Mar 31st, 10:30 AM - 12:30 PM

UH-02 A Case Report of the Potential Link Between Pulmonary Fibrosis and Diabetes Mellitus

Bryson T. Rose
Anderson University - South Carolina

Isabella Nielson
Anderson University - South Carolina

Nnenna Igwe
Anderson University - South Carolina

A Case Report of the Potential Link Between Pulmonary Fibrosis and Diabetes Mellitus

Isabella Nielson, Bryson Rose, and Dr. Nnenna Igwe

Abstract

Pulmonary fibrosis is a chronic lung disease that is characterized by the progressive and irreversible scarring of the lung tissue. This scarring greatly diminishes the efficiency of pulmonary function. After being diagnosed with pulmonary fibrosis, patients live, on average, only three to five years. Diabetes mellitus is known to damage the tissue and blood vessels in organs such as the heart and kidneys due to increased intravascular pressure. According to recent research, diabetes mellitus has also been linked to similar damage in the lungs. Additionally, a 2021 meta-analysis and systematic review of idiopathic pulmonary fibrosis suggests an association between diabetes mellitus and pulmonary fibrosis. The focus of this research is to analyze the possible relationship between diabetes mellitus and pulmonary fibrosis through review of published research and cadaveric investigation. This study intends to bring awareness to the potential link between diabetes mellitus and pulmonary fibrosis. This may aid physicians in the holistic treatment of diabetes mellitus to prevent or slow the onset of pulmonary fibrosis.

Methods and Materials

Cadavers

Two human cadavers were used for data collection.

- Both cadavers were examined in the Anderson University Cadaver Lab and obtained from the Gift of Body program in Columbia, SC.
- One cadaver was used to study the pathology of the lungs relative to this case study, while the other cadaver was used as a comparison.

Cadaver A

- 59 year-old female
- Died of congestive heart failure.
- Had valvular heart disease, pulmonary fibrosis, diabetes mellitus, pulmonary hypertension, and chronic kidney disease that contributed to her death.

Cadaver B

- 60 year-old male
- Died from metastatic anal melanoma.
- Other significant diseases including hypertension and anemia. This cadaver also had pulmonary fibrosis.

Instruments Used

The instruments used to dissect the cadavers included:

- Scalpels; Scalpels with size 22 blades were used for incisions on the cadaver as well as tissue removal.
- Forceps and Hemostats; Hemostats and forceps were used to aid in holding tissue in place.
- Bone saw. The bone saw was used to cut through ribs and the clavicle to open the thoracic cavity.

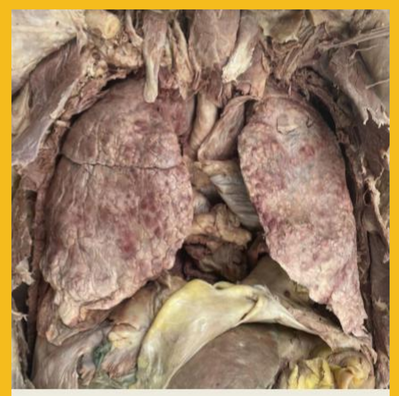
During the dissection, personal protective equipment was worn such as gloves, lab coats, and N95 masks (when using the bone saw).

Process of Dissection

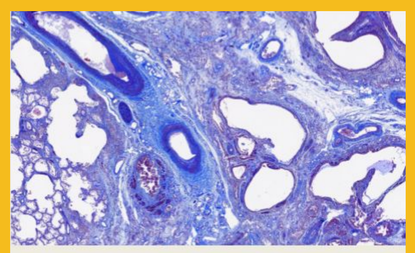
- A midsagittal incision was made through the anterior chest wall and three transverse incisions along the clavicular line, the nipple line, and subcostal, respectively.
- The cadavers were dissected by reflecting the skin, superficial fascia, deep fascia and muscles.
- Adipose tissue was removed from the cadaver to allow better views of structures and organs.
- Once all important structures were reflected and non-essential tissue removed, the anterior chest wall was removed with the bone saw by cutting through the clavicle and the ribs. After dissection was complete, we attempted to inflate the lungs using an ambubag.

Findings

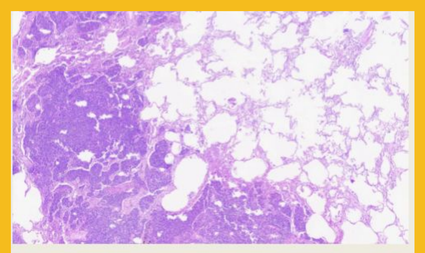
Pictured above is the chest cavity of cadaver A. Circled in red is the right lung that looks relatively normal; however, this lung was firm and sclerotic to the touch due to the pulmonary fibrosis. Circled in black is the left lung, the lower lobe and part of the upper lobe is pushed back into the chest cavity, due to cardiomegaly.



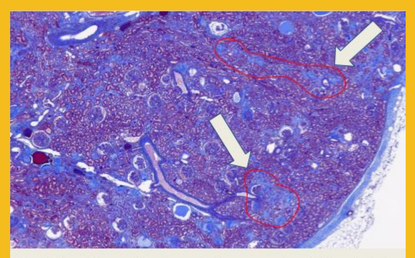
Pictured above is the chest cavity of cadaver B. This cadaver also had pulmonary fibrosis and the lungs were hard and scelortic to the touch. This cadaver did not have cardiomegaly and the lungs were in the normal position.



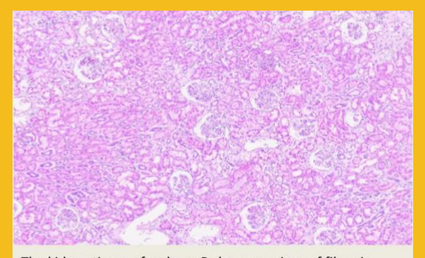
The lung tissue of cadaver A shows large collagen deposits which is a sign of pulmonary fibrosis.



The lung tissue of cadaver B looks normal on the right side of the slide, but the left side shows pulmonary fibrosis.



The kidney tissue of cadaver A shows scarring in the circled regions which is similar damage to the lungs.



The kidney tissue of cadaver B shows no signs of fibrosis. Rather the tissue is fairly healthy.

The histology confirms that cadaver B had idiopathic pulmonary fibrosis but did not have fibrosis in the kidney. However, the histology of cadaver A shows similar fibrosis in the lung and kidney tissue which supports the hypothesis that both tissues would be affected by vessel damage from diabetes mellitus.

Literature Review

In a recent 2021 meta-analysis and systematic review of idiopathic pulmonary fibrosis, evidence suggests that there is an association between diabetes mellitus and pulmonary fibrosis. In this article, various studies were reviewed concerning the association between diabetes mellitus and pulmonary fibrosis. However, this meta-analysis came to the conclusion that although there may be evidence to suggest that diabetes and pulmonary fibrosis are related, there needs to be stronger evidence and more studies done to make a firm conclusion[3]. A 2020 study suggested that the answer could be in the lungs themselves. Diabetes mellitus negatively impacts multiple major organs, mainly through micro-vascular damage.The lungs are very concentrated regions of micro-vascular structures because of their capillary-alveoli junctions. If the vascular damage in the lungs resembles that in the heart and kidneys, we may be able to show evidence of diabetes mellitus triggering the development of pulmonary fibrosis[4].

Discussion and Conclusions

The overall purpose of this research is to present a case for the connection between pulmonary fibrosis and diabetes mellitus. Previous research indicates that pulmonary fibrosis could be a clinical complication of diabetes mellitus and evidence of this was found within a cadaver at the Anderson University cadaver lab. This implication, while increasing knowledge of the pathophysiology of pulmonary fibrosis, could encourage physicians to approach patients holistically, exercising effective preventative care.

In accordance with our goals, the findings of this study demonstrate a probable link between diabetes mellitus and pulmonary fibrosis. Diabetes mellitus is associated with several known complications. There is now strong evidence to believe that pulmonary fibrosis may be one of these complications. The lungs being a target for inflammation and damage in pulmonary fibrosis patients warrants further investigation to better prepare physicians to practice and treat preventatively.

References and Acknowledgements

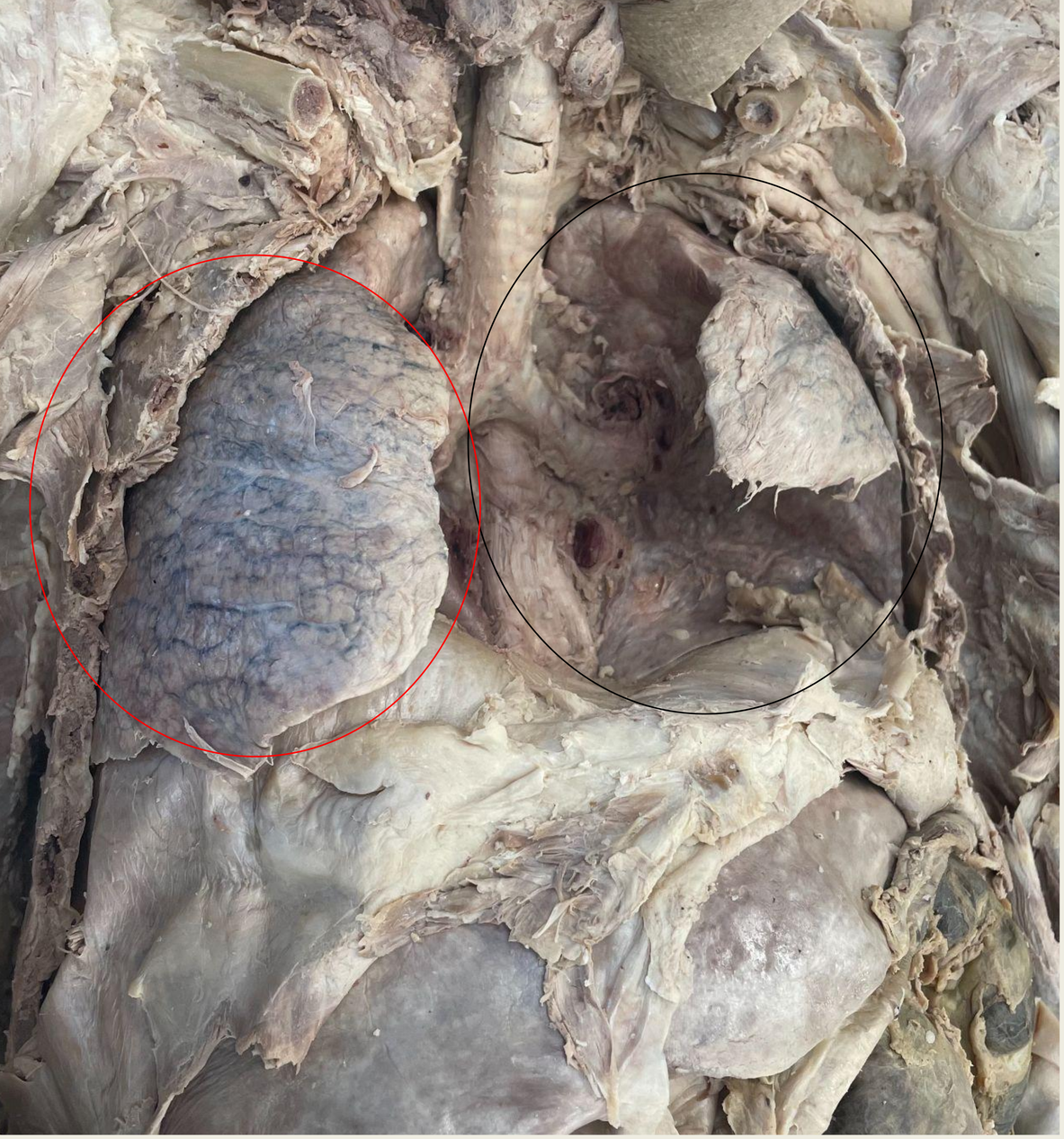
1.Living with pulmonary fibrosis FAQ. American Lung Association. (2020, March). Retrieved October 30, 2022, from https://www.lung.org/lung-health-diseases/lung-disease-lookup/pulmonary-fibrosis/patients/living-well-with-pulmonary-fibrosis/living-with-pulmonary#:~:text=A%20diagnosis%20of%20PF%20can,others%20who%20live%20much%20longer.

2.Tighe RM, Meltzer EB, Noble PW. Idiopathic Pulmonary Fibrosis. In: Grippi MA, Elias JA, Fishman JA, Kotloff RM, Pack AI, Senior RM, Siegel MD. eds. Fishman's Pulmonary Diseases and Disorders, Fifth Edition. McGraw Hill; 2015. Accessed August 30, 2022. https://accessmedicine.mhmedical.com/content.aspx?bookid=1344&sectionid=81190295

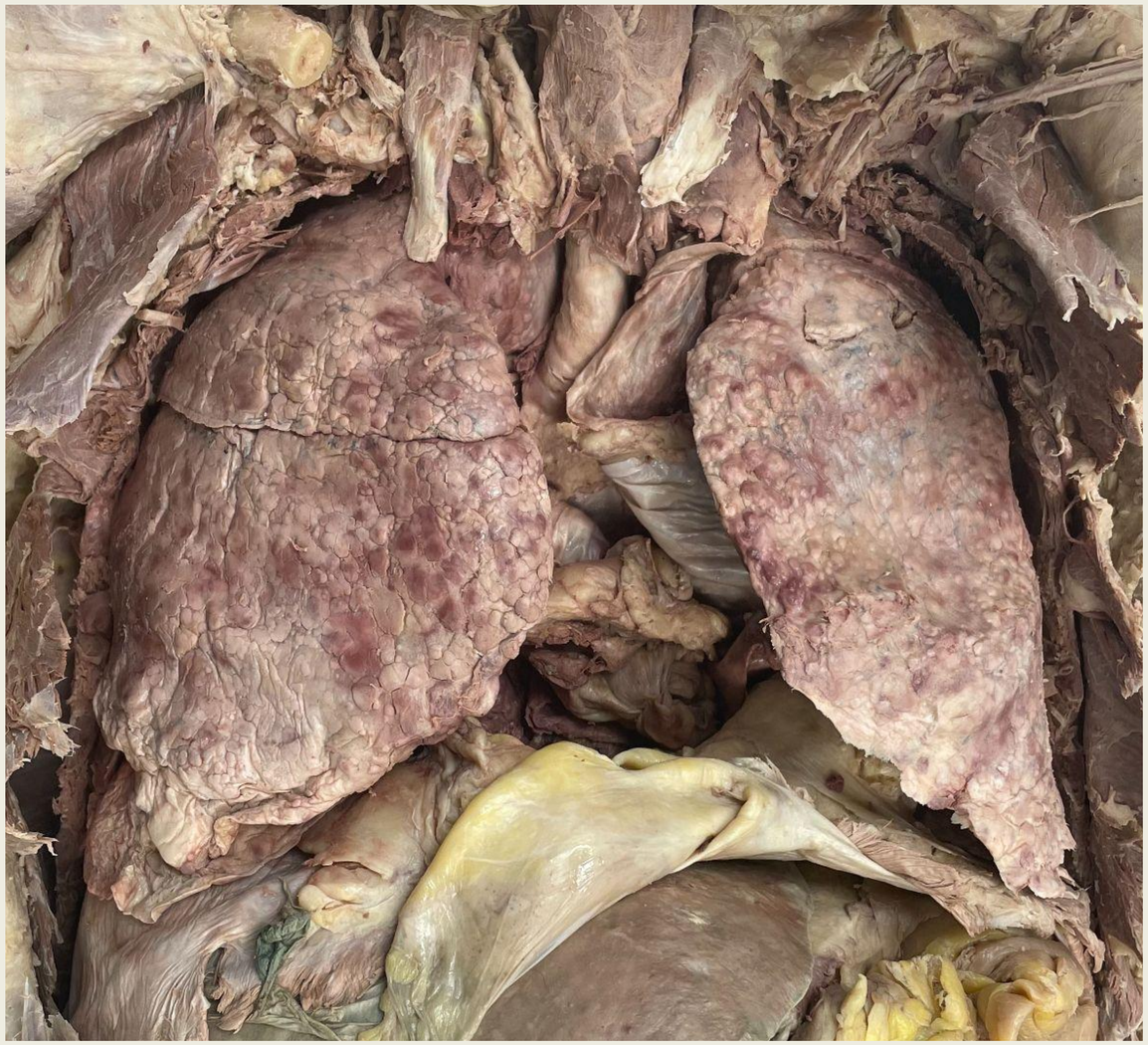
3.Bai, L., Zhang, L., Pan, T. et al. Idiopathic pulmonary fibrosis and diabetes mellitus: a meta-analysis and systematic review. Respir Res 22, 175 (2021). https://doi.org/10.1186/s12931-021-01760-6

4.Balamugesh, T., & Behera, D. (2007). Idiopathic pulmonary fibrosis. The Journal of the Association of Physicians of India, 55, 363–370.

Special thanks to AnMed pathology group and Derek Nelson who helped with the procurement of histology slides for the cadavers, to Dr. Don Peace for allowing us to use the cadaver lab, and to Dr. Igwe for her expertise and dedication to the completion of the study.

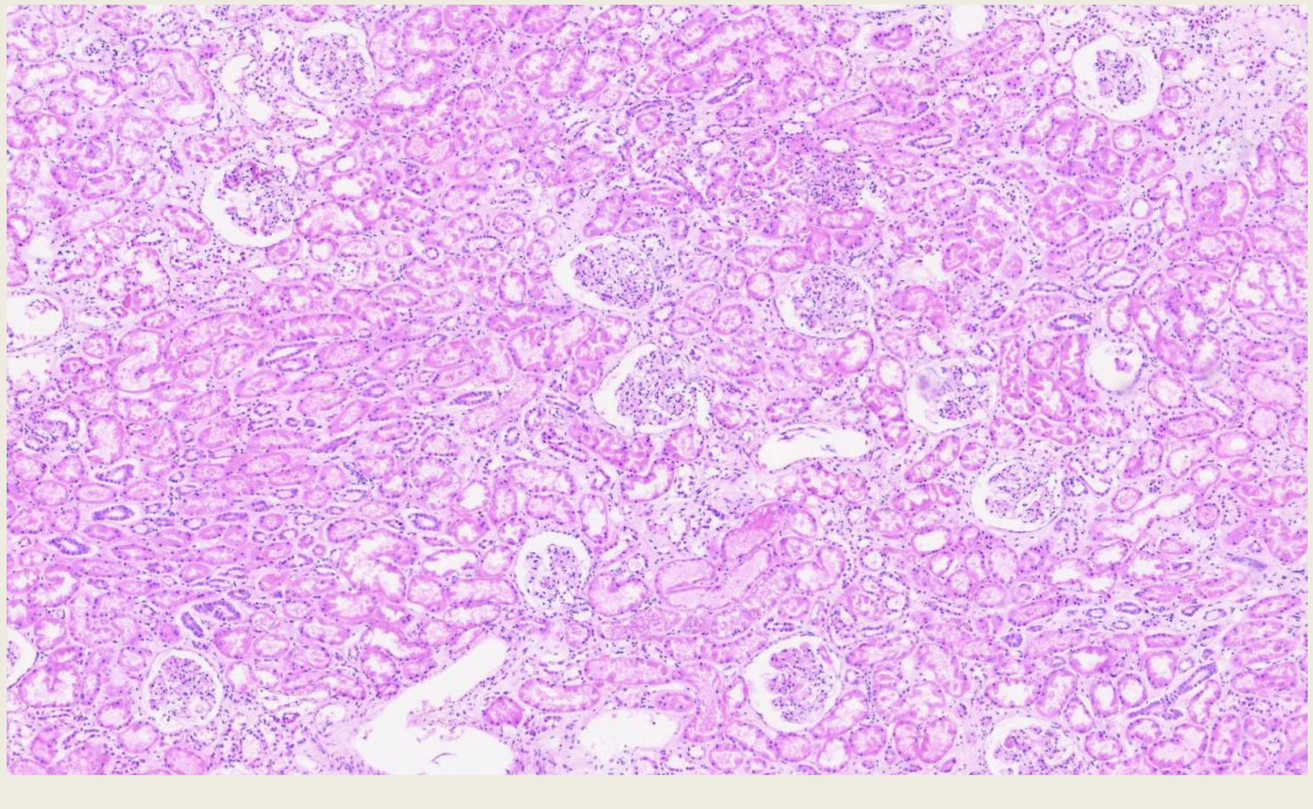


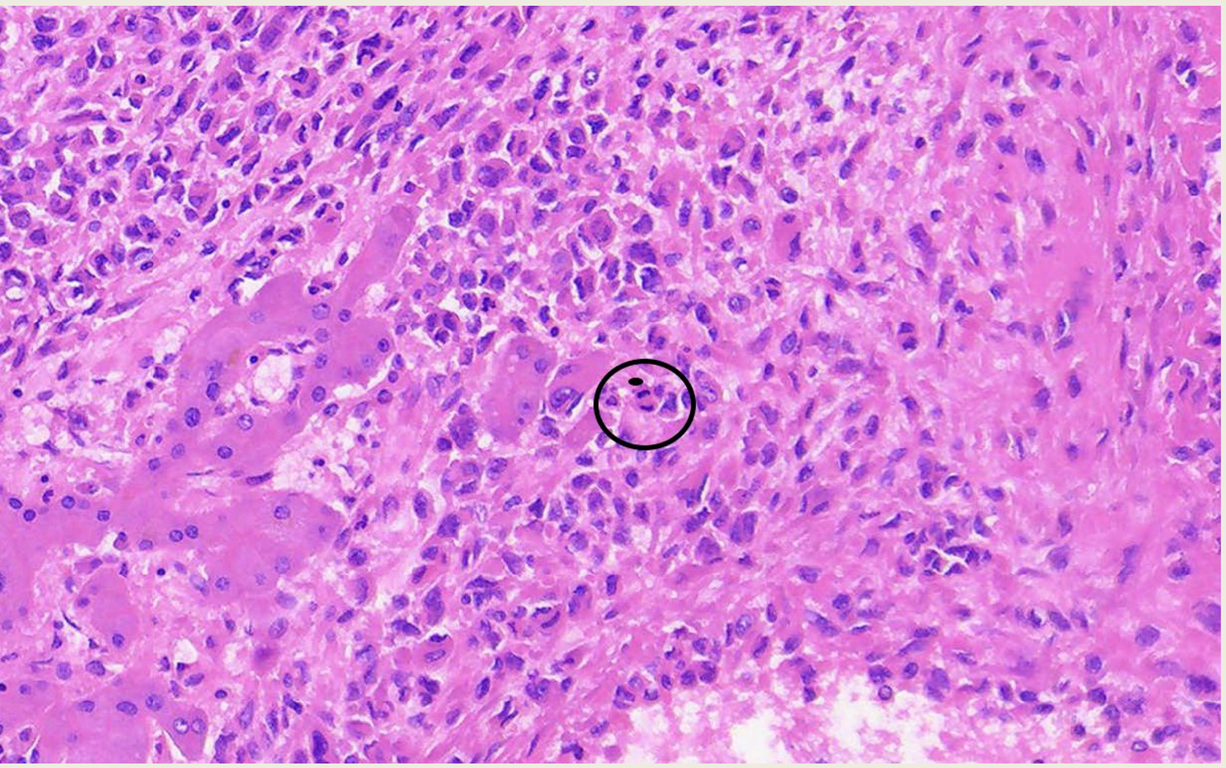
Pictured above is the chest cavity of cadaver A. Circled in red is the right lung that looks relatively normal; however, this lung was firm and sclerotic to the touch due to the pulmonary fibrosis. Circled in black is the left lung, the lower lobe and part of the upper lobe is pushed back into the chest cavity, due to cardiomegaly.

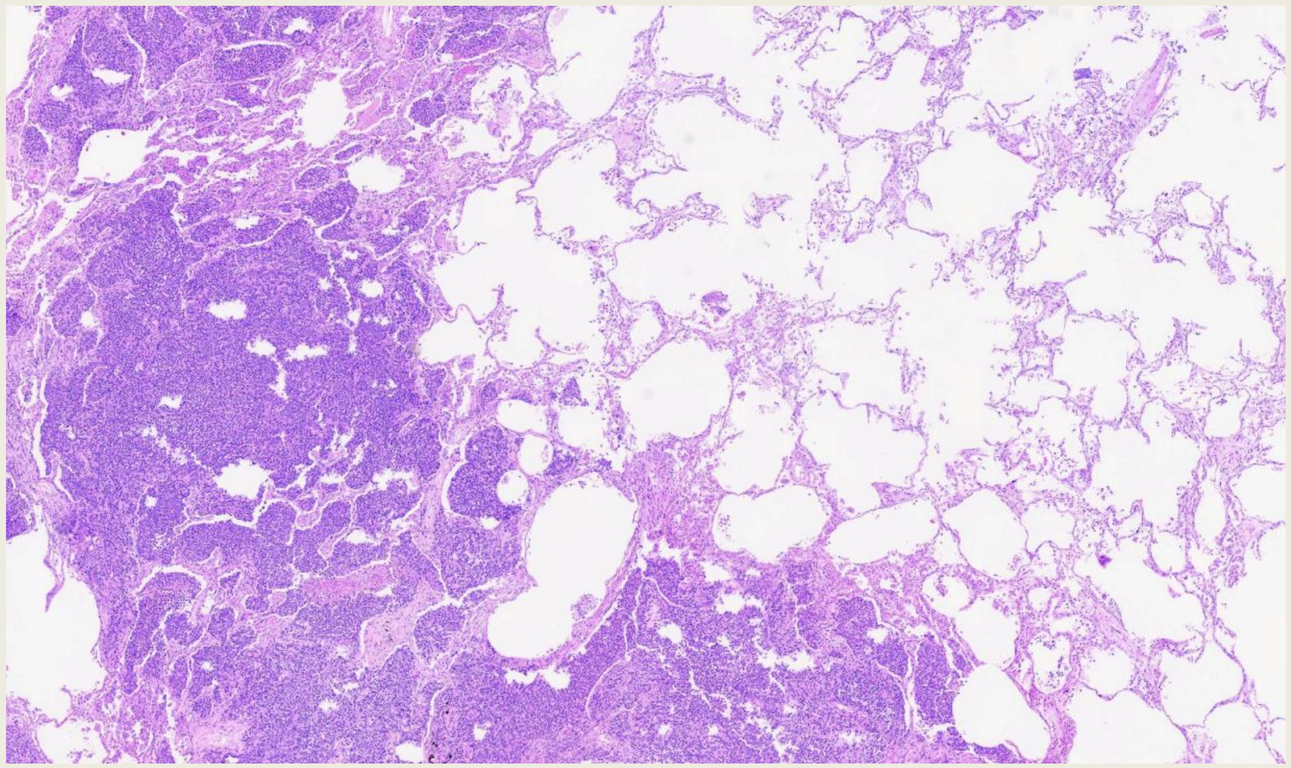


Pictured above is the chest cavity of cadaver B. This cadaver also had pulmonary fibrosis and the lungs were hard and scelortic to the touch. This cadaver did not have cardiomegaly and the lungs were in the normal position.

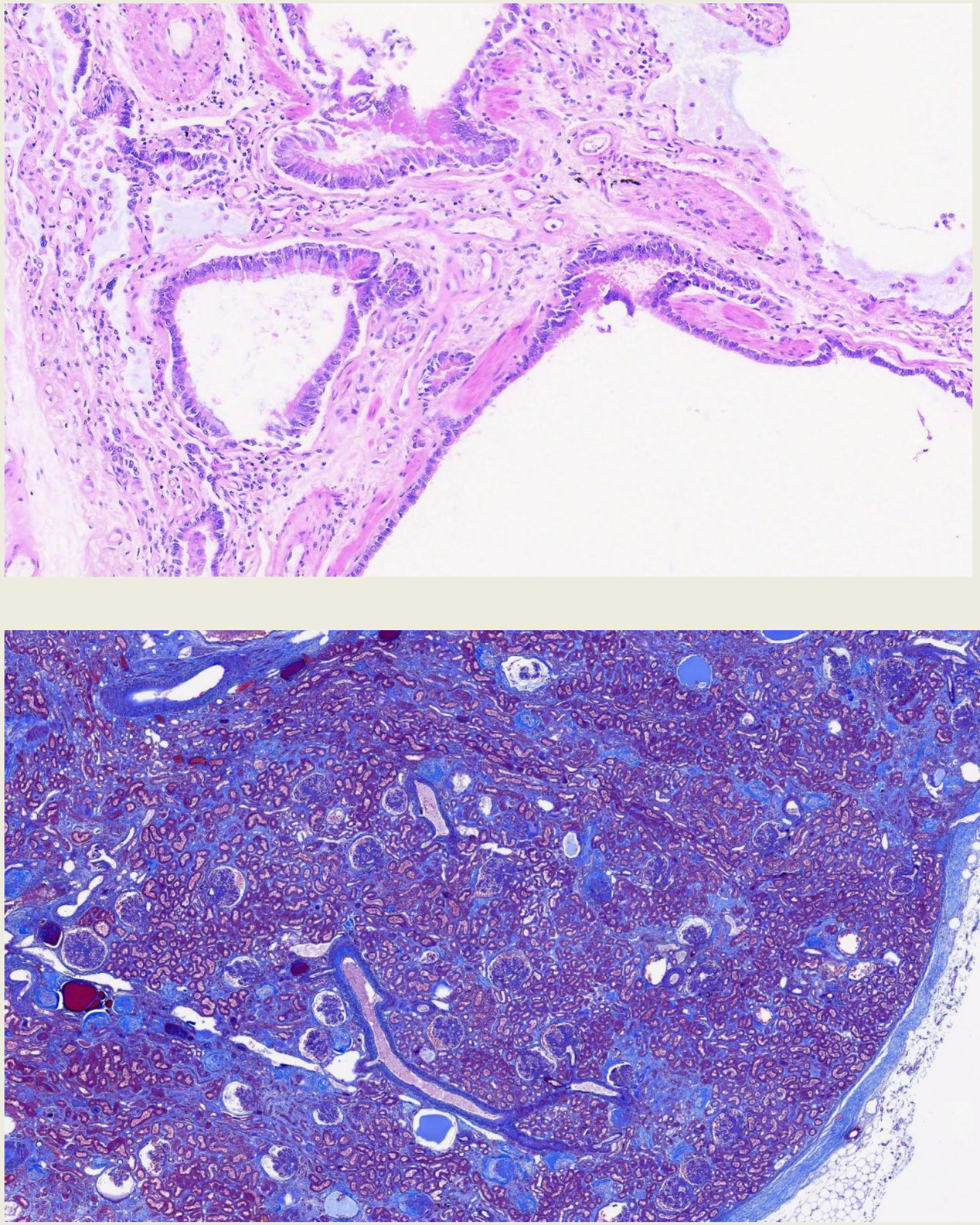
2468 histology slides

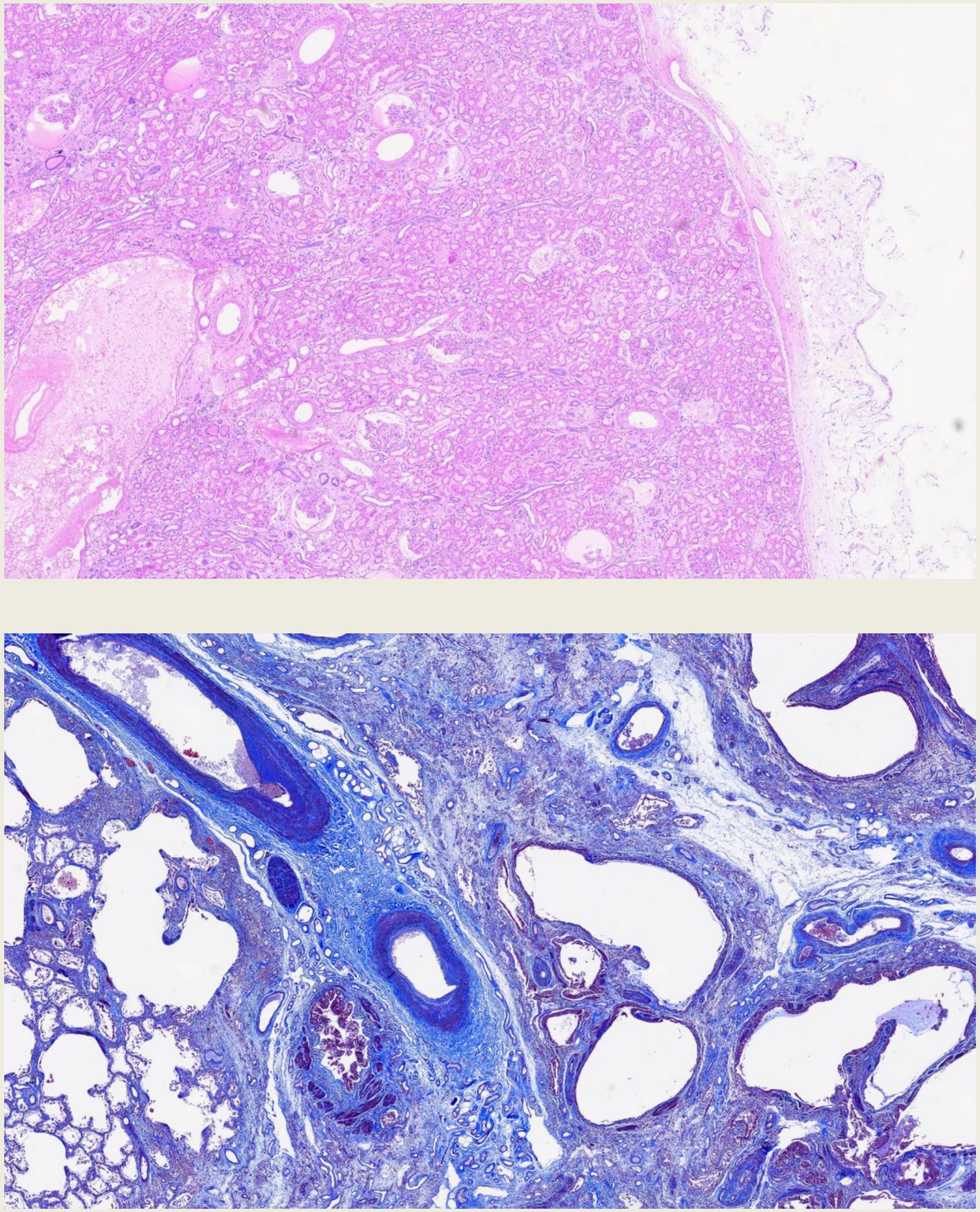


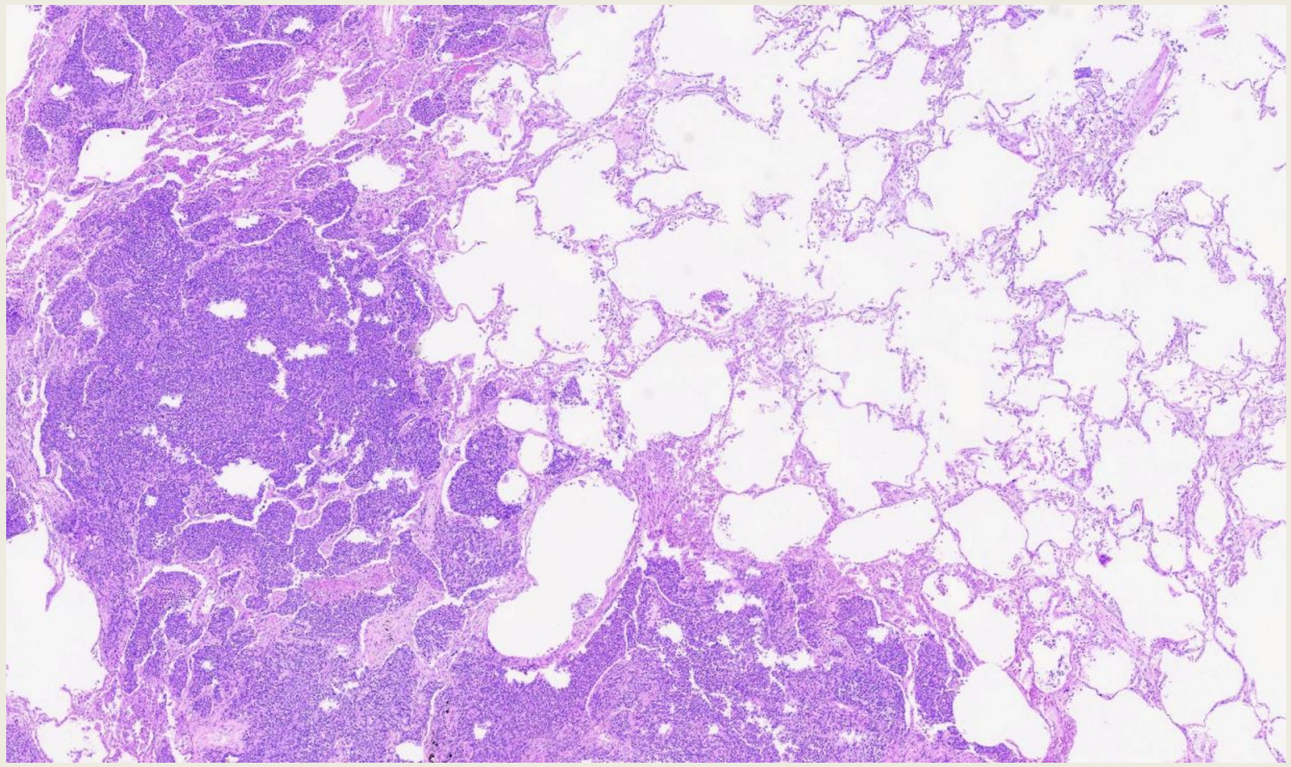




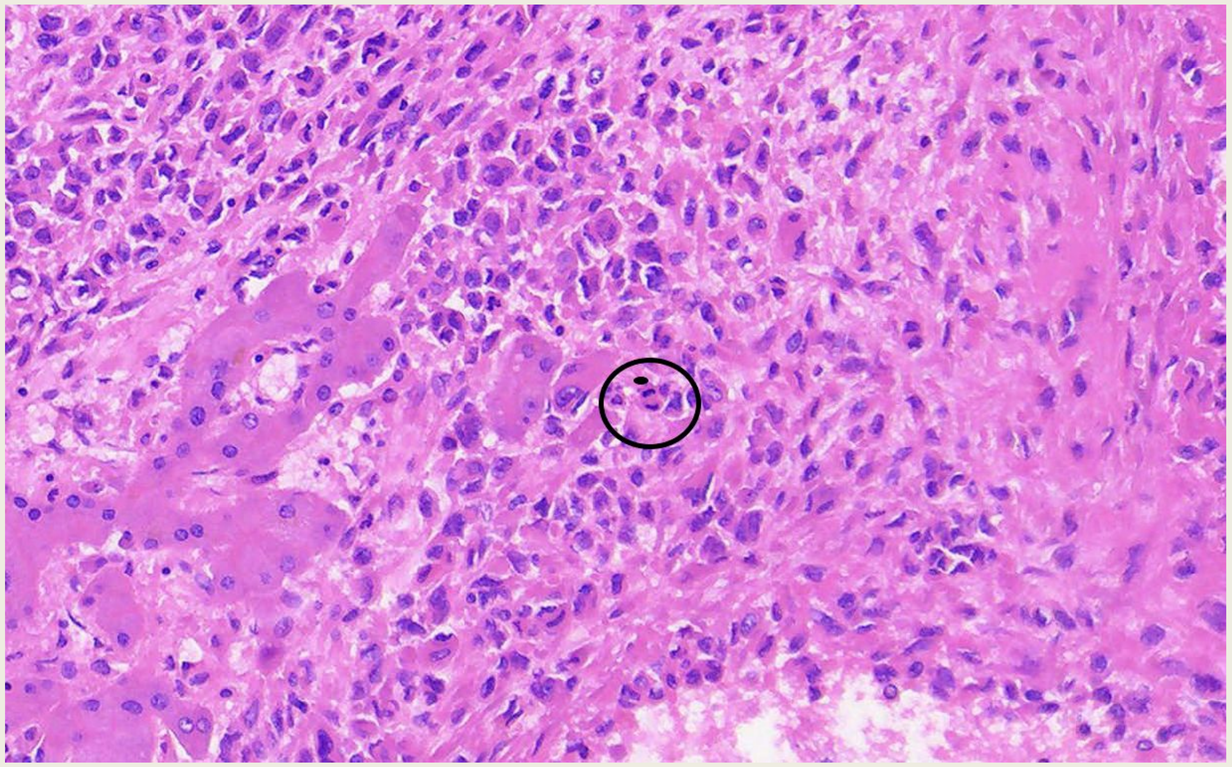
2441 histology images



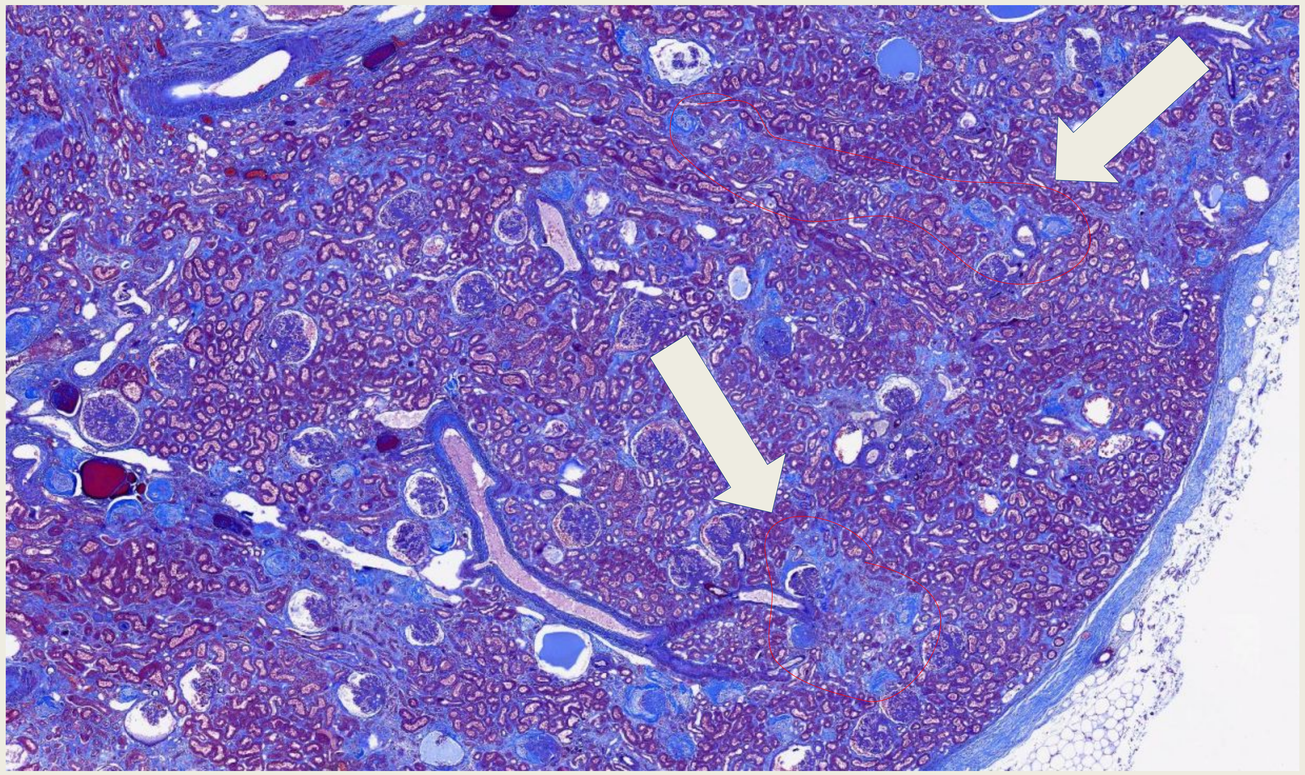




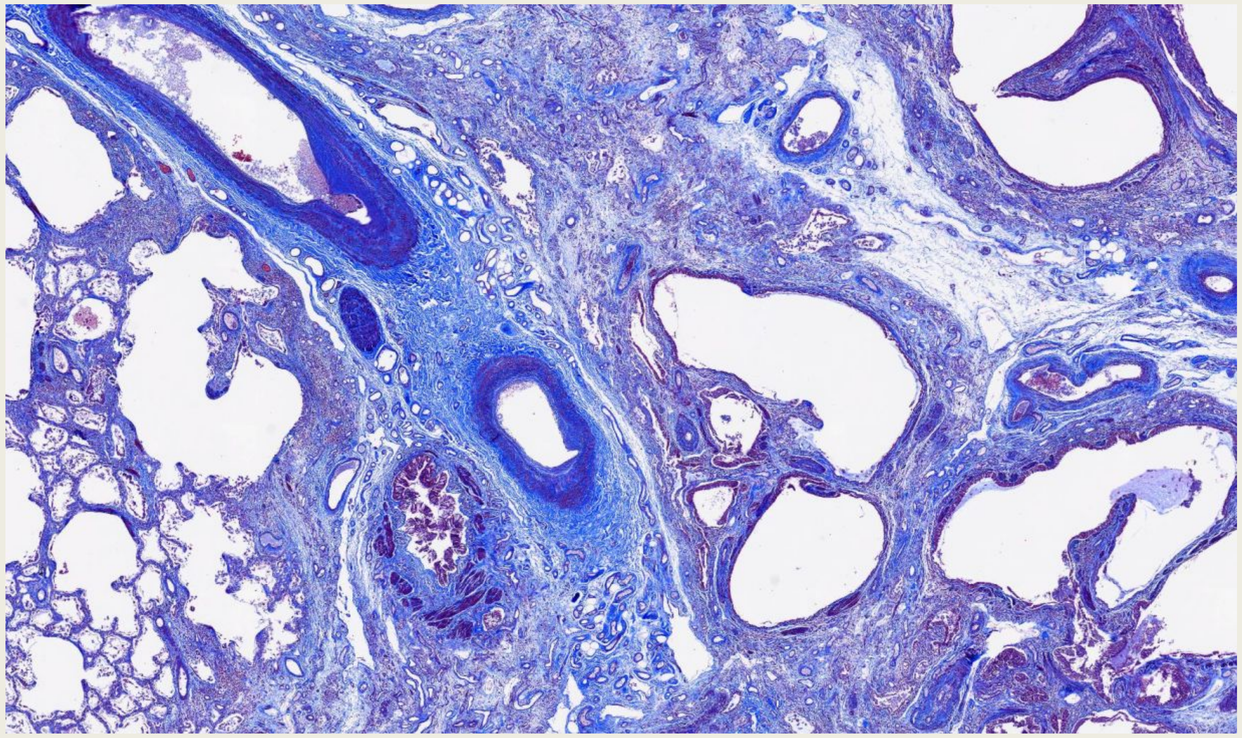
The lung tissue of cadaver B looks normal on the right side of the slide, but the left side shows pulmonary fibrosis.



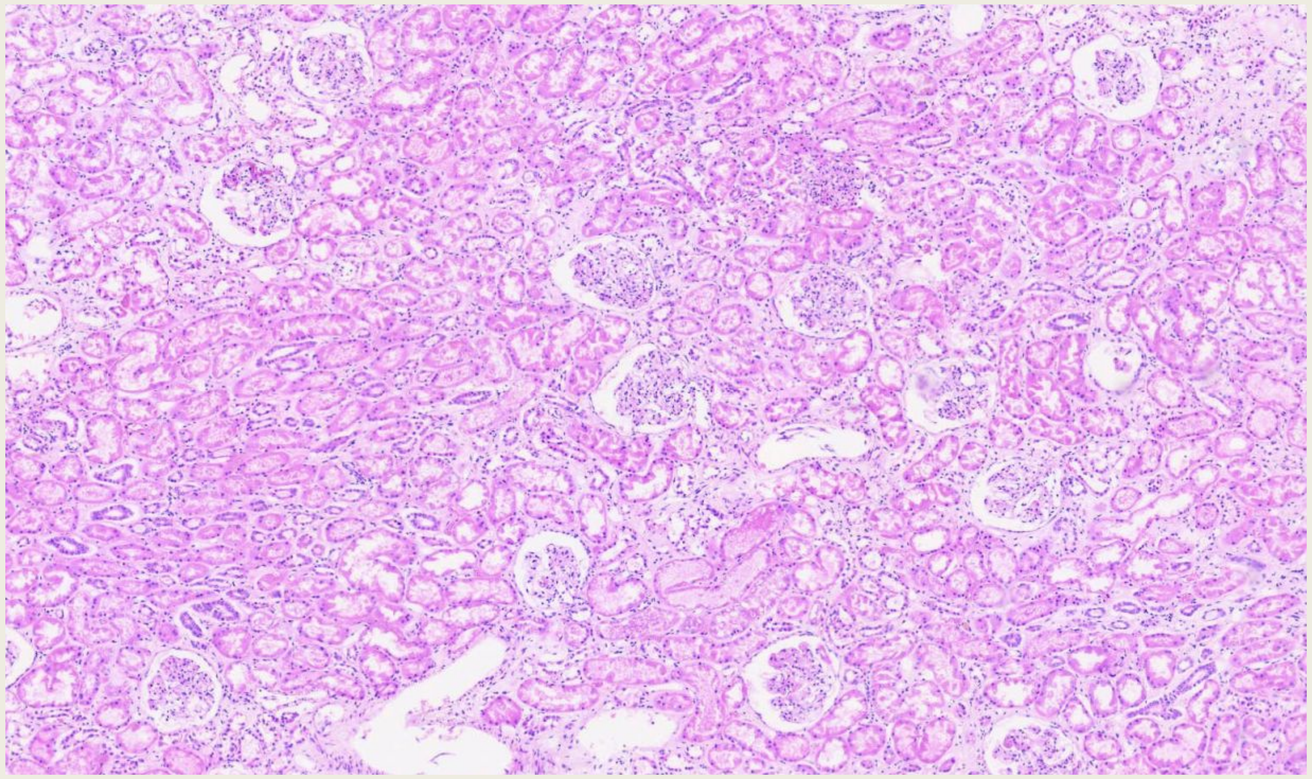
The liver tissue of cadaver B does not show scarring, but does show inflammatory cells and mitotic activity in the circled region.



The kidney tissue of cadaver A shows scarring in the circled regions which is similar damage to the lungs.



The lung tissue of cadaver A shows large collagen deposits which is a sign of pulmonary fibrosis.



The kidney tissue of cadaver B shows no signs of fibrosis.
Rather the tissue is fairly healthy.