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Title Page

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Title: Pneumoretroperitoneum secondary to pneumomediastinum in a child with COVID-19

Short running title: Pneumoretroperitoneum in a child with COVID-19

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## Main Text

Pneumomediastinum is a well-known complication of mechanical ventilation in patients with coronavirus disease 2019 (COVID-19)<sup>1</sup>; however, pneumoretroperitoneum is not. To our knowledge, this is the first report of pneumoretroperitoneum secondary to pneumomediastinum in a child with COVID-19.

A 3-year-old boy with metatropic dysplasia under home ventilation (peak inspiratory pressure (PIP) 14 cmH<sub>2</sub>O, positive end-expiratory pressure (PEEP) 7 cmH<sub>2</sub>O) via tracheostomy was admitted to the pediatric intensive care unit with severe COVID-19 pneumonia. He underwent mechanical ventilation (the highest ventilator setting: PIP 28 cmH<sub>2</sub>O, PEEP 13 cmH<sub>2</sub>O) with spontaneous breathing in the lateral decubitus position because of severe kyphoscoliosis and a narrow thorax. On day 10, pneumonia exacerbation was documented using computed tomography (CT) findings of diffuse ground-glass opacities. A follow-up computed tomography scan on day 14 showed a continuous pneumoretroperitoneum (Fig. 1a) originating from the pneumomediastinum (Fig. 1b). The presence of air in the retroperitoneal space could not be explained by any of the pathological findings.

We initiated lung-protective ventilation with muscle relaxants and esophageal pressure monitoring; PIP was decreased from 28 to 25 cmH<sub>2</sub>O, PEEP decreased from 13 to 10 cmH<sub>2</sub>O, the change in transpulmonary pressure decreased from 20 to 13 cmH<sub>2</sub>O. Lung protective

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ventilation was continued until we confirmed the disappearance of pneumoretroperitoneum and pneumomediastinum on chest radiography on day 19. The change in transpulmonary pressure was controlled below 15 cmH<sub>2</sub>O during and after 5 days of neuromuscular blockade to prevent the exacerbation and recurrence of pneumomediastinum.

Air travels through the anatomical fascial surface to other compartments. The retroperitoneum and mediastinum communicate through the esophageal hiatus<sup>2</sup>, and several rare cases of pneumomediastinum secondary to pneumoperitoneum or pneumoretroperitoneum have been reported<sup>3</sup>. Pneumoretroperitoneum attributed to pneumomediastinum is observed less frequently<sup>4</sup>. This is the first report of pneumoretroperitoneum arising from the pneumomediastinum in a patient with COVID-19. In this case, positive pressure ventilation and a protruding abdomen positioned higher than the narrow thorax in the lateral decubitus position likely contributed to the movement of air from the mediastinum to the retroperitoneal space. Conservative treatment with a lung-protective strategy to limit transpulmonary pressure was successful, as was the case with COVID-19-related pneumomediastinum<sup>5</sup>.

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#### Disclosure

The authors declare no conflict of interest.

#### Informed consent

We obtained informed consent from the patient's parents.

#### Author Contributions

Ma.T. M.N. contributed to the conception of the study. Ma.T. designed the study and drafted the manuscript; Y.I., W.I., and Mu.T. reviewed the manuscript, and supervised the study.

All authors read and approved the final manuscript.

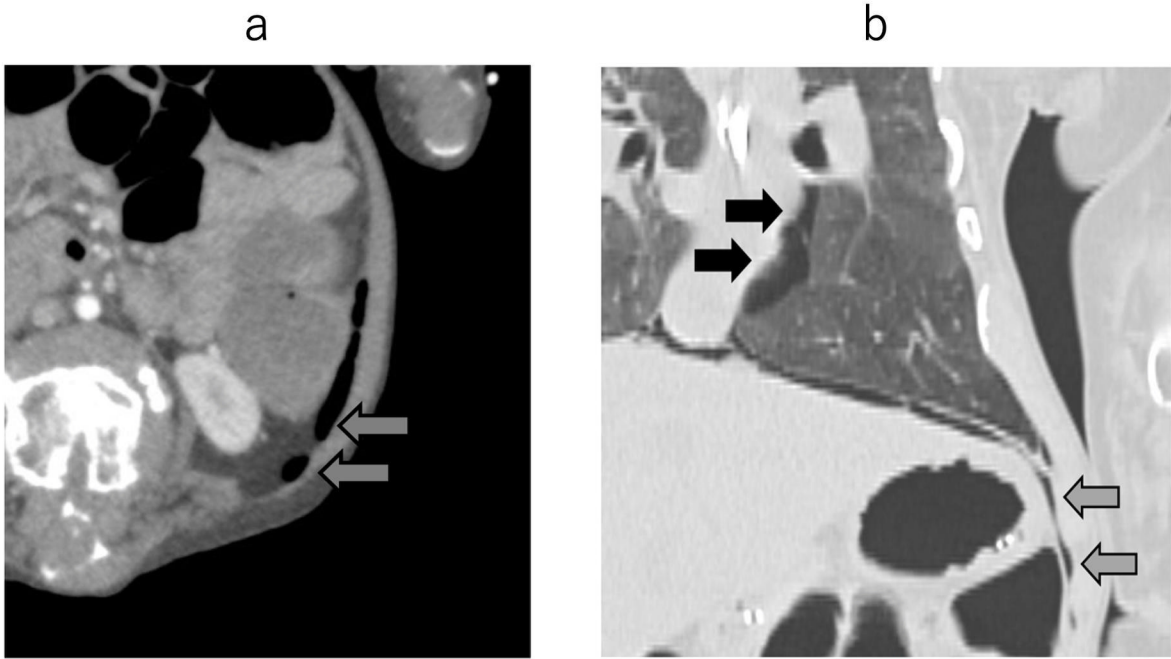
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