



UNIVERSITÄTS  
KLINIKUM  
HEIDELBERG

# SARS-CoV-2 Vaccination Autopsies

Institute of Pathology Heidelberg & COVID-19 Autopsy Registry BW  
September 2021 Prof. Dr. Peter Schirmacher



Baden-Württemberg

MINISTERIUM FÜR WISSENSCHAFT, FORSCHUNG UND KUNST

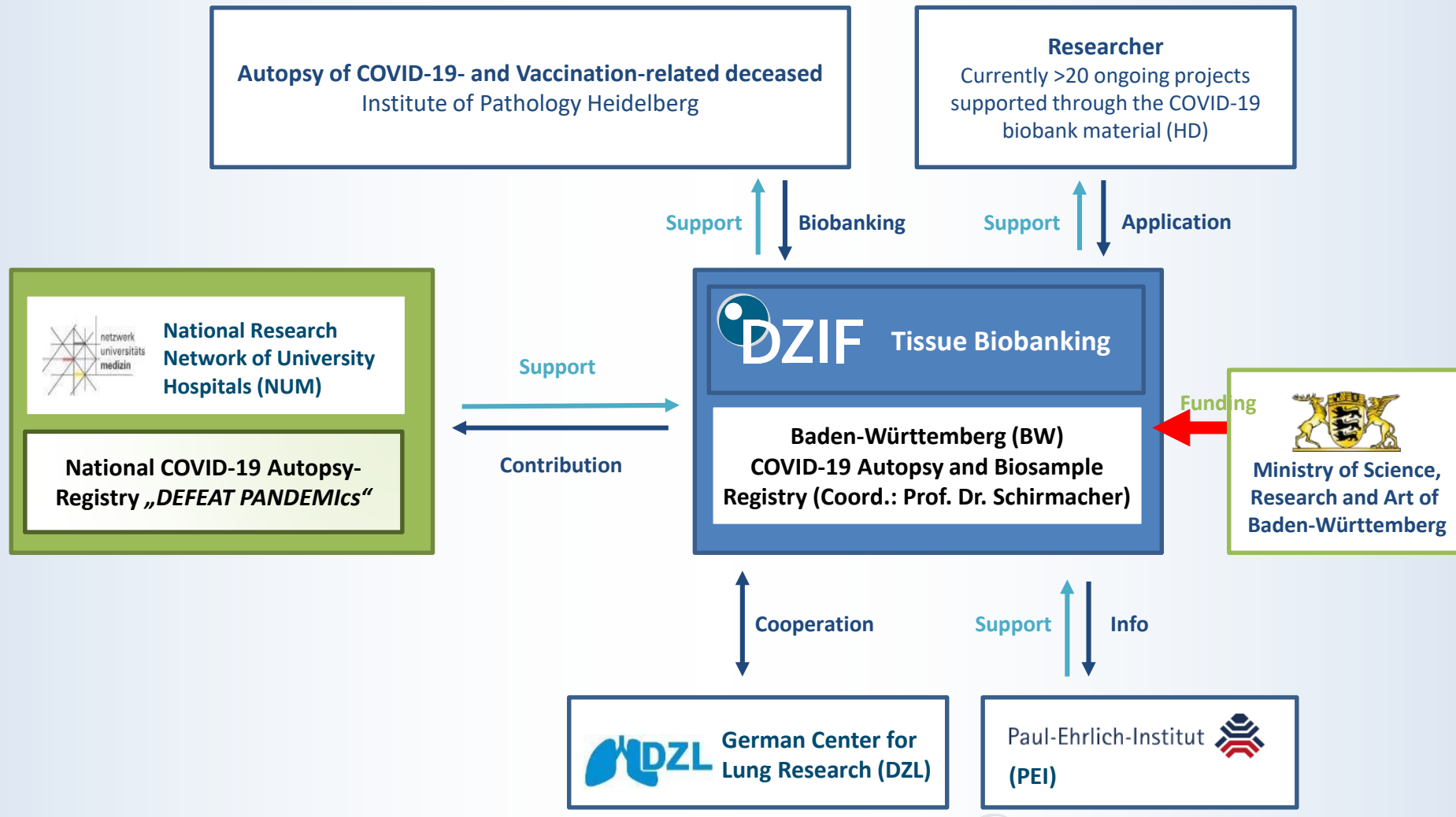


# COVID-Autopsy & Bioprobe Registry BW



Baden-Württemberg

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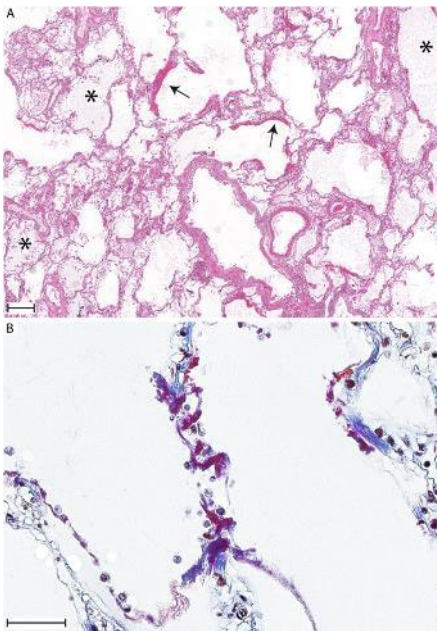
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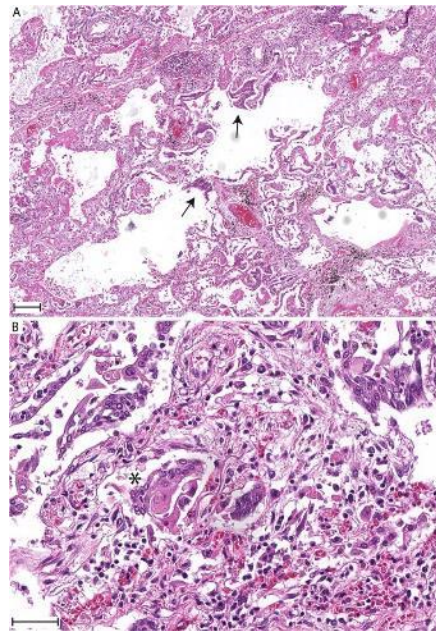
# COVID-19 Lung Pathology-Sequence

*Duration*

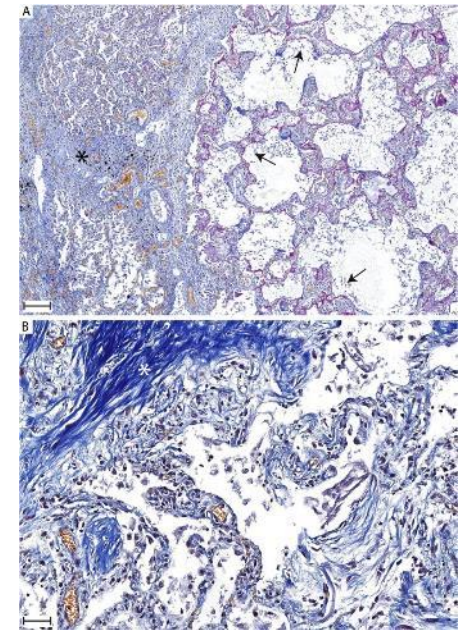
*Invasive ventilation*



Spotty microthrombosis and alveolar damage



Hyperplasia and squamous metaplasia of type II pneumocytes



Interstitial fibrosis

# Autopsy of Deceased in close Time Context to anti-SARS-CoV-2 Vaccination

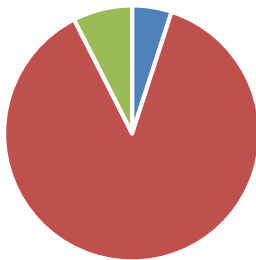


- 40 cases of persons found dead unexpectedly (otherwise not autopsied)
- Cooperation with authorities, state attorney, legal medicine and private practitioners (only possible in Heidelberg)
- Support funding and administration to enable autopsies
- Along §60 infectious diseases protection law
- Flagship cooperation of PEI



→ Only project of its kind in Germany and probably world wide

Place of Death



**>90 % found dead at home or in public (remainder died immediately at hospital admission); without medical contact between vaccination and death; no autopsy without program; extremely relevant for sudden cardiac death)**

■ Universitätsklinikum ■ zu Hause/tot aufgefunden ■ Externes KH

# mRNA-Vaccine induced Myocarditis Collective

**Table 2** Case characteristics

| Case | Gender | Age | BMI  | Vaccine type          | Dose   | Time from vaccination to death (days) | Time from death to autopsy (days) | Comorbidity                     | Grading – myocarditis (0 – 3) | Grading – epicarditis (0 – 3) | PCR analysis | Assessment of causal relationship |
|------|--------|-----|------|-----------------------|--------|---------------------------------------|-----------------------------------|---------------------------------|-------------------------------|-------------------------------|--------------|-----------------------------------|
| 1    | male   | 46  | 31.8 | Cormirnaty (BioNTech) | First  | 0                                     | 7                                 | AH                              | 2                             | 0                             | Negative     | Likely                            |
| 2    | female | 50  | 20   | Spikevax (Moderna)    | First  | 1                                     | 3                                 | -                               | 1                             | 2                             | Negative     | Likely                            |
| 3    | female | 62  | 22.5 | Cormirnaty (BioNTech) | First  | 7                                     | 3                                 | COPD                            | 1                             | 1                             | Negative     | Possible                          |
| 4    | male   | 55  | 30.1 | Cormirnaty (BioNTech) | Second | 4                                     | 3                                 | -                               | 2                             | 3                             | Negative     | Likely                            |
| 5    | female | 75  | 27.9 | Cormirnaty (BioNTech) | First  | 1                                     | 9                                 | AH, DM, Hashimoto's thyroiditis | 2                             | 2                             | HHV6         | Possible                          |

Abbreviations: *AH* arterial hypertension, *COPD* chronic obstructive pulmonary disease, *DM* diabetes mellitus

**Table 1** Likelihood assessment of vaccine-induced (epi-)myocarditis

| category                             | Criteria  |
|--------------------------------------|---|
| No vaccine-induced myocarditis       | - Absence of myocarditis<br>OR<br>- Myocarditis without temporal association to vaccination event<br>OR<br>- Myocarditis, definitely explained by other, especially infectious diseases defined by histological/microbiological/virological testing of cardiac tissue   |
| Possible vaccine-induced myocarditis | - Presence of myocarditis with temporal association to vaccination event, but presence of mitigating factors (e.g. detection of facultatively pathogenic infectious agents)<br>OR<br>- Presence of pericarditis with temporal association to vaccination event, but myocardial findings insufficient to establish definite myocarditis (e.g. Dallas criteria) |
| Likely vaccine-induced myocarditis   | - Presence of myocarditis with temporal association to vaccination event<br>AND<br>- Integration of histological phenotype, clinical presentation, and laboratory findings indicate no alternative differential diagnosis   |

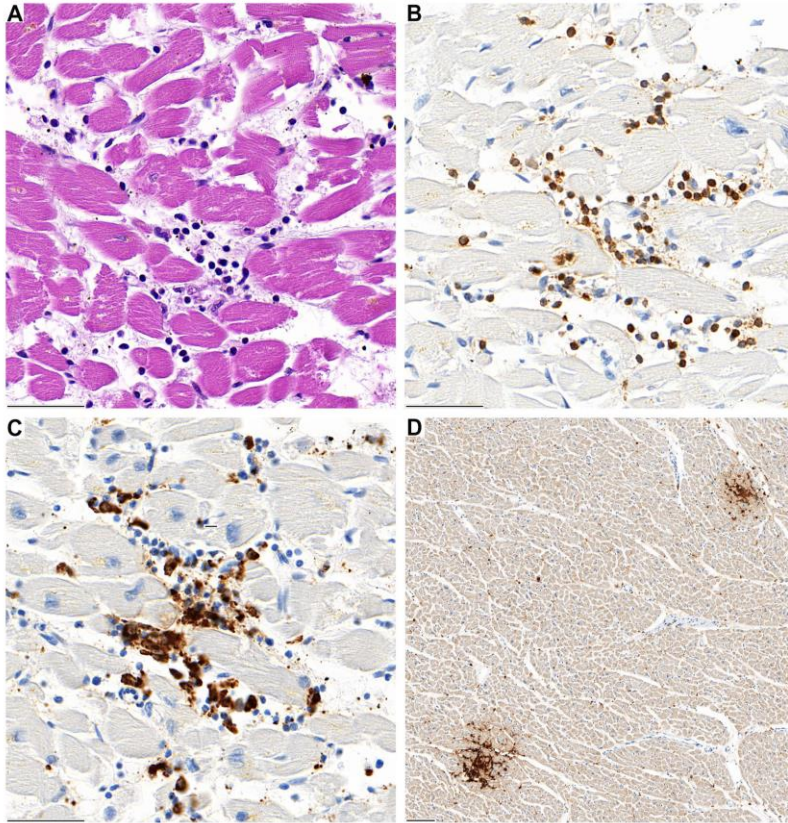
Clinical Research in Cardiology  
<https://doi.org/10.1007/s00392-022-02129-5>

ORIGINAL PAPER

## Autopsy-based histopathological characterization of myocarditis after anti-SARS-CoV-2-vaccination

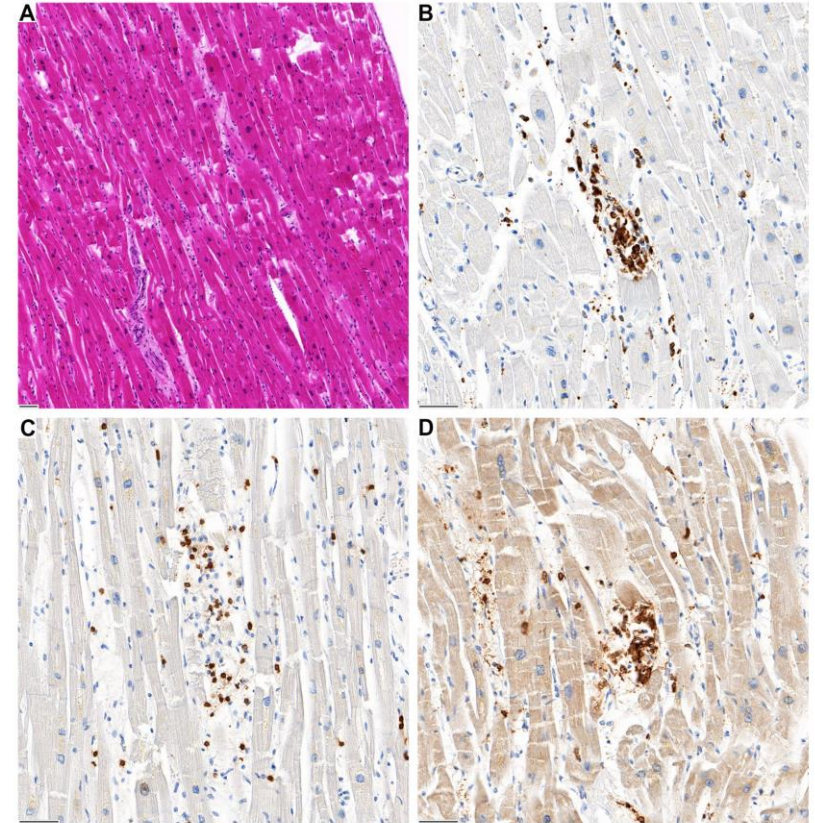
Constantin Schwab<sup>1</sup> · Lisa Maria Domke<sup>1,2</sup> · Laura Hartmann<sup>1,2</sup> · Albrecht Stenzinger<sup>1</sup> · Thomas Longrich<sup>1</sup> · Peter Schirmacher<sup>1</sup>

# Histology of mRNA-Vaccine induced Myocarditis



**Fig. 1** A Lymphocytic aggregates in the interventricular septum of case 1 with associated myocardiocyte destruction. B The infiltrate is predominantly composed of CD3-positive T-lymphocytes and C

CD68-positive macrophages. D In lower magnification two foci of CD4-positive lymphocytes are evident (D)



**Fig. 2** A Inflammatory focus in the left ventricular wall of case 2. B The infiltrate is predominantly composed of CD68-positive macrophages and C CD3-positive T-lymphocytes with (D) co-expression of CD4

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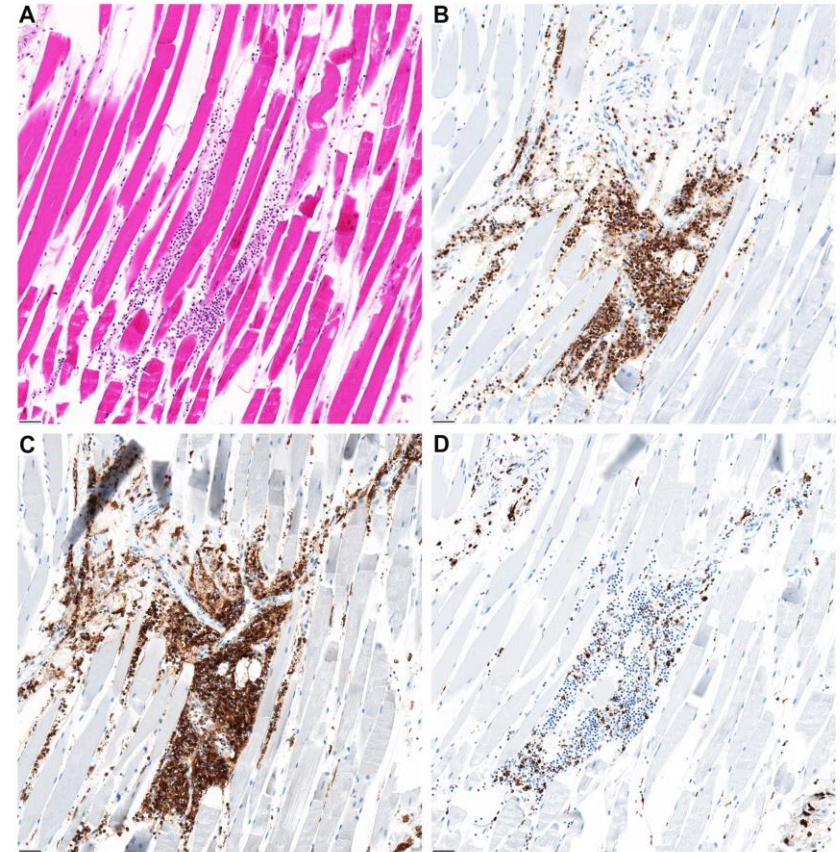
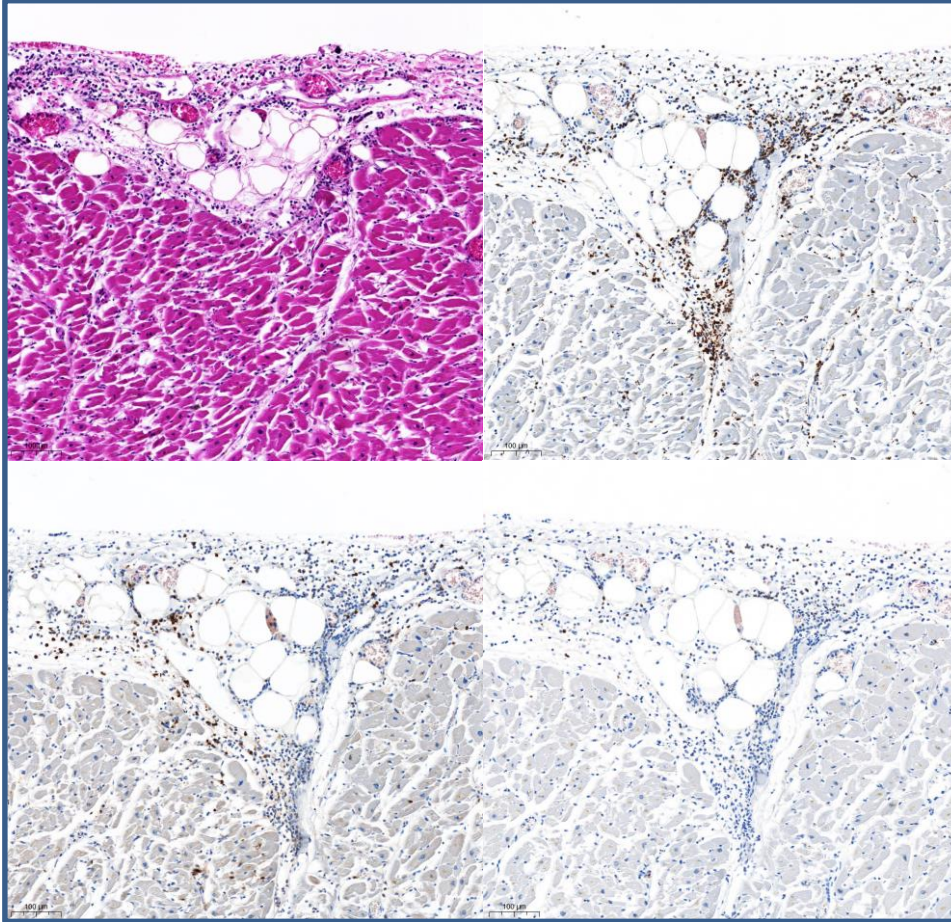
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# mRNA-Vaccine induced Epicarditis and Jab Site Inflammation



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**Fig. 3** A The jab site in the deltoid muscle reveals focal inflammation. The composition is similar to the phenotype of the myocardial infiltration showing predominantly B CD3 and C CD4-coexpressing lymphocytes and D interspersed CD68-positive macrophages

A HE  
B CD68  
C CD4  
D CD8

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Autopsy-based histopathological characterization of myocarditis after anti-SARS-CoV-2-vaccination

Constantin Schwab<sup>1</sup>, Lisa Maria Domke<sup>1,2</sup>, Laura Hartmann<sup>1,2</sup>, Albrecht Stenzinger<sup>1</sup>, Thomas Longerich<sup>1</sup>, Peter Schirmacher<sup>1</sup>



# Conclusions mRNA-Vaccine induced lethal Myocarditis

- Interstitial Myocarditis
- Focal and variable intensity (tendency: r/s>l heart), sufficient sampling required (can be missed)
- CD4>>CD8 T lymphocytes
- Mostly combined with lymphocytic epicarditis/inflammation of subepicardial fat tissue
- May be subtle – delayed morphology?
- Death by arrhythmogenic cardiac failure

**Requires sufficient sampling, good sample quality, expertise and special technology (IHC). Can be missed and definition may be impossible in severely damaged myocardium (CHD, CMP)**



# Published Lethal post mRNA-Vac Autopsy Cases

| Publication                              | number lethal cases | age     | gender (male/female or ratio male to female) |
|--|---------------------|---------|--|
| Mörz et al. (2022); Vaccines             | 1                   | 76      | male   |
| Schwab et al. (2022); Clin Res Cardiol   | 5                   | 46-75   | 0,67   |
| Kazama et al. (2022); CJC Open           | 1                   | 48      | female                                       |
| Kounis et al. (2022); J Clin Immunol     | 1                   | unknown | female                                       |
| Maiese et al. (2022); Vaccines           | 3                   | unknown | -  |
| Schneider et al. (2022); Int J Legal Med | 1                   | 65      | male   |
| Suzuki et al. (2022); Leg Med            | 2                   | 24, 39  | male   |
| Chen et al. (2022); ESC Heart Fail       | 1                   | 59      | male   |
| Choi et al. (2022); J Korean Med Sci     | 1                   | 22      | male   |
| Hoshino et al. (2002); J Cardiol Cases   | 1                   | 27      | male   |



# Published lethal/severe post mRNA Vac Myo- /Pericarditis Cases (Selection)

| Publication                               | cohort size | number lethal cases | severe cases | age   | gender (male/female or ratio male to female) | remarks                  |
|---|-------------|---------------------|--------------|-------|--|--------------------------|
| Simone et al. (2022); JAMA Intern Med     | 2,392,924   | 0                   | 15           | >18   | male   |                          |
| Lane et al. (2022); BMJ Open              | 18,204      | 122                 | 1260         | >18   | 1,50   | myo-/pericarditis cohort |
| Oh et al. (2022); J Korean Med Sci        | 683         | 0                   | 4            | 18-65 | male   |                          |
| Chen et al. (2022); Cureus                | 40          | 1                   | 35           | -     | 9  | case report              |
| Montgomery et al. (2022); JAMA Cardiology | 23          | 0                   | 23           | 20-51 | male   |                          |
| Mevorach et al. (2022); N Engl J Med      | 5,442,696   | 1                   | 136          | -     | -  |                          |
| Matthew et al. (2022); JAMA Intern Med    | 192,405,448 | -                   | 784          | -     | -  | Size = vaccine doses     |
| Buchan et al. (2022); JAMA Netw Open      | 19,740,741  | 0                   | 210          | 12-81 | 3,3  |                          |
| Massari et al. (2022); PLoS Med           | 2,861,809   | 1                   | 441          | 12-39 | 2,1  |                          |

**Scope dependent bias**



# Causality

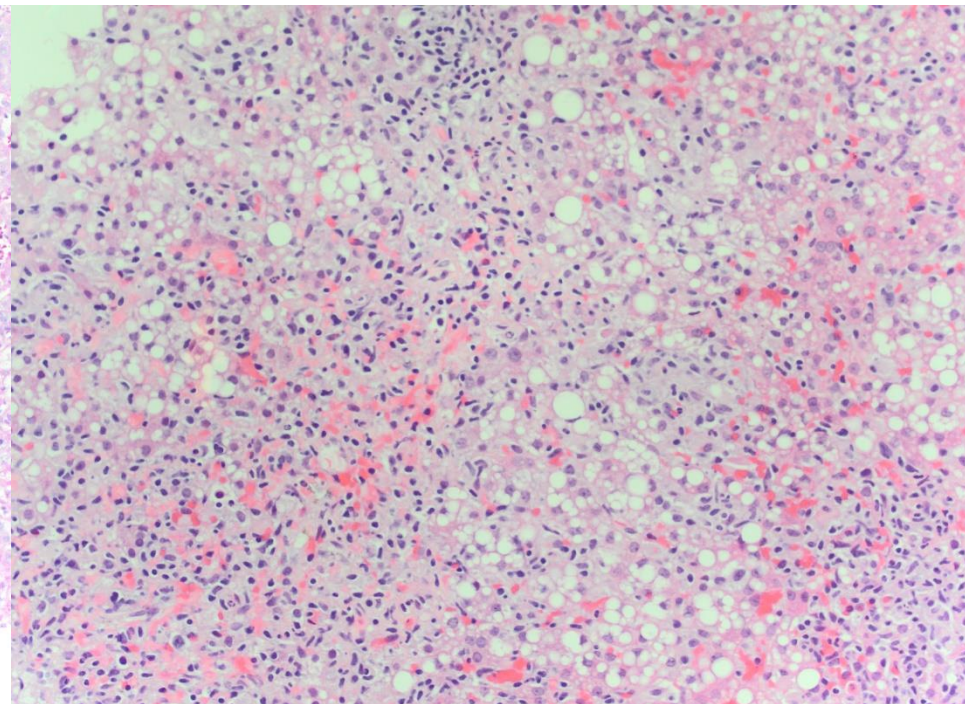
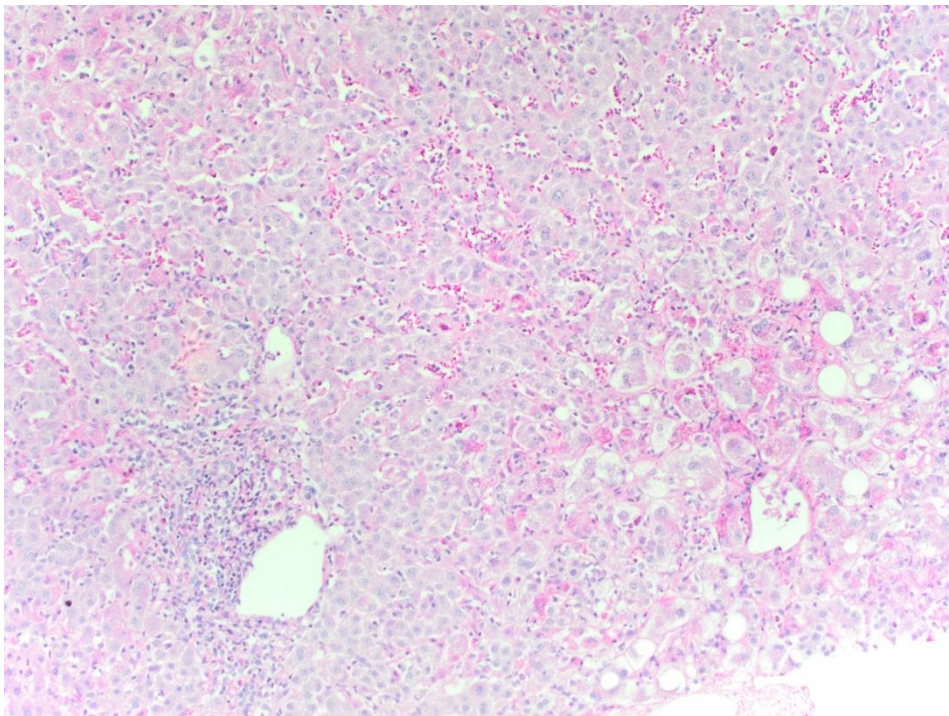
- Other causes of myocarditis (esp. infectious) consequently excluded
- Close time context (1-7 d)
- No preexisting cardiac damage
- Other causes of death excluded
- Plausible and consistent mechanism of damage (CD4-dominante T-cell-reaction argues for immunological mechanism) and death (arrythmogenic cardial failure)
- Causal chain: comparable immune reaction at jab site
- Comparable autopsy cases reported with similar morphology
- Reported diagnostic cases (non lethal) with similar morphology
- Extensive matching clinical reports of lethal cases

**Causality is proven with maximal certainty.**

# Other post mRNA-Vaccine Organ Failures

**Case 1:** Bx 10 d post Comirnaty; acute liver failure, clinically all causes consequently excluded

**Case 2:** Bx 14 d post mRNA Vac, overweight, NAFLD, acute liver failure



**Others reported to us: encephalitis, kidney failure, myositis, polyneuritis**



# Conclusions

- mRNA Vaccine induced Myo-/Pericarditis with lethal outcome or severe course is a proven fact
- Only autopsy is able to clarify unclear lethal cases; But: extremely low autopsy rate; insufficient work flows; poor autopsy skills, insufficient reporting/recognition
- Structural causes of underrecognition: No support, obstruction, administrative shortcomings, poor post-mortem examination state; non-believing (physicians/politics)
- Significant number of cases; substantial underreporting and nonrecognition
- Specific characteristics
  - Typical histology, immunohistology, course, male predominance
  - Younger than lethal COVID cases (recognition bias?)
- Many mechanistic unknowns
  - Mechanism of damage (immune mediated?)
  - Confounders, predisposition?
  - Reason for vaccine dependency; responsible vaccine components
  - Application dependency (i.v.)?
- Unclear clinical perspective
  - Chronic consequences even in inapparent cases (CMP)? (first cases)
  - Confounder in other cardiac diseases (aggravation?)/cardiac failure of other causes? (first reports)

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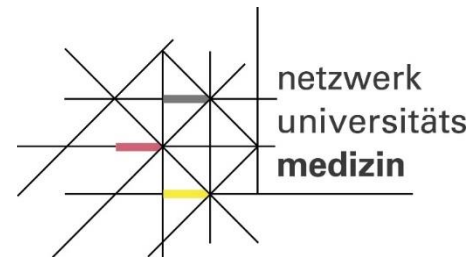
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