

# PREGNANCY



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“Did you know that embryologists have recently captured the moment of conception via fluorescence microscopy? What they discovered is that at the exact moment a sperm penetrates an egg, the egg releases billions of zinc atoms that emit light. Sparks fly, literally! That miracle of conception is a microcosm that mirrors God's first four words.”

– Mark Batterson, *Whisper: How to Hear the Voice of God*

# I LEGALLY CONCEIVED

**M**oment of conception. The earliest protection accorded to the life of the unborn by the Constitution. When is the moment of conception? This question was the subject of deliberations during the drafting of the 1987 Constitution.<sup>1</sup>

In *Imbong v. Ochoa*,<sup>2</sup> the Supreme Court adopted the medical definition of conception as beginning immediately at fertilization, which is the union of two haploid gametes, the spermatozoa, and the oocyte, to restore the diploid state, form a zygote<sup>3</sup> through the process of egg activation, and commence a series of mitotic divisions that results in cell differentiation and embryo development.

Conception is central in most of our laws relating to pregnancy. The Civil Code provides that birth determines personality but the *conceived* child shall be considered born for all purposes that are favorable to it,<sup>4</sup> provided the fetus is considered born if it is alive at the time it is completely delivered from the mother's womb. However, if the fetus had an

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<sup>1</sup> Pastor of Cosmopolitan Church and Ellinwood Church in Manila, was appointed by President Corazon Aquino to the Constitutional Commission which drafted the 1987 Constitution.

<sup>2</sup> G.R. No. 204819, April 8, 2014

<sup>3</sup> The cell formed by the union of a male sex cell (a sperm) and a female sex cell (an ovum). The zygote develops into the embryo following the instruction encoded in its genetic material, the DNA. "Medical definition of Zygote," Medical Editor: Melissa Conrad Stöppler, MD Reviewed on 3/29/2021, MedicineNet, <https://www.medicinenet.com/zygote/definition.htm>

<sup>4</sup> Art. 40, Civil Code.



**Zygote: egg cell after fertilization with a sperm.** The male and female pronuclei are converging, but the genetic material is not yet united. Nina Sesina, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons

intra-uterine life of fewer than seven months, it is not deemed born if it dies within twenty-four hours after its complete delivery from the maternal womb.<sup>5</sup>

The time of conception determines whether a child is legitimate or illegitimate. If *conceived* or born during the marriage of the parents, the child will be considered legitimate.<sup>6</sup> Those *conceived* and born outside a valid marriage are illegitimate unless otherwise provided for in the Family Code.<sup>7</sup>

The legitimacy of a child may be impugned on the ground that it was physically impossible for the husband to have sexual intercourse with his wife within the first 120 days of the 300 days which immediately preceded the birth of the child because of: (a) the physical incapacity of the husband to have sexual intercourse with his wife; (b) the fact that the husband and wife were living separately in such a way that sexual

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<sup>5</sup> Art. 41, Civil Code.

<sup>6</sup> Art. 164, Family Code.

<sup>7</sup> Art. 165, Family Code.

intercourse was not possible; or (c) serious illness of the husband, which absolutely prevented sexual intercourse.<sup>8</sup>

If the marriage is terminated and the mother contracted another marriage within three hundred days after such termination of the former marriage, these rules shall govern in the absence of proof to the contrary:

(1) A child born before one hundred eighty days after the solemnization of the subsequent marriage is considered to have been *conceived* during the former marriage, provided it be born within three hundred days after the termination of the former marriage;

(2) A child born after one hundred eighty days following the celebration of the subsequent marriage is considered to have been *conceived* during such marriage, even though it be born within the three hundred days after the termination of the former marriage. (259a)<sup>9</sup>

In legal practice, evidence of conception is needed to establish the rights of the unborn as well as its status.

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<sup>8</sup> Art. 166 (1), Family Code.

<sup>9</sup> Art. 168, Family Code.

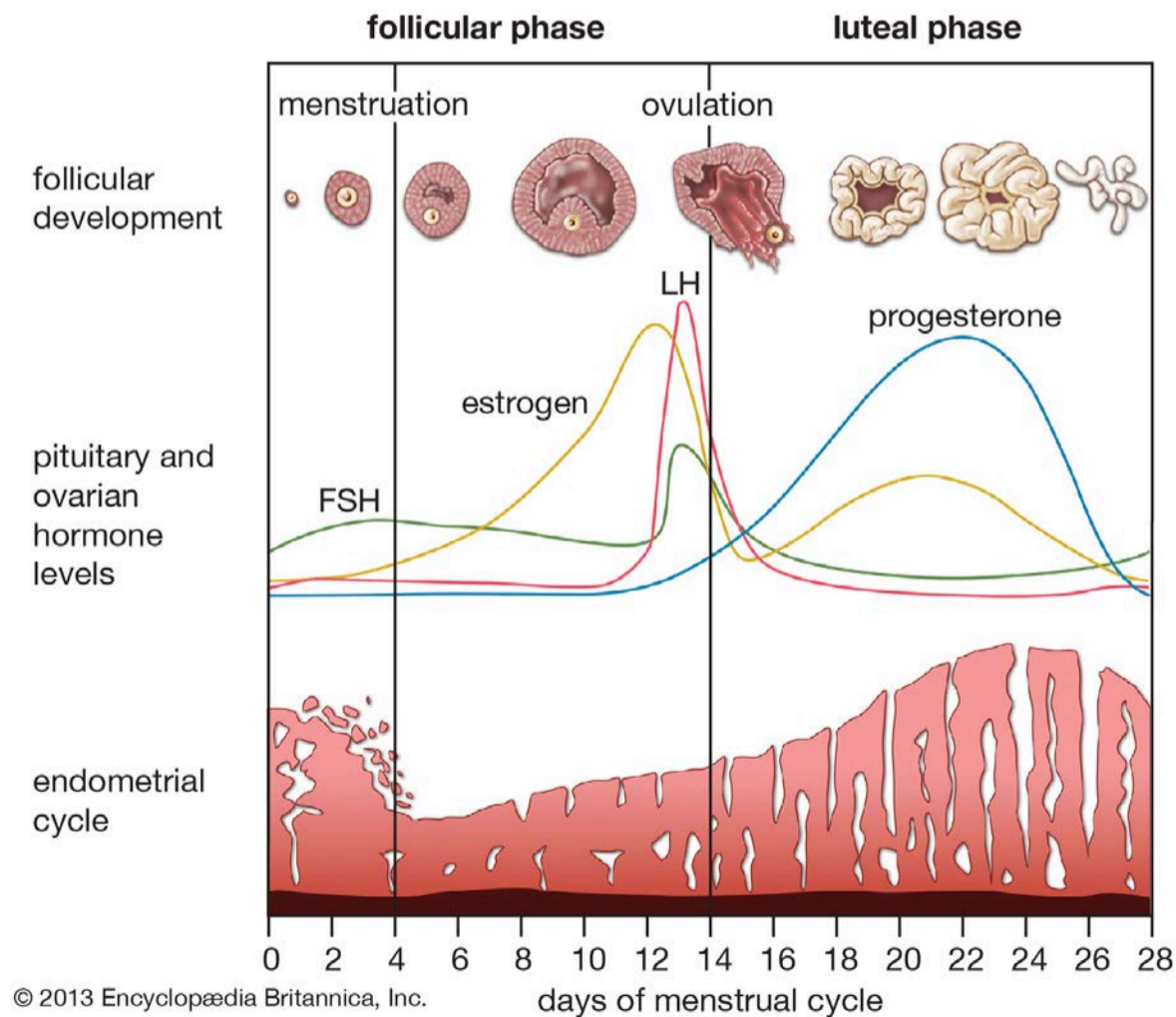
For You formed my inward parts;  
 You knitted me together in my mother's womb.  
 I praise You, for I am fearfully and wonderfully made...  
 PSALM 139: 13, 14A<sup>10</sup>

# 2 PREGNANCY

## MENSTRUAL CYCLE

An average menstrual cycle lasts 28 days. It starts with the first day of the Last Menstrual Period (LMP) and ends with the first day of the next menstrual period. However, the length of women's cycles varies, particularly for the first year or 2 after a young woman

The menstrual cycle



Cyclical changes during a woman's normal ovulatory menstrual cycle.

<sup>10</sup> King David, Israel, 1010–970 B.C.

has her first period. Women may have cycles as short as 21 days, or as long as 45 days during the first few years.<sup>11</sup>

## DATE OF CONCEPTION

Conception happens only during ovulation when fertilization takes place. Ovulation usually occurs on the 14<sup>th</sup> day after the menstrual period and lasts for less than 24 hours. Sperms can survive up to 7 days inside a woman's body.<sup>12</sup> The date of conception may be estimated by using the following formula based on the LMP:

$$\text{LMP} + \text{cycle length} - 14 = \text{conception date}^{13}$$

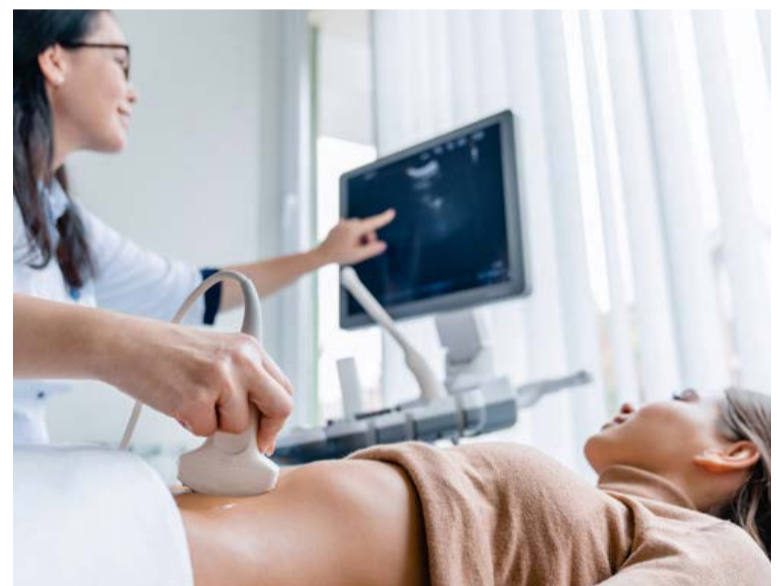
An average pregnancy lasts 280 days (40 weeks) from the first day of the last menstrual period (LMP) or 266 days after conception.<sup>14</sup> Using this information, the date of conception can also be estimated by:

$$\text{Due date} - 266 \text{ days} = \text{day of conception.}^{15}$$

## PREGNANCY CONFIRMATION ULTRASOUND

A pregnancy *confirmation ultrasound* is the best way to know how far along your pregnancy is and to determine when you conceived. Pregnancy ultrasounds look directly at the development of the growing baby to determine its age and when you likely conceived. This method is much more accurate than date-based calculation.

Proof on the date of conception using a confirmation ultrasound may be done using an expert witness, an Obstetrician-Gynecologist (OB-GYNE) preferably with a subspecialty in ultrasonology. Subspecialists in this field (OB-GYN ultrasonologists) are likely



Pregnancy confirmation ultrasound. Photo from [verywellfamily.com](https://www.verywellfamily.com)

<sup>11</sup> "Menstrual Cycle Overview," Health, Johns Hopkins Medicine, accessed October 16, 2021,

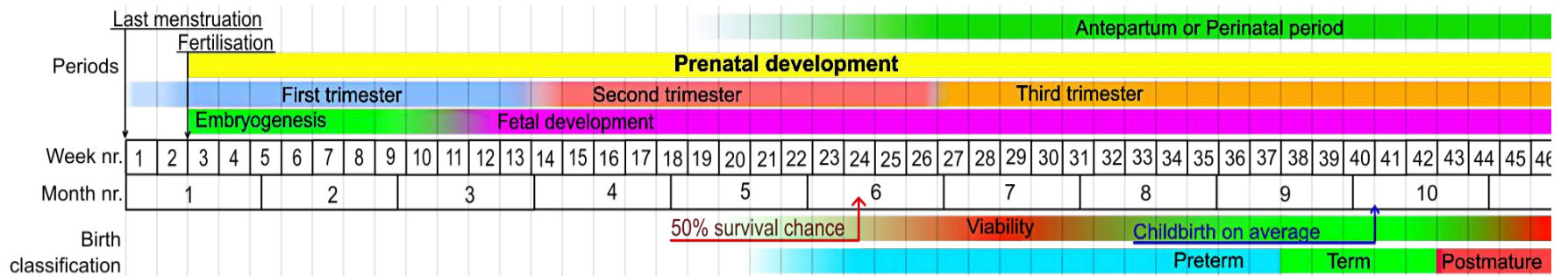
<sup>12</sup> Dominika Miszewska, Conception Calculator, Omni Calculator, accessed February 10, 2021, <https://www.omnicalculator.com/health/conception-date#conception-calculator-based-on-lmp>

<sup>13</sup> Id.

<sup>14</sup> Committee Opinion No 700: Methods for Estimating the Due Date. *Obstet Gynecol.* 2017 May;129(5):e150-e154. doi: 10.1097/AOG.0000000000002046. PMID: 28426621. <https://pubmed.ncbi.nlm.nih.gov/28426621/>

<sup>15</sup> Dominika Miszewska, Conception Calculator, Omni Calculator, accessed February 10, 2021, <https://www.omnicalculator.com/health/conception-date#conception-calculator-based-on-lmp>





Pregnancy timeline. Häggström, Mikael (2014). "Medical gallery of Mikael Häggström 2014". WikiJournal of Medicine 1 (2). DOI:10.15347/wjm/2014.008. ISSN 2002-4436. Public Domain.

members of the Philippine Society of Ultrasound in Obstetrics and Gynecology.<sup>16</sup> In the absence of confirmation ultrasound, the date-based calculation may be used in evidence.

## LENGTH OF PREGNANCY

*Gestational age* (GA) refers to the length of pregnancy after the first day of the last menstrual period (LMP) and is usually expressed in weeks and days. This is also known as the *menstrual age*.

*Conceptional age* (CA) also called the fertilization age, is the true fetal age and refers to the length of pregnancy from the time of conception.

An *embryo* is a developing offspring during the first eight weeks following fertilization, (ten weeks' gestational age) after which, the term *fetus* is used until birth.

Pregnancy is divided into three trimesters of approximately 3 months each. The first trimester includes conception, which is when the sperm fertilizes the egg. The fertilized egg then travels down the Fallopian tube and attaches to the inside of the uterus, where it begins to form the embryo and placenta.

Ultrasound has emerged as the more accurate method of assessing fetal gestational age, especially in the first trimester. Both *transvaginal*<sup>17</sup> and *transabdominal*<sup>18</sup> probe assessments are used to obtain a more accurate measurement of gestational age. Transvaginal is more helpful in first-trimester pregnancies. Multiple parameters have been described using ultrasound to aid in calculating gestational age and will be

<sup>16</sup> Website: <https://psuog.org/index.php>

<sup>17</sup> across or through the vagina. The ultrasound probe will be placed inside the vagina during the test.

<sup>18</sup> passing through or performed by passing through the abdomen or the abdominal wall.

described here. Additionally, postnatal scoring systems involving focused physical and neurologic exams may also provide insight into gestational age.<sup>19</sup>

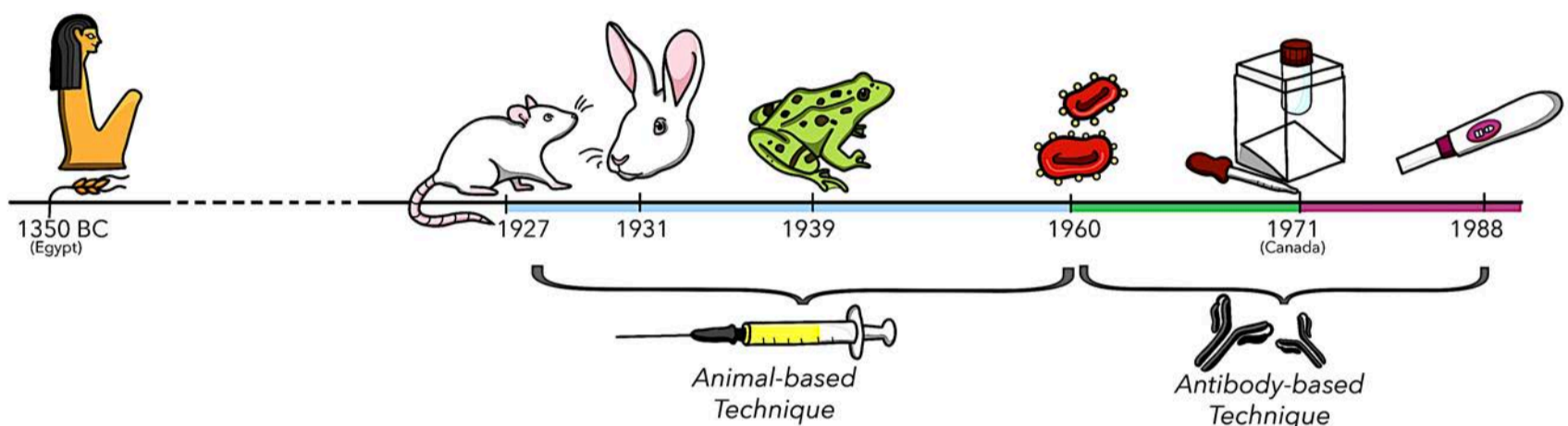
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<sup>19</sup> Naidu K, Fredlund KL. Gestational Age Assessment. [Updated 2021 Aug 2]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK526000/>

“There is only one pretty child in the world,  
and every mother has it.”  
Chinese Proverb

# 3 PROOF OF PREGNANCY

Test done in Lab, at Doctor's Office or at Home



Pregnancy timeline. Figure by Olivia Foster.

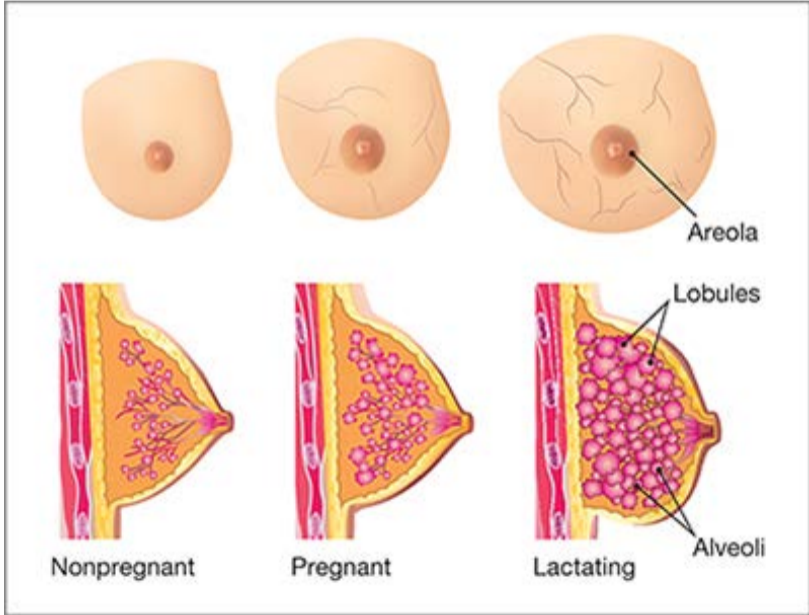
From ancient Egypt to today, the urine-based pregnancy test has improved in speed, accuracy, and feasibility. The oldest known test involved urinating on grain seeds and seeing if they sprouted. The late 1920s marked the first modern pregnancy tests, in which urine was injected into animals: pregnant women's urine made them ovulate. These tests required shipping urine to a lab and took at least a week to get results. Starting in 1960, antibodies allowed testing for pregnancy to be done in doctor's offices, making pregnancy testing faster and more routine. By 1971, an at-home version of this antibody-based test was available in Canada, although at-home testing didn't reach the USA until 1977. The first stick tests similar to at-home tests on the market today were developed in 1988.<sup>20</sup>




## PRESUMPTIVE SIGNS OF PREGNANCY

Anatomical and physiological changes occur during pregnancy as a result of an orchestra of hormones, electrolytes, enzymes, chemokines, histamines, bradykinins,

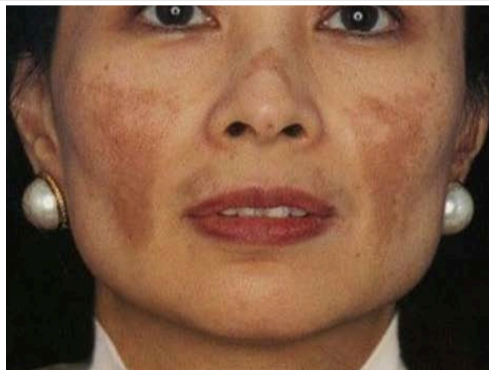

<sup>20</sup> Kelsey Tyssowski, "Pee is for Pregnant: The history and science of urine-based pregnancy tests," Harvard University, The Graduate School of Arts & Sciences, August 31, 2018, <https://sitn.hms.harvard.edu/flash/2018/pee-pregnant-history-science-urine-based-pregnancy-tests/>


prostaglandins, and immune cells creating a symphony of frenzied migration, division of millions of precursor cells undergoing morphological changes as they reach their final destinations in the developing human body. As the mother and baby adjust to each other, signs Many of these body adjustments mimic many conditions as well as produce signs and symptoms common with other illnesses. (Fig. 1)

<b>1st TRIMESTER (0-3 months)</b>	<b>Cause or explanation</b>	<b>Other causes or conditions with similar sign or symptoms</b>
<b>Missed period (amenorrhea)</b>	Hormones secreted by the blastocyst (after burrowing into the endometrial lining) take control of the menstrual cycle	malnutrition due to fad diets, cancer, liver disease, genetic or chromosomal disorders
<b>Nausea and vomiting</b>	Due to rapidly increasing levels of the hormone, human chorionic gonadotropin (hCG); nausea tends to peak around the same time as levels of hCG	exposure to toxins, emotional stress, gall bladder disease, brain tumors, inflammation of the brain or meninges
<b>Sensitivity to odors (hypersomnia)</b>	Due to high levels of the hormone estrogen	allergies, diabetes, Vitamin B-12 deficiency, Cushing syndrome
<b>Fatigue</b>	Occurs due to higher levels of the hormone progesterone, in order for the body to focus its energy on sustaining the pregnancy	anemia, insomnia, depression, hypothyroidism, caffeine overload, urinary tract infections
<b>Breast enlargement</b>	<p>Due to increased levels of estrogen, the mammary glands begin to enlarge in preparation for breastfeeding</p> 	use of oral contraceptives, hormone replacement therapy, polycystic ovarian disease
<b>Breast tenderness</b>	The enlargement of the mammary glands causes the breasts to become tender	mastitis (breast infection), certain drugs (e.g., oxythone, chlorpromazine), breast cyst, breast cancer

<p><b>Darkening and increase in size of the areola</b></p>	<p>The pigmented areas around each breast's nipple darken due to increased levels of progesterone and estrogen (this is believed to help the newborn find the breast at birth)</p> 	<p>Paget's disease, oral contraceptives, diabetes</p>
<p><b>Mood swings</b></p>	<p>Partly due to surges in hormones; characterized by change in emotional stability and irritability</p>	<p>Bipolar disorder; experiencing a significant life change; not getting enough sleep; not eating healthily; taking medications that impact mood or sleep.</p>
<p><b>Expanding abdomen</b></p>	<p>The placenta produces progesterone, which relaxes the muscles of the uterus so they can stretch as the pregnancy progresses</p> 	<p>obesity, uterine fibroids, certain cancer (ovaries, breast, bowel, stomach, pancreas, lung, liver)</p>
<p><b>2nd TRIMESTER (4-6 months)</b></p>	<p><b>Cause or explanation</b></p>	<p><b>Other causes or conditions with similar sign or symptoms</b></p>
<p><b>Quickening</b></p>	<p>Feeling fetal movements for the first time</p>	
<p><b>Stretch marks</b></p>	<p>Due to the expanding abdomen, breasts, legs, buttocks</p> 	<p>Family history of stretch marks; rapid growth in adolescence; rapid weight gain; using corticosteroids; having breast enlargement surgery; exercising and using anabolic steroids; having a genetic disorder such as Cushing's syndrome or Marfan syndrome</p>

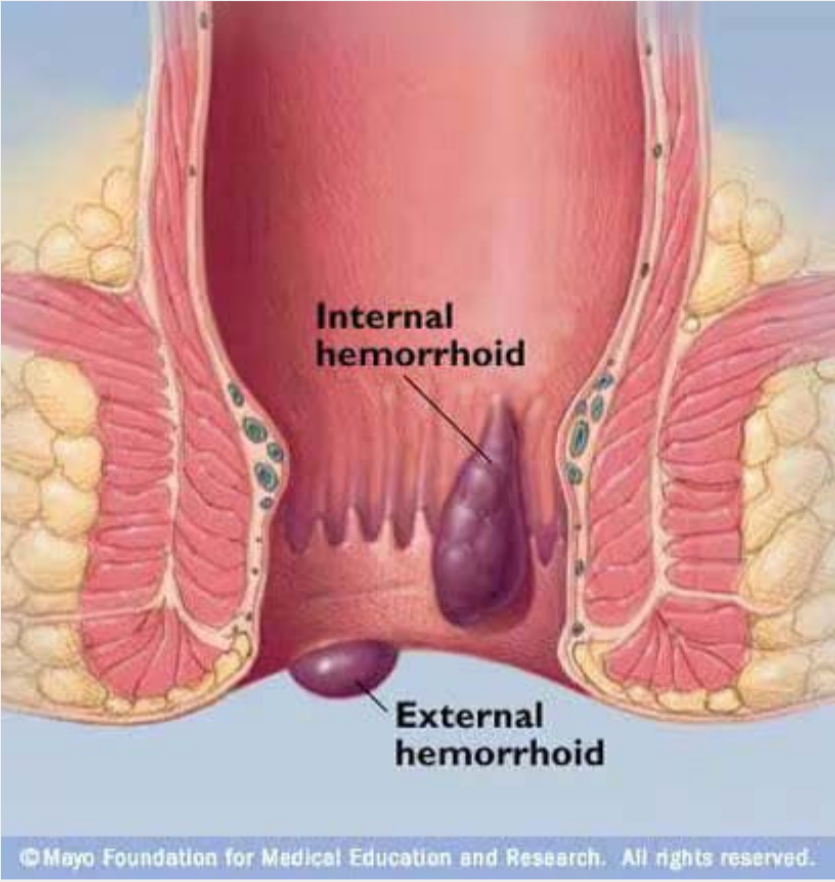

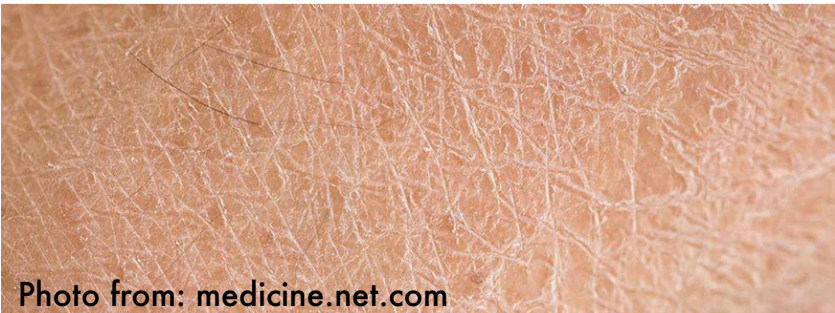
<b>2nd TRIMESTER (4-6 months)</b>	<b>Cause or explanation</b>	<b>Other causes or conditions with similar sign or symptoms</b>
<b>Sweating</b>	Due to hormonal changes, increased effort on physical activities due to the expanding uterus, and the fetus beginning to radiate body heat	diabetes, some forms of cancer, low blood sugar, thyroid conditions, nervous system disorders, infections
<b>Difficulty in sleeping</b>	Due to fetal movements or frequent urination at night	anxiety disorders, caffeine, nicotine and alcohol, medicines (alpha/beta blockers, corticosteroids, ACE inhibitors, H1 antagonists)
<b>Leukorrhea</b>	Higher levels of estrogen increase blood flow to the vagina, which, in turn, increases the release of a white-colored, odorless vaginal discharge (sign of a healthy vagina)	bacterial infections especially sexually transmitted diseases, yeast infection
<b>Hair growth</b>	Due to hormone stimulation of hair follicles on the head, arms, legs, and face	polycystic ovarian syndrome, increase of androgens, diabetes, medications such as steroids, minoxidil, danazol, cyclosporine, phenytoin
<b>Dry, itchy skin</b>	Particularly on the abdomen as the skin continues to grow and stretch due to the expanding uterus	eczema (dermatitis), psoriasis, scabies, parasites, burns, scars, insect bites, liver and kidney sieges, anemia, diabetes
<b>“Linea nigra”</b>	A dark line running from the pubic bone up the center of the abdomen to the ribs, which is caused by the increase in hormones	
<b>Slower digestion</b>	High levels of progesterone slow down the contractions of the esophagus and intestine, thus slowing down digestion	Gastroparesis - slowing of digestion, usually from unknown cause but may also be due to diabetes complications or after surgery
<b>Constipation</b>	Due to a slower digestion	low fiber diet, low hydration, lack of exercise, changes of routine, eating large amounts of milk or cheese, stress

<b>Hemorrhoids</b>	Due to constipation	sitting too long in the toilets, straining during bowel movements; being obese; having anal intercourse, regular heavy lifting
<b>Heartburn</b>	The placenta produces progesterone, which relaxes the valve that separates the esophagus from the stomach, allowing gastric acids to seep back up, causing an unpleasant burning sensation	too much intake of coffee, chocolate, or heavy meal
<b>Backaches</b>	Due to the expanding uterus affecting posture	sciatic nerve compression, spinal osteoarthritis, sacroiliaca joint dysfunction
<b>Facial skin changes (melasma)</b>	Dark patches appear on the face due to hormonal changes (mask of pregnancy)	radiation (UV, infra-red, estrogen and progesterone, thyroid disorders, skin care products
		
<b>Increased frequency in urination</b>	Due to increased blood flow to the kidneys and pressure from the weight of the pregnancy on the bladder	bladder stones; change in kidney function, Diabetes insipidus; diuretics; excessive consumption of total fluids, alcohol or caffeine.
<b>Edema</b>	Swelling of the ankles, hands, and face, due to fluid retention	long periods of standing or sitting; sitting or standing for too long; venous insufficiency; chronic (long-term) lung diseases; congestive heart failure. .
		

<p><b>Naval protrusion (bellybutton sticking out)</b></p>	 <p>Photo from:pond5.com</p>	
<p><b>Colostrum</b></p>	<p>Yellow, watery fluid produced by the mammary glands. Colostrum contains large amounts of antibodies that help protect the mucous membranes in the throat, lungs, and intestines of the infant. White blood cells are also present in large numbers and begin protecting the infant from harmful bacteria and viruses. Beneficial bacteria are also established in the digestive tract of an infant when colostrum is ingested.</p>	
<p><b>Estrogen</b></p>	<p>A pregnant woman will have more estrogen in her body during the 9 months of pregnancy than a woman who never gets pregnant will have in her entire lifetime.</p>	<p>obesity, stress, excessive alcohol consumption, polycystic ovary syndrome, uterine fibroids can increase estrogen levels</p>
<p><b>Progesterone</b></p>	<p>By the end of the pregnancy, levels of this hormone will increase seven times its normal levels during pregnancy.</p>	<p>ovarian cysts, ovarian cancer, molar pregnancy, adrenal gland disorder can increase progesterone levels</p>

<p><b>3rd TRIMESTER (7-9 months)</b></p>	<p><b>Causes or explanation</b></p>	<p><b>Other causes or conditions with similar sign or symptoms</b></p>
<p><b>Heart turns on its side</b></p>	<p>Takes place in order to make room for expanding uterus, which pushes other organs up as well</p>	
<p><b>Varicose veins</b></p>	<p>Swollen/bluish veins that may bulge near the surface of the skin, usually behind the legs. As the uterus grows, it puts pressure on the large vein on the right side of the body, which, in turn, increases pressure on the veins in the legs, making the veins swell from the extra pressure to return the blood from the extremities to the heart (as they work against gravity)</p>	<p>obesity, prolonged standing, restrictive clothing</p>
<p><b>Heartburn</b></p>	<p>The growing fetus crowds the abdominal cavity, pushing the stomach acids back up into the esophagus</p>	<p>gastroesophageal reflux disease, smoking, stress and anxiety</p>



<p><b>Hemorrhoids</b></p>	<p>Due to constipation</p>  <p>© Mayo Foundation for Medical Education and Research. All rights reserved.</p>	<p>obesity, sitting in the toilet for too long; low fiber diet, regular heavy lifting</p>
<p><b>Leg cramps</b></p>	<p>Experienced by about 50% of women during pregnancy. The cause of cramping is not yet fully understood and is attributed to factors such as changes in circulation during pregnancy and deficiencies in magnesium and calcium.</p>	<p>exercising, injury, exposure to cold temperature of legs, peripheral arterial disease, kidney disease</p>
<p><b>Shortness of breath</b></p>	<p>Due to the expanding uterus pushing up against the diaphragm</p>	<p>anxiety disorders, asthma, broken ribs, excess fluid around the heart.</p>
<p><b>Braxton-Hicks contractions</b></p>	<p>Usually painless uterine contractions that help the uterus prepare for birth</p>	 <p>Photo from: <a href="http://mountelizabeth.com.sg/">mountelizabeth.com.sg/</a></p>
<p><b>Increased frequency in urination</b></p>	<p>Due to increased blood flow to the kidneys and pressure from the weight of the pregnancy on the bladder</p>	
<p><b>Stretch marks</b></p>	<p>Due to the expanding abdomen, breasts, thighs, and buttocks</p>	
<p><b>Dry, itchy skin</b></p>	<p>Particularly on the abdomen as the skin continues to grow and stretch due to the expanding uterus</p>  <p>Photo from: <a href="http://medicine.net.com">medicine.net.com</a></p>	<p>atopic dermatitis, psoriasis, neurodermatitis, sebbhorheic dermatitis, ringworm, shingles, hive, folliculitis, eczema</p>

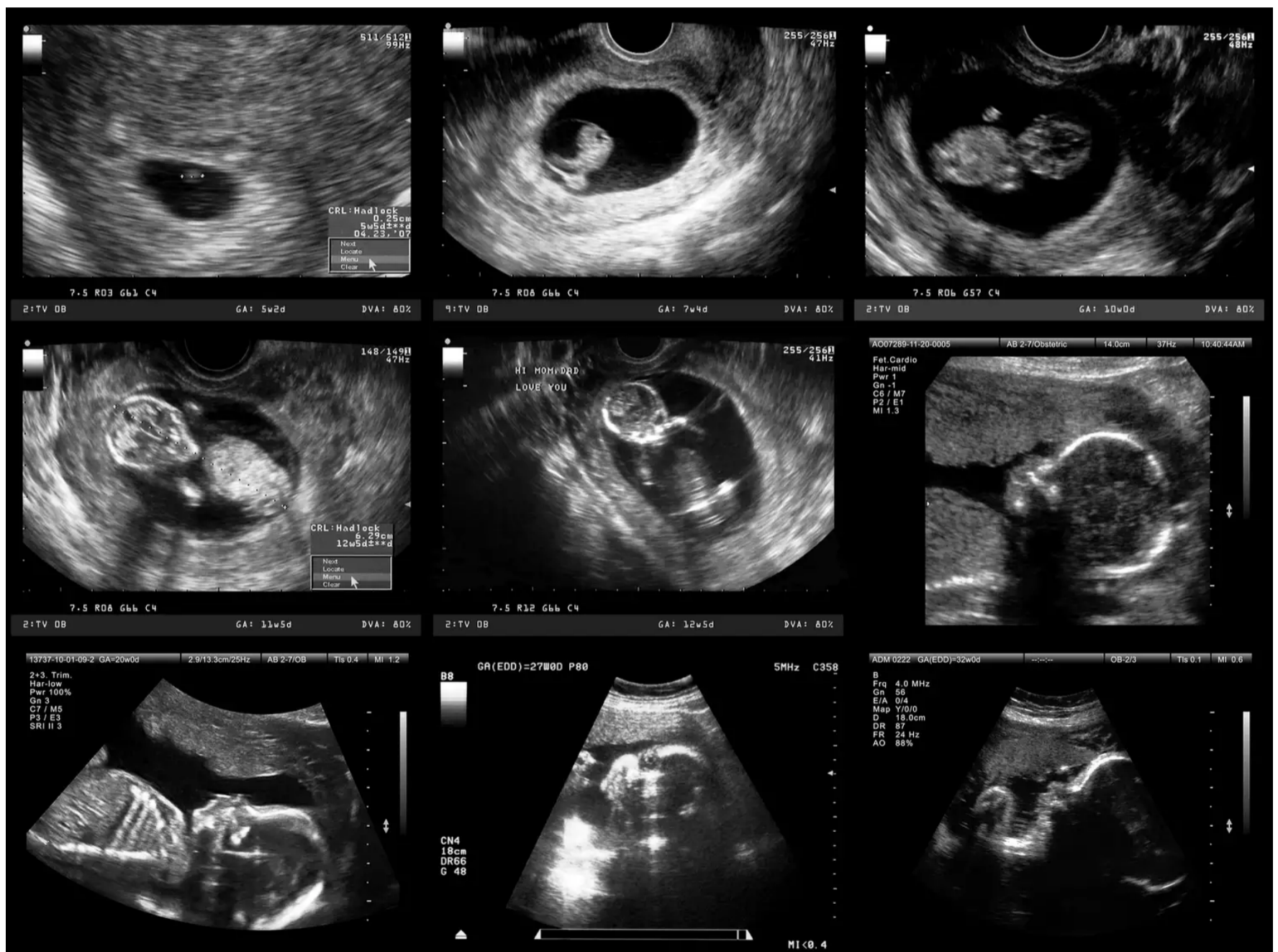
## POSITIVE PROOF OF PREGNANCY

Capturing the presence of the embryo or the fetus by audio, visual, or both through the use of medical devices establishes the definitive proof of pregnancy.

### ULTRASOUND

A pregnancy ultrasound is a test that uses high-frequency sound waves to image the developing baby as well as the mother's reproductive organs. The average number of ultrasounds varies with each pregnancy.<sup>21</sup>

An ultrasound, also called a sonogram, can help monitor normal fetal development and screen for any potential problems. It may likewise be used as evidence documenting pregnancy. Along with standard ultrasound, there are several more advanced ultrasounds — including a 3-D ultrasound, a 4-D ultrasound, and fetal echocardiography, which is an ultrasound that looks in detail at the fetus' heart.<sup>22</sup>



<sup>21</sup> Janelle Martel, "Pregnancy Ultrasound," Healthline, Medically reviewed by Debra Sullivan, October 7, 2016, <https://www.healthline.com/health/pregnancy/ultrasound>

<sup>22</sup> Id.

Ultrasound machines are configured differently for different indications. Those configured for use in obstetrics do not produce the higher temperatures delivered by machines using non-obstetric transducers and settings. Similarly, although color Doppler in particular has the highest potential to raise tissue temperature when used appropriately for obstetric indications, it does not produce changes that would risk the health of the pregnancy. However, the potential for risk shows that ultrasonography should be used prudently and only when its use is expected to answer a relevant clinical question or otherwise provide medical benefit to the patient.<sup>23</sup> When used in this manner and with machines that are configured correctly, ultrasonography does not pose a risk to the fetus or the pregnancy.

## X-RAY

The use of X-rays can capture the fetal form. It is not however a preferred way of documenting one's pregnancy because of the radiation to the fetus when this can be done using the ultrasound. The possibility of any harm to the mother and the unborn child from an x-ray is very small.<sup>24</sup>

The risk of harm to the baby depends on the gestational age and the amount of radiation exposure. Exposure to extremely high-dose radiation in the first two weeks after conception might result in a miscarriage. However, these dose levels aren't used in diagnostic imaging.<sup>25</sup>

Exposure to high-dose radiation two to eight weeks after conception might increase the risk of fetal growth restriction or birth defects. Exposure between weeks 8 and 16 might



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<sup>23</sup> Ultrasonography in pregnancy. ACOG Practice Bulletin No. 101. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2009;113:451–61.

<sup>24</sup> “X-Rays, Pregnancy and You,” USA Food & Drug Administration, 12/09/2017, <https://www.fda.gov/radiation-emitting-products/medical-x-ray-imaging/x-rays-pregnancy-and-you>

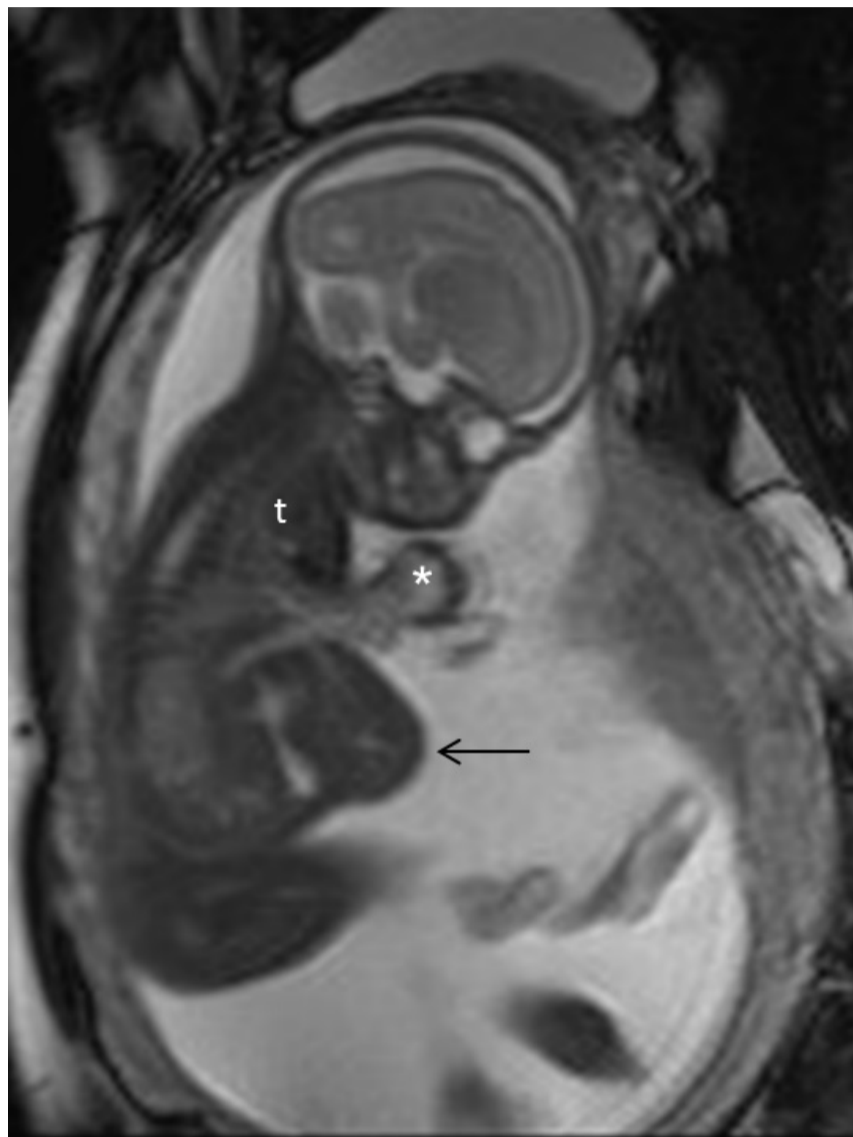
<sup>25</sup> Yvonne Butler Tobah, “Is it safe to have an X-ray during pregnancy?” Mayo Clinic, March 7, 2020, <https://www.mayoclinic.org/healthy-lifestyle/pregnancy-week-by-week/expert-answers/x-ray-during-pregnancy/faq-20058264>

increase the risk of a learning or intellectual disability. But the typical dose of a single radiation exposure associated with a diagnostic X-ray is much lower than the high dose associated with these complications.<sup>26</sup>

## MAGNETIC RESONANCE IMAGING

Magnetic resonance imaging (MRI), without MRI contrast agents, is not associated with any risk for the mother or the fetus, and together with medical ultrasonography, it is the technique of choice for medical imaging in pregnancy.<sup>27</sup>

For the first trimester, no known literature has documented specific adverse effects in human embryos or fetuses exposed to non-contrast MRI during the first trimester.<sup>28</sup> During the second and third trimesters, there is some evidence to support the absence of risk, including a retrospective study of 1737 prenatally exposed children, showing no significant difference in hearing, motor skills, or functional measures after a mean follow-up time of 2 years.<sup>29</sup>



MRI of fetus. Image from Creative Commons.

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<sup>26</sup> Id.

<sup>27</sup> "Guidelines for Diagnostic Imaging During Pregnancy and Lactation". American Congress of Obstetricians and Gynecologists. February 2016, <https://www.acog.org/en/Clinical/Clinical%20Guidance/Committee%20Opinion/Articles/2017/10/Guidelines%20for%20Diagnostic%20Imaging%20During%20Pregnancy%20and%20Lactation>

<sup>28</sup> Mervak, Benjamin M.; Altun, Ersan; McGinty, Katrina A.; Hyslop, W. Brian; Semelka, Richard C.; Burke, Lauren M. (2019). "MRI in pregnancy: Indications and practical considerations". *Journal of Magnetic Resonance Imaging*. 49 (3): 621–631. doi:10.1002/jmri.26317. ISSN 1053-1807. PMID 30701610. S2CID 73412175

<sup>29</sup> Mervak, Benjamin M.; Altun, Ersan; McGinty, Katrina A.; Hyslop, W. Brian; Semelka, Richard C.; Burke, Lauren M. (2019). "MRI in pregnancy: Indications and practical considerations". *Journal of Magnetic Resonance Imaging*. 49 (3): 621–631. doi:10.1002/jmri.26317. ISSN 1053-1807. PMID 30701610. S2CID 73412175.



Image by: Mikael Häggström, M.D. -Author info - Reusing images -, Radiocontrast-enhanced median plane CT scan of a pregnancy at 37 weeks of gestational

## COMPUTER TOMOGRAPHY SCAN

Computed tomography is a specific use of ionizing radiation that plays an important diagnostic role in pregnancy. Radiation exposure from CT procedures varies depending on the number and spacing of adjacent images.

Despite this lack of known harm, it generally is recommended that contrast only be used if required to obtain additional diagnostic information that will affect the care of the fetus or woman during the pregnancy.

“You never arrived in my arms,  
but you will never leave my heart.”  
ZOE CLARK-COATE

# 4 PROOF OF FETAL DEATH

## CAUSES OF FETAL DEATH

The loss of a fetus at any stage is a fetal demise. The cause of fetal demise is unknown in 60% of all cases. In cases where a cause is identified, the cause of fetal death can be attributable to fetal, maternal, or placental pathology. One prospective study attributed 64.9% of fetal death to placental pathology overall. The same study noted higher rates of fetal demise secondary to placental pathology at late gestational age.<sup>30</sup>

A meta-analysis of 96 population-based studies found that maternal overweight and obesity was the highest-ranking modifiable risk factor for stillbirth.<sup>31</sup> Advanced maternal age (>35 y) and maternal smoking were also significant. Small size for gestational age and abruption was the highest-ranking pregnancy disorder risk factors for stillbirth. Preexisting diabetes and hypertension are also important contributors to stillbirth.<sup>32,33</sup>

## EVALUATING FETAL DEATHS

Currently, which tests are most effective in evaluating a fetal demise have not been agreed upon. Therefore, authorities vary in their recommendations. Most of the testing recommendations in the past have been based on expert opinion rather than scientific studies. The Stillbirth Collaborative Research Network organized in the U.S. currently has

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<sup>30</sup> Korteweg FJ, Erwich JJ, Holm JP, Ravisé JM, van der Meer J, Veeger NJ. Diverse placental pathologies as the main causes of fetal death. *Obstet Gynecol.* 2009 Oct. 114(4):809-17.

<sup>31</sup> 7

Flenady V, Koopmans L, Middleton P, et al. Major risk factors for stillbirth in high-income countries: a systematic review and meta-analysis. *Lancet.* 2011 Apr 16. 377(9774):1331-40.

<sup>32</sup> 11

Gardosi J, Madurasinghe V, Williams M, Malik A, Francis A. Maternal and fetal risk factors for stillbirth: population based study. *BMJ.* 2013 Jan 24. 346:f108.

<sup>33</sup> “Evaluation of Fetal Death,” Medscape, accessed October 16, 2021, <https://emedicine.medscape.com/article/259165-overview>

ongoing studies, which will hopefully define the optimal diagnostic evaluation for this difficult clinical problem. To better understand the underlying pathophysiology that leads to fetal demise and thereby create appropriate interventions, experts proposed a uniform international classification system and recommended a complete stillbirth workup for every case of fetal demise.<sup>34</sup>

## ULTRASOUND

Based on the ultrasound, fetal death is indicated by the absence of fetal heartbeat, absent fetal movements, a gross distortion of fetal anatomy (maceration), soft tissue edema (skin >5 mm), echogenic amniotic fluid fetal demise fragments), thrombus in the fetal heart. <sup>35</sup>



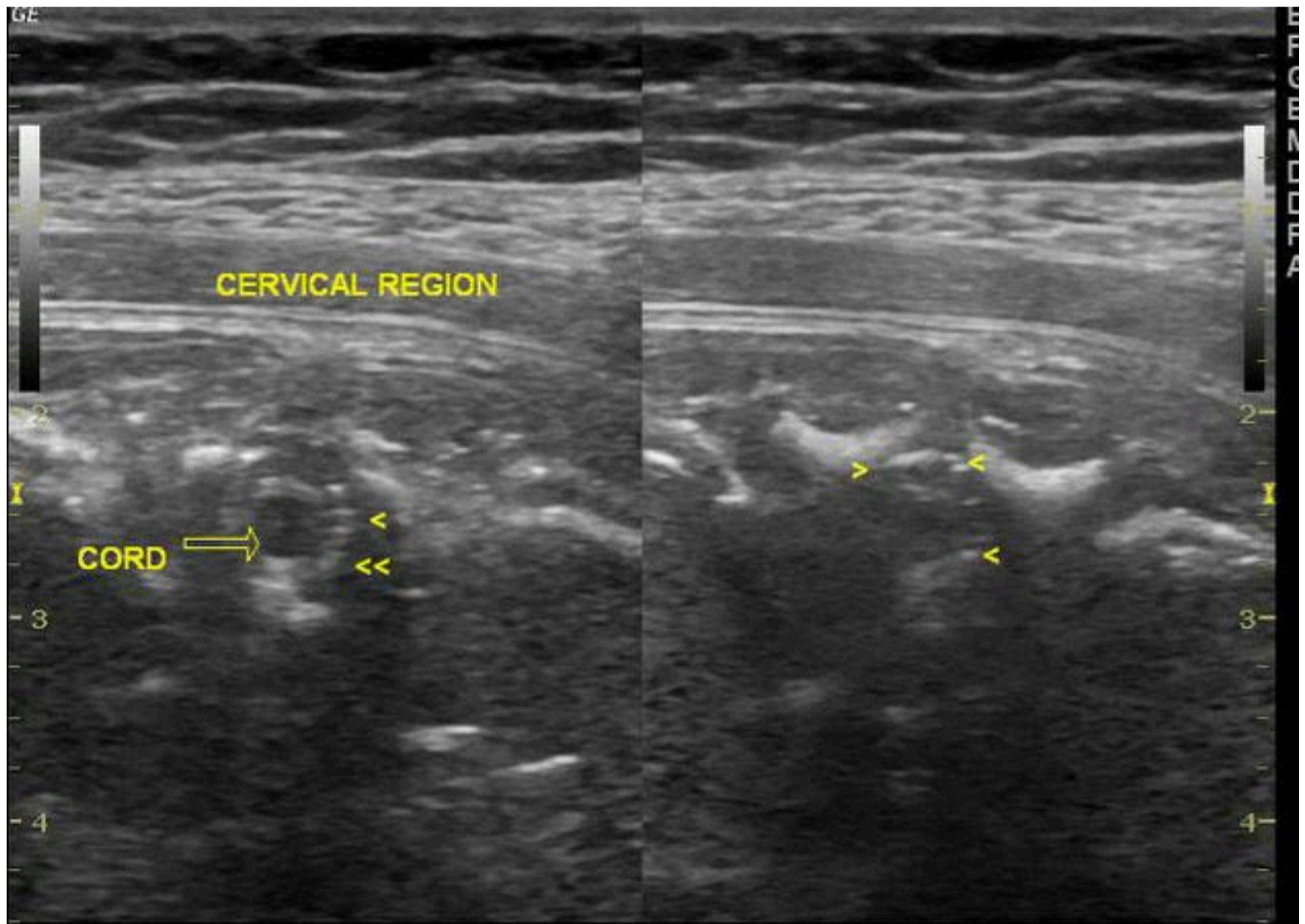
**Spalding sign.** Antenatal ultrasound due to absent fetal movements at 28 weeks of gestation. Case courtesy of Dr Kabil kumar loganathan, <a href="https://radiopaedia.org/?lang=us">Radiopaedia.org</a>. From the case <a href="https://radiopaedia.org/cases/52233?lang=us">rID: 52233</a>

<sup>34</sup> Reddy UM, Goldenberg R, Silver R, Smith GC, Pauli RM, Wapner RJ. Stillbirth classification--developing an international consensus for research: executive summary of a National Institute of Child Health and Human Development workshop. *Obstet Gynecol.* 2009 Oct. 114(4):901-14.

<sup>35</sup> Refaey, M., Bell, D. Fetal death in utero. Reference article, Radiopaedia.org. (accessed on 17 Oct 2021) <https://radiopaedia.org/articles/4877>

Spalding sign<sup>36</sup> of fetal death refers to the overlapping of the fetal skull bones caused by the collapse of the fetal brain. It appears usually a week or more after fetal death in utero. When fetal death has occurred loss of alignment and overriding of the bones of cranial vault occur due to shrinkage of cerebrum,<sup>37</sup> abdominal sonar examination may reveal an overriding of the fetal cranial bones.<sup>38</sup> Most estimates place the precise time of fetal death at about 4–7 days before overlapping and separation of the fetal skull bones appear.<sup>39</sup>

## ROBERT SIGN



**Robert sign.** Case courtesy of Dr Maulik S Patel, [Radiopaedia.org](https://radiopaedia.org/?lang=us). From the case [rID: 43419](https://radiopaedia.org/cases/43419?lang=us)

<sup>36</sup> This finding was originally described by Alfred Baker Spalding (1874-1942), an American Obstetrician, on abdominal radiographs and is indicative of fetal demise.

<sup>37</sup> The essentials of forensic medicine and toxicology. New delhi: Jaypee brothers. 2014. p. 438. ISBN 9789351525578.

<sup>38</sup> Olds' Maternal-Newborn Nursing, 8th edition, p. 1136.

<sup>39</sup> S. A. Journal of Radiology, March 1964, "Overlapping of the foetal skull bones in breech presentation. L.C.Handler, Department of Radiodiagnosis, Groote Schuur Hospital, Cape Town.



Robert<sup>40</sup> sign refers to the presence of a gas shadow within the heart or the greater vessels, in cases of fetal death in utero. It is a rare sign caused by postmortem blood degeneration, usually seen 1-2 days after death; and may be seen as early as 12 hours.<sup>41</sup>



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<sup>40</sup> First described as a sign on radiographs by J B Roberts in 1944 1; it was first described on ultrasound in 1983 by Barbara J Weinstein, American radiologist and Lawrence D Platt, American obstetrician. Weinstein BJ, Platt LD. The ultrasonic appearance of intravascular gas in fetal death. (1983) Journal of ultrasound in medicine : official journal of the American Institute of Ultrasound in Medicine. 2 (10): 451-4.

<sup>41</sup> St-Amant, M., Gaillard, F. Roberts sign (fetal demise). Reference article, Radiopaedia.org. (accessed on 17 Oct 2021) <https://radiopaedia.org/articles/24475>