February 2016 and May 2017. Permission was received from the Provincial Health Directorate to conduct a questionnaire of PHCPs working in Family Health Centers. Thirty-one family health centers affiliated with the Ankara Provincial Health Directorate were contacted, and 18 family health centers that agreed to conduct a questionnaire were visited. As a result, simple random sampling was used for selecting PHCPs. Here, consent was obtained from each family physician providing primary health-care services, and a questionnaire was conducted for PHCPs who agreed to participate in the survey.

Only fourth, fifth, and sixth-year medical students who have completed pediatric internships were included in the study. All students involved in this study were educated about prolonged jaundice, neonatal cholestasis, and samples of acholic and pale stools, and pictures were shown to them in pediatric rotation in stage 4 of medical school. Within the scope of the Gazi University education program, all students are shown acholic stool cards in theoretical and practical courses in term 4. In practical lessons, if any inpatients have acholic stools, they are shown, otherwise, training is provided again with using the stool color cards. All students in the fourth, fifth, and sixth grades between the dates of the study were invited to take part in a questionnaire, and all students who accepted the questionnaire were administered the questionnaire. We excluded students who did not complete a pediatric internship and who did not accept to fill questionnaire.

Data Collection—Preparing the Questionnaire

The knowledge of students and PHCP working in family health centers, which provide primary health-care services, about prolonged jaundice and acholic stool was evaluated by a questionnaire, as shown in Table 1.

The questions of the questionnaire were prepared using the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition (NASPGHAN) (2004) and the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition (2017) Guideline for the evaluation of cholestatic jaundice in infants.[6,8] The questionnaire was designed as follows: in the first step, 5 questions evaluating the knowledge of the participants about prolonged jaundice were asked. The sixth question was "Have you ever seen acholic stool before?". After answering yes or no to the sixth question, stool color cards with 9 colors mixed—used in Taiwan ® and modified by Canada®—were shown (Figure 1), and it was asked: "Which of the following stool pictures would you define as acholic? Please mark the ones that are acholic."

Table 1. Questionnaire

Questions
1. How do you describe prolonged jaundice in full-term infants? a) Ongoing jaundice after the seventh day b) Ongoing jaundice after the 10th day c) Ongoing jaundice after the 14th day d) Ongoing jaundice after the 21st day e) Ongoing jaundice after the 13th day
2. How do you describe prolonged jaundice in pre-term infants? a) Ongoing jaundice after the seventh day b) Ongoing jaundice after the 10th day c) Ongoing jaundice after the 14th day d) Ongoing jaundice after the 21st day e) Ongoing jaundice after the 13th day
3. Which biochemical test is the first test to be done in an infant with prolonged jaundice? a) Total bilirubin b) ALT c) AST d) GGT e) Bilirubin fractions (direct/indirect bilirubin ratio)
4. Which is the biochemically definition of direct bilirubinemia? a) Direct bilirubin is 5% of total bilirubin b) Direct bilirubin is 10% of total bilirubin c) Direct bilirubin is 20% of total bilirubin d) Direct bilirubin is 30% of total bilirubin e) Direct bilirubin is 40% of total bilirubin
5. Which one is the possible scenario for BA in a one-month-old infant? a) Birth weight is 2300 g, baby with microcephaly b) Birth weight is 2500 g, baby with ascid and hepatosplenomegaly c) Birth weight is 3500 g, baby with hepatomegaly d) Birth weight is 2500 g, baby with macrocephaly and unweighted e) Birth weight is 2500 g, baby with severe vomiting and cataract
6. Have you ever seen acholic stool? a) Yes b) No

AST, aspartate aminotransferase; ALT, alanine aminotransferase; GGT, gamma glutamyl transferase.

Ethics Committee Approval

The questionnaire and methodology for this study were approved by the Human Research Ethics Committee of the Gazi University (approval number and date: 31/January 25, 2016). Informed consent was received from the participants.

Statistical Analysis

Quantitative variables are demonstrated as mean ± SD. The Pearson's chi-square test or Fisher's test (when chi-square

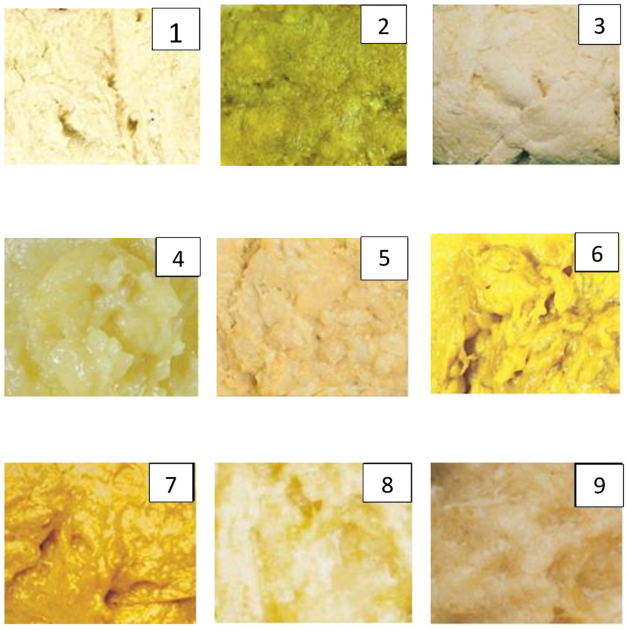

Figure 1. Stool colors.

test assumptions do not hold due to low expected cell counts) was used, where appropriate, to compare these proportions in different groups. Data were analyzed using the Statistical Package for the Social Sciences version 15.0 statistical package program (SPSS Inc., Chicago, Ill, USA). A *P*-value of less than .05 was considered statistically significant.

RESULTS

Characteristics of Participants

A total of 987 students and 127 PHCPs in 18 Family Health Centers were invited to fill out the questionnaire. Two hundred twelve students and 24 PHCPs (in 18 family health centers) did not accept to fill out the questionnaire. Fifty one of the questionnaires filled out by students and 15 questionnaires filled out by PHCP were deemed invalid. A total of 724 students and 88 PHCPs were accepted to fill out the questionnaire. Two hundred forty four, 237, and 243 students were in fourth, fifth, and sixth years of medical school, respectively.

Answers to Questionnaire

In total, 57% of students correctly answered the first question, and approximately 60% of all participants correctly answered the third question. For all participants, the rate of correct answers was less than 50% for 2, 4, and 5 questions (Table 2).

Four hundred seventy-eight (66.0%) of the students and 55 (62.5%) of PHCP had never seen acholic stool, and there was no significant difference between the 2 groups (*P* = .51).

Answers to Stool Colors

Twenty-four percent of the students and 11.4% of PHCP answered correctly to all of the stool colors. The rate of correct answers to cholic stool colors was approximately over 95% for students and over 90% for PHCP. The rate of correct answers to acholic stool colors was approximately 43.9%-87.6% for students and 23.9%-86.4% for PHCP, respectively. The rate

Table 2. Number/Rate of Correct Answers Given to First 5 Questions and Comparison Between Primary Healthcare Professionals and Students

Questions	Primary Healthcare Professionals n (%) (n = 88)	Students n (%) (n = 724)	*P*
1	40 (45.5)	418 (57.7)	**.028***
2	34 (38.6)	290 (40.1)	.80*
3	54 (61.4)	470 (64.9)	.51*
4	28 (31.8)	243 (33.6)	.74*
5	17 (19.3)	168 (23.2)	.41*

Value in bold indicates statistical significance.
*Pearson's chi-square was used.

of correct answers to acholic stool colors 1 and 3 were above 80%, and for other acholic stool colors (4,5,8,9), they were below 50%. According to these results, known percentages of acholic stool colors 1 and 3 were higher than other acholic stool colors (Table 3). Seeing acholic stool before did not affect the percentage of recognition both among medical students and PHCP (Table 4). A significant difference between stage 4, 5, and 6 medical school students was not found when they were evaluated for knowledge and recognition of acholic stool (Table 5).

DISCUSSION

This is the first study evaluating the recognition of acholic stool and management of prolonged jaundice in medical students who are candidates for PHCP and PHCP, who are responsible for the examination of newborns within the first month of life. This study showed that recognition and awareness of prolonged jaundice is low, and acholic stool is not well known in our country.

Biliary atresia is the most common cause of cholestatic jaundice in the first month of life and is also the most common cause of pediatric end-stage liver disease and pediatric liver transplantation.[8] Prolonged jaundice, pale-pigmented stools, and dark urine are clinical features of BA.[10] Therefore, acholic stool is an important clue for BA in a cholestatic infant and aids in

Table 3. Number/Percentage of Correct Answers Given to Stool Colors and Comparison Between Primary Health-care Professionals and Students

Stool Pictures	Primary Healthcare Professionals n (%) (n = 88)	Students n (%) (n = 724)	*P*
1	74 (84.1)	634 (87.6)	.36*
2	84 (95.5)	707 (97.7)	.27**
3	76 (86.4)	632 (87.3)	.81*
4	28 (31.8)	420 (58.0)	**<.0001***
5	39 (44.3)	318 (43.9)	.94*
6	80 (90.9)	687 (94.9)	.14**
7	85 (96.6)	691 (95.4)	.79**
8	41 (46.6)	486 (67.1)	**.0001***
9	21 (23.9)	341 (47.1)	**<.0001***

Values in bold indicate statistical significance.
*Pearson's chi-square was used.
**Fisher's exact test was used.

Table 4. Comparision of Correct Answers According to Whether Acholic Stool Has Ever Been Seen Previously

Stool Pictures	Primary Healthcare Professionals			Students		
	Yes, I Saw, n (%) (n = 33)	No, I Did Not See, n (%) (n = 55)	*P*	Yes, I Saw, n (%) (n = 246)	No, I Did Not See, n (%) (n = 478)	*P*
1	28 (84.8)	46 (83.6)	.88*	221 (89.8)	413 (86.4)	.18*
2	31 (93.9)	53 (96.4)	.63**	241 (98.0)	466 (97.5)	.69*
3	30 (90.9)	46 (83.6)	.52**	217 (88.2)	415 (86.8)	.59*
4	8 (24.2)	20 (36.4)	.24*	131 (53.3)	289 (60.5)	.063*
5	14 (42.4)	25 (45.5)	.78*	101 (41.1)	217 (45.4)	.27*
6	30 (90.9)	50 (90.9)	1**	235 (95.5)	452 (94.6)	.58*
7	32 (97)	53 (96.4)	1**	234 (95.1)	457 (95.6)	.77*
8	14 (42.4)	27 (49.1)	.54*	166 (67.5)	320 (66.9)	.89*
9	6 (18.2)	15 (27.3)	.33*	98 (39.8)	243 (50.8)	**.005***

Value in bold indicates statistical significance.
*Pearson's chi-square was used.
**Fisher's exact test was used.

differentiating BA from many other causes of cholestasis. In our country, all one-month-old children visit primary health care for vaccination. We conducted a survey of students, many of whom started working in primary health care after graduating from medical schools in Türkiye and PHCP. Our aim was to evaluate the knowledge of primary healthcare workers and candidates of primary health care, where one-month-old babies are almost obliged to be seen. Primary healthcare professionals should be able to recognize acholic stool to refer suspected babies to a pediatric gastroenterologist for BA evaluation.

In this study, the first four questions were about awareness of prolonged jaundice and cholestasis, when to worry, and what to do. The first and second questions were about patient age-defining prolonged jaundice. More than half of the participants did not know the exact infantile age defined as prolonged jaundice. In the third and fourth questions, we asked about the initial biochemical tests to perform in cases of prolonged jaundice and also asked for the definition of direct bilirubinemia. Only 60% of the participants indicated direct bilirubin as the first biochemical test, and merely 30% of the participants could define direct bilirubinemia. In both groups, about half of them could not answer the first four questions related to prolonged jaundice and cholestasis correctly. NASPGHAN recommends that formula-fed infants with jaundice older than 2 weeks should be evaluated for cholestasis with total and conjugated (direct) serum bilirubin. In breastfed infants, serum total and conjugated (direct) bilirubin levels should be checked if they become icteric after the age of 3 weeks.[8] This made us think that the delayed diagnosis of cholestatic jaundice may be because of a lack of knowledge.

Our fifth question was about one possible scenario for BA in a 1-month-old infant. Approximately 80% of the participants did not know that infants with BA are timely delivered, healthy-looking, well-growing babies with jaundice. This clinical well appearance poses a challenge in distinguishing babies with biliary atresia from those with physiological jaundice or breast milk jaundice. Similar to our study, Palermo et al.[11] reported that 70% of pediatricians were unfamiliar with the early and prolonged jaundice management in their study, which evaluated pediatricians' knowledge by questionnaire. They detected that one-third of the pediatricians in their study did not refer 6-week-old patients with laboratory findings indicating cholestasis on time. Santos Silva et al[12] reported that the intensity of jaundice was the main reason for a significant number of nurses to seek medical observation. However, the severity of jaundice is not correlated with the severity of the underlying disease. In addition, conjugated bilirubin is not ordered by 30% of physicians in newborns, although other signs of the disease

Table 5. Number/Percentage of Correct Answers Given to Stool Colors and Comparison Between Students

Stool Pictures	Students						*P*
	Fourth year (n = 244)		Fifth year (n = 237)		Sixth year (n = 243)		
	n	%	n	%	n	%	
1	214	87.7	208	87.8	212	87.2	.982*
2	2	0.8	9	3.8	6	2.5	.097*
3	210	86.1	213	89.9	209	86.0	.347*
4	147	60.2	142	59.9	131	53.9	.282*
5	102	41.8	105	44.3	111	45.7	.683*
6	9	3.7	12	5.1	16	6.6	.349*
7	8	3.3	11	4.6	14	5.8	.421*
8	168	68.9	163	68.8	155	63.8	.396*
9	116	47.5	120	50.6	105	43.2	.262*

*Pearson's chi-square was used.

are present. Independent of patient age, 28.9% of physicians do not order conjugated bilirubin, and 4.2% order it if the patient is older than 2 months.

In this study, acholic stool awareness of the participants was quite low. Acholic stool colors 1 and 3 were better known than colors 4, 5, 8, and 9. The percentages of recognition were less than about 50% for these 4 colors. A one-month-old baby with BA often has mildly yellowish pale stools. These stool colors are seen in the early stages of BA when the the blockage is not fully complete. The colors 4, 5, 8, and 9, which could be defined as mildly yellowish pale stools, were not recognized well by physicians. Bakshi et al[13] also showed photographs of normal, acholic, and indeterminate infant stools to pediatricians and pediatric nurses at 3 university hospitals and asked them to classify each stool as "suspect" or "normal" for BA. They had reported that one-third of the stools were not correctly identified by physicians and nurses, and there were no differences among the 3 institutions or between doctors and nurses in identifying a suspected stool. Santos Silva et al[12] evaluated the clinical approach of general care physicians, general pediatricians, neonatologists, and nurses about neonatal jaundice and aimed to determine the health-care professional's ability to recognize pale stools. They conducted a questionnaire and a panel with 8 different colored stool photographs. They reported that physicians and nurses revealed a similar ability to recognize pale stools. The independent variable associated with this skill was specialization, both in physicians and nurses. The more specialized they were, the better they performed. In their study, physicians from the university hospital revealed a greater capacity than those in regional hospital and primary health care units did. Our study population consisted of PHCP and medical students, who were not specialized in children, and similarly, their recognition of acholic stool was found to be low in this study. We believe that the low knowledge level of medical students, who are the candidate professionals of the primary healthcare system, causes delay in the diagnosis of BA.

In Taiwan, there is a relatively high incidence of BA. The national Kasai operation rate before 60 days of age was 47.2% from 1976 to 2000. For this reason, Taiwan implemented a pilot regional screening program for acholic stool from 2002 to 2003. Stool color cards were given to parents of newborn infants, and normal and acholic stool colors were demonstrated to them. After a pilot regional study, a national stool color screening system was established by integrating the infant stool color card into the child health booklet given to every neonate in Taiwan since 2004. In this study, the national Kasai operation rate before 60 days of age was 60% in 2004 and increased to 74.3% in 2005. Universal screening using stool color cards effectively improved the prognosis of infants with BA in Taiwan. The jaundice-free rate after surgery was significantly improved, from 37.0% in the era without stool card screening (1976-2000) to 59.5% in 2004-2005 with universal screening. In subsequent analyses, the authors concluded that the implementation of this screening program led to earlier diagnosis and earlier Kasai surgery, and was associated with improved 3-year jaundice-free survival compared with a cohort of historical controls.[14] After Taiwan, Argentina, Switzerland, and Japan performed stool color card screening and BA education programs.[15-17] Gu et al[16] found that the timing of Kasai surgery and long-term native liver survival rates were improved with this program. Mogul et al[17] and Schreiber et al[18] also reported that stool color card screening for biliary atresia is feasible, effective, and cost-effective method.[19,17] The study conducted in Türkiye by Hanalioğlu et al[20] showed that the mean age at diagnosis of BA was 73.1 ± 4.7, and the mean age at Kasai operation was 76.8 ± 4.7. In another national center, Karakoyun et al.[21] evaluated 99 patients diagnosed with BA from 1990 to 2002 (27 patients) and from 2003 to 2015 (72 patients) retrospectively and showed that the mean age of Kasai operation was 149 days (20-730 days) between 1990 and 2002 and 61 days between 2003 and 2015. These studies demonstrate that the timing of Kasai operation is late in our country.

The limitations of this study are the small number of PHCPs, the fact that pediatricians were not included in the study, and PHCPs were asked to fill out the questionnaire on a volunteer bias.

In conclusion, recognition and awareness of prolonged jaundice are low, and acholic stool is not well-known. This may lead to late referrals and delayed diagnoses of patients with BA to pediatric gastroenterologist. Stool card screening programs are still not implemented in our country. Considering the international success of stool color cards, the use of stool color cards could improve outcomes of BA in our country as well. We believe that increasing awareness among all health-care professionals, especially PHCPs, about prolonged jaundice, direct hyperbilirubinemia, acholic stool, and using stool cards will contribute to the success in the early diagnosis and treatment of BA.

Ethics Committee Approval: This study were approved by the Ethics Committee of Gazi University (approval number: 31; date: January 25, 2016).

Informed Consent: Written informed consent was obtained from the patients who agreed to take part in the study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – N.G.K., S.S.; Design– N.G.K., S.S., B.D.; Supervision – S.S., B.D.; Resources –N.G.K.; Materials – N.G.K.; Data Collection and/or Processing – N.G.K., S.S.; Analysis and/or Interpretation – N.G.K., S.S., B.D.; Literature Search – N.G.K., S.S.; Writing – N.G.K.; Critical Review – S.S., B.D.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: This study received no funding.

REFERENCES

1. Crofts DJ, Michel VJ, Rigby AS, Tanner MS, Hall DM, Bonham JR. Assessment of stool colour in community management of prolonged jaundice in infancy. *Acta Paediatr.* 1999;88(9):969-974. [CrossRef]
2. Gilmour SM. Prolonged neonatal jaundice: when to worry and what to do. *Paediatr Child Health.* 2004;9(10):700-704. [CrossRef]
3. Balistreri WF, Bezerra JA. Whatever happened to "neonatal hepatitis"? *Clin Liver Dis.* 2006;10(1):27-53. [CrossRef]

4. Okulu E, Erdeve Ö, Tuncer O, et al. Exchange transfusion for neonatal hyperbilirubinemia: a multicenter, prospective study of Turkish Neonatal Society. *Turk Arch Pediatr*. 2021;56(2):121-126. [CrossRef]
5. Serinet MO, Wildhaber BE, Broué P, et al. Impact of age at Kasai operation on its results in late childhood and adolescence: a rational basis for biliary atresia screening. *Pediatrics*. 2009;123(5):1280-1286. [CrossRef]
6. Moyer V, Freese DK, Whitington PF, et al. Guideline for the evaluation of cholestatic jaundice in infants: recommendations of the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition. *J Pediatr Gastroenterol Nutr*. 2004;39(2):115-128. [CrossRef]
7. Chardot C. Review Biliary atresia. *Orphanet J Rare Dis*. 2006;1:28. [CrossRef]
8. Fawaz R, Baumann U, Ekong U, et al. Guideline for the evaluation of cholestatic jaundice in infants: joint recommendations of the North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition and the European Society for Pediatric Gastroenterology, Hepatology, and Nutrition. *J Pediatr Gastroenterol Nutr*. 2017;64(1):154-168. [CrossRef]
9. Lien TH, Chang MH, Wu JF, et al. Effects of the infant stool color card screening program on 5-year outcome of biliary atresia in Taiwan. *Hepatology*. 2011;53(1):202-208. [CrossRef]
10. Yang MC, Chang MH, Chiu SN, et al. Implication of early-onset biliary atresia and extrahepatic congenital anomalies. *Pediatr Int*. 2010;52(4):569-572. [CrossRef]
11. Palermo JJ, Joerger S, Turmelle Y, Putnam P, Garbutt J. Neonatal cholestasis: opportunities to increase early detection. *Acad Pediatr*. 2012;12(4):283-287. [CrossRef]
12. Santos Silva E, Moreira Silva H, Azevedo Lijnzaat L, et al. Clinical practices among healthcare professionals concerning neonatal jaundice and pale stools. *Eur J Pediatr*. 2017;176(3):361-369. [CrossRef]
13. Bakshi B, Sutcliffe A, Akindolie M, et al. How reliably can paediatric professionals identify pale stool from cholestatic newborns? *Arch Dis Child Fetal Neonatal Ed*. 2012;97(5):F385-F387. [CrossRef]
14. Hsiao CH, Chang MH, Chen HL, et al. Universal screening for biliary atresia using an infant stool color card in Taiwan. *Hepatology*. 2008;47(4):1233-1240. [CrossRef]
15. Wildhaber BE, Majno P, Mayr J, et al. Biliary atresia: Swiss national study, 1994-2004. *J Pediatr Gastroenterol Nutr*. 2008;46(3):299-307. [CrossRef]
16. Gu YH, Yokoyama K, Mizuta K, et al. Stool color card screening for early detection of biliary atresia and long-term native liver survival: a 19-year cohort study in Japan. *J Pediatr*. 2015;166(4):897-902.e1. [CrossRef]
17. Mogul D, Zhou M, Intihar P, Schwarz K, Frick K. Cost-effective analysis of screening for biliary atresia with the stool color card. *J Pediatr Gastroenterol Nutr*. 2015;60(1):91-98. [CrossRef]
18. Schreiber RA, Masucci L, Kaczorowski J, et al. Home-based screening for biliary atresia using infant stool colour cards: a large-scale prospective cohort study and cost-effectiveness analysis. *J Med Screen*. 2014;21(3):126-132. [CrossRef]
19. Schreiber RA, Barker CC, Roberts EA, et al. Biliary atresia: the Canadian experience. *J Pediatr*. 2007;151(6):659-665. e1. [CrossRef]
20. Hanalioğlu D, Özen H, Karhan A, et al. Revisiting long-term prognostic factors of biliary atresia: a 20-year experience with 81 patients from a single center. *Turk J Gastroenterol*. 2019;30(5):467-474. [CrossRef]
21. Karakoyun M, Baran M, Turan C, Kılıç M, Ergun O, Aydoğdu S. Infants with extrahepatic biliary atresia: effect of follow-up on the survival rate at Ege University Medical School transplantation center. *Turk J Gastroenterol*. 2017;28(4):298-302. [CrossRef]