

## Kawasaki Self Assessment Questions 2016-2020

### Question 1

A 2-year-old African American boy presents to your clinic for evaluation of fever. His mother states that he has had fever up to 39°C that started 5 days ago and his eyes and lips are red. The boy had 1 episode of vomiting yesterday and 1 watery stool today. He is eating and drinking less than usual, but urinating normally. The boy has a sibling that is currently well. On physical examination, the boy is irritable. His temperature is 39.2°C, heart rate is 120 beats/min, and his blood pressure is 80/50 mm Hg. He has bilateral, nonpurulent conjunctivitis. His lips and tongue are red with hypertrophied papillae. He has a morbilliform rash on his chest. The dorsum of his hands and feet appear edematous. The remainder of his physical examination is unremarkable. You order laboratory studies. His erythrocyte sedimentation rate is 40 mm/h and his white blood cell count is 15,200/ $\mu$ L ( $15.2 \times 10^9$  /L). His other laboratory results are normal. Of the following, the MOST concerning feature of the boy's presentation that warrants further evaluation is his:

- A. duration of fever
- B. erythrocyte sedimentation rate
- C. tachycardia
- D. vomiting and diarrhea
- E. white blood cell count

### Question 2

A 3-year-old boy develops a rash and fever. He has been febrile for 7 days, in association with decreased appetite and energy. He continues to drink well and has normal urine output. A red rash has been present for a few days, and this morning the skin on his fingers started to peel. The boy's heart rate is 130 beats/min, respiratory rate is 30 breaths/min, blood pressure is 100/60 mm Hg, and pulse oximetry is 99% on room air. He is irritable but consolable. His conjunctiva are injected without exudate ([Item Q107A](#)). His tongue looks like a strawberry, and his hands and feet are slightly swollen with peeling skin on his fingers ([Item Q107B](#)). The child is admitted to the local hospital. Of the following, the BEST next step in management is to administer:

- A. aspirin orally and immunoglobulin intravenously
- B. aspirin orally and methylprednisolone intravenously
- C. immunoglobulin and methylprednisolone intravenously
- D. oxacillin and methylprednisolone intravenously

### Question 3

A 3-year-old girl has had fever for 6 days. Her father states that for the past 3 days her temperature has been at least 38.9°C, and it is not improving. He indicates that her eyes are red and she has a rash. He says she has been very cranky and that her appetite is decreased. He reports no vomiting, diarrhea, dysuria, cough, or trouble breathing. Her immunizations are up-to-date. The family was on vacation at a crowded amusement park for the first 3 days of her illness. She was seen at an urgent care center near the park where no etiology for her fever was found and no testing was done. Her temperature is now 38.9°C. She is irritable but interactive and cooperates with the examination. She has injected conjunctiva bilaterally without exudate, erythematous and cracked lips, and a polymorphous rash on her trunk and legs. The remainder of the physical examination findings are normal. Of the following, the MOST appropriate next steps in the diagnostic approach for this child include:

- A. chest radiography, complete blood cell count with differential, blood culture, and urine culture
- B. complete blood cell count with differential, comprehensive metabolic panel, C-reactive protein level, and urinalysis
- C. nasopharyngeal swab for influenza A and B, rapid streptococcal antigen test, and heterophile antibody test
- D. serum measles IgM antibody, complete blood cell count with differential, and nasopharyngeal swab for viral culture

### Question 4

A 6-month-old uncircumcised male infant presents to the emergency department with a 7-day history of fever, with a temperature of up to 39.2°C. Five days ago, he was seen at urgent care and diagnosed with a "viral illness". Two days later, he was seen by his pediatrician, who obtained screening labs and performed a suprapubic aspiration for urine. The CBC and urinalysis were normal, and the blood and urine cultures were negative. On physical examination, the infant is

alert, but very fussy. He has bilateral nonpurulent conjunctival injection and a scarlatiniform rash on his trunk. His heart rate is 160 beats/min and his blood pressure is 80/55 mm Hg. His parents do not consent to lumbar puncture or urine catheterization, but a venous blood sample is obtained and a bagged urine specimen was sent for urinalysis. Laboratory results are as follows:

- White blood cells, 10,500/ $\mu$ L ( $10.5 \times 10^9$  /L) with 65% neutrophils, 25% lymphocytes, 10% atypical lymphocytes
- Platelets, 452,000  $\times 10^3$ / $\mu$ L ( $452 \times 10^9$  /L)
- Erythrocyte sedimentation rate, 60 mm/h
- C-reactive protein, 4.5 mg/L
- Urinalysis shows 12 WBC/hpf
- Alanine aminotransferase, 20 U/L
- Aspartate aminotransferase, 25 U/L

All of the following features support the diagnosis of “incomplete” KD, EXCEPT:

- A. Echocardiography showing an ejection fraction of 65%
- B. Alanine aminotransferase, 20 U/L
- C. Erythrocyte sedimentation rate, 60 mm/h
- D. Infant with unexplained fever for  $\geq 7$  days
- E. Urinalysis with 12 WBC/hpf

### **Question 5**

A 15-month-old girl with a history of epilepsy treated with phenobarbital is being evaluated for a rash. For the past several days she has had a low-grade fever, decreased energy and appetite, and an increase in her baseline seizure frequency. Her eyes have been slightly red and itchy, and she developed several small sores inside her mouth the day before the visit. This morning, she awoke with a widespread, red rash. She is fussy and refusing to eat or drink. She had 1 wet diaper overnight, but has not voided yet today. She appears ill. She has a temperature of 38.4°C, heart rate of 185 beats/min, and respiratory rate of 16 breaths/min. She has bilateral nonpurulent conjunctival injection, cracking of her lips, multiple shallow ulcerations on her buccal and gingival mucosa, and a diffuse rash ([Item Q55](#)). Of the following, the intervention MOST highly associated with an improved clinical outcome for this patient is prompt:

- A. administration of broad-spectrum antibiotics
- B. administration of high-dose corticosteroids
- C. administration of intravenous immunoglobulin
- D. discontinuation of phenobarbital

### **Question 6**

A 10-month-old Asian American male infant is brought to the office with 6 days of fever and a new rash. His mother states that he has been difficult to feed for 2 days because he is so irritable. He has had 2 wet diapers in the last 24 hours. Vital signs show a temperature of 39.5°C rectally, respiratory rate of 30 breaths/min, heart rate of 160 beats/min, and a blood pressure of 90/65 mm Hg. Physical examination shows an alert, but very fussy infant with dry, cracked lips, erythematous hands and feet, unilateral cervical lymphadenopathy, and nonexudative bulbar conjunctivitis. There is an erythematous maculopapular rash on his trunk and arms. Laboratory results are notable for white blood cells in the urine, elevated ESR, anemia, and elevated ALT. The patient is admitted to the hospitalist service. Echocardiography shows bilateral coronary artery dilatation. High-dose aspirin and intravenous immunoglobulin are administered. Over the next 48 hours, he remains febrile but his oral intake improves. Of the following, the BEST next step in management is:

- A. administration of broad-spectrum antibiotics
- B. administration of intravenous immunoglobulin
- C. discharge home on low-dose aspirin with close PCP and cardiology follow-up
- D. discharge on high-dose aspirin with close PCP and cardiology follow-up

### **Question 7**

A 4-year-old girl was admitted to the pediatric inpatient floor from the emergency department for a constellation of symptoms, including a high fever for six days in conjunction with dry, cracked lips, erythematous hands and feet, unilateral cervical lymphadenopathy, and nonexudative bulbar conjunctivitis. Her fever resolved with the standard

treatment and no vascular changes were seen on echocardiography. She has been fever free for 24 hours and is now ready for discharge. Of the following, the MOST appropriate discharge recommendation for this patient is:

- A. Return to the emergency department if her fever returns within 12 hours
- B. Continue high-dose aspirin for 6 weeks
- C. Delay live virus vaccines for 11 months
- D. Follow-up with cardiology in 6 weeks for repeat echocardiography

### **Question 8**

A 2-year-old generally healthy boy comes into the Emergency Department with a chief complaint of fever, rash and lethargy. This is his fourth day of fever, which has been spiking as high as 40°C between doses of acetaminophen. He was seen yesterday by his primary care physician who prescribed amoxicillin after a physical exam revealed a possible otitis media. This morning, he developed a rash and he has been lethargic. His lips have been dry and cracked but the parents attributed this to his decreased PO intake. He has not produced a wet diaper today. On exam, he is febrile to 39°C, with HR 165, RR 24, BP 70/40, O2 Sat 98% on room air. He appears lethargic and irritable. He has non-purulent, injected conjunctiva bilaterally. His tympanic membranes appear red with some retained fluid. His lips are red, dry and cracked. Oropharynx is dry, without oral or pharyngeal lesions. He has prominent unilateral lymphadenopathy. His chest is clear to auscultation, but he is tachypneic. He is tachycardic with a regular rhythm, and soft systolic murmur is heard at the left lower sternal border. Abdominal exam is benign. He has 2+ distal pulses, and capillary refill is about 3 seconds. His hands and feet appear edematous and erythematous. He has a diffuse morbilliform rash over his abdomen and back. Of the following, what is the MOST appropriate management strategy?

- A. Order an echocardiogram and begin treatment for Kawasaki disease if there is coronary dilation.
- B. Draw blood cultures and begin intravenous dopamine infusion.
- C. Obtain blood cultures, bladder catheterization for urinalysis/culture, and lumbar puncture.
- D. Place an IV, administer 10 cc/kg of isotonic crystalloid, and order 2 g/kg IVIG.

## Answers

- |      |      |
|------|------|
| 1. A | 5. D |
| 2. A | 6. B |
| 3. B | 7. C |
| 4. B | 8. D |

## Detailed Explanations

### **Question 1**

The boy in the vignette has Kawasaki disease (KD). The most concerning feature that requires further evaluation of his symptoms is the duration of fever. The boy has several features of KD including fever of 5 days' duration, changes in his extremities, polymorphous rash, conjunctivitis, and mucosal findings. He has a slightly elevated erythrocyte sedimentation rate, which is nonspecific and could occur with any type of immune system activation, including a viral infection. The boy's tachycardia is likely caused by fever and not something that would necessarily warrant further workup. He had vomiting and diarrhea only once and urination is normal. The boy's white blood cell count is only slightly elevated and is not concerning in the setting of an acute illness. The differential diagnosis of a child with this presentation is broad. Early in its course, KD mimics several conditions, including several viral illnesses that can present similarly, such as adenovirus, enterovirus, influenza, roseola infantum, and Epstein-Barr virus. In very young or unimmunized patients the practitioner must consider measles. Bacterial infections that can mimic KD include scarlet fever, cervical lymphadenitis, Rocky Mountain spotted fever, and leptospirosis. The skin peeling associated with KD is also seen in toxin-mediated diseases such as toxic shock syndrome or scalded skin syndrome. Drug hypersensitivity reactions, including Stevens-Johnson syndrome, can mimic KD. More rare conditions such as systemic juvenile idiopathic arthritis, and periodic fever syndromes can present with continuous fever of unknown origin. Mercury poisoning can also present similarly to KD. The diagnostic criteria for KD include fever for at least 5 days, with at least 4 of the following: bilateral, non-exudative, bulbar conjunctivitis; oropharyngeal changes; cervical lymphadenopathy; polymorphous rash; and peripheral extremity changes. The oropharyngeal changes can include strawberry tongue, erythema of the oropharyngeal mucosa, or erythematous or cracking lips. The extremity changes include erythema or edema of the palms and soles in the acute phase or periungual desquamation of the fingertips in the later subacute phase of KD. The diagnosis can be difficult in cases where the patient has fever for 5 or more days but does not meet criteria for diagnosis. Incomplete KD is the term used for patients with fever for 5 or more days, but with only 2 or 3 of the principal clinical features. In such cases, echocardiography is recommended. KD can be diagnosed in patients when coronary artery disease is detected with 2-dimensional echocardiography. Other laboratory study abnormalities that support a diagnosis of KD are low albumin, elevated alanine aminotransferase, significantly elevated platelets, elevated white blood cell count, or sterile pyuria. Risk factors for coronary artery aneurysms include male sex, age younger than 1 year, prolonged fever, delayed diagnosis, fever that persists after treatment, low hemoglobin, high white blood cell count, high absolute band count, very high erythrocyte sedimentation (ESR) or C-reactive protein, low platelet count, or low albumin. It should be noted that after intravenous immunoglobulin treatment, ESR is no longer helpful in determining the level of inflammation.

### **PREP Pearls**

- The diagnostic criteria for Kawasaki disease (KD) include fever for at least 5 days and at least 4 of the following: bilateral, nonexudative, bulbar conjunctivitis; oropharyngeal changes; cervical lymphadenopathy; polymorphous rash; and peripheral extremity changes.
- No laboratory study is diagnostic for KD, but elevated erythrocyte sedimentation rate, elevated C-reactive protein, elevated platelets, anemia, low albumin, elevated alanine aminotransferase, elevated white blood cell count, and sterile pyuria can support the diagnosis.
- Echocardiography should be performed in cases of incomplete or suspected KD.

### **Question 2**

The child in the vignette meets the criteria for Kawasaki disease (KD) and requires treatment with aspirin and intravenous immunoglobulin (IVIG). The other combinations of therapeutics would not be useful.

Kawasaki disease is an acute febrile illness that can result in vasculitis of medium-sized arteries, notably, the coronary arteries. Children who have fever for at least 4 days and at least 4 of the 5 principal criteria meet the requirements for a diagnosis of KD. The fever is described to be abrupt in onset and typically higher than 39°C. Without treatment, the fever can last 11 to 12 days. The other principal criteria include:

- bilateral, nonexudative, limbic-sparing conjunctivitis
- oropharyngeal changes including erythema and cracking of the lips, strawberry tongue ([Item C107](#)), and/or erythema of oral and pharyngeal mucosa
- maculopapular, diffuse erythroderma or erythema multiforme–like rash
- erythema and edema of the hands and feet in acute phase and/or periungual desquamation
- cervical lymphadenopathy  $\geq 1.5$  cm, usually unilateral

Other symptoms can include myalgia, arthralgias, arthritis, irritability, transient facial palsies, sensorineural hearing loss, abdominal pain, vomiting, diarrhea, acalculous distention of the gallbladder, and hepatomegaly.

The differential when considering a diagnosis of KD includes measles, adenovirus, enterovirus, and Epstein-Barr virus infections. One should also consider Stevens Johnson syndrome and toxin-mediated syndromes seen in staphylococcal or streptococcal infections.

Children with KD typically have leukocytosis with a predominance of neutrophils and immature cells, normocytic normochromic anemia, and thrombocytosis. Inflammatory markers, including erythrocyte sedimentation rate and C-reactive protein, will be elevated and should be drawn at presentation. Some children will have transaminitis and mild hyperbilirubinemia. Most children will have sterile pyuria. Children with KD are at risk for coronary artery aneurysms. Echocardiography is the imaging modality of choice in suspected KD, and should be performed at diagnosis, 1 to 2 weeks later, and again after 5 to 6 weeks. Echocardiography should be used to evaluate for coronary abnormalities, myocardial dysfunction, and valvular dysfunction; the coronary arteries should be carefully investigated looking for areas of dilation and irregularities.

Treatment with IVIG and aspirin should be initiated at diagnosis, ideally within the first 7 days. A single 2-g/kg infusion of IVIG should be given, usually over 10 to 12 hours. Administration of moderate (30-50 mg/kg per day) to high-dose (80-100 mg/kg per day) aspirin is continued until the patient is afebrile for 48 to 72 hours. The dose of aspirin is under debate but a recent study showed that lower-dose aspirin was not inferior to high-dose aspirin. High-dose aspirin is used for its anti-inflammatory properties. Thereafter, low-dose aspirin (3-5 mg/kg per day) should be given for 6 to 8 weeks from onset of illness (for its antiplatelet effects), until no coronary abnormalities are noted on echocardiography. If coronary abnormalities are found, aspirin may be continued as directed by cardiology specialists. The incidence of coronary artery lesions in those who receive timely IVIG administration is less than 5%.

#### PREP Pearls

- Treatment of Kawasaki disease includes intravenous immunoglobulin 2 g/kg as a single infusion, usually given over 10 to 12 hours, and administration of moderate (30-50 mg/kg per day) to high-dose (80-100 mg/kg per day) aspirin continued until the fever abates.
- Children with fever for 4 or more days and at least 4 of the 5 principal criteria meet the requirements for a diagnosis of Kawasaki disease. Principal criteria include bilateral, nonexudative, limbic-sparing conjunctivitis; oropharyngeal changes (red cracked lips, strawberry tongue, and/or erythema of oral and pharyngeal mucosa); maculopapular, diffuse erythroderma or erythema multiforme–like rash; erythema and edema of the hands and feet and/or periungual desquamation; and cervical lymphadenopathy greater than or equal to 1.5 cm, usually unilateral.
- Kawasaki disease can result in vasculitis of medium-sized arteries, notably, the coronary arteries.

#### Suggested Readings

- Dallaire F, Fortier-Morissette Z, Blais S, et al. Aspirin dose and prevention of coronary abnormalities in Kawasaki disease. *Pediatrics*. 2017;139(6):e20170098. doi:[10.1542/peds.2017-0098](#).
- Jackson AM. Kawasaki disease. In: McInerney TK, Adam HM, Campbell DE, DeWitt TG, Foy JM, Kamat DM, eds. *American Academy of Pediatrics Textbook of Pediatric Care*. 2nd ed. Elk Grove Village, IL: American Academy of Pediatrics; 2017:2228-2235. [Pediatric Care Online](#).
- McCrindle BW, Rowley AH, Newburger JW, et al; American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee of the Council on Cardiovascular Disease in the Young; Council on Cardiovascular and Stroke Nursing; Council on Cardiovascular Surgery and Anesthesia; and Council on Epidemiology and Prevention. Diagnosis, treatment, and long-term management of Kawasaki disease: a scientific statement for health professionals from the American Heart Association. *Circulation*. 2017;135(17):e927-e999. doi:[10.1161/CIR.0000000000000484](#).
- Son MBF, Newburger JW. Kawasaki disease. *Pediatr Rev*. 2018;39(2):78-90. doi:[10.1542/pir.2016-0182](#).

### Question 3

The girl in this vignette demonstrates clinical signs and symptoms consistent with Kawasaki disease (KD). A complete blood cell count with differential, comprehensive metabolic panel, C-reactive protein level, erythrocyte sedimentation rate, and urinalysis will add to the diagnosis and guide treatment. Kawasaki disease is associated with vasculitis of coronary and other medium-sized, extraparenchymal arteries. Early initiation of treatment with intravenous immunoglobulin and high-dose aspirin can mitigate long-term effects on coronary vessels.

The etiology of KD remains unknown. There is no gold-standard diagnostic test; thus, the diagnosis is based on clinical and laboratory criteria. Kawasaki disease should be suspected in a child with a fever, typically greater than 39°C, for at least 5 days' duration. The diagnosis is made from the fever along with other signs and symptoms as described in suggested reading 1 (<http://circ.ahajournals.org/content/110/17/2747>). More than 90% of children with KD have bilateral, nonexudative, limbic-sparing conjunctivitis (**Item C141**). A diffusely erythematous oropharynx with cracked lips and a strawberry tongue are often seen, but oral ulcers and tonsillar exudate are not typical for KD. The hands and feet are often swollen early in the course, and a desquamating rash on distal fingers and toes is common. Bullae and vesicles are not typically seen.

Clinical features including arthritis and arthralgia, vomiting and diarrhea, abdominal pain, extreme irritability, testicular swelling, and a desquamating rash in the groin, are associated with KD and can mimic other conditions. Children with suspected KD based on clinical and/or laboratory findings should undergo echocardiography to assess for coronary artery abnormalities and overall heart function. If coronary abnormalities are seen, the child should be treated for KD, regardless of whether all criteria are met.

Infants and children with some criteria for KD, but not quite meeting the clinical case definition, should be assessed for "incomplete KD." Nearly all children with KD have elevated inflammatory markers. Therefore, children with a C-reactive protein level less than 3.0 mg/dL (286 nmol/L) and erythrocyte sedimentation rate less than 40 mm/h should be evaluated daily for continued fever and change in laboratory values. If peeling of the distal hands or feet is seen, echocardiography should be performed. If the C-reactive protein level is 3.0 mg/dL (286 nmol/L) or greater or the erythrocyte sedimentation rate is 40 mm/h or greater, the clinician should assess for whether the child meets other laboratory criteria as described in suggested reading 1 (<http://circ.ahajournals.org/content/110/17/2747>). For those with fewer than 3 other criteria, echocardiography is recommended. If vascular changes are seen on echocardiography, treatment is recommended. If no changes are seen, echocardiography should be repeated if fever persists. If 3 or more other laboratory criteria are met, the child should undergo echocardiography and be treated for KD. For infants 6 months of age and younger who have had at least 7 days of fever without other clinical criteria, laboratory testing should be done to determine if laboratory criteria for KD are met.

Viral and bacterial infections, particularly adenovirus infection and streptococcal pharyngitis, may also present in a similar fashion to KD and should be excluded before treating for KD. Therefore, a broad viral respiratory panel and rapid antigen testing for streptococcal pharyngitis may be helpful; however, positive results alone do not exclude KD. While Epstein-Barr virus infection can present similarly to KD, a heterophile antibody test has a high false-negative rate in younger children. Because the child in this vignette has no respiratory symptoms and is fully immunized, chest radiography and blood culture are not indicated. A typically developing 3-year-old should be able to report dysuria; in the absence of dysuria, a urinary tract infection is less likely. A serum measles IgM antibody test and, in certain circumstances, viral culture from a nasopharyngeal sample can diagnose measles. However, measles prevalence is much less likely in this vaccinated child and in the absence of an epidemic; decisions around testing for measles in this context should be done in consultation with public health officials.

#### PREP Pearls

- Kawasaki disease should be suspected in a child with fever for several days, even when signs and symptoms less common in Kawasaki disease (eg, headache, vomiting) are present.
- Infants younger than 6 months with Kawasaki disease can present with fever and few or no accompanying clinical features. Echocardiography is recommended in these infants with fever for 7 or more days and elevated inflammatory marker levels.

#### Suggested Readings

- Newburger JW, Takahashi M, Gerber MA, et al. Diagnosis, treatment, and long-term management of Kawasaki disease: a statement for health professionals from the Committee on Rheumatic Fever, Endocarditis and Kawasaki Disease, Council on Cardiovascular Disease in the Young. American Heart Association. *Circulation*. 2004;110(17):2751. (<http://circ.ahajournals.org/content/110/17/2747>).
- Son MB, Newburger JW. Kawasaki disease. *Pediatr Rev*. 2013;34(4):151-162. doi:[10.1542/pir.34-4-151](https://doi.org/10.1542/pir.34-4-151).



#### **Question 4**

A subset of patients do not meet all the criteria for diagnosis of KD, yet they are believed to have “incomplete” KD and should be treated. These include:

- infants with fever for  $\geq 7$  days with no other explanation
- or
- children with fever for  $\geq 5$  days and 2 or 3 principal criteria who have a C-reactive protein  $\geq 3$  mg/dL and/or an erythrocyte sedimentation rate  $\geq 40$  mm/h
- and
- either positive echocardiography findings
    - (coronary abnormalities, myocardial dysfunction, or valvular dysfunction)
- or
- $\geq 3$  supportive laboratory findings
    - anemia
    - thrombocytosis
    - hypoalbuminemia
    - elevated alanine aminotransferase
    - white blood cell count [WBC]  $\geq 15,000/\mu\text{L}$  [ $15 \times 10^9/\text{L}$ ] or  $\geq 10$  WBC/high-power field in the urine

Alanine aminotransferase of 20 U/L is within the normal range, and does not support a diagnosis of incomplete KD. It is also worth highlighting that sterile pyuria in KD is due to urethritis, and as a result, it is possible to have a normal urinalysis obtained by suprapubic aspiration or catheterization, which bypass the urethra.

#### **Question 5**

The girl in this vignette has Stevens-Johnson syndrome (SJS). Treatment is supportive, although it is essential that potentially causative medications be discontinued immediately. Studies have not shown conclusive benefit from intravenous immunoglobulin or corticosteroid administration. Although secondary bacterial infections are common, prophylactic antibiotics are not indicated and have been associated with increased mortality.

Stevens-Johnson syndrome and toxic epidermal necrolysis (TEN) are manifestations of the same pathologic process of cell-mediated epidermal and mucosal necrosis. The 2 conditions differ in the extent of skin involvement, with less than 10% of a patient's body surface area affected in SJS, 10% to 30% affected in SJS/TEN overlap, and more than 30% of the body surface area affected in TEN. Medications are believed to be the most common trigger of SJS and TEN in children, and many other cases are associated with infection. Common triggers include nonsteroidal anti-inflammatory medications, sulfa-containing antibiotics, phenobarbital, carbamazepine, and lamotrigine, as well as infections with *Mycoplasma pneumoniae*, cytomegalovirus, herpes simplex virus, and hepatitis A virus.

Patients with SJS/TEN typically present with fever, myalgias, malaise, and other flu-like symptoms. Several days later, patients develop macules with purpuric centers that evolve into vesicles and bullae, as well as mucosal lesions. Large areas of skin may detach. Ocular signs and symptoms can include eye pain, photophobia, purulent conjunctivitis, keratitis, and endophthalmitis. Mucosal symptoms may include stomatitis, vaginitis, and urethritis. Extensive skin involvement can cause fluid and protein loss, pain, and hypothermia, and in severe cases, can lead to hypovolemic shock and multiorgan failure. Secondary bacterial infections and sepsis are the leading causes of mortality in patients with SJS/TEN.

Morbidity and mortality are reduced with early diagnosis and early discontinuation of causative medications. Treatment is supportive, with careful attention to pain management, fluid and electrolyte balance, and wound care. Patients may require transfer to a burn center for comprehensive wound care.

It is important to distinguish SJS/TEN from erythema multiforme (EM). Patients with EM do not have systemic symptoms of fever and malaise. Skin lesions in EM are targetoid without epidermal detachment, and patients have either little or no mucosal involvement ([Item C55](#)).

#### **PREP Pearls**

- Stevens-Johnson syndrome and toxic epidermal necrolysis are presentations along a spectrum of disease severity.
- Patients with Stevens-Johnson syndrome/toxic epidermal necrolysis present with fever and flu-like symptoms followed by macules with purpuric centers that develop into vesicles and bullae. Patients typically have mucosal involvement (conjunctivitis, stomatitis, urethritis, and/or vaginitis).

- In children, Stevens-Johnson syndrome/toxic epidermal necrolysis is commonly triggered by medications (eg, nonsteroidal anti-inflammatory drugs, sulfa-containing antibiotics, and antiepileptic medications) or infections (eg, *Mycoplasma pneumoniae*, cytomegalovirus, herpes simplex virus, and hepatitis A virus).
- Treatment for Stevens-Johnson syndrome/toxic epidermal necrolysis requires the prompt removal of any potentially causative medications and supportive care, with attention to pain management, fluid and electrolyte status, and wound care.

### **Suggested Readings**

- Alerhand S, Cassella C, Koyfman A. Stevens-Johnson syndrome and toxic epidermal necrolysis in the pediatric population: a review. *Pediatr Emerg Care*. 2016;32(7):472-476. doi: [10.1097/pec.0000000000000840](https://doi.org/10.1097/pec.0000000000000840).
- Ferrandiz-Pulido C, Garcia-Patos V. A review of causes of Stevens-Johnson syndrome and toxic epidermal necrolysis in children. *Arch Dis Child*. 2013;98(12):998-1003. doi: [10.1136/archdischild-2013-303718](https://doi.org/10.1136/archdischild-2013-303718).
- Powers S, Carter-Beard G. Rash, eye pain, lesions in an adolescent. *Pediatr Rev*. 2010;31(12):e86-e90. doi: [10.1542/pir.31-12-e86](https://doi.org/10.1542/pir.31-12-e86).

### **Question 6**

The patient described in this vignette has the symptoms of Kawasaki disease (KD) and is in a high risk demographic group for development of complications. The laboratory data is consistent with KD including pyuria, elevated inflammatory makers, and evidence of hepatic involvement. Patients with persistent fever despite treatment with IVIG are at a higher risk of coronary artery aneurysm (CAA) development. For the boy in this vignette, the best next step in management is to administer a second dose of IVIG. A second dose of IVIG, infliximab, or steroids, as well as continuation of high dose ASA, are among the recommendations in this situation. Treatment with IVIG will help prevent development of CAA. A very high risk group for development of CAA are younger male children of Asian heritage, such as described in the vignette. In less complicated cases where the patient becomes afebrile after initial IVIG administration, the high dose ASA is decreased to low dose ASA.

### **Question 7**

The most appropriate answer is C. delay live virus vaccines for 11 months. Per AAP Red Book guidelines, measles- or varicella-containing vaccines are contraindicated for 11 months after treatment of KD with IVIG. Use of IVIG can be associated with low-grade fevers within the first 48 hours of administration. However, the development of a fever after 36 hours from the end of the initial IVIG infusion would be considered evidence of IVIG-resistant Kawasaki disease. Therefore, the patient should return to the emergency department if her fever returns AFTER 36 hours from the end of the infusion. While there is some practice variation in the dosing and duration of aspirin therapy, it would not be appropriate to continue high-dose aspirin for 6 weeks in a patient with normal echocardiography. Some practitioners continue high-dose aspirin until patients are afebrile for 48 hours, while others continue high-dose aspirin for 2 weeks, before transitioning to low-dose aspirin. At 6 weeks, low-dose aspirin treatment is typically discontinued if the echocardiogram is normal. At a minimum, it is recommended that echocardiography be performed at diagnosis, 1 to 2 weeks later, and 5 to 6 weeks after discharge. Patients with evidence of coronary artery dilatation require more frequent monitoring to inform treatment decisions. Close cardiology follow-up is essential, and waiting 6 weeks for follow-up would not be appropriate. This patient should follow-up with cardiology within 1 to 2 weeks of discharge.

### **Question 8**

This patient's presentation is consistent with Kawasaki disease shock syndrome. While the patient has only had 4 days of fever, in the presence of all 5 clinical symptoms typical of Kawasaki disease (KD) a diagnosis can be made after only 3-4 days of fever. The hemodynamic instability in these patients can be the result of myocardial dysfunction, peripheral vasodilation, hypovolemia, or a combination of any of these phenomena. Thus, an echocardiogram is an important testing modality to look for myocardial dysfunction and/or coronary artery involvement, however treatment should not be delayed once the clinical diagnosis has been made. In this case, the patient is tachycardic, hypotensive, with delayed capillary refill and historical and physical exam findings consistent with hypovolemia. While a pressor might eventually be necessary, the best first step would be volume resuscitation. Since the status of the cardiac function is unknown, it would be reasonable to give 10 cc/kg as opposed to 20 cc/kg to ensure the patient responds well to therapy without developing pulmonary edema. IVIG and high-dose aspirin are the treatments of choice for KD shock syndrome and typically result in a dramatic and rapid improvement in symptoms, however rapid correction of the patient's shock is the most important initial therapeutic intervention. While occult infection plus sepsis needs to be considered in the



differential diagnosis, the clinical picture of KD is so clear in this case that delaying therapy to obtain a lumbar puncture or bladder catheterization would not be advisable.