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## Case Report

# Postnatal ultrasonography for evaluation of hernia sac of neonate with congenital diaphragmatic hernia

Takahiro Hosokawa, MD<sup>a,\*</sup>, Yutaka Tanami, MD<sup>a</sup>, Yumiko Sato, MD<sup>a</sup>, Eiji Oguma, MD<sup>a</sup>, Kanako Omata, MD<sup>b</sup>, Hiroshi Kawashima, MD<sup>b</sup>, Yoshitake Yamada, MD<sup>c</sup>

<sup>a</sup>Department of Radiology, Saitama Children's Medical Center, 1-2 Shintoshin Chuo-ku, Saitama 330-8777, Japan

<sup>b</sup>Department of Surgery, Saitama Children's Medical Center, 1-2 Shintoshin Chuo-ku, Saitama 330-8777, Japan

<sup>c</sup>Department of Radiology, Keio University School of Medicine, 35 Shinanomachi, Shinjuku-ku, Tokyo 160-8582, Japan

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## ABSTRACT

Congenital diaphragmatic hernia (CDH) is one of the most common major congenital anomalies. The presence of a hernia sac is associated with additional benefits in terms of improved neonatal survival. Here, we report a case of CDH with a hernia sac detected via postnatal ultrasonography. Our literature search did not find other cases where CDH with hernia sac was found by postnatal ultrasound in neonates. In prenatal imaging, the diagnosis of CDH with a hernia sac is challenging. In our case, the meniscus of the thymus was clearly noted, and smooth convexity between the hernia contents and thymus was detected. Although evaluation of the presence of a hernia sac with postnatal ultrasonography might be difficult, our findings suggest that a hernia sac could be evaluated with postnatal ultrasonography.

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## Introduction

Congenital diaphragmatic hernia (CDH) is one of the most common major congenital anomalies, with postnatal mortal-

ity rates ranging from 30% to 50% [1,2]. Pulmonary hypoplasia and pulmonary hypertension have been reported to be the primary causes of postnatal morbidity and mortality [3,4].

It has recently been shown that the presence of a hernia sac is associated with additional benefits in terms of improved

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**Research involving Human Subjects:** This research was performed in accordance with the tenets of the Declaration of Helsinki.

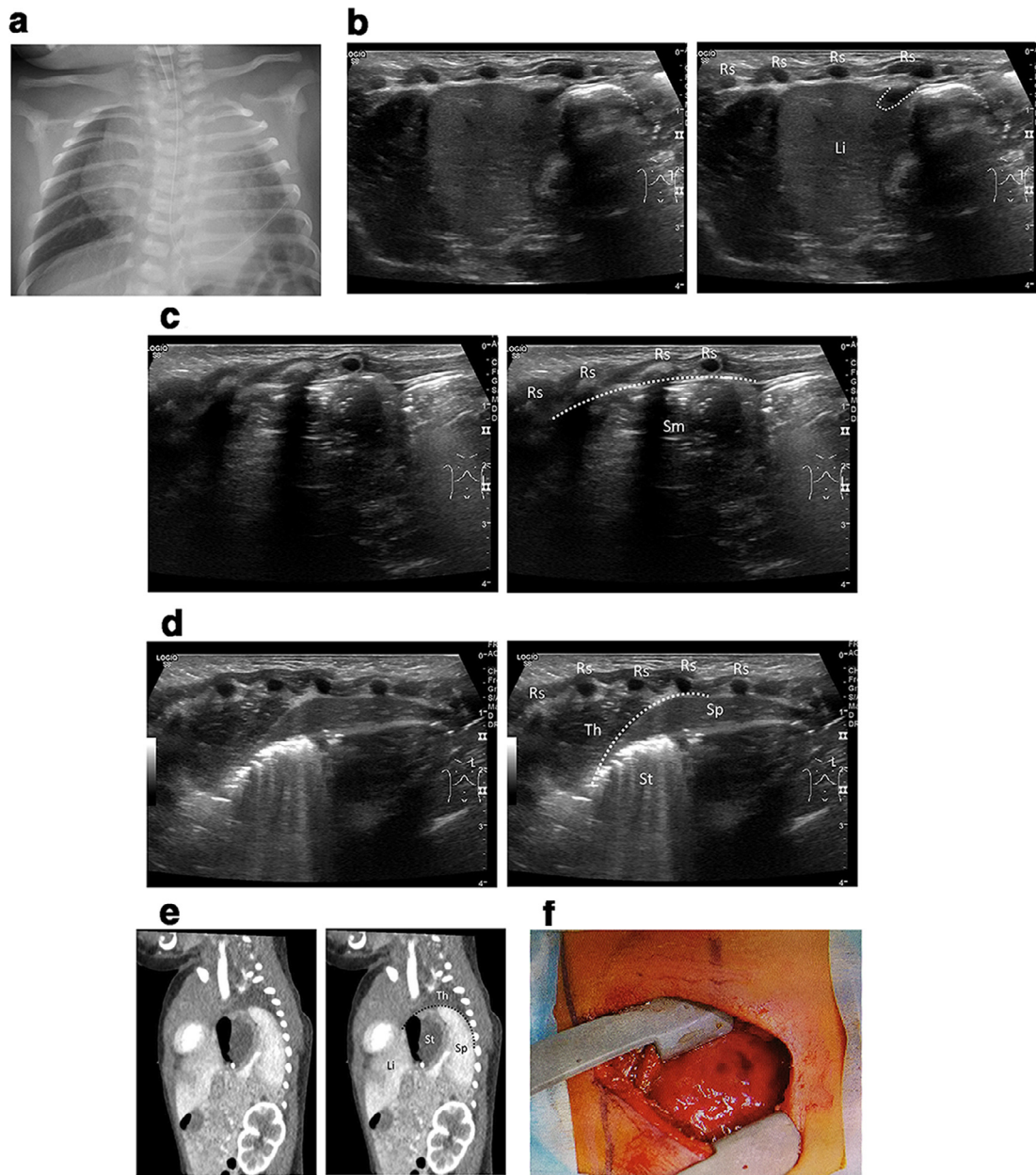
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\* Corresponding author.

E-mail addresses: [snowglobe@infoseek.jp](mailto:snowglobe@infoseek.jp) (T. Hosokawa), [tanami.yutaka@scmc.pref.saitama.jp](mailto:tanami.yutaka@scmc.pref.saitama.jp) (Y. Tanami), [sato.yumiko@scmc.pref.saitama.jp](mailto:sato.yumiko@scmc.pref.saitama.jp) (Y. Sato), [oguma.eiji@scmc.pref.saitama.jp](mailto:oguma.eiji@scmc.pref.saitama.jp) (E. Oguma), [omata.kanako@scmc.pref.saitama.jp](mailto:omata.kanako@scmc.pref.saitama.jp) (K. Omata), [kawashima.hiroshi@scmc.pref.saitama.jp](mailto:kawashima.hiroshi@scmc.pref.saitama.jp) (H. Kawashima), [yamada@rad.med.keio.ac.jp](mailto:yamada@rad.med.keio.ac.jp) (Y. Yamada).

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**Fig. 1** – A 0-day-old male neonate with congenital diaphragmatic hernia.

(a) Radiograph shows the small intestine and stomach located in the left thorax.

(b) The right panel is a schematic presentation of the left panel. In the anterior subcostal view, sagittal ultrasonography of the anterior side shows the anterior marginal edge of the diaphragm as a hypoechoic structure (surrounded by a dotted line). The hernia contents include the liver (Li). Rs indicates ribs.

(c) The right panel is a schematic presentation of the left panel. In the intercostal view, sagittal ultrasonography of the lateral side does not show the lateral segment of the diaphragm. The hernia contents include the small intestine (Sm). The dotted line indicates the lateral wall of the thorax. Rs indicates ribs.

(d) The right panel is a schematic presentation of the left panel. Sagittal ultrasonography of the middle of the left clavicle shows smooth convexity between the hernia contents and thymus (Th) (c). The hernia contents include the spleen (Sp) and stomach (St). Rs indicates ribs.

(e) The right panel is a schematic presentation of the left panel. Sagittal reconstructed computed tomography shows smooth convexity between the hernia contents and thymus (Th). The dotted line indicates the smooth convexity. The hernia contents include the spleen (Sp), stomach (St), and liver (Li). The meniscus of the thymus is visible.

(f) Open repair via a left thoracotomy is performed. The hernia contents are covered by a membrane.

neonatal survival [5–9]. Approximately 20% of neonates with CDH were reported to have a hernia sac [5–9]. Hernia contents have a thin covering composed of single layers of parietal peritoneum and parietal pleura [5,6]. The surgical approach is decided according to the size of the diaphragm defect. Furthermore, during repair, it has been noted that the diaphragm defect tends to be smaller and more amenable to primary repair when hernia contents are constrained by a sac [8,10].

Although the evaluation of the defect size of CDH using postnatal ultrasonography was reported in few recent reports [11–13], the evaluation of a hernia sac was not noted. Here, we report a case of CDH with a hernia sac detected via postnatal ultrasonography. Our literature search did not find other cases where CDH with hernia sac was found by postnatal ultrasound in neonates.

## Case presentation

The patient was a 0-day-old male neonate with CDH. The diagnosis of CDH was not made prenatally. CDH was diagnosed when respiratory distress occurred after birth (Fig. 1a). Postnatal ultrasonography and computed tomography were performed.

Although the anterior rim of the diaphragm was noted during ultrasonography, the lateral rim was not identified (Fig. 1b, c). The hernia contents had a concave shape and compressed the thymus, and pleural effusion and ascites were not detected. Sagittal ultrasonography and computed tomography showed smooth convexity between the hernia contents and the thymus (Fig. 1d, e). The meniscus of the thymus was visible. Therefore, considering the ultrasonography findings, open surgery was planned. The hernia sac was evident during surgery, and primary repair was performed (Fig. 1f).

## Discussion

To our knowledge, this is the first case in which a hernia sac was visualized by using postnatal ultrasonography. The diagnosis of CDH with a hernia sac during prenatal imaging is challenging. Previous studies have shown that magnetic resonance imaging has a sensitivity of about 0.5 for detecting the presence of a sac, and a hernia sac or eventration was prospectively questioned by ultrasonography in about 50% of cases [6,7]. According to a previous study, the following prenatal imaging findings are indicative of CDH with a hernia sac: (1) the meniscus of the lung being posterior or apical to the hernia contents; (2) encapsulated appearance of hernia contents, exerting a less than expected mass effect on the heart and mediastinum; (3) presence of pleural fluid outlining the sac from above; and (4) presence of ascites outlining the sac from below [7]. In our case, the meniscus of the thymus, instead of that of the lung, was clearly noted and a smooth convexity between the hernia contents and thymus was identified. The finding of a concave shape might indicate a hernia sac. Pleural fluid or ascites was not present in our case. Our case had a

relatively good circulatory status; therefore, these additional findings might not have been present.

After birth, the alveolar fluid is absorbed and the lungs are filled with air. In addition, when the infant begins to swallow, the gastrointestinal tract is filled with air. Therefore, if the lung and gastrointestinal tract within the hernia sac are filled with air, evaluation of the shape of the hernia contents becomes difficult, as air obstructs the view on ultrasonography. Evaluation of the presence of a hernia sac with postnatal ultrasonography is difficult, similar to that with prenatal imaging. However, in our case, a hernia sac was successfully evaluated with postnatal ultrasonography.

## Conclusion

We reported a rare case of CDH with a hernia sac detected via postnatal ultrasonography. Although it might be difficult to evaluate the presence of a hernia sac with postnatal ultrasonography, our findings suggest that a hernia sac could be evaluated with postnatal ultrasonography.

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