



# Use of the Lung “Float Test” (Hydrostatic Lung Test): An Inaccurate, Outdated, and Unethical Forensic Practice

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## Introduction

The so-called “floating lung” or hydrostatic test has been used for decades in the United States and elsewhere as part of legal processes involving suspected infant or neonatal deaths.<sup>1, 20-24</sup>

Forensic experts are often called upon to establish whether an infant (“neonate”) was stillborn or was born alive and subsequently died. Historically, many have used the “floating lung” test, which is a centuries-old<sup>2</sup> traditional method for evaluating whether there was air in the lungs of the neonate by taking lung tissue and observing whether it floats (for example, there was air or gas in the lung) or sinks (for instance, there was no or a relative lack of air or gas) in water or formalin (used to preserve tissue samples). If the lung floats — indicating the possibility that there was air or gas in the lung — the implication was that the neonate breathed before its death.

### What is the “floating lung” test?

The “floating lung” test, also known as the hydrostatic test, can be performed as part of an autopsy by placing the lungs, or pieces of them, in water and assessing whether they float. A floating lung, it has been argued, may provide evidence that a newborn has taken breaths, and was therefore born alive before dying. It has been used as part of legal investigations attempting to evaluate whether a neonate was born alive or whether it was stillborn.

This test, however, has been deemed wholly unreliable by pathologists and forensic experts for decades and is therefore not accepted by the wider forensic pathology community as a credible or accurate test to distinguish between live versus stillbirth. Nevertheless, despite its documented inaccuracy, the test is still being used and entered into evidence by prosecutors in countries such as France, Germany, Italy, Russia, the United Kingdom, and the United States, as well as countries in Latin America.

The inaccuracy of the test means that it is unethical to rely on its findings as the sole determinant of suspected neonatal death. Reliance on this inaccurate and outdated test would be particularly concerning given its potential use in litigation involving accusations of people having performed, or undergone, an abortion.<sup>3</sup>

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## Is the “floating lung” test accurate?

We reviewed all published medical articles in PubMed through January 2023. Several studies and case reports looked at the accuracy of the test alone or in combination with other tests.<sup>4-11</sup> There is consensus among the authors of the articles reviewed that the HT is highly inaccurate and should never be used alone when performing a postmortem assessment of a deceased neonate.

Pathologists and other medical experts have argued for decades that this test is an invalid way of determining live as opposed to stillbirth and that there is no way to state, to a reasonable degree of

medical probability, much less medical certainty, that an infant was born alive. It is just as likely the infant was born dead (due to a miscarriage or stillbirth).

One of the main reasons to avoid using the test is its inaccuracy. For example, in some studies, the lungs of infants who were known to be stillborn still floated, causing a “false positive.” This can occur for several reasons:

- Because of “putrefaction” or decomposition of the body;
- Through the provision of resuscitation (cardiopulmonary resuscitation, or CPR, mouth-to-mouth or via ventilation); or
- Through the handling of a deceased neonate’s body by law enforcement, clinical staff, or during transport or the postmortem examination.

Likewise, other studies have shown that the lungs of infants known to be born alive (to have breathed before dying), ended up sinking (“false negative”) due to, for instance, the presence of fluid in the fetal lung (for example, after a waterbirth). Such results limit the conclusions that can be reached based on this test.

According to one of the leading forensic pathology textbooks, “There are too many recorded instances when control tests have shown that stillborn lungs may float and the lungs from undoubtedly live-born infants have sunk, to allow it to be used in testimony in a criminal trial.”<sup>12</sup>

Similarly, a leading pediatric forensic medicine textbook notes that “the use of the property of lungs to float in water (or buffered formalin) as a determinant of live birth is fraught with difficulty. It is unwise to rely on it as the only determinant of live birth even when some or any of the published modifications, which allegedly improve reliability, are introduced.”<sup>13</sup>

“False- positive and false-negative are the reason why the hydrostatic test results are not reliable. There are well-known influences that may affect the results.”<sup>6</sup>

## What other methods are used to assess whether a neonate was born alive?

There is no single test that can determine and resolve such a question conclusively. Forensic experts consider multiple assessment methods, while recognizing that a high degree of certainty is rarely achieved. Some of these methods include taking a complete history of the pregnancy and events surrounding the death of the newborn, as well as the personal medical history of the pregnant person. Other test modalities have been used as part of a comprehensive assessment. Imaging studies such as postmortem MRI or CT scan are being evaluated for their potential to provide more accurate results.<sup>14-19</sup> An autopsy with microscopic studies of organs and tissues and microbiological tests are commonly used. Genetic and metabolic tests to ascertain whether a neonate had any anomalies that could have contributed to death should also be part of the evaluation.

The test has been deemed wholly unreliable by pathologists and forensic experts for decades and is therefore not accepted by the wider forensic pathology community as a credible or accurate test to distinguish between live versus stillbirth.

## Why is the test important?

The consequences of getting such a determination wrong in a medical-legal context can be devastating. While this is true for a “false negative,” it is especially true for a “false positive” result. A false-positive result (interpreting a stillbirth as having breathed, and thus born alive) could incorrectly lead to accusation of infanticide against of birthing persons, medical practitioners, or caregivers or lead to their wrongful conviction.

“Even one such failure negates the whole history of the test ... the authors are saddened to contemplate the number of innocent women who were sent to the gallows in previous centuries on the testimony of doctors who had an uncritical faith in this crude technique,” state the authors of one of the leading textbooks on forensic medicine.<sup>12</sup>

As the noted pathologist Dr. Lester Adelson, wrote: “Unless the pathologist has incontrovertible criteria of post-natal survival, e.g., well expanded lungs, food in the stomach, or vital reaction in the stump of the umbilical cord, she is legally bound not to diagnose live birth.”<sup>20</sup>

Despite the clear rejection by renowned forensic experts of the test to determine whether a neonate has taken a breath, courts have played a deleterious role in promoting its continued use.<sup>3</sup>

U.S.-based prosecutors in several states have relied on the test to seek convictions of feticide, murder, or manslaughter against women who have undergone self-managed abortions or experienced a stillbirth.<sup>21-24</sup> While there is no way to know how common the use of the test is, Pregnancy Justice, an organization that defends people charged with crimes in connection with their pregnancies and pregnancy outcomes, is aware of nearly 10 cases in recent years in which the “lung float” test was used or considered by prosecutors to support prosecutions of pregnancy-related crimes in states such as California, Illinois, Indiana, and Ohio. The reliance on this test to prosecute women experiencing stillbirths or neonatal death for aggravated homicide is consistent with the practice of courts in countries that have prioritized pursuing legal cases against women with obstetric emergencies, including El Salvador which has criminalized abortion in all circumstances and where between 2000 and 2019, 181 women who experienced obstetric emergencies were prosecuted for aggravated homicide or abortion.<sup>24</sup>

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## Conclusion

The so-called “floating lung” test, also known as the hydrostatic test, has been used historically, and in some cases contemporaneously in legal proceedings assessing whether a neonate was born alive. Despite its being deemed for decades by dozens of authoritative pathologists and forensic experts as wholly unreliable and inaccurate, the test is still being used as a part of routine practice.

Reflecting the clear consensus among forensic medical experts that the test is highly inaccurate and should not be used — certainly never as the only test when performing a postmortem assessment of a deceased neonate — prosecutors and judges must refrain from relying on these tests as determinative in prosecuting crimes related to conduct in pregnancy.

## References:

1. Chris Milroy, "Neonatal Deaths, Infanticide, and the Hydrostatic (Floatation) Test: Historical Perspectives", 2012. Accessed February 16, 2023.
2. The Hydrostatic Test of Stillbirth. *Hospital (Lond 1886)*. 1900;29(742):190.
3. Aziza Ahmed, "Floating Lungs: Forensic Science in Self-Induced Abortion Prosecutions," *Boston University Law Review* 100, no. 1111 (2020).
4. Isabella Aquila, Pietrantonio Ricci, Rita Mocciano, and Santo Gratteri, "A Case of Suspected Illegal Abortion: How Clinicians May Assist the Forensic Pathologist," *BMJ Case Rep.*(2018), <https://doi:10.1136/bcr-2017-220577>.
5. Jan Dressler, Uwe Schmidt, Uwe Hanisch, Günter Demmler, Axel Riehn, and Stefan Pollak "Neonatal Freshwater Drowning After Birth in the Bathroom," *Am J Forensic Med Pathol*. 32, no. 2(June 2011):119-123, doi:[10.1097/PAF.0b013e318187dff9](https://doi.org/10.1097/PAF.0b013e318187dff9).
6. Rania Azzahra, Salsazayasya Parikesit, Nita Novita, Hermin Aminah Usman, "Pathological Findings of the Lung at Neonatal Autopsy in Dr. Hasan Sadikin General Hospital Bandung Period 2016-2019," *Althea Medical Journal*8, no. 3 (2021):149-154. doi:[10.15850/amj.v8n3.2337](https://doi.org/10.15850/amj.v8n3.2337).
7. T. Ohshima, T. Kondo, Z. Lin Z, and T. Nagano, "Suspected Maternal Infanticide in a Case of Hydranencephaly," *Int J Legal Med*105 (1993): :351-354, doi:[10.1007/BF01222120](https://doi.org/10.1007/BF01222120).
8. G. Cecilie Alfsen, Christian Lycke Ellingsen, Lotte Hernæs, "The Child Has Lived and Breathed.» Forensic Examinations of Newborns 1910-1912," *Tidsskr Nor Laegeforen* 133 (2013): 2498-2501, doi:[10.4045/tidsskr.13.0898](https://doi.org/10.4045/tidsskr.13.0898).
9. Jack J. Moar, "The Hydrostatic Test-a Valid Method of Determining Live Birth?," *Am J Forensic Med Pathol*18, no. 1 (1997): :109-110, doi:[10.1097/00000433-199703000-00027](https://doi.org/10.1097/00000433-199703000-00027).
10. Wendy Lavezzi, Kristina Keough, Paul Der'Ohannesian, et al., "The Use of Pulmonary Interstitial Emphysema as an Indicator of Live Birth," *Am J Forensic Med Pathol*;24, no. 1 (2003): 87-91, doi:[10.1097/01.PAF.0000052108.20359.C8](https://doi.org/10.1097/01.PAF.0000052108.20359.C8).
11. Bianca Phillips and Beng Beng Ong, "Was the Infant Born Alive?' A Review of Postmortem Techniques Used to Determine Live Birth in Cases of Suspected Neonaticide," *Acad Forensic Pathol*8, no. 4 (2018): 874-893, doi:[10.1177/1925362118821476](https://doi.org/10.1177/1925362118821476).
12. Pekka Saukko and Bernard Knight, *Knight's Forensic Pathology*, 4th ed. (Boca Raton: CRC Press, 2016).
13. Jean Keeling, "Fetal and Perinatal Death," in *Paediatric Forensic Medicine and Pathology* (London: Hodder Arnold, 2009).
14. Owen J. Arthurs, John C. Hutchinson, Neil J. Sebire, "Current Issues in Postmortem Imaging of Perinatal and Forensic Childhood Deaths," *Forensic Sci Med Pathol*13, no. 1 (2017): 58-66, doi:[10.1007/s12024-016-9821-x](https://doi.org/10.1007/s12024-016-9821-x).
15. Anna-Lena Große Ostendorf, Markus A. Rothschild, Annette M. Müller & Sibylle Banaschak, "Is the Lung Floating Test a Valuable Tool or Obsolete? A prospective autopsy study," *Int J Legal Med*127, no. 2 (2013): 447-451, doi:[10.1007/s00414-012-0727-1](https://doi.org/10.1007/s00414-012-0727-1).
16. Joy L. Barber, Neil J. Sebire, Lyn S. Chitty, Andrew M. Taylor & Owen J. Arthurs, "Lung Aeration on Post-mortem Magnetic Resonance Imaging Is a Useful Marker of Live Birth Versus Stillbirth," *Int J Legal Med*129, no. 3 (2015): 531-536, doi:[10.1007/s00414-014-1125-7](https://doi.org/10.1007/s00414-014-1125-7).
17. Mathilde Ducloyer, Lucile Tuchtan, Clémence Delteil, Marie-Dominique Piercecchi, et al., "Lung Density Measurement in Postmortem Computed Tomography: A New Tool to Assess Immediate Neonatal Breath in Suspected Neonaticides," *Int J Legal Med*134, no. 3 (2020):1159-1166, doi:[10.1007/s00414-019-02103-3](https://doi.org/10.1007/s00414-019-02103-3).
18. U.N. Tumanova, V.M. Lyapin, V.G. Bychenko, A.I. Shchegolev, and G.T. Sukhikh, "Potentialities of Postmortem Magnetic Resonance Imaging for Identification of Live Birth and Stillbirth," *Bull Exp Biol Med*167, no. 6 (2019):823-826, doi:[10.1007/s10517-019-04631-9](https://doi.org/10.1007/s10517-019-04631-9).
19. Edward L. Mazuchowski, Dori M. Franco, Philip J. Berran, and H. Theodore Harcke, "The Virtual Hydrostatic Test," *Am J Forensic Med Pathol*38, no. 1 (2017): 24-28, doi:[10.1097/PAF.0000000000000287](https://doi.org/10.1097/PAF.0000000000000287).

20. Lester Adelson, *The Pathology of Homicide: A vade Mecum for the Pathologist, Prosecutor and Defense Counsel* (Springfield: Charles C. Thomas, 1974).
21. Ryan Phillips, “Infant Death Case Heading Back to Grand Jury,” *Starkville Daily News*, May 9, 2019, [https://www.starkvilledailynews.com/infant-death-case-heading-back-to-grand-jury/article\\_cf99bcbo-71cc-11e9-963a-eb5dc5052c92.html](https://www.starkvilledailynews.com/infant-death-case-heading-back-to-grand-jury/article_cf99bcbo-71cc-11e9-963a-eb5dc5052c92.html).
22. “Discredited Tests Should no Longer Be Used to Determine If a Baby Was Born Alive: Editorial,” *cleveland.com*, June 19, 2022, <https://www.cleveland.com/opinion/2022/06/discredited-tests-should-no-longer-be-used-to-determine-if-a-baby-was-born-alive-editorial.html>.
23. Leon Neyfakh, “False Certainty,” *Slate*, February 5, 2015, <https://slate.com/news-and-politics/2015/02/purvi-patel-feticide-why-did-the-pathologist-use-the-discredited-lung-float-test.html>.
24. Kate Snyder, “Sorority Sisters Detail Pregnancy,” *Zanesville Times Recorder*, May 11, 2016, <https://www.zanesvilletimesrecorder.com/story/news/local/2016/05/11/weaver-trial-testimony-baby-took-several-breaths-before-death/84231286/>.
25. Agrupación Ciudadana por la Despenalización del Aborto, “Del Hospital a La Cárcel 1998-2019: Consecuencias Para las Mujeres Por la Penalización sin Excepciones de la Interrupción del Embarazo en El Salvador,” *El Salvador*, 2019, <https://agrupacionciudadana.org/download/del-hospital-a-la-carcel-tercera-edicion/?wpdmdl=13171&refresh=651ae443b84f81696261187>. See also Center for Reproductive Rights, “Case of Manuela v. El Salvador: The Impact of Blanket Abortion Bans on Women Experiencing Obstetric Emergencies,” [https://reproductiverights.org/wp-content/uploads/2021/03/Factsheet-MANUELA\\_INGLES.pdf](https://reproductiverights.org/wp-content/uploads/2021/03/Factsheet-MANUELA_INGLES.pdf).



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