The Front Lines of the Fight Against COVID-19

A TOWN HALL CONVERSATION XIV

We will begin at 10 a.m.

Hosted by the Houston Methodist DeBakey Heart & Vascular Center Council and the Houston Methodist Women’s Health Task Force
How does an acute COVID-19 infection cause heart injury?

- Elevated heart blood biomarkers (troponin I and BNP) signify heart injury
  - Studies suggest injury most often is not due directly to the virus but to the body’s inflammatory and blood clotting responses to the virus
  - Autoantibodies (AB)
  - Super-activated white blood cells (WBC)

Plaque in right coronary artery

AB: Macro/micro thrombosis
WBC: Plaque Rupture/heart attack
https://labblog.uofmhealth.org
How does an acute COVID-19 infection cause heart injury?

- COVID-19 infection frequently causes hypoxia (low oxygen concentration in the blood) due to pneumonia, fast heart rates, low blood pressure which increases the amount of oxygen the heart needs to function. The heart normally receives more oxygen by increasing blood flow through expansion of the coronary arteries in the heart.

- People with underlying coronary artery disease are at high risk for heart injury during COVID-19 infection because blockages prevent the blood vessels in the heart from expanding to provide increased blood flow/more oxygen to the heart muscle.
How does an acute COVID-19 infection cause heart injury?

• In rare cases COVID-19 virus can directly attack the heart muscle (myocarditis) causing chest pain, heart failure, and abnormal heart rhythms (atrial fibrillation, ventricular fibrillation, ventricular tachycardia) in < 1% of patients.

• Cardiac MRI (CMR) is the best way to diagnose myocarditis after all other COVID-19 heart affects have been excluded.

• If CMR supports the diagnosis of myocarditis, AHA/ACC myocarditis guidelines for athletes advocate a 6-month holiday from the sport.

https://www.acc.org
How does an acute COVID-19 infection cause heart injury?

- Heart failure can also develop during an acute COVID-19 infection due to the severe stress placed on the heart during the infection (stress cardiomyopathy or Takotsubo’s cardiomyopathy).

- Regardless of the exact mechanism of the elevated heart blood biomarkers (troponin I and BNP) the higher the level of these biomarkers the greater the risk of death from the COVID-19 infection.

- Echocardiography is the first line imaging modality used to determine how COVID-19 is affecting the heart during an acute infection.
How does long COVID affect the heart?

• “Long COVID” is lingering symptoms that persist beyond the acute infection and may include: fatigue, brain fog, shortness of breath, chest pain, and dysautonomia or POTS (Postural Orthostatic Tachycardia Syndrome) like syndrome.

• 60-80% of discharged patients reported at least one of these symptoms 50 days following COVID-19 diagnosis, 35% non-hospitalized reported long COVID symptoms 14-21 days after initial diagnosis.
How does long COVID affect the heart?

• Those with fatigue, shortness of breath and chest pain should be screened for myocarditis with heart blood biomarkers, inflammatory markers, ECG, echocardiography and, if these suggest myocarditis, CMR.

• Dysautonomia/POTS treatment is currently supportive (home blood pressure and pulse logs, push fluids, salt, midodrine, beta blockers, ivabradine).

https://www.acc.org
COVID-19 Pandemic Affects on Patients with Heart Disease

- Stress from the COVID-19 pandemic has led to high blood pressure, poor sleep habits, overeating, unhealthy food choices, weight gain, increased use of tobacco and other drugs.
- Fear and anxiety have led to missed appointments to manage these risk factors in patients with heart disease.
- Telehealth and home-based cardiac rehab can help physicians meet the pent-up demand for preventive services.

https://www.acc.org
Innovations in Imaging for Limb Threatening Ischemia

Trisha Roy MD PhD FRCSC

May 13, 2021
Limb Threatening Ischemia

Arteries become narrowed and blood flow decreases in arteriosclerosis

Build up of fatty substances in the wall of the artery
Limb Threatening Ischemia

1 Year Amputation Rate: ~20-25%
1 Year Mortality: ~20%

COVID-19 & Limb Threatening Ischemia

Impact of the COVID-19 Lockdown Strategy on Vascular Surgery Practice: More Major Amputations than Usual

Puck M.E. Schuivens,1 Manon Buijs,1 Leandra Boonman-de Winter,2 Eelco J. Veen,1 Hans G.W. de Groot,1 Thijs G. Buimer,1 Gwan H. Ho,1 and Lijckle van der Laan,1,3 Breda, the Netherlands and Leuven Belgium
How does COVID-19 cause Limb Threatening Ischemia?

Source: NETEC
How does COVID-19 cause Limb Threatening Ischemia?

Source: NETEC
How does COVID-19 cause Limb Threatening Ischemia?

COVID-19 plays a role in activating all 3 elements of “Virchow’s Triad”
Treatment Options

Angiogram with narrowed artery revealed

X-ray area
Femoral artery
Catheter injecting contrast

ENDOVASCULAR WITH BALLOON & STENT
Roy et al. PAD in era of precision medicine. JEVT 2016 23(5):751-761
Many Treatment Options

- Thin Cap Fibroatheroma
- Fibrous Plaque
- Pathological Intimal Thickening
- Chronic Total Occlusion
- Diffuse Speckled Calcium
- Acute Thrombus/Calcified Nodule
- Concentric Calcium

- collagen
- healed thrombus/decalcified tissue
- necrotic core
- smooth muscle
- acute thrombus
- calcium
### MRI-Histology

#### Images and Annotations:

- **MRI Scan:**
  - Highlighted area marked with a red circle and asterisk (C).

- **Histological Markers:**
  - Collagen
  - Necrotic core
  - Healed thrombus/dense fibrous tissue
  - Smooth muscle
  - Acute thrombus
  - Calcium (highlighted in red)

---

The MRI scan shows a detailed view of the highlighted area, indicating the presence of calcium, necrotic core, and other histological markers as labeled in the image.
MRI-Histology

CTA

MRI (UTE)

MRI (SSFP)

- Collagen
- Healed thrombus/dense fibrous tissue
- Necrotic core
- Smooth muscle
- Calcium
- Acute thrombus
MRI: Mechanical Properties

- T2W
- UTE
- μCT
- Movat’s Pentachrom

Force (N)

- HARD: 1.71
- SOFT: 0.40

N = 9
N = 25
Future Approach

Future Medicine
More Personalized Diagnostics

Adapted from: CrownBio
Thank You

Mentors
Dr. Alan Lumsden
Dr. Christof Karmonik
Dr. Dipan Shah

Post-Docs
Dr. Kavya Sinha
Dr. Marton Berczelli

Translational Imaging Center
Lien Phan
Vi Phan

Houston Methodist Research Institute
Clinician-Scientist Award

Jerold B. Katz Investigator Award
COVID-19 Vaccine Update

Town Hall, May 13, 2021

H. Dirk Sostman, MD FACR
Ernest Cockrell, Jr. Presidential Distinguished Chair
EVP & Chief Academic Officer
Real World Data on Vaccination

• Israel
  – 96% protection from infection
  – April 23 was first day in 7 months with 0 COVID deaths

• Scotland
  – Hospitalization reduced by 85% (Pfizer) and 94% (AstraZeneca)
  – 30% reduction in household contact infections after one dose

• England
  – Public Health England – vaccine efficacy 73% (AstraZeneca) to 89% (Pfizer)
  – Cambridge Health – 75% reduction in asymptomatic infection
  – Public Health England – 45% reduction in household transmission

• USA
  – Houston Methodist – reduced employees’ positive test rate 95%
  – St. Jude – 94% reduction in asymptomatic, 100% in symptomatic (2 doses)
  – CDC study – vaccination reduces incidence rate of all infections by 97%
## CDC Breakthrough Infection Data

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Infections</strong></td>
<td>92 / 1,000</td>
<td>0.74 / 1,000</td>
</tr>
<tr>
<td></td>
<td>Probably much higher</td>
<td>29% of the infections were asymptomatic</td>
</tr>
<tr>
<td><strong>Hospitalizations</strong></td>
<td>900 / 1,000,000</td>
<td>5.1 / 1,000,000</td>
</tr>
<tr>
<td></td>
<td>Probably much higher</td>
<td></td>
</tr>
<tr>
<td><strong>Deaths</strong></td>
<td>1,680 / 1,000,000</td>
<td>0.91 / 1,000,000</td>
</tr>
</tbody>
</table>
Why Get Two Doses?
Houston Methodist Patient Outcomes

- 91,134 patients
- January 1 – April 4, 2021
  - 70.2% not vaccinated
  - 4.5% had one dose of vaccine
  - 25.4% had two doses of vaccine
- 2,017 COVID hospitalization
- 225 COVID mortality

<table>
<thead>
<tr>
<th></th>
<th>Pfizer Vaccine</th>
<th>One Dose</th>
<th>Two Doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitalization</td>
<td>Prevention of</td>
<td>77%</td>
<td>96%</td>
</tr>
<tr>
<td>Prevention of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>Prevention of</td>
<td>64%</td>
<td>99%</td>
</tr>
</tbody>
</table>

Recommended interval between doses:
Pfizer 3 weeks, Moderna 4 weeks – CDC allows 6 weeks

Maximum possible interval is not known
Vaccine Safety Overview

Phase 3 Clinical Trials

- How many people received the vaccine?
  - Pfizer – 46,307
  - Moderna – 15,208
  - J&J – 23,190
- Severe reactions in vaccine groups?
  - Nothing beyond what was seen in placebo group or general population
- There is now 6 months of safety follow-up on thousands of people

Real World Experience

- Rare reactions seen with wide deployment of vaccines:
  - Small number of severe allergic reactions (mostly Moderna and Pfizer)
  - Extended duration of local reaction in injected arm (mostly Moderna)
  - Systemic rashes
  - Blood clot risk (J&J)
- 152 million people have been vaccinated in USA
- Pfizer vaccine approved for EUA in 12-15 year olds (May 10, 2021)
• Females 18 – 49
  – 667 hospitalizations prevented
  – 127 ICU admissions prevented
  – 12 deaths prevented
  – 13 cases of TTS

• Females > 50
  – 4,794 hospitalizations prevented
  – 1,292 ICU admissions prevented
  – 563 deaths prevented
  – 2 cases of TTS

Sara Oliver MD, ACIP Meeting April 23, 2021

I recommend women 18-49 consider getting Pfizer or Moderna vaccine
Emergency Use Authorization (EUA) vs. Approval

FDA SUMMARY: Criteria for EUA

• SARS-CoV-2 can cause a serious or life-threatening disease.
• Based on the totality of scientific evidence available, including data from adequate and well-controlled trials, it is reasonable to believe that the vaccine may be effective to prevent such serious or life-threatening disease.
• The known and potential benefits of the vaccine, when used to prevent the identified serious or life-threatening disease, outweigh the known and potential risks of the vaccine.
• There is no adequate, approved, and available alternative to the vaccine for preventing the disease or condition.

[Rule of thumb – EUA requires 2 months of safety follow-up, full approval requires >6 months. Pfizer will submit for full approval within a few weeks. Likely FDA will grant approval this year.]
Update on Vaccines and Viral Variants
# Viral Variants and Vaccines

<table>
<thead>
<tr>
<th>Vaccine Efficacy</th>
<th>D614G</th>
<th>UK – B.1.1.7</th>
<th>S Africa – B.1.351</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pfizer</td>
<td>95%</td>
<td>85% - 95%*</td>
<td>75% - 100%</td>
</tr>
<tr>
<td>Moderna mRNA-1273</td>
<td>94%</td>
<td>89%</td>
<td></td>
</tr>
<tr>
<td>J&amp;J</td>
<td>72%</td>
<td>72%</td>
<td>57%</td>
</tr>
<tr>
<td>Novavax</td>
<td>95%</td>
<td>89%</td>
<td>60% (HIV negative)</td>
</tr>
<tr>
<td>AstraZeneca</td>
<td>70%</td>
<td>76%</td>
<td>10%</td>
</tr>
</tbody>
</table>

*In vitro, similar slightly reduced potency against B.1.1.7, B.1.526 and P.1 variants

All vaccines show much reduced potency against B.1.351 in vitro

B.1.1.7 is 90+% of isolates in Houston
Country of Qatar

- B.1.1.7 = 44.5% of cases, B.1.351 = 50% of cases
- Prevention of infection
  - B.1.1.7 – 89.5%
  - B.1.351 – 75%
- Prevention of severe, critical or fatal disease
  - Any form of SARS-CoV-2 – 97.4%
  - B.1.1.7 or B.1.351 – 100%

Country of Israel

- B.1.1.7 = 95% of COVID cases
- Prevention of
  - Asymptomatic infection – 91.5%
  - Symptomatic infection – 97.0%
  - Hospitalization – 97.2%
  - Death – 96.7%
• Compared three options
  – Third shot of mRNA-1273
  – Booster of mRNA-1273.351 (optimized to SA variant)
  – 50:50 mixture

• Before booster
  – 6-8 months after primary vaccination
  – 92.5% had detectable titers against D614G
  – Only 50% had detectable titers against B.1.351 or P.1

• After booster versus B.1.351
  – GMT = 1400 for mRNA-1273.351
  – GMT = 864 for mRNA-1273
What Does the Future Hold?

• Something close to herd immunity is possible this year – with vaccines
  – Normal life with some additional precautions
  – COVID-19 becomes a “normal disease”

• S protein mutations – over time – will likely require updated vaccines
  – Need for surveillance of COVID mutations
  – mRNA technology well suited to respond to viral mutations
    • Science – several weeks
    • Regulatory – a few months
  – Annual COVID booster likely needed for the next several years

• Once first exposure to COVID is in childhood, may become a mild endemic illness – many years from now
  – Great pandemic of 1889-1890 “ Asiatic flu” killed 1 million people out of a world population of 1.5 billion
  – Probably coronavirus HCoV-OC43 jumping cattle → humans
  – HCoV-OC43 is now one cause of the common cold
Houston Methodist Testing Trend

Confirmed COVID-19 Lab Tests

- Positive COVID-19 Tests
- 7 Day Rolling Average of Percent of Positive Tests
New COVID-19 Cases Reported in U.S. by Day

MY TWO KEY TAKE HOME MESSAGES TODAY:

TRUST THE VACCINES!

GIVE US 45 DAYS!!
High vaccination rates and compliance with public health prevention measures are essential to control the COVID-19 pandemic and to prevent surges in hospitalizations and deaths in the coming months.
THE 3 VACCINEERS

ALL FOR ONE...

AND ONE FOR...

NOPE!
Uneven Willingness to Get Vaccinated Could Affect Herd Immunity

In some parts of the United States, inoculation rates may not reach the threshold needed to prevent the coronavirus from spreading easily.

Estimated share of adults who would “definitely” or “probably” get the vaccine

40  60  65  70  75  80  90%
How Likely Are You To Get The COVID-19 Vaccine When It Becomes Available To You?
Number of Vaccine Doses Administered by Day in the U.S.

New reported doses administered by day

2.16 million average doses per day

New doses — reported

https://www.nytimes.com/2021/05/03/health/covid-herd-immunity-vaccine.html
Starting in week 11, the labels on Pfizer vaccine vials were updated to increase the number of doses per vial from 5 to 6 doses.
Number of Vaccine Doses Administered by Week in the TMC

WEEKLY DOSES ADMINISTERED (ALL DOSES, 1ST AND 2ND) - TMC HOSPITAL SYSTEMS

May 9, 2021

[Bar chart showing weekly vaccine doses administered with specific dates and numbers]
Number of Vaccine Doses Administered by Week at HM

Vaccine Doses Administered by Week at Houston Methodist

<table>
<thead>
<tr>
<th>Week</th>
<th>1st Dose</th>
<th>2nd Dose</th>
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<tbody>
<tr>
<td>1</td>
<td>8,664</td>
<td>6,729</td>
</tr>
<tr>
<td>2</td>
<td>6,518</td>
<td>6,729</td>
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<tr>
<td>3</td>
<td>22,738</td>
<td>27,206</td>
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<td>4</td>
<td>18,587</td>
<td>23,353</td>
</tr>
<tr>
<td>5</td>
<td>23,353</td>
<td>22,393</td>
</tr>
<tr>
<td>6</td>
<td>32,282</td>
<td>50,398</td>
</tr>
<tr>
<td>7</td>
<td>56,326</td>
<td>50,364</td>
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<td>8</td>
<td>50,364</td>
<td>50,398</td>
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<td>9</td>
<td>37,744</td>
<td>39,727</td>
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<td>10</td>
<td>39,388</td>
<td>42,940</td>
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<td>11</td>
<td>48,508</td>
<td>44,648</td>
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<td>21</td>
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Individuals Vaccinated at HM by Day

Total First Doses: 383,413
Total Second Doses: 334,340
Children 12 to 15 Are Cleared By FDA to Get Pfizer Vaccine

U.S. health regulators have for the first time cleared a Covid-19 vaccine’s use in children, paving the way for many to be immunized before summer camps and the start of the next school year.

Millions of people ages 16 years and older have taken the shot from Pfizer Inc. and partner BioNTech SE. The U.S. Food and Drug Administration’s decision Monday widens the vaccine’s use to children as young as 12.

The move comes after a study of 2,260 adolescents found the two-dose shot...
Vaccine Clinics Accepting Walk-Ins

Get your Pfizer COVID-19 vaccine. Walk-ins welcome! Mon., Wed., Fri.: 8 a.m. - 5 p.m. and Tues., Thurs.: 8 a.m. - 7 p.m.
COVID-19 Vaccine Myths

MYTH #1
The vaccine can affect my DNA
Why it's false: The genetic material in COVID-19 vaccines cannot interact with or change your DNA in any way.

MYTH #2
A vaccine developed so quickly can't be safe
Why it's false: Available vaccines have undergone thorough testing and external review. These vaccines may seem new, but there's decades of research behind them.

MYTH #3
The vaccine can give me COVID-19
Why it's false: The mild side effects associated with the vaccines are a sign that your body is building immunity to the virus. These vaccines cannot give you COVID-19.

MYTH #4
The COVID-19 vaccine can affect my fertility
Why it's false: There's no data to suggest that these vaccines pose a risk to someone who is pregnant or wants to become pregnant.

MYTH #5
I don't need the vaccine because I've already had COVID-19
Why it's false: You may experience some level of immunity after having COVID-19, but it's unclear how long this protection might last.

MYTH #6
I don't need the vaccine because I'm young and healthy
Why it's false: Even mild COVID-19 can cause uncomfortable and/or lingering symptoms. Plus, even those who are young and healthy must be vaccinated to achieve herd immunity.

MYTH #7
I don't need to wear a mask after being vaccinated
Why it's false: Until herd immunity is reached, wearing a mask and social distancing continue to be important safety measures.
ROOT FOR THE ASTROS AND
GET YOUR COVID-19 VACCINE

SUNDAY, MAY 9, 11:10 A.M. – 1:10 P.M.
UNION STATION, MINUTE MAID PARK

HOUSTON Methodist
LEADING MEDICINE

OFFICIAL HEALTH CARE PROVIDER
Houston Methodist partnered with Houston Music Foundation, the Heights Theater and local musician Bun B to provide vaccines at the Heights Theater on May 5th.
Vaccine Mandate for Houston Methodist Employees

Houston hospital threatens to fire workers who refuse COVID-19 vaccine

A Texas hospital system will require employees to get the Covid-19 vaccine and could fire them if they don't comply

Houston Methodist Employee Vaccination Rates

- Fully Compliant and In Progress

Fully Compliant: 96.95%

Non-Compliant: 3.05%
MY TWO KEY TAKE HOME MESSAGES TODAY:

TRUST THE VACCINES!

GIVE US 45 DAYS!!
THANK YOU FOR ATTENDING OUR TOWN HALL CONVERSATION

If you’d like more information about women’s health or The Society for Leading Medicine, please contact us at foundation@houstonmethodist.org.

*Take care and be well*

[Logo: Houston Methodist Leading Medicine]