



# Transdiaphragmatic autopsy approach: our experience in the Sars-CoV-2 pandemic

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The Sars-CoV-2 pandemic challenged us with the task of studying a highly infectious disease, without a thorough knowledge of the risks involving autopsy procedures, especially considering that there are no definitive evidences on how long the virus could survive in a cadaver [1].

Since the persistence of the virus in corpses represents a real risk of infection for the autopsy staff [2–4], we devised a variation on the Virchow's technique to reduce the time of exposition to the thoracic organs.

Our autopsy protocol consists of an “abdominal” and of a “thoracic” phase.

## Abdominal phase

A craniocaudal midline incision from the xiphisternum to the pubic symphysis is performed. The rectus abdominis muscles are severed at the limit between the middle and the lower third in order to access the abdominal cavity, allowing for the exposition of the intestinal tract that

is removed and inspected. The greater omentum is then removed. Access to the spleen is gained by inserting the left hand behind the stomach fundus. The splenic vein and artery are cut. Using Klemmer pliers, the intestine is removed from the ligament of Treitz to the rectum. The kidneys and the adrenal glands are removed “en bloc.” The duodenum, the stomach, and the pancreas are afterwards removed and inspected. The hepatoduodenal ligament is cut, allowing the liver removal.

The diaphragm is now well visible (Fig. 1). The anterior pars costalis of the diaphragm is then breached (Fig. 2).

## Thoracic phase

In order to evaluate the eventual presence of pleural effusions, we carried out an incision along the costal margin, on the ventral face of the diaphragm.

Afterwards, we remove the whole left hemidiaphragm, and then we insert the hand in the pleural cavity in order to evaluate the presence of visceral-parietal adhesences.

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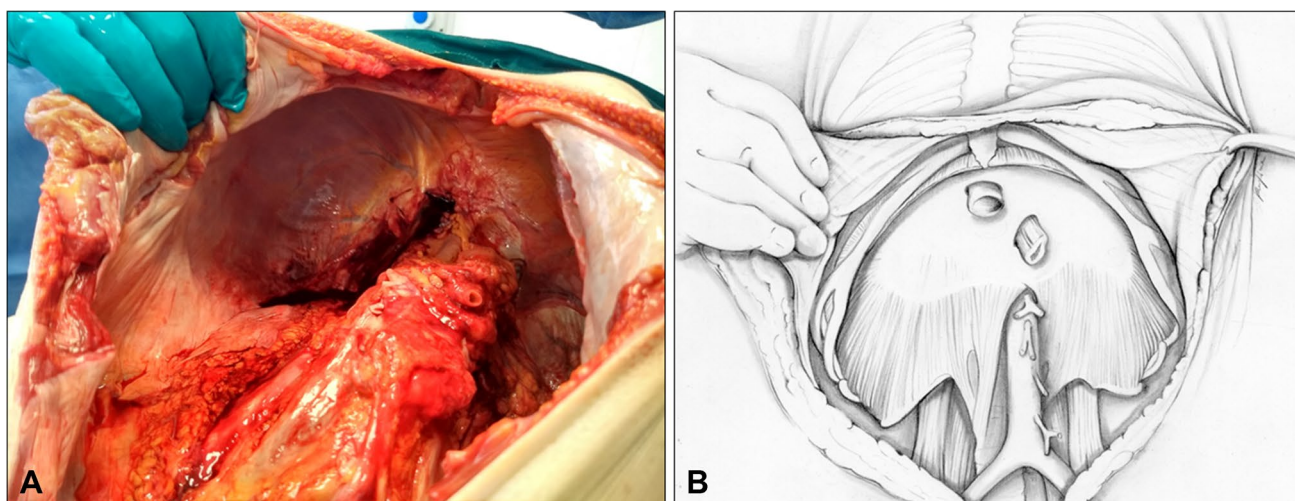
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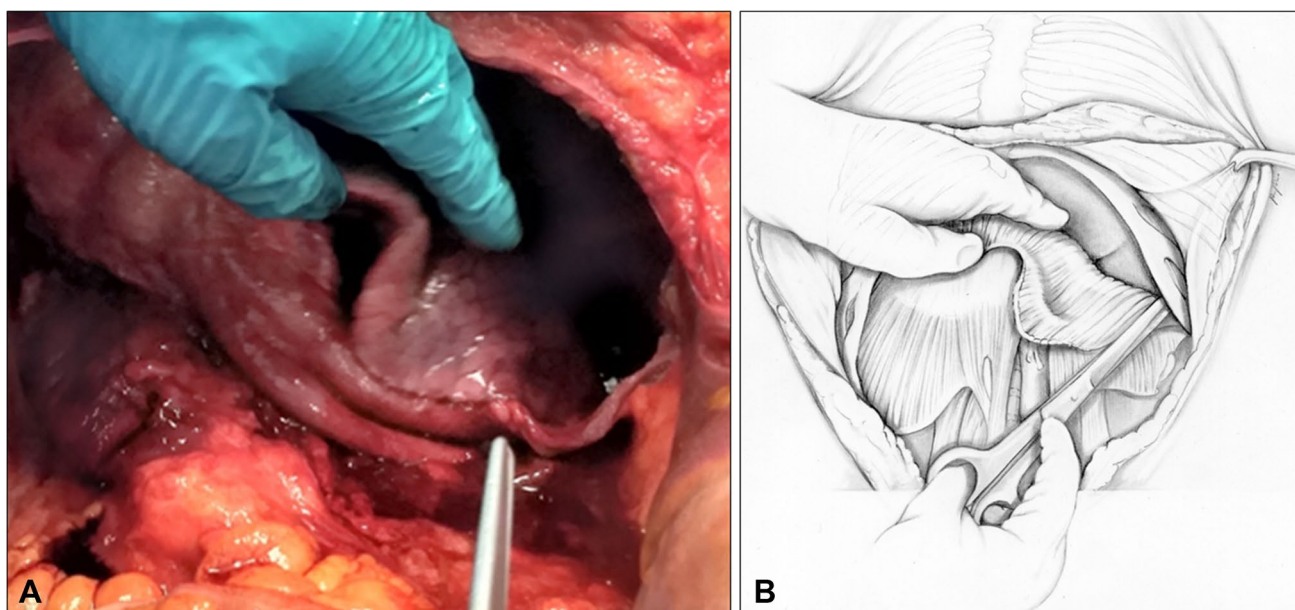
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**Fig. 1** The diaphragm at the end of the abdominal phase



**Fig. 2** Breaching the pars costalis of the diaphragm allows for the access to the lungs

After the identification of the lung hilum structures, we proceed to section the pericardial ligaments with a blunt tip scissors, reaching for the homolateral lung hilum.

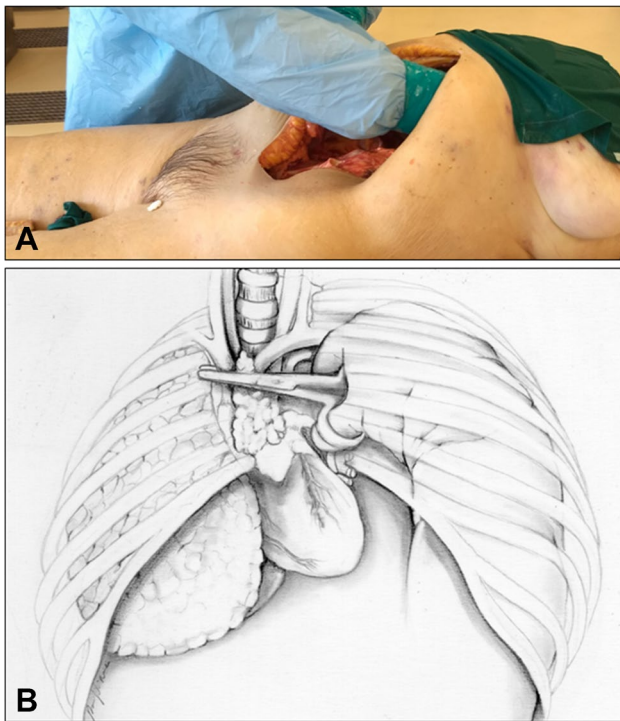
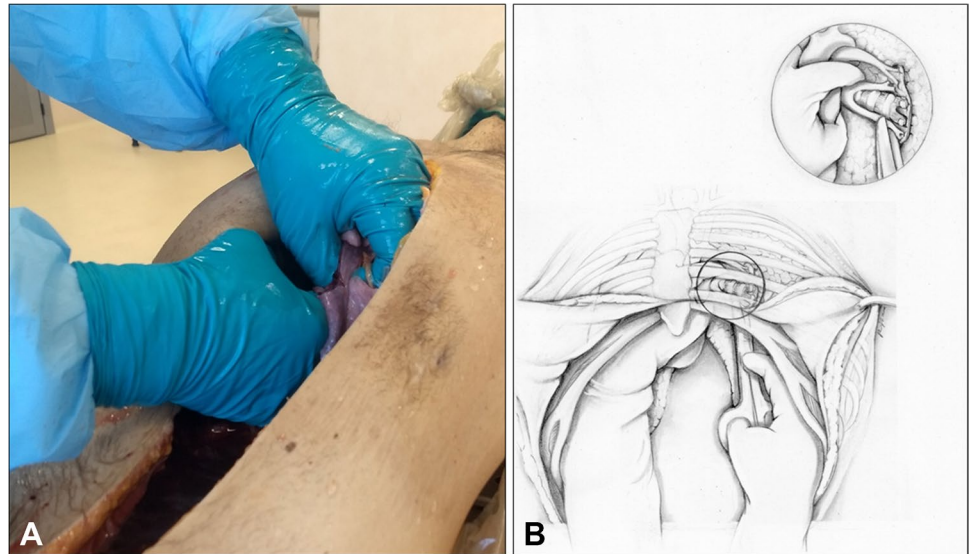
The following structures are then sectioned in order: the left inferior pulmonary vein, the inferior lobar bronchus, the left superior pulmonary vein, the superior lobar bronchus,

and the left pulmonary artery (Fig. 2). The lung is then extracted and examined.

The right hemidiaphragm is removed, leaving in place the portion of the central tendon fusing with the fibrous pericardium through the pericardiophrenic ligament.

With blunt tip scissors, we sever the subclavian artery, the left brachiocephalic vein, the common carotid artery, the

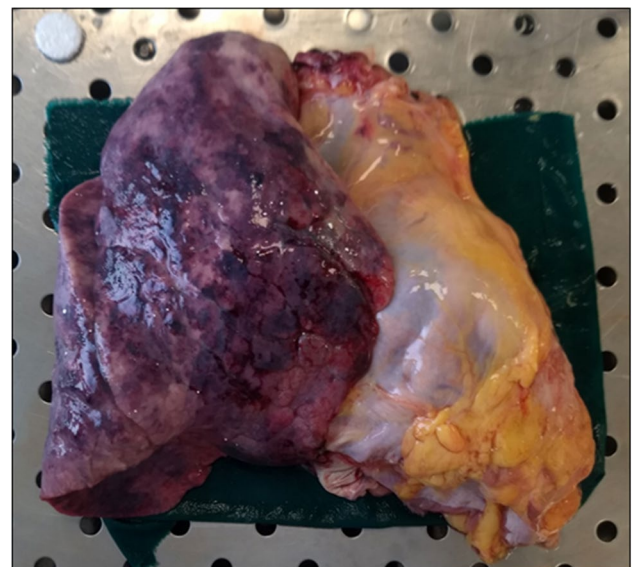
**Fig. 3** The left inferior pulmonary vein, the inferior lobar bronchus, the left superior pulmonary vein, the superior lobar bronchus, the left pulmonary artery are severed



**Fig. 4** The right lung is removed after the resection of the pulmonary ligament, the inferior pulmonary vein, the bronchial arteries and the main bronchus and the pulmonary artery

brachiocephalic trunk, the trachea, the esophagus, and the right brachiocephalic vein (Fig. 3).

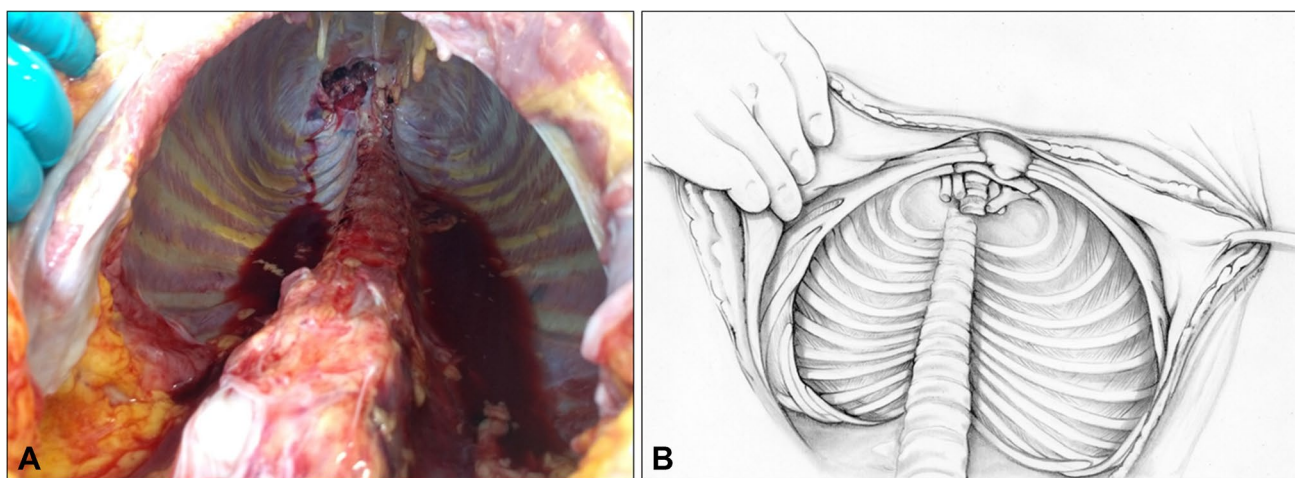
The esophagus is isolated up to the diaphragmatic hiatus, all along with the anatomic structures in the posterior mediastinum. The inferior vena cava and cardias are



**Fig. 5** The heart, the aortic arch and the right lung after their en-bloc removal

severed, releasing the mediastinal organs from the remaining binding structures.

Going through the phrenicopleuralis fascia and mediastinal pleura, the right lung is removed after the resection of the pulmonary ligament, the inferior pulmonary vein, the



**Fig. 6** The empty thorax after the procedure, is now available for inspection

bronchial arteries, the main bronchus, and the pulmonary artery.

The heart, the aortic arch, and the right lung are removed en bloc (Figs. 4 and 5).

The empty thorax can now be inspected (Fig. 6).

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#### Declarations

The study was conducted in accordance with ethical standards from the Declaration of Helsinki.

**Conflict of interest** The authors declare no competing interests.

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