

Approach to fever in children

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Fever is a common problem in children

- 65% of children <2years will visit a physician for fever.
- Fever is 60–80% of clinical encounters.
- Most commonly due to self limited viral illness, but sometimes due to serious illness.

What is a fever?

- A fever is a rise in internal temperature above the normal .
- **Why temp. increase with infections:**
- Fever helps the body to fight infections by stimulating the body's natural defences.

Temperature varies according to Site of measurement

- Feel warm is unreliable and inaccurate:
- Axillary reading is 35.9-degree C.
- Oral is 36.5 degrees C.
- Tympanic is 36.6 degrees C.
- Rectal is 37.0 degrees C. is the most accurate.

Is the fever beneficial? YES

- Fever inhibits the growth of bacteria & replication of viruses.
- It enhances immunological processes, including activity of IL-1, T-helper cell, cytolytic T-cells, B- cell and immunoglobulin synthesis.
- Fever increase the mobility, phagocytosis and killing of bacteria by polymorphonuclear leukocytes.

Fever pathogenesis

➡ **Exogenous pyrogens:**
Micro-organisms, Ag-Ab complex, foreign proteins,
bacterial toxins (Endotoxin, Enterotoxin, TSS toxin,
Erythrogenic toxin), capsule polysaccharides, drugs,
pyrogenic steroids Peptidoglycan, IL-1, IL-2, TNF, IFN ➡

Monocytes, macrophages, neutrophils, lymphocytes, glial cell ➡
Endogenous pyrogens: ➡ IL-1 α - β , IL-6, IL-11, IFN α - β ,
➡ **TNF α - β , Oncostatin M.**

➡ Increase in PGE₂ synthesis and
CAMP level ➡ **TRC**
affected
➡ Increased heat production,
reduction in heat loss ➡ **FEVER**

Increases body temperature as a diagnostic sign Fever and Hyperthermia.

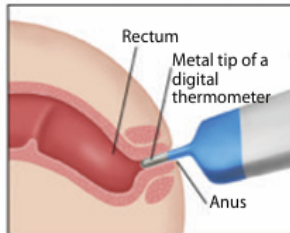
Fever is present when an increase in body temperature occurs through a **modification of the hypothalamic temperature set-point due to exposure to endogenous pyrogens.**

hyperthermia is an increase in body temperature because of a failure of thermoregulation, either because of increased heat absorption, heat production and/or reduced ability to dissipate it

Hyperthermia

- Hyperthermia is less common in children, compared to fever.
- Most cases of hyperthermia are due to **environmental hyperthermia**, caused by massive heat exposure, which overcomes the body's thermoregulation, such as in the case of **“forgotten baby syndrome” involving children left in cars during hot season**.
- **“Heat stroke”** is defined as a core temperature $\geq 40^{\circ}\text{C}$ accompanied by central nervous system dysfunction due to environmental heat exposure .

Re-check Temperature



Temperature measurement 1

- Rectal temperature **most accurate** for estimating core body temperature.
- recommended for children < 4 years of age.
- Oral temperature is considered to be one of the most accurate sites, although it is on average 0.5 °C lower than rectal temperature. not suitable for children under 5 years of age.
- Axillary temperature : a viable alternative, its sensitivity is inferior to rectal temperature . **abnormal when it is above 37.5 °C**.
- In newborns, axillary temperature as reliable as rectal temperature, although values tend to be 0.25 °C–0.5 °C lower.

Temperature measurement 2

- The National Institute for Health and Care Excellence (NICE) : guidelines recommend measuring body temperature in the axilla, using an electronic thermometer for infants less than 4 weeks of age and chemical dot or electronic thermometers in older children.
- American Academy of Pediatrics : suggests **rectal** thermometry for children } <4 years and oral thermometry in older children.
- Mother tactile : one study showed that mothers could accurately detect fever by tactile assessment (sensitivity 84%, specificity 76%) .

How to categorize fever

- **Low-grade:** 37.3 to 38.0 C.
- **Moderate-grade:** 38.1 to 39.0 C.
- **High-grade:** 39.1 to 41 C.
- **Hyperthermia:** Greater than 41 C.

For The Ill Febrile child

Vital signs

- CheckTemp.: check for fever or hypothermia.
- Check heart rate: tachycardic may be bradycardic
- RR: Tachypnea, hypopnea or apnea.
- BP : Initially normal but later hypotension.
- appearing ill do :Pulse oximetry (SaO₂), Capillary re fill time (< 2 Sec)

Blood glucose (> 40mg/dl in newborn, > 60 mg/dl in children)

- Quick emergency questions

Recent vaccine: DPT : fever after 24hr. MMR: after 5-7 days.

ASK about convulsion: meningitis.

Ability to swallow: Tonsillitis, pharyngitis.

Vomiting: increase intracranial pressure.

Other GIT symptoms.

Take Detailed History:

- Localizing symptoms : cough, headache, photophobia, diarrhoea, vomiting, abdominal pain, musculoskeletal pain, rash
- Travel
- Sick contacts
- Immunizations history.
- Medication: prior treatment with antibiotics may mask signs of a bacterial infection
- High risk: prematurity, immunosuppression/oncological conditions central line in situ, chronic lung disease, congenital heart disease, previous invasive bacterial infections,

Important to know

- Teething does not cause fever
- Vaccination: Post vaccination fever is common, with a typical onset within 24 hours of immunization and duration up to 2-3 days; however, in an unwell child, fever should not be attributed to vaccination alone.

Respiratory symptoms: Pneumonia

- Respiratory signs and symptoms, **tachypnea** consider **pneumonia**,
- Tachypnea defined by WHO:
- In children <2 M
: >60/minute.
- children 2–12 months: >50/minute.
- Children >12 months: >40/minute

For The Ill Febrile child: check for

- – Level of consciousness and activity.
- Presence of Respiratory distress.
- Abnormal Color (Central cyanosis, pallor, Jaundice)
- Poor perfusion (mottling, Delayed pulses)
- Hydration status (Skin turgor, sunken eyes, depressed fontanel, absent tears and no sweat, urine output)

Types of FEVER

1. Continuous Fever

Fever remains high with minimal fluctuation

🔑 Example: Typhoid



2. Intermittent Fever

Fever comes and goes

🔑 Example: Malaria

3. Remittent Fever

Fever remains but fluctuates $>1^{\circ}\text{C}$ daily

🔑 Example: Infective endocarditis

4. Relapsing Fever

Fever disappears for days and returns

🔑 Example: Borrelia infection

The Learning Child

Physical Examination: suggest serious infection:

- Age younger than one month,
- Poor Arous ability.
- Petechial rash.
- Delayed capillary refill.
- Dyspnea respiratory effort,.
- And above all: physician assessment and feeling

For Neonates

- **For children <1 month** of age with fever, in whom lumbar puncture and hospitalization for empiric antibiotic therapy pending cultures are always recommended. **Consider Covering group B beta strep.** From birth canal.
- **For full-term children 1 to 3 months: if ill appearing:** do Septic work up+ Lumbar puncture and parenteral antibiotics .
- **For well-appearing children:** Do blood testes and observation .

Neck rigidity and bulging fontanell



Brudzinski's neck sign

Bulging fontanelle and serious bacterial infection (SBI):

a bulging fontanelle can be a sign of bacterial meningitis, it may also be due to more benign causes (Roseola infantum).

In a series of 153 febrile infants between 3 and 11 months of age with fever and a bulging fontanelle, only 1 (0.6%) had bacterial meningitis, These findings suggest that, in

febrile infants with a bulging fontanelle who are otherwise well-appearing and have no laboratory evidence of bacterial infection, close observation without lumbar puncture is a reasonable option.

The causes of fever 2m- 5y.

- **Respiratory**: Nasopharyngitis, Otitis media, pneumonia.
- **GI** infection: GE.
- **CNS** infections: meningitis, encephalitis.
- **UTI**: pyelonephritis, cystitis.
- Connective tissue diseases.

Infections in Children 3–36 m of age:

- Conjugate vaccines for *Haemophilus influenzae*, *Streptococcus pneumoniae*, and *Neisseria meningitidis* has led to a significant reduction in Serious bacterial infections .
- So immunization status should always be questioned.
- Infections may be due to new serotypes' not included in vaccine strains .

Age 2 m- 5y: if patient looks sick:

- Complete sepsis work-up & IV. antibiotics.
- Blood and urine culture.
- Stool culture if there is blood or mucus in the stool.

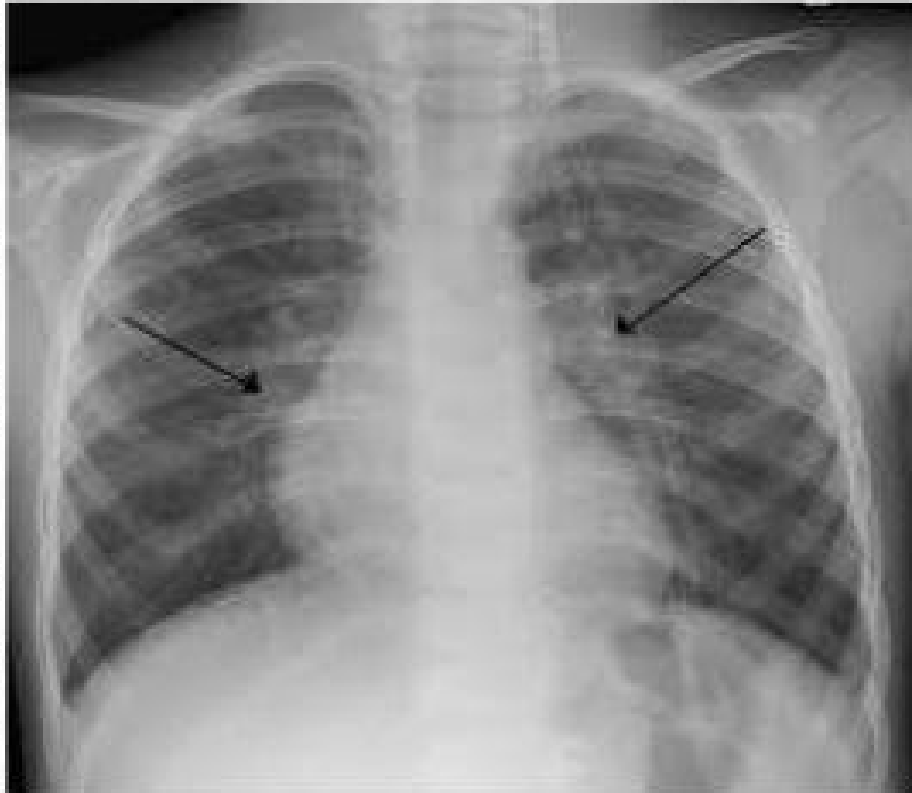
CXR Viral VS Bacterial:

- Viral pneumonia: : starts gradually with general malaise, wheezing, and watery cough, affecting both lungs diffusely.
- Bacterial pneumonia : usually start suddenly with high fever, chills, and productive cough,
- localized lung consolidation.
- Key differences lie in onset (slow vs. fast), symptoms (flu-like vs. severe/localized), sputum (watery vs. purulent),

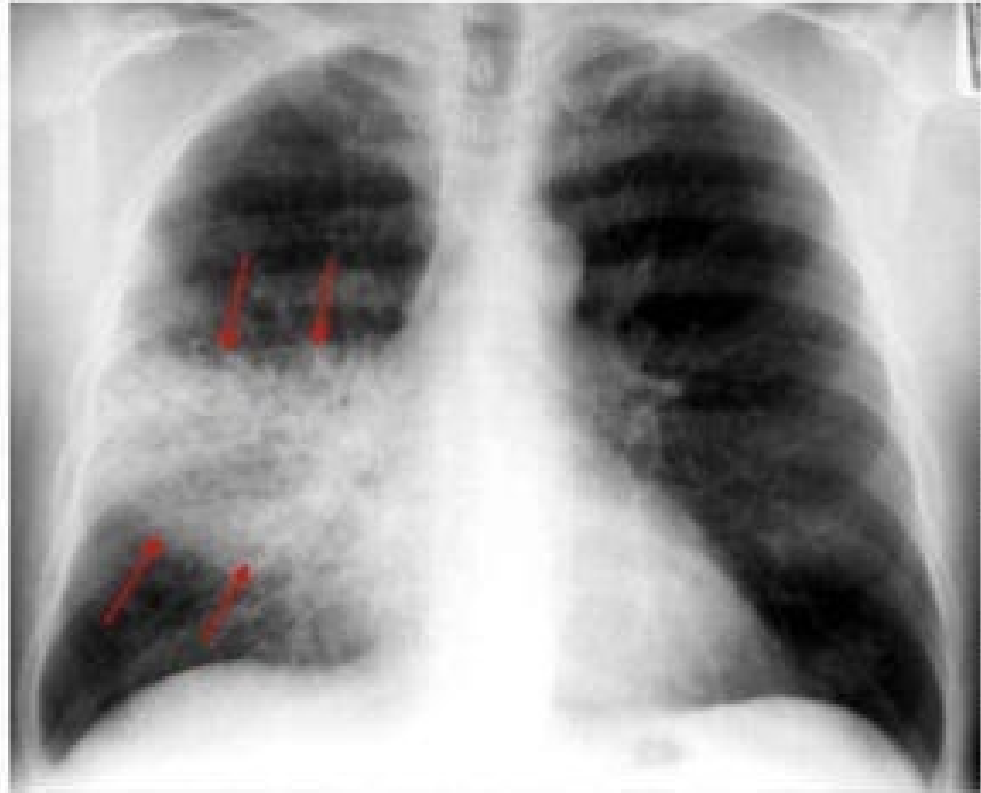
Pneumonia: Viral vs Bacterial Clinical Judgment

- The best guide to distinguishing bacterial from viral pneumonia is **clinical judgment**.
- X ray findings,

Viral vs Bacterial Pneumonia



Viral

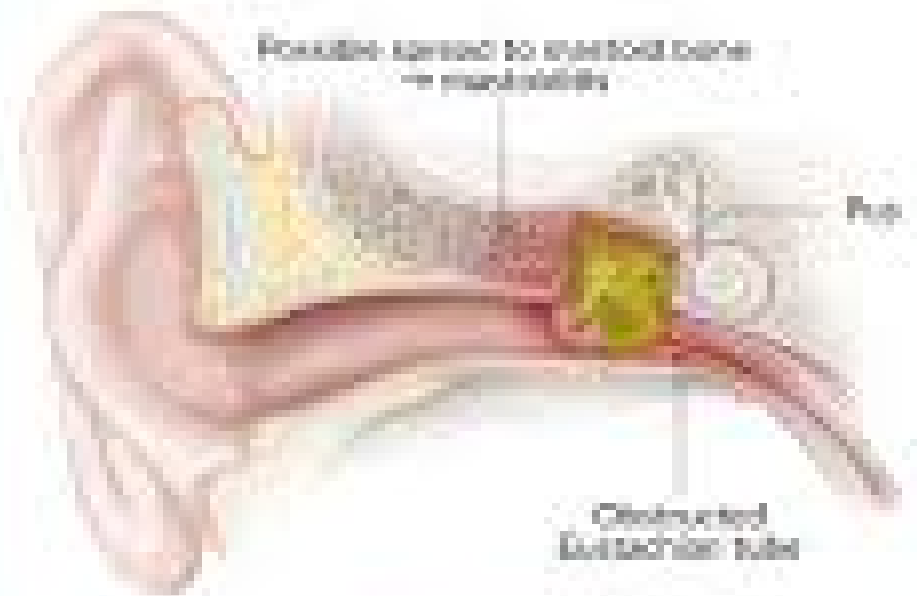
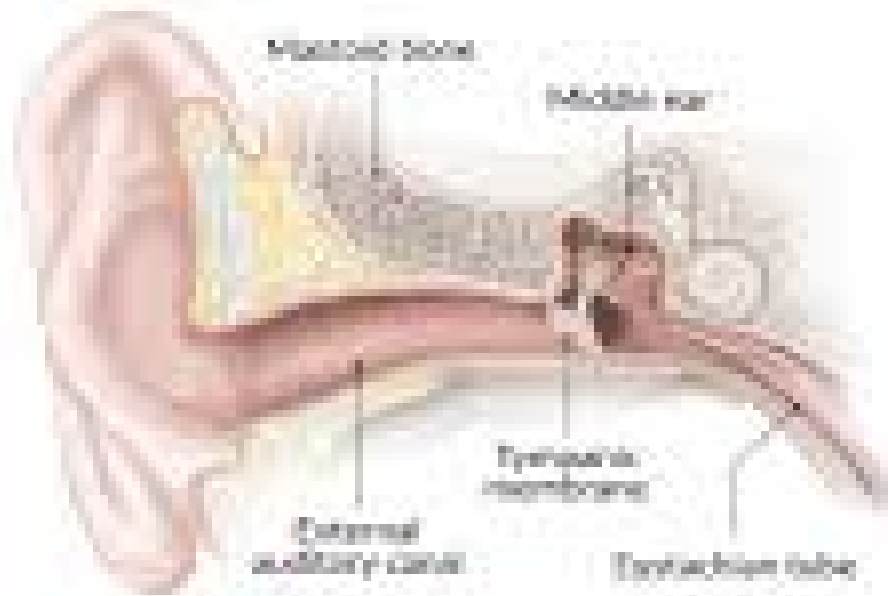


Bacterial

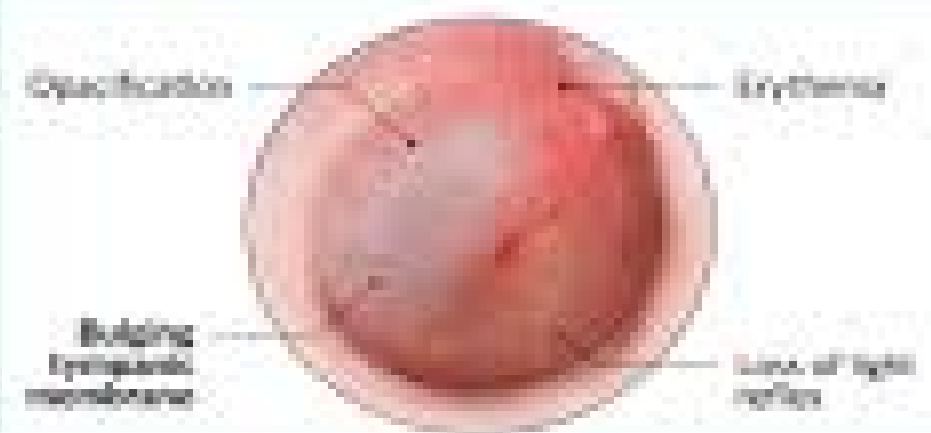
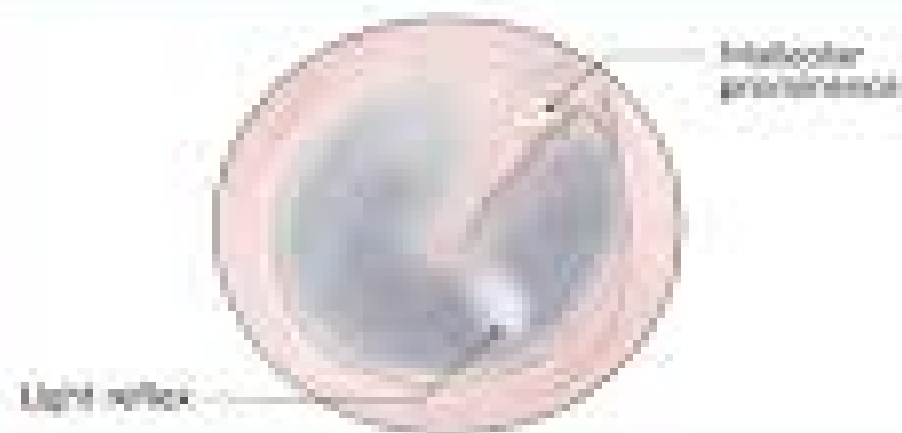
Normal

Acute otitis media

Anatomy



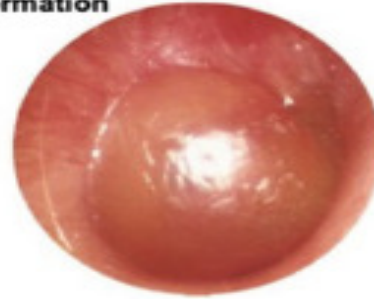
Diagnosis and treatment



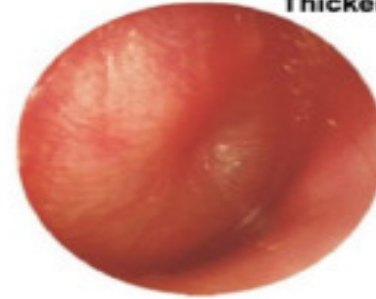
Viral versus bacterial infections.



Bullous formation



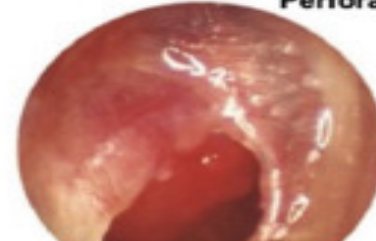
Thickening



Middle ear effusion



Perforation



Streptococcal Pharyngitis



Original Image by [James Heilman, MD](#) (CC BY)

Viral Pharyngitis



Original Image by [Cameron Smith, MD](#) (CC BY)

Fever without source (FWS) Urinary Tract Infection (UTI)

- UTI can be clinically inapparent in well-appearing children with Fever without source (FWS).
- UTI is the most common Serious bacterial infection (SBI) in febrile children <24 months, with an overall prevalence of 7%.
- AAP 1999 guidelines recommended that all children aged 2 to 24 months with Fever without source (FWS) be tested for UTI.

Lab. work up for febrile child.

- White blood cell and absolute neutrophil counts.
- **Procalcitonin** and other Acute phase reactant

PCT levels rise in response to bacterial infections more rapidly than other markers, such as C-reactive protein and ANC.

PCT is more specific than WBC count.

- **Do Cultures:** Blood, Urine, CSF, Sputum, any other body fluids

Acute phase reactants are many like:

- 1- ESR.
- 2- CRP.
- 3- Procalcitonin.
- 4- Fibrinogen.
- 5- Serum ferritin.

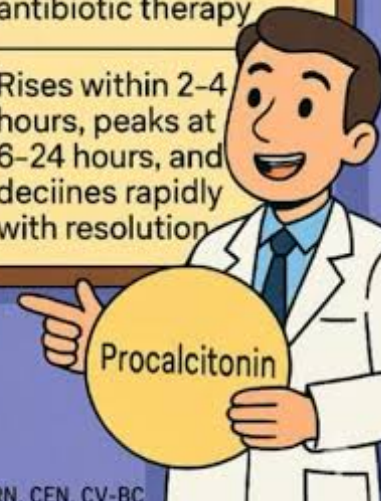
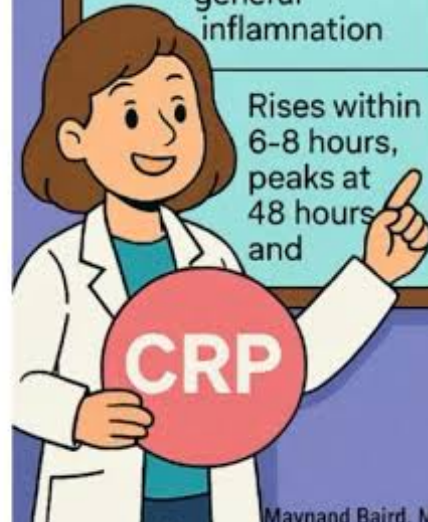
Procalcitonin

procalcitonin synthesis by **thyroid C cells**. responsible for serum calcium regulation. Normal serum levels < 0.05 ng/mL. can be increased up to 100 to 1000 fold due to **circulating endotoxins or cytokines** (interleukin (IL), tumor necrosis factor (TNF)).

The extra synthesis of PCT occurs in the liver, pancreas, kidney, lung, intestine, and leukocytes; notably, the synthesis of PCT is suppressed within these tissues in the absence of bacterial infection.(increase with bacterial infection, not viral infections)

CRP vs Procalcitonin

CRP	Procalcitonin
 Rises in response to inflammation, not specific to bacterial	More specific for bacterial infections; less likely to rise in viral or non-infectious inflammation.
 Used to detect and monitor general inflammation	Helps distinguish bacterial from viral infections and guide antibiotic therapy
Rises within 6-8 hours, peaks at 48 hours and	Rises within 2-4 hours, peaks at 6-24 hours, and declines rapidly with resolution



Rigors and Serious Bacterial Infection (SBI)

- Rigors may be associated with a higher probability of SBI (15% vs. 6% in children without rigors).
- Leg pain has also been reported as a possible early sign of bacterial sepsis and meningococcal disease
- Night sweats are a relatively nonspecific symptom..

Recurrent fevers

Respiratory infections represent the main cause of recurrent fever. A normal infant may experience up to 11 respiratory infection episodes per year, especially if they have older siblings or attend daycare centers. Most of these episodes are due to self-limiting viral infections, (providing that these children do not have other alarm features suggesting an immune deficiency disorder).

But unusually frequent serious infections (e.g., 2 or more pneumonias or deep-seated infections or sinus infections within a year or 8 or more episodes of otitis media within a year), as well as infections by unusual or opportunistic pathogens, should **raise concern for an immune deficiency disorder**

Fever with rash (6 famous causes) (Really Sick Children Must Eat Tomato)

1-Really : Rubella.

2-Sick :Scarlet fever.

3-Children : Chickenpox.

4-Must : Measles.

5-Eat. : Erythema infectiosum (slapped cheek) parvo v.

6-Tomato. : Typhoid fever.

Scarlet fever (Second disease)

The first signs of scarlet fever can be flu-like symptoms, including a high temperature, a sore throat and swollen neck glands (a large lump on the side of your neck). **Strawberry tongue**

A rash appears 12 to 48 hours later. It looks like small, raised bumps and starts on the chest and tummy, then spreads. The rash makes skin feel rough, like sandpaper.

caused by Group A streptococcus . affects children between 5–15y.



Measles or Rubella (6th disease)



Koplik spots



- Vesicular rash: may be caused by
- chickenpox or shingles

3rd cause of fever with rash



Shingles (Herpes zoster)



Erythema infectiosum (Fifth Disease) caused by Parvo virus

- It's the fifth illness described with similar rash.
- Affect **school age** children.
- Low grade fever followed by a rash. **Slapped cheek appearance**
- Rash **fades with central clearing** giving **reticulated appearance**.



Rose spots in typhoid fever (6th disease)



Look for the rash of specific diseases:

Roseola infantum

Other name: Exanthem subitum (which means “sudden rash”).

- Infants and young children (occasionally bulging fontanell)
- High fever lasting 1–5 days, Looks well
- Insufficient findings to explain the fever.
- Abrupt drop of temperature and appearance of generalized rash which disappears quickly, **DIAGNOSTIC FOR ROSEOLA**.
- Cause : human herpesvirus 6, less commonly by human herpesvirus 7



SYMPTOMS OF KAWASAKI DISEASE

If your child has a fever and shows 4 of these symptoms, they could have Kawasaki disease. Consult your doctor immediately.



A



E



I



F



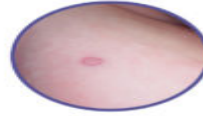
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J



Red eyes, without any discharge



Redness of the BCG scar



Rash on the body, including the buttock/diaper area



Irritability and crankiness



Fever for 5 days or more



Red and/or cracked lips; red "strawberry" tongue



Swollen lymph nodes in the neck



Red palms and soles, swelling of the hands and feet, peeling of skin of the fingers and toes (usually 2-3 weeks later)



Criterion		Features
Rash		Diffuse, polymorphous, erythematous occurring on the trunk and limbs. Variable: Maculopapular Erythema multiforme-like Scarlatiniform Inflammation at the site of a BCG scar can now be considered as part of this core criterion (Fukazawa et al. 2020).
Conjunctival injection		Bilateral, non-exudative. Limbal sparing (area immediately around the iris is clear/white)
Mucositis		Dryness, cracking and bleeding of the lips and mucosa Strawberry tongue
Extremity changes		Swelling, erythema, induration Subsequent peeling occurs from the second week of illness At 1-2 months, Beau's lines may appear on the nails.
Lymphadenopathy		Cervical, usually unilateral Typically >1.5cm

Images: McCrindle et al. 2017

Fever of unknown etiology (FUO)

Definition , Criteria:

- 1-Documented fever of more than one week duration.
- 2-Fever documented in the hospital.
- 3-No apparent diagnosis after an investigation for one week in the hospital.

Fever of unknown origin (FUO)

Fever of unknown origin (FUO) in children is defined as a fever lasting more than 1 week with negative preliminary investigations.

1-Infections are the most frequent cause of FUO (51% in a series) .

2-non-infectious causes (25%),

3-Remaining unexplained (23%).

.

TABLE 1

COMMON CAUSES OF **FEVER OF UNKNOWN ORIGIN**

Bacterial infections	Osteomyelitis, pyelonephritis, abscess, infective endocarditis, tuberculosis, cat scratch disease, typhoid fever
Viral infections	Epstein-Barr virus, cytomegalovirus, enterovirus, adenovirus
Malignancy	Leukemia, lymphoma, neuroblastoma
Autoimmune	Juvenile idiopathic arthritis, systemic lupus erythematosus, inflammatory bowel disease
Miscellaneous	Kawasaki disease, drug fever, periodic fever

FUE or fever of unknown source (FWS)

- When a cause for fever cannot be identified by history and physical examination it is called “fever without source” (FWS)
- a minority of children with FWS will have a **serious bacterial infection (SBI)** (mainly urinary tract infection (UTI), less commonly pneumonia, sepsis, or meningitis),
- the majority will have mild, self-resolving viral illnesses.

Temperature reducing agents:

- Tepid sponging
- Removing excess clothing.
- Giving ibuprofen
- C. Giving Paracetamol.
- Aspirin: should be avoided, it causes Reye's syndrome.

Antibiotics

- Limit prescription of antibiotics to bacterial infections only or when its highly suspected.
- Liberal use of antibiotics promote antibiotic resistance.

Treatment of fever

Fever is one of the most worrisome symptoms for **parents & healthcare providers** concerned that untreated fever may lead to brain damage, seizures and death.

Called **“fever phobia”**.

While the central nervous system is sensitive to extreme temperatures (over 41.5 °C) fever represents a controlled physiologic phenomenon, and temperatures over 41 °C are remarkably rare, possibly owing to protective mechanisms in the thermoregulatory centers.

the most serious and common adverse events associated with fever are related to antipyretic drugs

Adverse events following a febrile illness are therefore related to the underlying condition not to the rise in temperature[.].

Treatment of fever con...

- Fever plays a physiologic role in response to infection, inhibiting bacterial growth and viral replication, and enhancing the immune response .
- A recent meta-analysis, however, found no evidence that use of antipyretics prolongs illness in children.
- since fever itself is not dangerous, antipyretic treatment should be reserved for distressed children, aiming at improving the child's wellbeing rather than achieving normothermia.
- Antipyretic treatment has not been shown to prevent recurrence of febrile seizures and should not be recommended for this purpose.

Treatment of fever con...

- Response to antipyretics cannot predict the severity of the underlying illness, since children with bacterial and viral illnesses have a similar response to antipyretics. However, evaluating if the child's conditions markedly improve with antipyretic treatment may be useful to discern whether it was related to fever or to the severity of the underlying illness .
- Parents should be instructed to observe for signs and symptoms of serious illness or dehydration in the child, rather than concentrate solely on temperature.

Treatment of fever con...

- Physical treatments like tepid sponging or cold baths are not recommended, since their efficacy is modest and they can distress the child.
- Similarly, undressing or over-dressing are not recommended in order to avoid excessive shivering or over-heating.
- Ibuprofen and acetaminophen are the only drugs approved for treatment of fever in children , and they are generally considered to be equally safe and effective for reducing temperature and relieving discomfort.
- **Ibuprofen, at 10 mg/kg/dose**, may provide a more rapid and longer lasting effect than acetaminophen, but this difference was less evident in studies evaluating **acetaminophen at 15 mg/kg** rather than at 10 mg/kg .

Treatment of fever con...

- Combination therapy with **acetaminophen plus ibuprofen** seems to be slightly more effective in reducing body temperature compared with monotherapy alone.
- It may increase medication errors and adverse events & increased risk of kidney injury reported.

Treatment of fever con...

Adverse Effects of Fever Treatment

Both ibuprofen and acetaminophen are considered safe when used appropriately, and adverse events are rare. The most serious adverse effects are

Hepatic injury for acetaminophen, and

Acute kidney injury and gastrointestinal bleeding for ibuprofen.

Our aim is Allert doctors taking care of children
not to miss serious illness.

THANK YOU

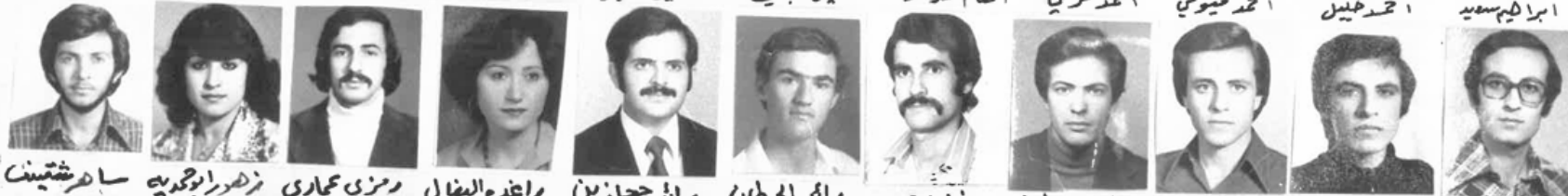




كلية الطب في الجامعة الاردنية الدفعة الرابعة 1981



أبراهيم سعيد | محمد خليل | أحمد خميسي | أحمد مرعي | انعام حداد | ايمن الحايي | ايمن كركر | باجبى يعقوب | بسام اهزنف | بسام حن | يسير السعد



جمال وادي | حنين ابوطوق | حنين وهيب | خضر مهنه | خليل عيد | رائد الجيطان | رائد حجازين | رائد البقال | رمزي عماري | زهره ابو جديده | ساهر شقيقت



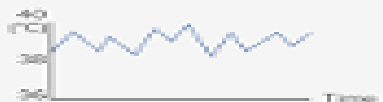
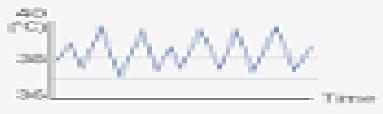
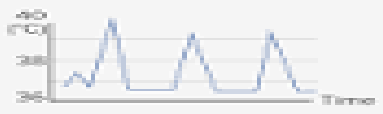
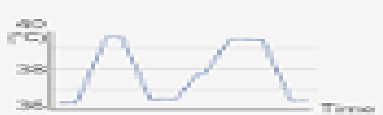
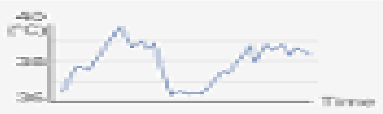
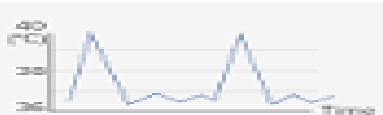
سلام جبريل | معلوف ابولين | سمير زبانه | سميرة ابو الريس | مها دالمير | لها لبه سمائل | عاكنه ابريمه | عزام الميخري | عمر البوريني | فائقه حسن | فايز حمزه

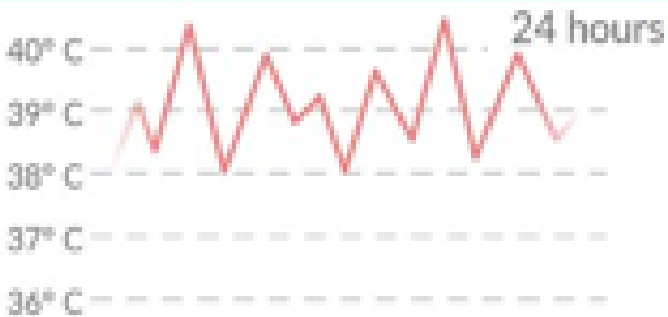
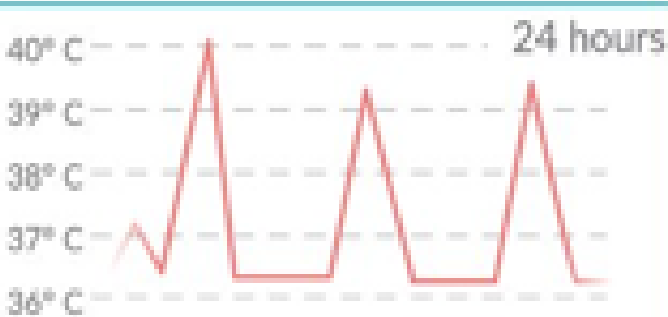


فايز مشعون | فايق حادين | فخري عبد المزان | ليدى ابولين | محمد ابورميه | محمد المن | محمد حنين | محمد سلامه | محمد بطاينه | مراد الخياط | مينا النقيب



هاله زلعي | هاني حشاش | هريشه توكوليان | والي السيد | دنا دوبراوي | ياسين عايد

Continuous fever	 Temperature continuously remains above normal, with daily fluctuations $< 1^{\circ}\text{C}$.	• Typhus • Viral pneumonia
Remittent fever	 Temperature continuously remains above normal, with daily fluctuations $\geq 1^{\circ}\text{C}$.	• Typhus • Sepsis • Tuberculosis • Rheumatic fever
Intermittent fever	 Temperature remains above normal only for a certain period, later returning back to normal.	• Pleuritis • Sepsis
Biphasic fever	 Fever that breaks and returns twice a day	• Yellow fever • Dengue • Malaria • Typhoid • Leptospirosis
Undulant fever	 Temperature continuously remains above normal, with daily fluctuations $\geq 1^{\circ}\text{C}$.	• Brucellosis
Recurrent fever	 Relapsing fever: Days of fever followed by an afebrile period of several days and then a relapse into additional days of fever, usually after 14–21 days. Pel-Ebstein fever: Fever lasting 1–2 weeks followed by 1–2 weeks of an afebrile period Periodic fever: Fever that recurs over months or years; associated with the absence of infection of malignancy	• Pleuritis • Sepsis

		
Remittent		• Viral infections • Acute bacterial endocarditis
Intermittent		• Pyogenic, focal infections • Tuberculosis • Juvenile idiopathic arthritis
Undulant		• Brucellosis
		

 Types of Fever			
PAGE No. DATE / /			
No.	Type of Fever	Features	Examples / Causes
1.	CONTINUOUS FEVER	Temperature remains high and does not fall more than 1°C in 24 hours.	Typhoid, Pneumonia, Malaria (continued)
2.	REMITTENT FEVER	Temperature is high but falls to normal level, then rises again; variation >1°C in 24 hours.	Malaria, Septicemia, Brucellosis
3.	INTERMITTENT FEVER	Temperature rises and remains for some time, then returns to normal, and again rises.	Malaria (Tertian, Quartan)
4.	SUSTAINED FEVER	Temperature remains high and varies less throughout the day.	Typhoid, Typhus, Pneumonia
5.	RELAPSING FEVER	High fever for several days, then returns to normal for several days, then recurred.	Relapsing Fever (Borrelia)
6.	HECTIC FEVER	Irregular and large variations in temperature with marked rise and fall.	Septicemia, Abscess, Endocarditis
7.	DOUBLE (SADDLE BACK) FEVER	Fever rises, falls for some days and then rises again with a second peak.	Dengue (classic pattern)
8.	BIPARTITE FEVER	Fever occurs in two spikes in a day with normal temperature in between.	Malaria (Quartan type)
9.	PEL-EBSTEIN FEVER	Temperature gradually rises step by step and then suddenly falls to normal.	Hodgkin's Lymphoma

Types of Fever

Understanding Fever Patterns & Causes

1. Fever Patterns Most Important



Continuous:
↑ All day
Typhoid, Pneumonia



Remittent:
Fluctuates > 1°C
Malaria, Endocarditis



Intermittent:
Fever → Normal
Malaria, Septicemia
Types: Quotidian > Every day
Tertian > Every 48 hrs
Quartan > Every 72 hrs



Relapsing:
Fever → Returns
Borrelia infection
Example: Septicemia, Abscess



Relapsing:
Borrelia infection



Hectic (Septic):
Chills & Sweating
Example: Septicemia, Abscess

2. Based on Cause



Infectious:
Typhoid, Malaria



Non-Infectious:
Drugs, Cancer

3. Based on Duration



Acute
≤ 7 days
Viral Fever



Sub-Acute
7-14 days
Typhoid



Chronic
> 14 days
Tuberculosis

Exam Tip: "Fever = Resetting of Hypothalamic Set-Point"

Ask about Which method the family
Temp. may vary according to the method.

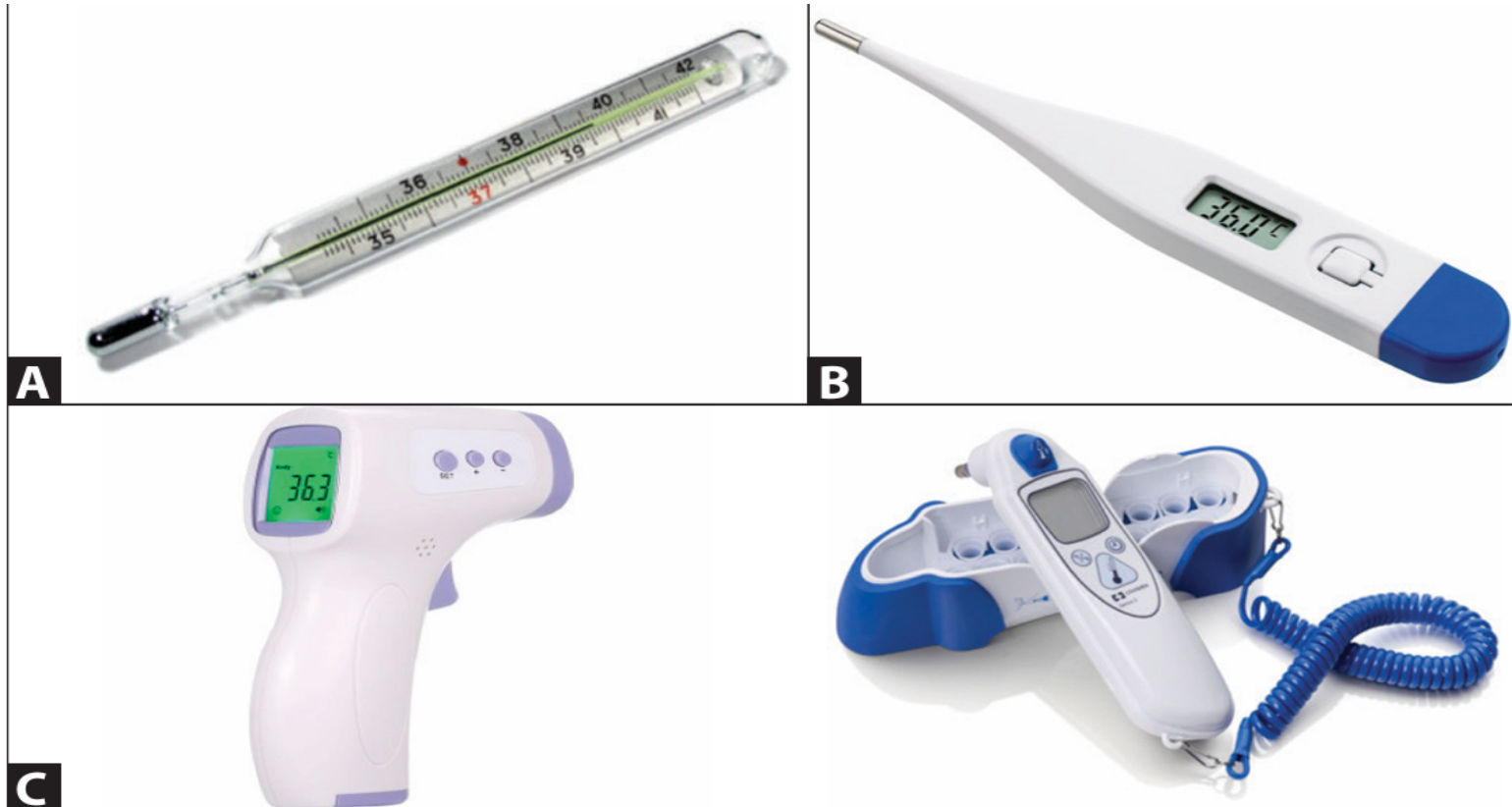


Figure 2. Thermometers.

A Mercury glass thermometer **B** Electronic thermometer **C** Infrared thermometers

Clinical assessment of fever

Traffic light system

- Check for any **immediately life-threatening features**.
- Use traffic light system to check for symptoms and signs that **predict the risk of serious illness**.
- Look for a **source of fever** and check symptoms and signs associated with **specific diseases**.
- Measure and record temperature, heart rate, respiratory rate, capillary refill time and assess for dehydration.

Traffic light system: green



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Colour	Normal colour of skin, lips and tongue
Activity	Responds normally to social cues Content/smiles Stays awake or awakens quickly Strong/normal cry/not crying
Hydration	Normal skin and eyes Moist mucous membranes
Other	None of the amber or red symptoms or signs

amber
کهرمانی



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Colour	Pallor reported by parent/carer
Activity	Not responding normally to social cues Wakes only with prolonged stimulation Decreased activity No smile
Respiratory	Nasal flaring Tachypnoea: RR>50/min age 6-12 months, RR>40/min age >12 months Oxygen saturation $\leq 95\%$ in air Crackles
Circulation and Hydration	Tachycardia: • >160bpm in under 1s • >150bpm in 12-24 months • >140bpm in 2-5 year olds Dry mucous membranes Poor feeding in infants CRT ≥ 3 seconds Reduced urine output
Other	Fever for ≥ 5 days Swelling of a limb or joint Non-weight bearing/not using an extremity Rigors Age 3-6 months with temperature $\geq 39^{\circ}\text{C}$

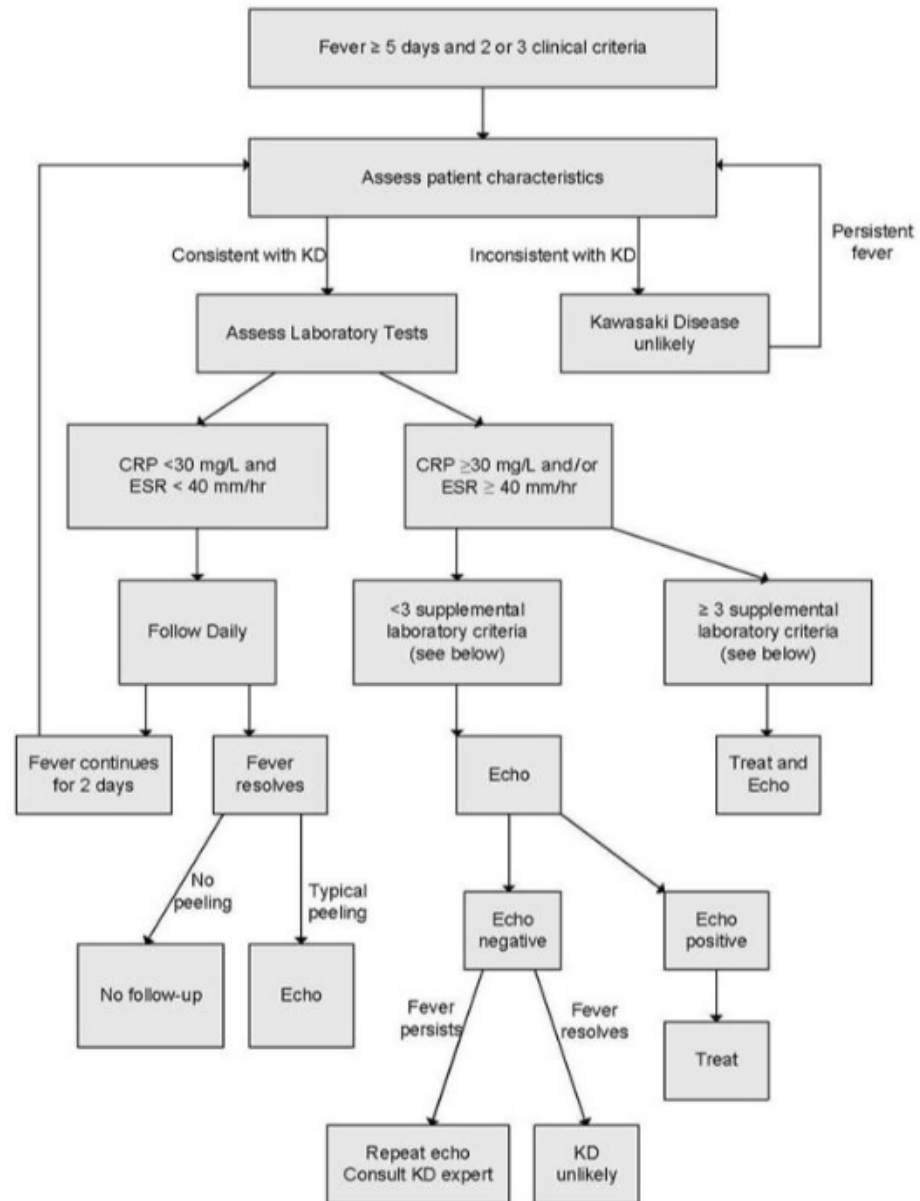
RED



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- Age <3 months, temperature $\geq 38^{\circ}\text{C}$
- Non-blanching rash
- Bulging fontanelle
- Neck stiffness
- Status epilepticus
- Focal neurological signs
- Focal seizures

- Pale/mottled/ashen/blue
- No response to social cues
- Appears ill to a healthcare professional
- Does not wake or if roused does not stay awake
- Weak, high-pitched or continuous cry
- Grunting
- Tachypnoea: RR >60 breaths/minute
- Moderate or severe chest indrawing
- Reduced skin turgor



- Several physiologic factors influence body temperature, including time of the day (with a nadir in the morning and a late afternoon peak). level of activity; meals; age (infants and young children generally have higher temperatures than older children).
- In infants, core temperature can be as low as 36 °C during nocturnal sleep, but can rise up to 37.8 °C during active periods of the day, especially after feeding .
- fever can be generally defined as a thermoregulated elevation of body temperature above normal daily variation.
- for clinical and research purposes, fever is often defined as a core temperature of 38 °C or higher.

Hyperthermia continue....

- [35]. Malignant hyperthermia is a rare genetic disorder (1 in 14,000 pediatric general anesthesia) associated with several forms of congenital myopathy and triggered by succinylcholine or inhalational anesthetics agents; clinical features include rapid onset of extremely high temperature (38.5–46 °C), usually heralded by masseters spasm, muscle rigidity, metabolic acidosis, and hemodynamic collapse. Specific treatment, with discontinuation of involved anesthetics, muscular relaxation with sodium dantrolene, and correction of metabolic acidosis, has dramatically reduced the mortality, once as high as 70%, to less than 5%

serious bacterial infection (SBI)

- there is an association with a greater likelihood of SBI for temperatures $>39^{\circ}\text{C}$.
- In a prospective study fever $>39^{\circ}\text{C}$ was associated with an increased risk of SBI, especially in infants under 6 months However, this cut-off still missed 82% of SBI episodes in this age group.
- In a prospective series of 103 children with a temperature $>41^{\circ}\text{C}$, almost 50% had an SBI and a higher risk of meningitis.

4.The value of associated clinical findings

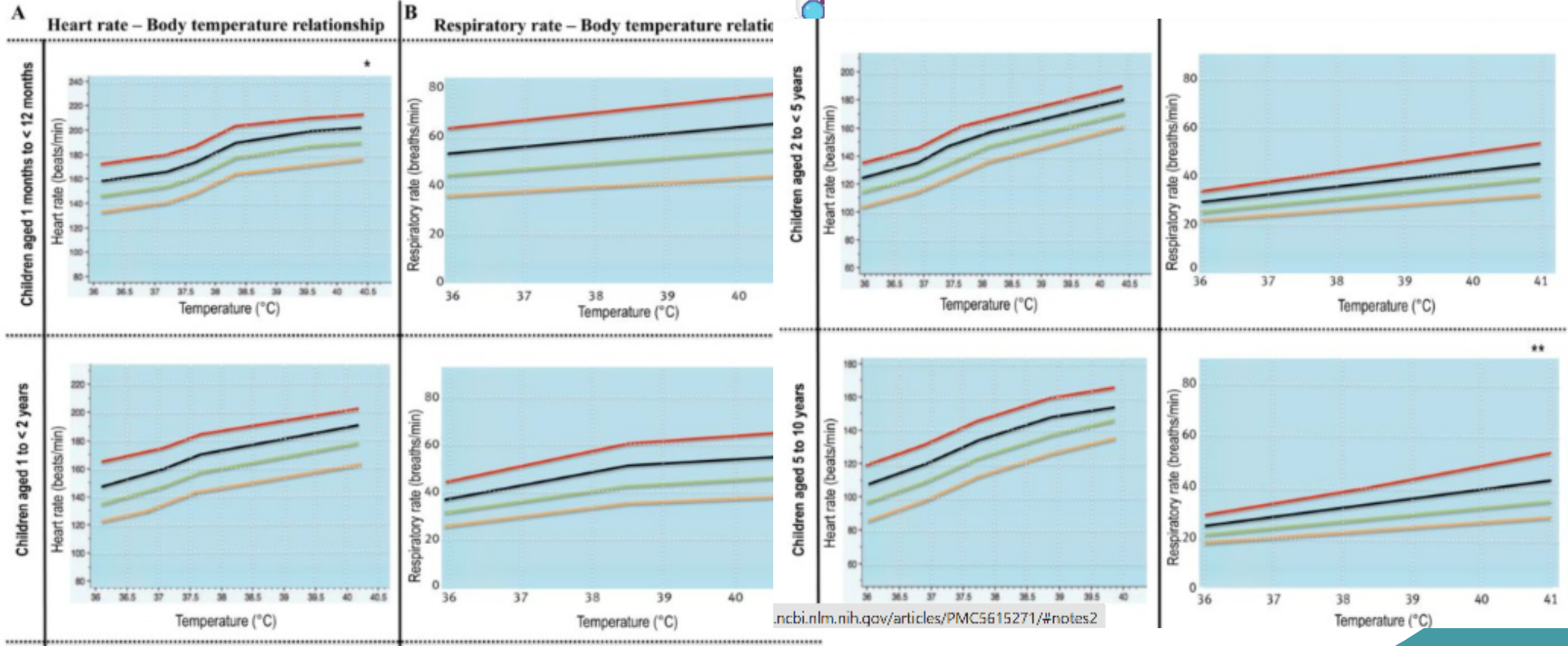
serious bacterial infection (SBI)

Gathering as much information as possible in the first, hands-off, phase of the visit is pivotal.

Physical signs such as pallor, mottled appearance, ashen or blue skin color, reduced activity , tachypnea and tachycardia, capillary refill time >3 s, and a reduced urine output are all concerning for SBI (“red flags”) .

- Tachypnea: although the World Health Organization criteria for the diagnosis of pneumonia include tachypnea alone (isolated tachypnea is a poor indicator of pneumonia in the presence of wheezing) .

Age-specific temperature-related heart and respiratory rate centile charts (modified from references)



FEVER AND SKIN RASH (EXANTHEM)

- o **R**eally **S**ick **C**hildren **M**ust **E**at **I**omato
- o 1st disease : Rubella
- o 2nd disease : Scarlet fever
- o 3rd disease : Chickenpox
- o 4th disease : Measles
- o 5th disease : Erythema infectiousum (Slapped cheek)
- o 6th disease : Typhoid fever(rose spot)



APPROACH TO FEVER

- **Details History:**

- Time
- Grade
- Duration
- Diurnal variation

- **Associated Symptoms**

- **Drug History:**

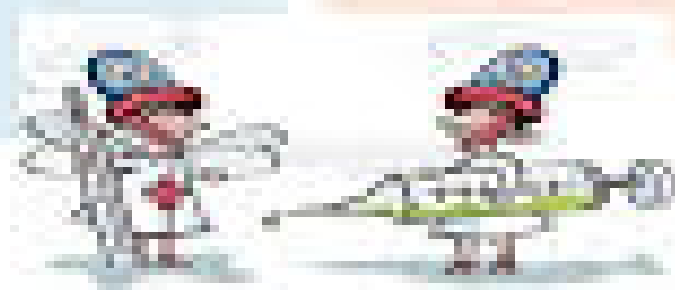
- **Past history: PMH & PSH**

- **Family History:**

- **Travel History**

- **Physical Examination:**

- Vital Signs
- Neurological Exam.
- Skin Lesions, Mucous Membrane
- Eyes
- ENT
- Lymphadenopathy
- Lungs and Heart
- Abdominal Region: [Hepatomegaly, Splenomegaly]
- Musculoskeletal



The Evaluation of infants and young children with a fever.

The risk of SBI in infants <3 months of age is higher than at any other age in childhood (approximately 3.75/1000 live full term births) .

As a result, the prevalence of SBI in febrile infants ranges from 8% to 12.5%, and it is even higher (up to 20%) in neonates (≤ 28 days old) . laboratory testing are recommended, even in patients with signs and symptoms of a viral respiratory infection .

All children in this age group should have urinalysis to rule out UTI, complete blood count, and blood cultures, plus stool culture in cases of diarrhea and chest X-ray in cases of signs of pulmonary disease.

Apart from the neonatal period, however, chest X-ray may be omitted if there is a high likelihood of uncomplicated bronchiolitis.

Acute phase reactant as a predictors for Serious Bacterial Infection (SBI)

- C-reactive protein (CRP) and procalcitonin (PCT) may aid in identifying children at risk for SBI better than WBC.
- there is some evidence that PCT may be more accurate than CRP for detecting invasive bacterial infections in children <3 months of age. (**Invassive bacterial infection(IBM), defined as bacteremia and meningitis**)
- **French study:** PCT and CRP had a similar diagnostic accuracy for detecting SBI, but PCT performed significantly better than CRP in infants with IBM (using a cutoff value of 0.3 ng/mL for PCT and 20 mg/L for CRP).
- This advantage may be associated with the fact that PCT has been shown to have a greater predictive value than CRP for IBM in the very first hours (<8 h) of fever onset (in all other instances, CRP preferable similarly accurate and less expensive).

- Teething is not a cause of fever.
- Immunization is a common cause of fever, and up to 50% of infants may experience fever 24–48 h after immunizations.
- Prophylactic treatment with acetaminophen reduces the incidence of fever, but may transiently decrease antibody response. Since there are few data on the long-term effects of this practice [82], and since many children may not need it at all,
- we do not suggest routine prophylactic treatment with acetaminophen after immunizations, reserving it for symptomatic children.

6-The value of clinical prediction rules

The most commonly used clinical prediction rules include Rochester criteria (for infants aged 0 to 60 days)

Philadelphia criteria (for infants aged 29–60 days)

Boston criteria (for infants aged 28–89 days).

These were designed to provide a set of reassuring criteria that allow safe discharging if requirements are met. Overall, these criteria tend to have a very high negative predictive value (over 99%) but a low positive predictive value (14% for Philadelphia criteria, 12.3% for Rochester criteria). In fact, they were designed to have a high sensitivity for SBI (i.e., allow safe discharge), even though at expenses of specificity, and they still represent the basis of standard clinical management of febrile infants in many institutions.

Recurrent fever cont...

- Several non-infectious conditions can cause recurrent fevers, PFAPA (periodic fever, aphthous stomatitis, pharyngitis, and cervical adenitis) syndrome is the most common cause of periodic fever in children, and is diagnosed on clinical criteria (regularly recurrent bouts of fever lasting 3–6 days with onset before 5 years of age, and at least 1 of the 3 associated symptoms, in the absence of upper respiratory tract infections or cyclic neutropenia)
- Fever episodes show a dramatic response to a single dose of oral corticosteroids.
- familial Mediterranean fever, mevalonate kinase deficiency, tumor necrosis factor receptor-associated periodic syndrome,

FMF

- Mediterranean fever may begin with an atypical presentation characterized by attacks of fever alone, possibly delaying diagnosis .

FUO: Hemophagocytic lymphohistiocytosis (HLH)

- is a life-threatening inflammatory syndrome resulting from an excessive and uncontrolled activation of the immune system that may be due to a genetic disorder or secondary to acquired conditions, both infectious and non-infectious.
- It most frequently affects infants <2 years of age but may occur at all ages. Delays in the diagnosis are among the main causes of poor outcomes.
- HLH should be suspected in cases of unexplained fever with multiple organ involvement (most commonly hepatomegaly, splenomegaly, lymphadenopathy, but also central nervous system, respiratory, cardiac, and skin involvement).
- associated with specific laboratory abnormalities (cytopenias, high serum ferritin levels, liver function and coagulation abnormalities, low serum fibrinogen, hypertriglyceridemia).
- A useful red flag is represented by the fall of ESR despite worsening of patient's conditions.

FUO: Factitious fever

Factitious fever should be suspected in school-age children and adolescents with a history of persistent fever without skin warmth or sweating, normal clinical and laboratory findings, prolonged loss of school days and a normal temperature when not self-measured .

Similarly, caregiver-fabricated illness (also known as **Munchausen-by-proxy syndrome**), a form of child abuse, should be considered in cases of unexplained prolonged fevers or infectious symptoms .

Illness may be falsely reported, simulated, or actually induced. Common presenting features include recurrent fevers, infections, diarrhea, and rashes, often with a history of multiple diagnostic procedures, medical treatments, and hospitalizations. Typically, despite extensive investigations, the presented complaints cannot convincingly be attributed to known medical conditions, and the child often improves in the absence of the caregiver, who, notably, may not seem to be concerned about the patient's symptoms.

Drug fever: mechanisms of drug fever in children

Drug fever is a febrile reaction to a specific drug in the absence of other conditions that could explain it

Mechanisms of drug fever in children. (Modified from [\[122\]](#)).

Mechanism	Drugs
Altered thermoregulation	Antihistamines, antileukotrienes, atropine, levothyroxine, monoamine oxidase inhibitors, phenothiazines, epinephrine
Administration related	Amphotericin B, bleomycin, cephalosporins, vaccines, vancomycin
Pharmacologic action of the drug	Anti-neoplastic agents (e.g., 6-mercaptopurine, bleomycin, chlorambucil, cisplatin, cytosine arabinoside, L-asparaginase, vincristine), heparin, sirolimus, everolimus.
Idiosyncratic reaction	Anesthetic agents (e.g., enflurane, halothane) chloramphenicol, haloperidol, phenothiazines, nitrofurantoin, primaquine phosphate, quinidine, quinine, sulphonamides
Hypersensitivity reaction	Allopurinol, antimicrobial agents, carbamazepine, phenytoin, procainamide, quinidine, quinine, sulphonamides

Drug fever cont..

Typically, fever disappears once the offending drug is discontinued.

Drug fever can be difficult to diagnose during an intercurrent infectious disease, since fever could be misinterpreted as a sign of the underlying disease.

In investigating FUO, a complete history can be extremely useful, and should include contact with infected individuals or animals, previous travel history

alimentary habits, drugs, bites from animals, ticks, or insects, as well as past medical history.

Treatment of fever con...

Table 2.

Risk factors and contraindications for antipyretic drugs in children (from [116,117,118,119,120,121,122]).

Risk Factors		
Ibuprofen		Acetaminophen
Gastrointestinal Complications	Renal Injury	Hepatotoxicity
Previous peptic ulcer	High dose	Diabetes mellitus
High dose or multiple NSAIDs use	Volume depletion	Obesity
Concomitant corticosteroid therapy	Low urine output	Chronic undernutrition or prolonged fasting
Concomitant anticoagulant therapy	Concomitant use of diuretics, ACE inhibitors, sartans	Myopathies
	Concomitant administration of acetaminophen	Protracted therapy.
		Concomitant therapy with antiepileptic drugs, isoniazid, rifampin, trimethoprim-sulfamethoxazole.

Treatment of fever con...

Contraindications	
Ibuprofen	Acetaminophen
Allergy, angioedema or bronchospasm reactivity to NSAIDs Volume depletion Renal impairment	Allergy, angioedema or bronchospastic reactivity to acetaminophen
Hepatic impairment/portal hypertension	Severe hepatic impairment
Duct-dependent congenital heart diseases	
Thrombocytopenia or clotting disorders	
Active peptic ulcer disease	
Inflammatory bowel diseases	

Febrile illness with rash is common

first

second

third

fourth

fifth

sixth

diseases

measles

scarlet fever

rubella

duke's disease

erythema infectiosum

rubeola



Diagnostic criteria for Kawasaki disease

The diagnosis of KD requires the presence of fever lasting at least 5 days* without any other explanation combined with at least 4 of the 5 following criteria. A significant proportion of children with KD have a concurrent infection; therefore, ascribing the fever to such an infection or to KD requires clinical judgment.

Bilateral bulbar conjunctival injection

Oral mucous membrane changes, including injected or fissured lips, injected pharynx, or strawberry tongue

Peripheral extremity changes, including erythema of palms or soles, edema of hands or feet (acute phase), and periungual desquamation (convalescent phase)

Polymorphous rash

Cervical lymphadenopathy (at least 1 lymph node >1.5 cm in diameter)

KD: Kawasaki disease.

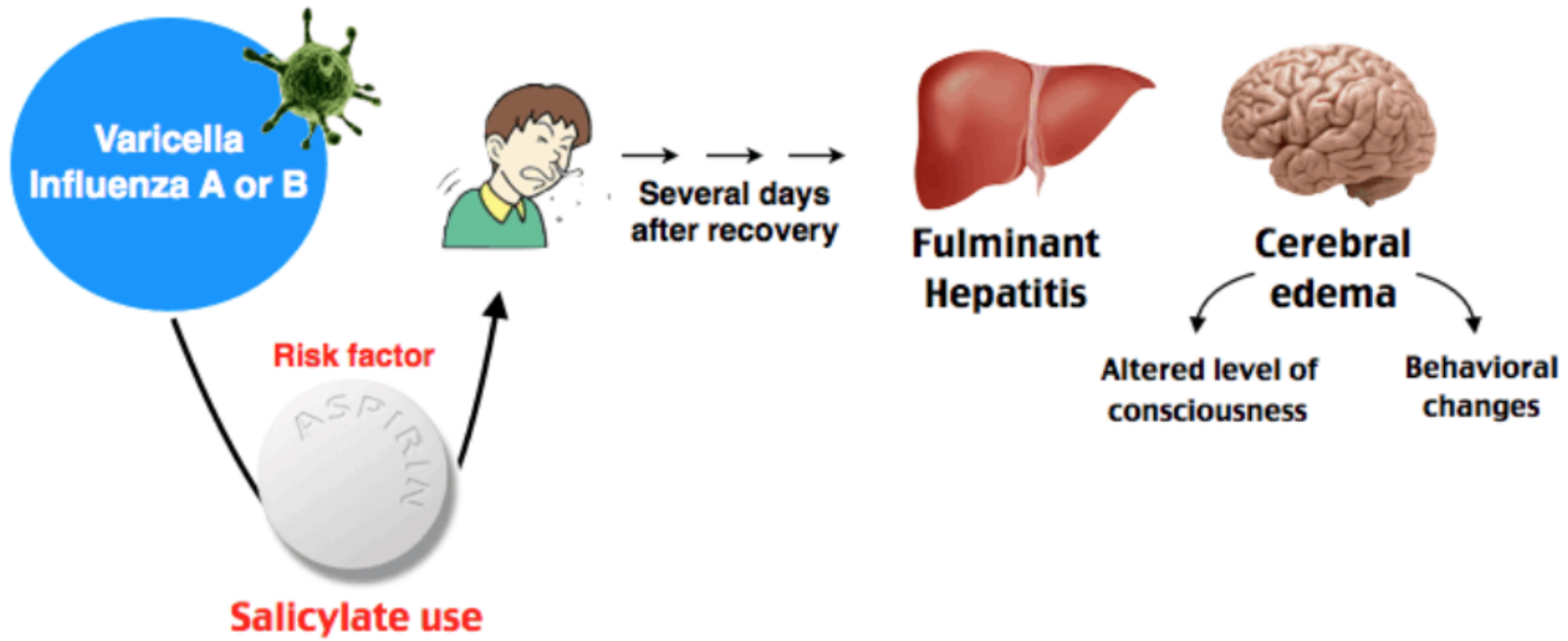
* If ≥ 4 of the above criteria are present, a diagnosis of KD can be made on day 4 of illness.

Most of FUO result (causes)

1–from common diseases that may be atypical in their presentations .

2– most causes tends to be infectious and collagen vascular diseases: Like Juvenile Rheumatoid arthritis and Systemic Lupus Erythromatosis (SLE).

VIRAL INFECTION & SALICYLATE USE. Reys syndrom



Hyperthermia causes continue....

- Hyperthermia may be caused by **abnormal thermoregulation or increased heat production from Central nervous system injury to the hypothalamus** (either congenital or acquired) may lead to **temperature dysregulation and** hyperthermia (central fever”).
- **Intoxication from hyperthermia-inducing drugs** may result in severe hyperthermia; sympathomimetic drugs (cocaine, methamphetamine, MDMA), anticholinergic drugs (e.g., antihistamines, tricyclic antidepressants), serotonergic drugs (serotonin syndrome), and salicylates.

Non-blanching rash and Serious bacterial infection (SBI)

- although a non-blanching rash should always raise concern.
- In a well-appearing children with fever and petechiae (small, non-blanching, macular hemorrhagic skin spots <2 mm in diameter) **are still at low risk of SBI**. In a study none of the 357 well-appearing children had SBI, while 6 out of 53 ill-appearing children had SBI. In another series of 55 only 9% eventually had bacterial sepsis, and they also had other concerning clinical features or abnormal laboratory tests .
- studies suggest that well-appearing children with fever and petechiae, without frank purpura, and with normal blood tests, can be observed for 4–6 h, reassessed, and eventually discharged.