MIS-C (MULTISYSTEM INFLAMMATORY SYNDROME IN CHILDREN)

Abstract

Multisystem inflammatory syndrome in children (MIS-C) is also called as Pediatric Inflammatory multisystem syndrome (PIMS). It is a serious condition which associated with the Covid- 19. The children affected from the corona virus shows minor symptoms, but they develop the major organs inflammation. The exact cause is unknown. The children develop signs and symptoms associated with major organ involvement and shows significant laboratory Investigation changes. The treatment followed by the symptoms of the children but the prevention is the major cure for the disease. It is a treatable condition and the children shows better prognosis on proper and early treatment.

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I. INTRODUCTION

Multisystem inflammatory syndrome in children (MIS-C) is a serious disease that has link with covid-19. This condition is also called as Pediatric Inflammatory Multisystem Syndrome (PIMS). Children affected with corona virus had only mild symptoms but they develop MIS-C as a complication of the Covid-19 infection. Some of the body organs in the children got severely inflamed due to the infection. Organs and tissues severely inflamed are skin, eyes, lungs, heart, gastrointestinal system, kidneys and blood vessels. Signs and symptoms develops depend the organ or tissue inflammation. The U.S centers for Disease Control and Prevention (CDC) and the National Institutes of Health are working seriously with researchers and doctors to find the risk factors, early diagnosis and treatment on the MIS-C.

II. CAUSES

The exact causes of MIS-C is yet unknown. The children develops excessive immune system response that related to Covid-19. If children with MIS-C have positive antibody results, it means that the children have recently infected with Covid-19. Some of the children have the current positive results with the Covid-19 infection.

III. RISK FACTORS

The children aged between 3 to 12 years old (in average school age children) have infected more with MIS-C.

1. **Emergency warning signs of MIS-C**
   - Depend on skin tone- Pale, grey or blue colored skin, lips and nail beds
   - Inability to stay awaken or wake up
   - New confusions
   - Breathing difficulty
   - Severe abdominal pain

2. **Symptoms:** Multisystem inflammatory syndrome in children develops the signs and symptoms such as

   - Fever (lasts for 24 hours or even three to four days longer)
   - Unusual extra tried
   - Skin and mucous membrane symptoms:
     - Skin rashes (red spots, blotches or bumps), bloodshot eyes, cracked lips, swollen tongue, swollen or red extremities and inflamed mucous membrane in the mouth.
   - Respiratory symptoms
     - Cough and shortness of breath
   - Cardiovascular symptoms
     - Cold or clammy skin, breathing difficulty, low blood pressure, dizziness or light headedness, increased or irregular heart rate, shock, myocardial dysfunction, myocarditis, pericarditis, valvulitis, coronary abnormalities, elevated troponin, NT-proBNP.

- Gastrointestinal symptoms
  - Abdominal pain, vomiting and diarrhea
- Hematological system
  - Coagulopathy/ raised PT, APTT, D-dimer, elevated CRP, Procalcitonin
- Lymphatic system
  - Lymph node enlargement
- Neurological system
  - Headache, neck pain, tingling or numbness of hands and feet and seizures
  - The symptoms are not same to every child. They show symptoms with different combinations.

IV. LABORATORY TESTS

The laboratory investigations have tier 1 and tier 2.

1. Tier 1 tests are

- Complete blood count (CBC)
- C-Reactive protein (CPR)
- Erythrocyte sedimentation rate (ESR)
- Reverse transcription polymerase chain reaction (RT-PCR)
- Rapid antigen test (RAT)
- Liver function test (LFT)
- Renal function test (RFT)
- Electrolyte markers
- Random blood sugar (RBS)
- Blood gas analysis
- Serological test(SARS-CoV-2 serologic test is suggested (It should be taken before administering intravenous immunoglobulin (IVIG) or any other exogenous antibody treatment).

- (**Note:** Tier 2 tests should be done on –
  - If these test are positive, CRP > 5mg/dl, ESR > 40 mm/hr, ALC < 1000, platelets < 1,50,000, Na <135, hypoalbuminemia, neurophilia.
  - If tier 1 is negative, look for alternative diagnosis)

2. Tier 2 tests are

- Electrocardiogram (ECG)
- Echocardiogram (ECHO)
- Brain natriuretic peptide (BNP)
- Troponin test
- Fibrinogen
- Lactate dehydrogenase (LDH)
- Ferritin
- Triglyceride
- Prothrombin time (PT)

- Activated partial thromboplastin time (APTT)
- D-dimer test
- Procalcitonin
- Interleukin – 6 test (IL- 6)

(**Note:** If the child is sick/ shock/ hypotension, both tier tests should be done)

V. TREATMENT

If the child have any of the symptoms of MIS-C, hospitalization is necessary. The primary supportive and symptomatic treatment against the inflammatory process are

- Administer intravenous immunoglobulin (IVIG) – 2gm/kg on two consecutive days (max 200 gm)
- IV methyl prednisolone 1- 2 mg/ kg/ day (max 1 gm)- changed to oral dexamethasone / prednisolone after 3- 5 days, then tapered by 25% every week and stop after 3- 4 weeks.
- Aspirin 3- 5 mg/ kg (max 81 mg) - avoid in bleeding or thrombocytopenia < 80000
- ECHO – 2 week and 6 week, if coronary involvement is there, follow ECHO regularly till coronaries became normal along with aspirin.
- Fluid resuscitation
- Respiratory support
- Thrombotic prophylaxis is given for hypercoagulable patients.
- In severe cases, extracorporeal membranous oxygenation (EMCO)

1. **Treatment – Follow up:** After the discharge of the child from hospital, the follow up care should be taken such as
   - CBC, CRP should be repeated 1 week after discharge
   - If CRP is normal, steroids can be tapered and stopped
   - No NSAID’s ahould be administered if the child is in Aspirin
   - Limit the exercises or strenous activities for 2 weeks to 2 months
   - It ic not recommended to tak e live viral vaccines for next 8 months after IVIG.

2. **Prevention:** The CDC recommends the following steps to prevent from the exposure of the Covid-19 disease

   - **Hand Wash:** Wash hands for 20 minutes with soap and water. In the absence of soap, frequently clean the hands with hand sanitizer that should contain 60% of alcohol.

   - **Wear Mask:** Wear face mask in indoor places where it is crowded. It is compulsory to wear a face in outdoor areas. If the child is atleast 2 years old, it is necessary to wear the face mask that should cover nose and mouth. Proper handling of face mask and disposal should be maintained.

   - **Practice Social Distancing:** Keep the child at least 6 feet (2 meters) away from other people.

- **Avoid Touching Eyes, Nose And Mouth:** Encourage the child to avoid touching his/ her face.

- Cover the mouth with tissues or hand kerchief when the children cough or sneeze Educate the children to use tissues or hand kerchief while coughing or sneezing to avoid the spread of germs.

- **Avoid people Who Are Sick:** Avoid visiting people who are having the symptoms of covid-19. Avoid the children to get in contact with them.

- **Clean and Disinfect High-Touch Surfaces Every Day:** Clean the high- touch surface with disinfect solutions. High-touch surface such as door knobs, handles, side rails, switches, remotes, tables, chairs, keyboards, faucets, toilets. It is necessary to clean the toys of the children with appropriate measures.

- **Wash The Clothes:** Wash clothes after every use. Wash the clothes with soap or detergents.

3. **Complications:** MIS-C can lead to further complications to vital organs such as heart, lungs and kidneys. In rare cases, MIS-C can lead to permanent damage to vital organs. This can even lead to death.

4. **Prognosis:** MIS-C is completely a treatable condition. Most of the children recover fully from the illness with early diagnosis, correct time attention and with proper medical treatments.

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