**INSIDE**
**Assessing the Effectiveness of FETO,** a New Experimental Therapy for Congenital Diaphragmatic Hernia

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JOHNS HOPKINS MEDICINE | NEWS FROM THE JOHNS HOPKINS CENTER FOR FETAL THERAPY


## Top-Notch, Collaborative Care with Pediatrics

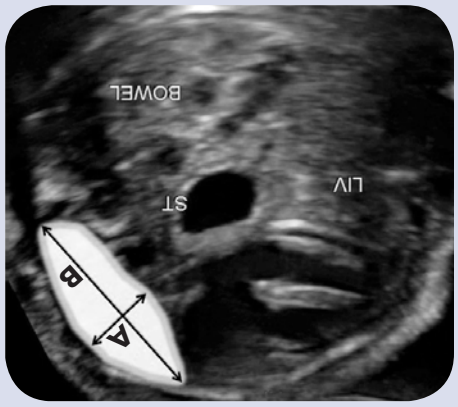
Eric Jelin's pediatric surgical team, together with the fetal therapy team led by Ahmet Baschat, is one of the few combined multidisciplinary programs in the country that offers state-of-the-art care for congenital diaphragmatic hernia (CDH). It provides:

- **Prenatal counseling to parents** about what to expect during and after delivery. Parents are invited to meet with the various specialists involved in postnatal CDH care and to tour the neonatal and pediatric intensive care units prior to birth.
- **Seamless coordination with fetal care teams** to understand the nature and extent of the developmental defects. This allows Jelin and his colleagues to help tailor and optimize management after birth to deliver the best possible postnatal treatment.
- **The most advanced techniques** for supporting and treating CDH. These include minimally invasive repair and repair on extracorporeal membrane oxygenation.
- **Multidisciplinary pediatric care** through a dedicated CDH clinic that brings together various clinical specialists who provide coordinated, continuous care through childhood and adolescence.

## Diagnostic Criteria and Assessment of CDH Severity

**Congenital diaphragmatic hernia (CDH) is diagnosed when a prenatal ultrasound demonstrates abdominal organs in the affected hemithorax and mediastinal shift of the heart to the contralateral side.**

**In the plane of the four-chamber view, the maximal perpendicular dimensions of the contralateral lung are measured (see figure). Traditionally, lung size was related to the fetal head circumference (lung-to-head ratio, or LHR). In contrast to the LHR, the observed-to-expected LHR (O/E LHR), expressed as a percentage of expected lung size, allows for assessment of severity independent of gestational age (Table, Jani et al 2008).**




$$\text{LHR} = \frac{\text{Length A (mm) x Length B (mm)}}{\text{Head circumference (mm)}}$$

$$\text{O/E LHR} = \frac{\text{Observed LHR}}{\text{Expected LHR}}$$

| Severity | O/E LHR | LHR | Liver | Survival |
|---|---|---|---|---|
| Extreme | <15% | <0.4 | – | 0% |
| Severe | 15–24% | 0.4–0.84 | Up<br>Down | 30% |
| Moderate | 25–34%<br>35–44% | 0.85–1.3<br>1.35–1.75 | Up<br>Down<br>Up | 50–70% |
| Mild | 35–44%<br>>45% | 1.35–1.75<br>>1.8 | Down<br>Up<br>– | 75–100% |

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NEWS FROM THE JOHNS HOPKINS CENTER FOR FETAL THERAPY

# Assessing the Effectiveness of FETO, a New Experimental Therapy for Congenital Diaphragmatic Hernia

Congenital diaphragmatic hernia (CDH) is a developmental defect characterized by a partial or complete absence of the diaphragm. It affects approximately one in 4,000 fetuses. The condition can allow abdominal organs, such as the liver and intestines, to protrude into the thoracic cavity and compress the lungs, disrupting lung development. In severe cases, all aspects of lung physiology are affected, leading to significant morbidity and mortality after birth.

## The Johns Hopkins Center for Fetal Therapy: A National Leader

The Johns Hopkins Center for Fetal Therapy is one of only a few centers nationwide with the expertise and experience to provide comprehensive CDH care. Directed by **Ahmet Baschat**, the center's team can diagnose CDH early in pregnancy, counsel patients about the underlying disorder, and provide and coordinate treatment—both before and after birth.

A defining feature of the center is its seamless integration with the Johns Hopkins Children's Center's multidisciplinary fetal program, directed by **Eric Jelin**. This team brings together clinical specialists in pediatric surgery, pulmonology, cardiology, neurology, nutrition and other areas to provide state-of-the-art care for babies with CDH, from birth through childhood and adolescence.

Baschat's group of highly dedicated and trained specialists, including maternal-fetal medicine specialist **Jena Miller**, is engaged in an international, multicenter study of an experimental CDH therapy, known as fetoscopic tracheal occlusion, or FETO. The premise of FETO is to encourage early lung growth by temporarily blocking the trachea, thereby trapping the fluid that normally accumulates in the fetal lungs.

## Evaluating FETO, a New Experimental Therapy for CDH

While the definitive treatment for CDH is postnatal surgical repair of the diaphragm, clinicians have long sought treatment methods that can be applied during the fetal period to improve lung formation and function.

In 2009, researchers in Belgium and elsewhere in Europe published the results of a large feasibility study of FETO involving more than 200 cases of CDH.[1] Notably, the study reported significant increases in survival in both left-side CDH—from 24.1 percent to 49.1 percent—and right-side CDH—from zero to 35.5 percent. Although these results seem encouraging, the beneficial effects of FETO are unproven until they are evaluated using gold-standard methods, such as a randomized controlled clinical trial.

To address this need, researchers in the U.S. and Europe recently launched an international, multicenter, randomized controlled clinical trial to evaluate FETO. Known as the TOTAL (Tracheal Occlusion to Accelerate Lung Growth) Trial, the effort will assess the safety and efficacy of FETO in severe CDH. The Johns Hopkins center is one of seven U.S. centers participating in the TOTAL Trial. So far, only a handful of centers have demonstrated technical proficiency in FETO. Johns Hopkins reached this milestone in July 2015.

According to FDA regulations, each U.S. trial center must first complete an initial feasibility phase before enrolling patients in the randomized controlled portion of the TOTAL Trial. Johns Hopkins is now undergoing its feasibility phase and will likely complete it within one or two years.

"This experimental therapy is based on really solid science," says Baschat. "It has now moved to the point where we have the expertise in this country, with a handful of centers that can do the procedure in a technically proficient manner, and now these centers are working together in an academic collaboration that is designed to bring the truth as quickly as possible to patients and providers."

## The Role of Referring Physicians

A major challenge in CDH is identifying the defect early in pregnancy and quickly referring patients to a high-volume fetal therapy center, such as the one at Johns Hopkins, for subsequent follow-up and care. On fetal ultrasound, key findings that suggest CDH include a displaced heart—found on the right side, instead of its normal left-side position—and cystic lesions in the chest, representing stomach or intestines.

During the feasibility phase, all patients who qualify for FETO and wish to undergo the therapy can receive it. However, once the feasibility phase is closed and the randomized controlled phase begins, eligible patients will be chosen at random to receive—or not receive—the therapy.

## FETO at a Glance

Fetoscopic tracheal occlusion (FETO) is an experimental procedure performed between 26 and 29.6 weeks of gestation in severe cases of congenital diaphragmatic hernia. It is performed using minimally invasive technique under ultrasound guidance.

- A fetoscope is directed into the mouth of the fetus and down into the trachea.
- Using a catheter, a deflated balloon is inserted into the trachea, just above the point where it divides into the right and left lungs.
- Once the balloon is in place, it is inflated gently with saline and detached from the catheter.
- The balloon typically remains in place until around 34 weeks, when it is removed through a second fetoscopic procedure or deflated under ultrasound guidance.

### Video Extra

Maternal-fetal medicine specialist **Jena Miller** answers questions about congenital diaphragmatic hernias, the fetoscopic tracheal occlusion treatment and its outcomes.
**hopkinsmedicine.org/clinicalconnection/cdh**

References
[1] Jani JC et al. Severe diaphragmatic hernia treated by endoscopic tracheal occlusion. *Ultrasound in Obstetrics & Gynecology* 2009 34: 304-10


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