



# Echocardiographic Assessment of Strain and Associations with Markers of Clinical Severity in Multisystem Inflammatory Syndrome in Children (MIS-C) Associated with COVID-19

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# Research Mentors

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# Aims

- Describe echocardiographic findings and incidence of strain abnormalities in MIS-C patients at sub-acute follow-up
- Evaluate for persistent abnormalities in function (including strain) in MIS-C at sub-acute follow-up
- Evaluate for associations between follow-up strain abnormalities and markers of clinical severity during hospitalization in MIS-C



# Methods

- Retrospective case control study/retrospective cohort study
- **Inclusion Criteria:** Patients < 22yo diagnosed with MIS-C at Lurie from March 2020 - March 2021 (CDC/WHO criteria) with 3-10 week follow-up
- **Exclusion Criteria:**
  - CKD, chronic HTN, malignancy, or preceding cardiac disease (CHD, cardiomyopathy, known systolic or diastolic dysfunction prior to MIS-C)
  - No follow-up echo available (excluded from strain analysis portion)
  - Poor echo quality (precluding strain measurements)



# Methods

- Clinical and demographic data via retrospective Epic chart review
- Speckle tracking echocardiography using TomTec CPA for strain
  - GLS: Global longitudinal strain
  - 4C-LS: 4-chamber longitudinal strain
  - CS: Circumferential strain (mid-ventricle)
  - LAS: left atrial strain
- Age and gender matched controls



# Results: MIS-C at Lurie

- 60 admissions from March 2020-March 2021
- Mean age 8.9 years (1-17 yo), 58% male
  
- 65% had hypotension
- 57% admitted to ICU
- 45% received inotropic support
- 7% intubated/ventilated
- No ECMO or mortality
- Mean LOS 8 +/- 3 days



# MIS-C at Lurie: Race/Ethnicity

- Cohort: 39% Hispanic, 29% African-American, 27% White
- Total hospital days (though not statistically significant with  $p=0.36$ ):
  - Hispanic: **Median 8** (IQR 6-10)
  - African-American: **Median 7** (IQR 6-9)
  - White/Other: **Median 6** (IQR 6-7.5)
- No differences in clinical severity markers or in follow up strain values by race/ethnicity



# Labs

- **97% COVID Ab +** (one presumed seronegative MIS-C presentation)
- 26% COVID PCR +
- Peak inflammatory markers: Median ESR 71, **Mean CRP 17.5** (SD 7.9)



# Troponin and NT-proBNP

- Troponin elevated in **17%** of patients
  - Higher peak troponin **associated with hypotension** in univariate analysis only ( $p=0.04$ )
  - Higher peak troponin was not associated with ICU admission or strain values at follow-up
- Median peak **NT-proBNP: 5,321** (IQR 1,712-17,425)
  - Higher peak NTproBNP was associated with hypotension ( $p=0.04$ ), ICU admit ( $p=0.03$ ), and total ICU days ( $p=0.004$ ),
  - NT-proBNP not associated with strain at follow-up



# LV Function and Strain

- **LV EF <55% in 28% during hospitalization**
  - Median lowest EF during hospitalization: 57% (IQR 52-61)
- **LV EF <55% in 6% at follow-up**
  - Median EF at 3-10 week follow up: 65% (IQR 61-67)
- **Strain at sub-acute follow-up:**
  - Mean GLS: -20.4% +/- 2.8%
  - Mean 4C-LS: -20.6% +/- 3.1%
  - Mean CS: -26% +/- 3%
  - Mean LAS: -34.5% +/- 10.7%



# Results

- Higher **peak CRP** was associated with
  - ICU admission (**13.9 vs 20.2**,  $p=0.03$ ), hypotension, and total ICU days
  - **Lower CS ( $p=0.04$ ) and GLS ( $p=0.03$ ) at sub-acute follow-up**
- Lower EF during hospitalization and any EF  $<55\%$  were associated with ICU admission ( $p=0.04$ ,  $p=0.03$  respectively)
- Total LOS and ICU LOS were associated with lower GCS at 3-10 wk follow up ( $p=0.04$ )



# Limitations

- 60 MIS-C patients, though only 45 for strain analyses
  - 13/60 did not have an echo 3-10 weeks post discharge, 1 followed up elsewhere, 1 excluded due to pre-existing LVH
- No large datasets establishing normative strain values in pediatrics (particularly TomTec-based)
  - Addressed with age-matched controls



# Conclusions

- **Circumferential and left atrial strain are decreased** at sub-acute follow-up in MIS-C despite normal LVEF
- **Total LOS and ICU LOS** were associated with **lower CS** at follow-up
- In-hospital **peak NT-proBNP** was associated with **markers of clinical severity** (hypotension, ICU admit, ICU LOS), but not with follow-up strain
- **Peak CRP** was associated with multiple **markers of clinical severity** (ICU admit, hypotension, ICU LOS) as well as lower strain at sub-acute follow-up (CS, GLS) in MIS-C



# Clinical Impact

- We hope our findings may assist in risk stratification and outpatient follow-up guidance, with awareness that long-term sequelae are not well known and return to play precautions are not yet well established



# Thank You!

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