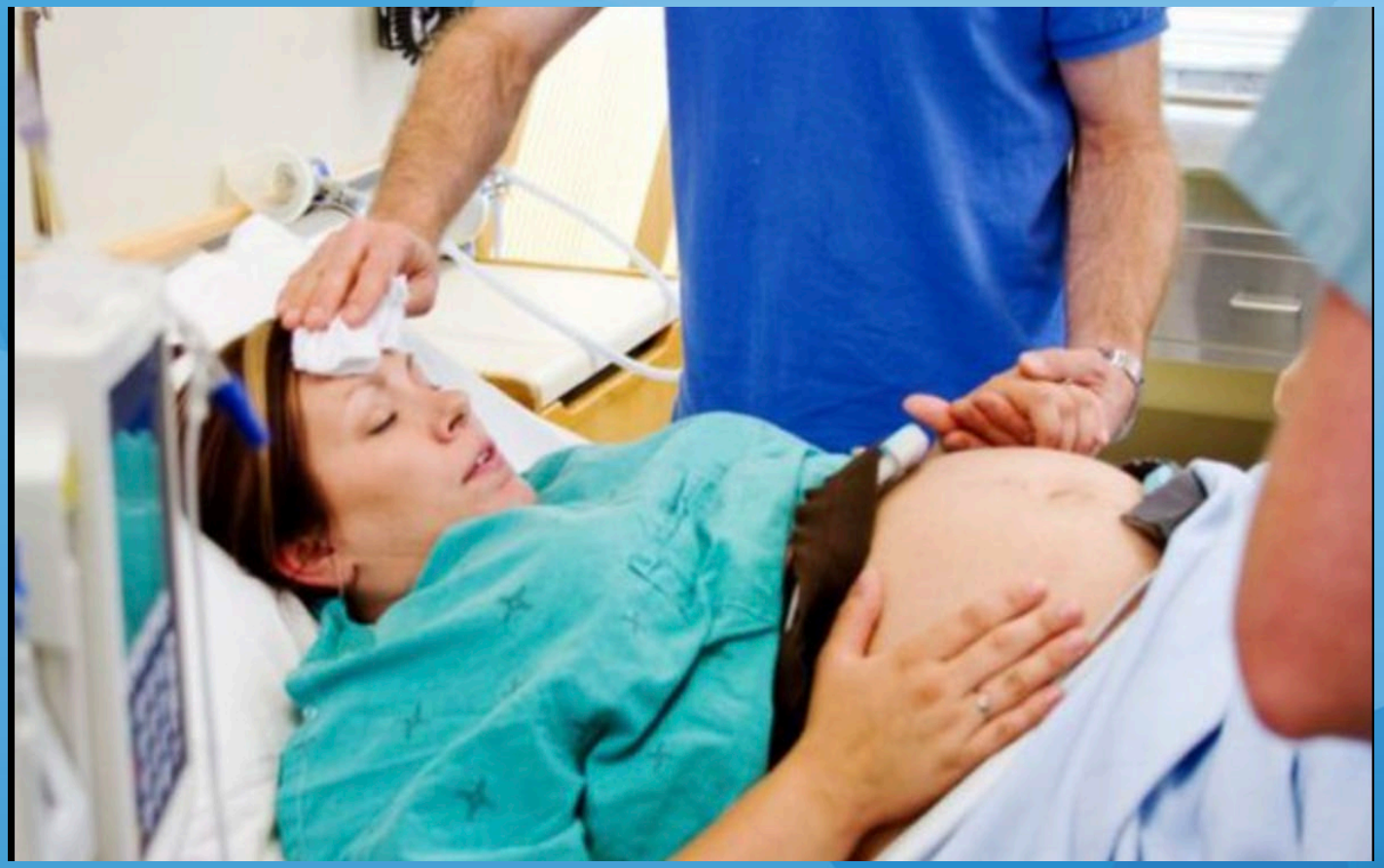

Intrapartum fever (fever during labor)

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- an infectious or noninfectious etiology.
- nulliparity, prolonged labor, and prelabor rupture of membrane
- intraamniotic infection (IAI) and/or receive neuraxial anesthesia,
- In the absence of a preexisting febrile disorder (eg, respiratory infection), most pregnant women who develop fever in labor are presumed to have IAI and are treated with broad spectrum antibiotics.

MECHANISM

- elevated body temperature have fever, which occurs when the hypothalamic thermoregulatory center is reset at a higher temperature by **"endogenous pyrogens"** produced by specific host cells in response to infection, inflammation, injury, or antigenic challenge.

- These pyrogenic polypeptides include the cytokines interleukin (IL)-1 alpha and IL-1 beta, IL-6, tumor necrosis factor (TNF)-alpha and TNF-beta, and interferon

- an elevated temperature represents hyperthermia (body temperature rise due to insufficient heat loss; thermoregulatory center is not reset) rather than fever.

- As an example, some pharmacologic agents (eg, atropine, the recreational drug "ecstasy") raise core temperature by blocking sweating or vasodilation without changing the normal hypothalamic set-point.

DEFINITION

- Fever is defined as an elevation of body temperature above normal daily variation.
- The threshold for intrapartum fever has generally been considered to be a maternal temperature ≥38°C (≥100.4°F) orally.
- in normal parturients, which ranged from 34.6 to 37.6°C (94.3 to 99.7°F) upon admission to the labor unit

- There was a diurnal distribution, with a peak from midnight to 2 AM and a nadir from 11 AM to noon.

- "triple I," which stands for intrauterine infection or inflammation or both) and their neonates recommended defining maternal fever as maternal temperature ≥39°C (≥102.2°F) on one reading orally or ≥38°C (≥100.4°F) and less than 39°C (102.2°F) on two readings 30 minutes apart orally

PREVALENCE

- .several factors differences in prevalence of risk factors in the populations studied, use of different diagnostic criteria, and temporal changes in obstetric practice (eg, increased use of intrapartum antibiotics and neuraxial anesthesia).

- The prevalence has increased in use of neuraxial anesthesia. Intrapartum fever is now common: 6.8 percent or 1 in 15 women in labor

TEMPERATURE MEASUREMENT

- in the **oral sublingual pocket with an electronic contact thermometer** because it is accurate and the most convenient method for detecting intrapartum maternal fever

- Good technique is important because mouth breathing, hyperventilation, ingestion of ice or a hot beverage, and oxygen administration can affect oral temperature.

- A prudent approach is to ensure that the mother has not consumed fluids or ice in the 15 minutes before the temperature is determined

- Tympanic and axillary temperature measurements are particularly susceptible to user error

- Noncontact tympanic temperature approximates core temperature but may be inaccurate because of incorrect placement of the sensor in the ear canal or interference by cerumen.
- Axillary temperature is 1.0 to 2.0°C (1.8 to 3.6°F) lower than oral temperature; an accurate measurement requires the probe to be positioned over the axillary artery and the arms positioned at the patient's side
- Rectal temperatures are generally 0.6°C (1.0°F) higher than oral readings.

- oral temperature correlated better with intrauterine/core temperature than tympanic membrane or skin temperature on the thigh or abdomen

DIAGNOSTIC EVALUATION

- **History and physical** — A careful history and physical examination should be performed to look for potential causes of fever, both obstetric and nonobstetric.

- The physical examination should include standard vital signs, auscultation of the lungs, and assessment of fundal tenderness, abdominal tenderness, costovertebral angle tenderness, and the character of amniotic fluid (eg, odor

- Neuraxial anesthesia is associated with intrapartum fever.

- ●Prolonged labor, prolonged membrane rupture, multiple digital vaginal examinations (especially with ruptured membranes), and exposure to intrauterine devices such as an intrauterine pressure catheter or a fetal scalp electrode are risk factors for intraamniotic infection (IAI).

- ●The source of fever may be an infection that began antepartum, such as a urinary tract infection or the common cold, or more rarely influenza, pneumonia, listeriosis, *Clostridioides* (formerly *Clostridium*) *difficile* colitis, or appendicitis

- ●Drug fever can present several days after initiation of a medication.
- ●Fetal tachycardia may occur in response to maternal fever or intrauterine infection.
- a category I fetal heart rate pattern does not reliably exclude fetal/neonatal infection and no pattern is specific for intrauterine infection

NICHD criteria for category I, II, and III FHR tracings

Category I
All of the following criteria must be present. Tracings meeting these criteria are predictive of normal fetal acid-base balance at the time of observation.
Baseline rate: 110 to 160 bpm
Moderate baseline FHR variability
No late or variable decelerations
Early decelerations may be present or absent
Accelerations may be present or absent
Category III
Category III tracings are predictive of abnormal fetal acid-base status at the time of observation. Prompt evaluation is indicated and most parturients will require expeditious intervention, such as provision of supplemental oxygen, change in position, treatment of hypotension, and discontinuation of any uterotonic drugs being administered. Category III tracings include either (1) or (2) below.
(1) Absent baseline FHR variability and any of the following:
▪ Recurrent late decelerations
▪ Recurrent variable decelerations
▪ Bradycardia
(2) Sinusoidal pattern
Category II
FHR tracing does not meet criteria for either category I or III and is considered indeterminate.

White blood cell (WBC) count and differential

- obtaining a WBC count in patients who appear clinically ill or with a temperature ≥39°C (102.2°F).
- WBC count is limited because high values normally occur during labor. in laboring patients of 10,000 to 16,000 cells/microL, with an upper level as high as 29,000 cells/microL
- the mean count increased linearly with the duration of elapsed labor
- especially when accompanied by a left shift or bandemia.

Blood cultures

- has not been studied specifically in intrapartum women

- **We suggest blood** cultures for women who appear clinically ill or with temperature ≥39°C (102.2°F).

- untreated bacteremia can lead to sepsis and shock, although these serious sequelae are rare in pregnant/postpartum women in resource-rich countries, as these women tend to be young and healthy

- indications for blood cultures:
- fever ≥39°C (102.2°F),
- chills,
- hypothermia,
- leukocytosis with left shift,
- neutropenia,
- and the development of otherwise unexplained organ dysfunction (eg, renal failure, sepsis)

- blood cultures are not routinely performed in women with suspected IAI.

- The treatment of IAI is delivery and antibiotic therapy, and empiric therapy is effective in 85 to 90 percent of these patients.

- For suspected pyelonephritis, blood cultures are less useful than urine cultures.

- **Urine testing** — Urinary dipstick testing is fast, convenient, and low in cost. a clean catch midstream urine collection, via a straight catheter, or from an indwelling catheter.
- It is considered positive if either leukocyte esterase or nitrite is detected: the presence of enteric organisms that convert urinary nitrate to nitrite.

- sensitivity and specificity for infection are 50 and 97 percent, respectively; thus, there is a high false negative rate

- Urine culture is not practical as a first-line diagnostic test when a woman is in labor since results may take 24 to 48 hours after collection

- **Sputum testing** — Testing sputum for a microbial diagnosis in women with suspected community-acquired pneumonia is optional.
- For most patients, omitting sputum testing is appropriate because empiric treatment is usually successful and the diagnosis of pneumonia is based on chest radiograph.

- **Influenza testing** — Pregnant women in labor with a flu-like illness should undergo diagnostic testing for influenza.
- A rapid antigen or immunofluorescence antibody test provides results soonest.

- **Amniotic fluid testing** — Amniocentesis is rarely performed in patients in whom delivery is expected within a few hours..

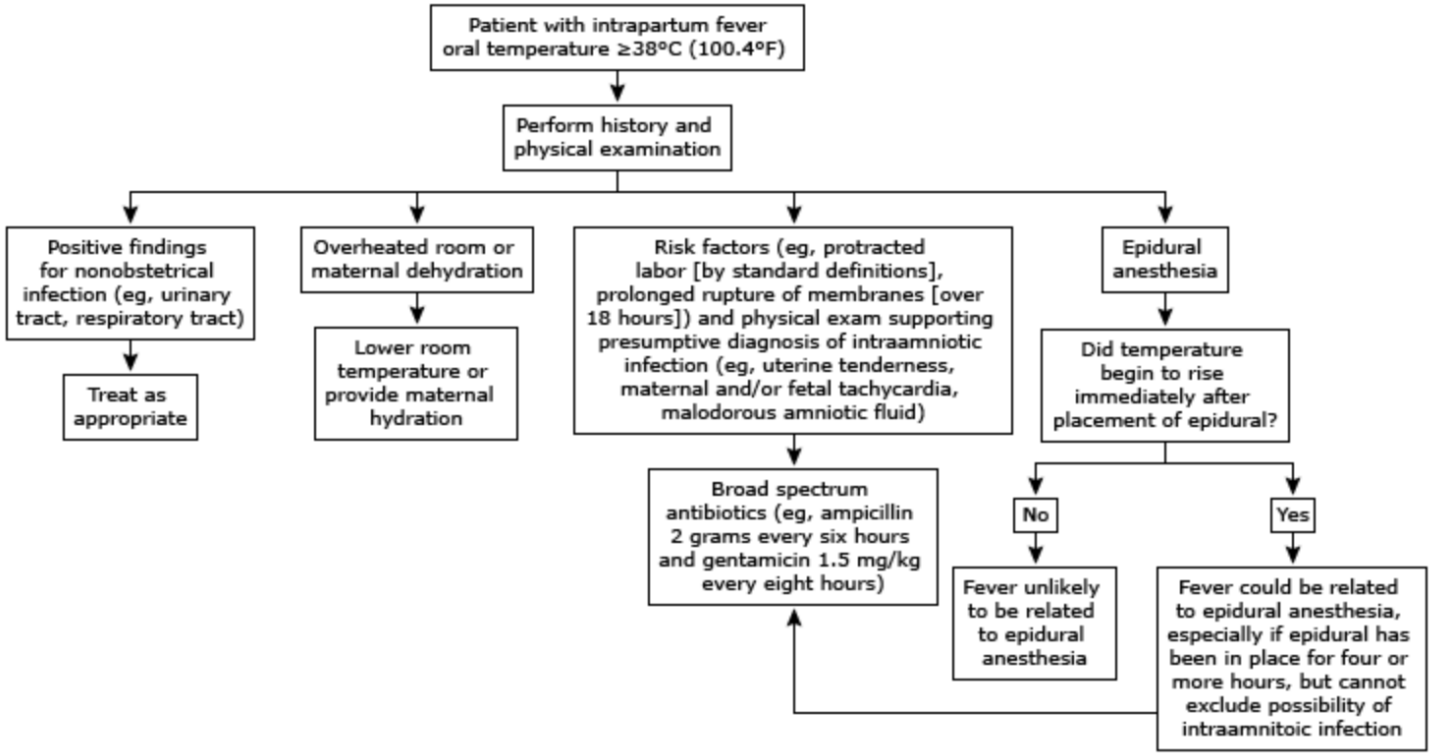
- **Biological markers** —that measurement of biological markers (eg, C-reactive protein) in maternal serum is unreliable for detecting intrauterine infection in clinical practice
- amniotic fluid IL-6 and IL-8 levels are significantly elevated with IAI, these diagnostic markers **are also not used clinically.**

COMMON ETIOLOGIES AND MANAGEMENT

- intraamniotic infection (IAI) and use of neuraxial anesthesia.
- antibiotics for treatment of IAI are usually administered when maternal temperature is ≥38°C (≥100.4°F) orally and other infection-related sources of fever (respiratory, urinary tract, gastrointestinal, etc) have been reasonably excluded

- General supportive measures for febrile patients, regardless of the etiology, include acetaminophen,
- reduction in room temperature,
- reduction of clothing,
- and rehydration, as indicated.

Intrapartum fever algorithm



Infectious etiologies

- **Intraamniotic infection (chorioamnionitis)** — IAI (also called chorioamnionitis) refers to infection of the amniotic fluid, membranes, placenta, and/or decidua.
- the essential criterion for diagnosis of IAI is just a maternal fever, which is a manifestation of systemic inflammation.
- Other criteria (clinical and laboratory) are insensitive.

- For clinical research, the diagnosis of IAI has usually been based upon the presence of maternal fever ≥38°C (≥100.4°F) orally **and** at least two of the following conditions
- ●Maternal tachycardia (greater than 100 beats/minute)
- ●Fetal tachycardia (greater than 160 beats/minute)
- ●Uterine tenderness
- ●Foul odor of the amniotic fluid
- ●Maternal leukocytosis (greater than 15,000 cells/cubic millimeter)

Classification of triple I

Features of isolated maternal fever and triple I* with classification¶	
Terminology	**Features and comments**
Isolated maternal fever ("documented" fever)	Maternal oral temperature ≥39.0°C (102.2°F) on any one occasion is documented fever. If the oral temperature is 38.0°C (100.4°F) to 38.9°C (102.02°F), repeat the measurement in 30 minutes; if the repeat value remains at least 38.0°C (100.4°F), it is documented fever.
Suspected triple I	Fever without a clear source plus any of the following: 1. Baseline fetal tachycardia (greater than 160 beats per min for 10 min or longer, excluding accelerations, decelerations, and periods of marked variability) 2. Maternal white blood cell count greater than 15,000 per mm^3 in the absence of corticosteroids 3. Definite purulent fluid from the cervical os
Confirmed triple I	All of the above plus objective laboratory findings of infection, such as$^{\Delta}$: 1. Positive amniotic fluid Gram stain for bacteria, low amniotic fluid glucose (eg, ≤14 mg/dL), high amniotic fluid white cell count in the absence of a bloody tap (eg, >30 cells/mm^3), or positive amniotic fluid culture results, or 2. Histopathologic evidence of infection or inflammation or both in the placenta, fetal membranes, or the umbilical cord vessels (funisitis)

min: minutes; mm: millimeters.

* Triple I refers to intrauterine inflammation or infection or both.

¶ Discontinue the use of the term "chorioamnionitis." Refer to UpToDate text for discussion.

Δ Laboratory studies on amniotic fluid should be performed on fluid obtained by amniocentesis. Placental histopathology is obtained after delivery.

- Common maternal complications of IAI include labor abnormalities, need for cesarean delivery, uterine atony, postpartum hemorrhage, endometritis, and septic pelvic thrombophlebitis.

- Fetal complications include early onset neonatal sepsis, pneumonia, and meningitis

- Delivery is indicated after diagnosis of IAI.

- Prompt treatment with broad spectrum antibiotics with coverage for group B *Streptococcus* reduces maternal and neonatal morbidity.
- Ampicillin plus gentamicin is a common regimen.

Urinary tract infection

- — Urinary tract infections are common in pregnant women and can complicate labor at term.

- Signs and symptoms of upper or complicated urinary tract infections include fever, flank pain, nausea, vomiting, and costovertebral angle tenderness with or without lower urinary tract symptoms such as dysuria, frequency, urgency, suprapubic pain, and hematuria.
- Simple cystitis (infection confined to the bladder) is not associated with fever.

Respiratory tract infection

- — Upper respiratory tract infection is common in pregnant women, especially in the winter, when the etiology is likely viral.
- are nasal congestion, rhinorrhea, and scratchy throat, but sore throat, cough, and malaise also occur frequently.
- Fever, if present, tends to be low grade. Supportive treatment is indicated

- Pneumonia classically presents with the sudden onset of rigors followed by fever, pleuritic chest pain, and cough productive of purulent sputum.

- The diagnosis of pneumonia is similar to that in nonpregnant individuals.
- A chest x-ray

- Antibiotic therapy is targeted to cover the infecting organisms typically associated with community acquired pneumonia in nonpregnant patients.
- Pregnant women may be treated safely with azithromycin or azithromycin and ceftriaxone.

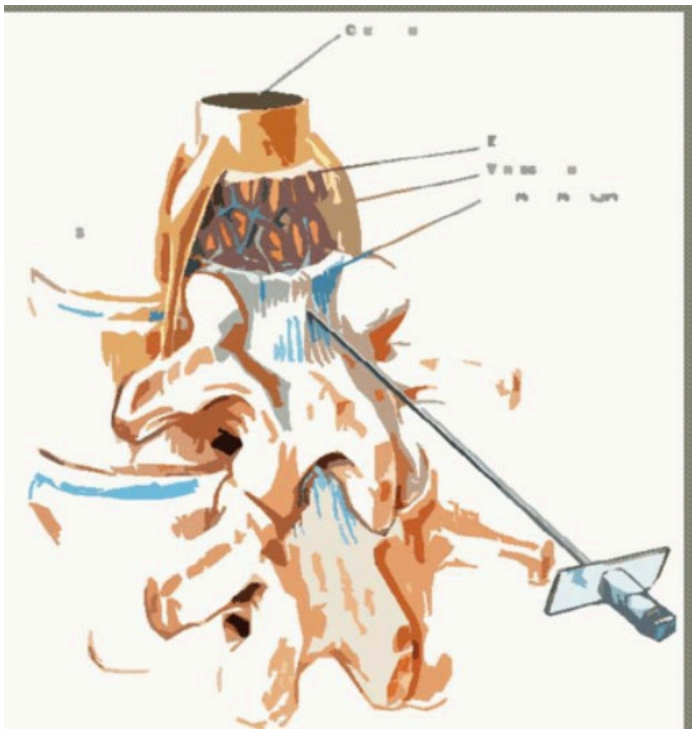
Influenza

- characteristically begins with the abrupt onset of fever, headache, myalgia, and malaise after an incubation period of one to four days (average two days).
- such as nonproductive cough, sore throat, and nasal discharge.
- Pregnant women are more likely to have complications from influenza.

Noninfectious etiologies
Use of neuraxial anesthesia

- temperature increase associated with neuraxial anesthesia is incompletely understood.
- ●A primary sterile inflammatory response either in the placenta or in the epidural space (followed by secondary placental inflammation)

- ●Use of neuraxial anesthesia and IAI share risk factors such as nulliparity, induction of labor, internal monitoring, more vaginal examinations, longer labor, and longer duration of rupture of membranes.



- ●Reduced heat loss.
- Laboring women with epidural anesthesia have less pain-induced hyperventilation and less perspiration because of sympathetic block, which may reduce heat loss.
- vasodilation below the level of neuraxial blockade increases heat loss and is typically associated with a slight decrease in core temperature in nonpregnant patients.

- ●Abnormality in maternal thermoregulation.

- Most laboring women do not experience an increase in temperature following neuraxial anesthesia, but for those who do, the rise in maternal temperature occurs immediately.

- Temperature increases average 0.33°F/hour (0.18°C)

- Nulliparous women are more likely to have longer labors and are more likely to have intrapartum fever than multiparas; the risk of neuraxial anesthesia related fever in nulliparas is 13 to 33 percent

- ropivacaine was associated with less intrapartum fever than levobupivacaine
-
- The specific technique may also be a factor.

- Neither prophylactic acetaminophen nor cefoxitin prevent the maternal temperature elevation

- **Labor or delivery in an overheated room** — When the temperature of the surroundings becomes greater than that of the skin, the body is no longer able to lose heat by conduction or radiation

- Measures to promote temperature reduction include
- lowering room temperature,
- removing blankets and clothing,
- hydration if the patient is dehydrated,
- and applying cool,
- wet towels to the skin.

- **Drug fever** — Drug fever is a diagnosis of exclusion. The timing of the onset of fever in relation to beginning a drug and the pattern of fever are frequently not helpful in making a diagnosis.

Newborn consequences

- **Infection-related maternal fever** – When maternal fever is due to an infectious process, peripartum transfer of the infection to the fetus/neonate is a major concern
- The risk to the newborn depends on the type of infection. For intraamniotic infection (IAI) (chorioamnionitis), short-term adverse outcomes include neonatal sepsis, meningitis, and pneumonia; potential long-term outcomes include neurodevelopmental delay and cerebral palsy.
- Appropriate intrapartum maternal antibiotic therapy reduces the risk of fetal/neonatal infection

- **Neuraxial anesthesia-related related maternal fever** –is not associated with an increased rate of proven neonatal sepsis

- Triggers for septic work-up in neonates include low birth weight, prematurity, hypothermia at birth, maternal group B beta-hemolytic streptococcal colonization, preeclampsia, and maternal hypertension