DISTINGUISHING MULTISYSTEM INFLAMMATORY SYNDROME IN CHILDREN FROM TYPHUS USING ARTIFICIAL INTELLIGENCE

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Background: Multisystem inflammatory syndrome in children (MIS-C) following SARS-CoV-2 infection shares common features with several other inflammatory states, most notably Kawasaki Disease. The bacterial infection of murine typhus is also in the differential for MIS-C in endemic areas, including Texas. As the therapeutic approaches to these disorders differ, it is essential to distinguish them as soon as possible after presentation (i.e., well before serologic testing can confirm typhus). Our objective was to develop a computer algorithm to accurately predict MIS-C v typhus.

Materials/Methods: Retrospective chart review was used to compare the first surge of MIS-C patients (56) admitted to the TCH system (through November 2020) with the 50 patients admitted in 2020 and ultimately diagnosed with typhus. Demographic, clinical, and laboratory features available within 6 hours of presentation (43 elements) were extracted by record review. Elements were passed through an attention module that computed their importance, then entered into a long-term, short-term memory (LSTM) network classified as MIS-C or Typhus. The patients were divided into training and test cohorts respecting their proportion in the dataset.

Results: Compared to typhus patients, MIS-C patients were younger (8.4 v 11.2 years, p=0.004) and slightly more male (59% v 52%). More identified as Hispanic (84% v 49%, p=0.0002) or Black (23% v 8.5%, p=0.045). The majority (71%) of MIS-C patients presented on day 4-6 of fever, but most (84%) typhus patients presented with ≥6 days (4.9 v 7.3 days, p<0.0001). Typhus patients were more likely to have rash (86% v 51%, p=0.001) and MIS-C patients to have red eyes (71% v 36%, p=0.0003) and oromucosal changes (32% v 12%, p=0.013), other clinical features were similar. MIS-C patients had higher C-reactive protein (17.7 v 9.8 mg/dL), fibrinogen (558 v 394 mg/dL) and neutrophil-to-lymphocyte ratio (12 v 3.5), all p<0.0001, but other laboratory parameters were similar. MIS-C patients were more likely to require ICU admission than patients with typhus (66% v 6%, p<0.0001). Using the 43 elements, our LSTM model predicts the diagnosis on the test cohort with > 95% accuracy.

Conclusions: The clinical and laboratory similarities between typhus and MIS-C present a diagnostic challenge. Our interprofessional collaboration has brought timely diagnosis, days before serologic testing results, within reach. Studies are ongoing to refine the model, including reducing the number of features while maintaining diagnostic accuracy.

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