FEVER IN CHILDREN

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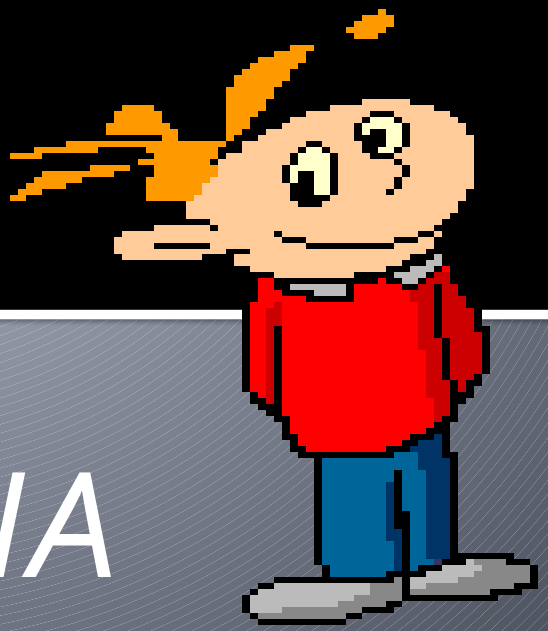
Kid Fevers:



FEVER PHOBIA

Aim of this lecture

- *Understand approach to evaluating a febrile child*
- *Have knowledge of commonly used medications from the pediatric aspect*
- *Identify a sick child and provide for timely treatment*

Discussion ----------

- *Fever ---Mechanism ? Good Or Bad ?*
- *Approach*
- *Clues to the Cause of fever*
- *Management of fever*

What is fever?

- Fever is a neurochemical response, common to many animals
- Controlled in the human hypothalamus and mediated by numerous endogenous and exogenous chemicals

What is fever?

- Nerves in the hypothalamus maintain a normal "set point" temperature, usually in a range around 37C (98.6F)
- Set point varies in a circadian rhythm with lowest at around 4am and highest between 4-8pm

What's "normal"?

- Most common definitions are based on a study by Wunderlich in *1868*
  - "Normal" 37C (98.6F)
  - "Upper limit of normal" 38C (100.4F)

- Weaknesses: *1.* Thermometry used,
  2. Use of axillary temps

What about the numbers?

FEVER

- Defined as a rectal temp 100.4 or higher.
- Relations b/n recta, oral & axillary temperature:-

  Rectal 0.5 C > oral 0.5 C > axillary 0.5 C

Thermometry

- Body temperature can be measured at several sites:-

1. Axilla
2. Oral cavity
3. Rectum
4. Ear canal (Tympanic membrane)
5. Temporal artery

Thermometry

- Three types thermometers are available:-

1. Mercury
2. Electronic
3. Infrared

Thermometry

Mercury thermometer-

- Cheaper
- Suitable for home use
- Take 2-4 minutes to measure temp
- No need of calibration

Thermometry

- Electronic Thermometer:-

1. Take lesser time (only 30 seconds)
2. Convenient to use
3. Need calibration → so subject to calibration errors

Thermometry

- Infrared thermometer:-

  1. Very quick
  2. Closely approximate rectal temperature
  3. Expensive

Thermometry

- Gold standards are rectal for children and oral for older children and adults
- Axillary temps are not reliable and may vary as much as 1°C from rectal
- *There is no reliable conversion factor for axillary vs rectal temps*

Thermometry

- Tympanic thermometry is not accurate and may be technique-dependent
- Infrared temporal artery (TA) thermometry is better than tympanic thermometry
- TA temperature is consistently lower than rectal temps.

TYPE OF FEVER

1.INTERMITTENT:- If temperature touches baseline daily & present for few hours

2.CONTINUOUS:- If temperature does not fluctuate more than 1 C & not touch the baseline

3.REMITTENT:- If temperature fluctuation is more thane 1C.

4.HECTIC/SEPTIC:-If fluctuation is extremely wide (usually >2C)

Cont.....

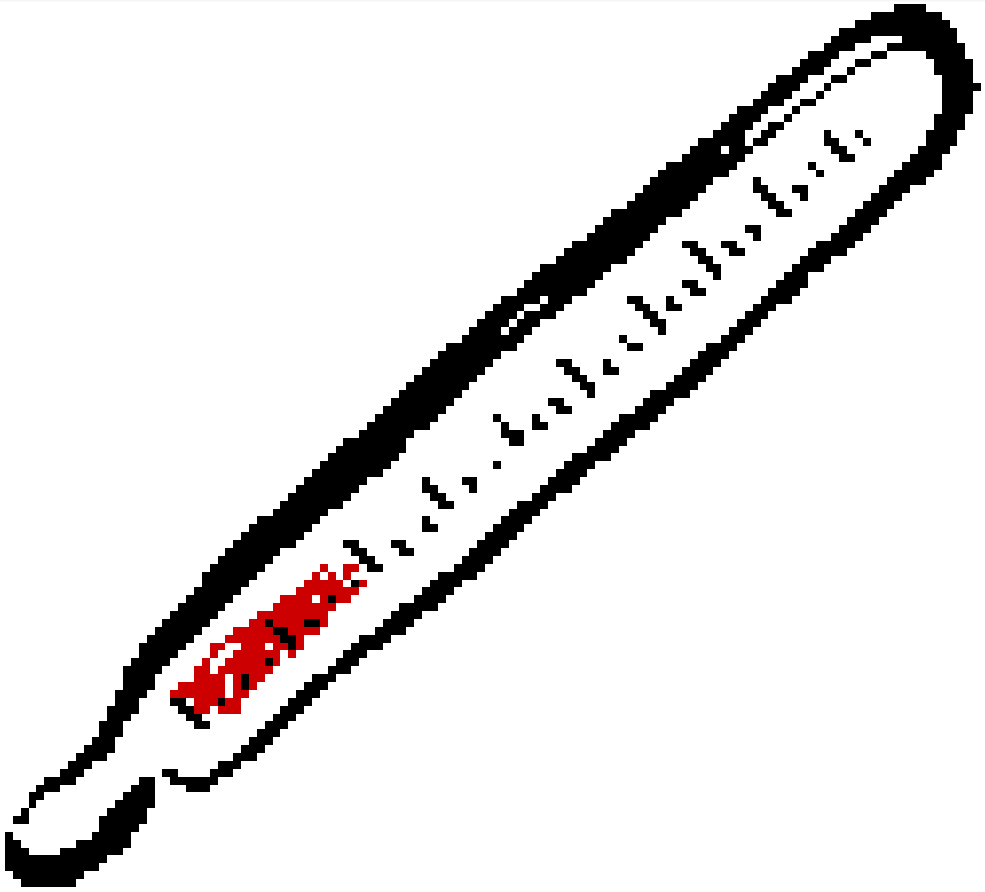
TYPE OF FEVER cont.....

5.QUOTIDIAN:- fever occurs daily

6.TERTIAN:- fever comes on alternate days

7.QUARTAN:- there is two days interval b/n two attacks

How hot is “high”?



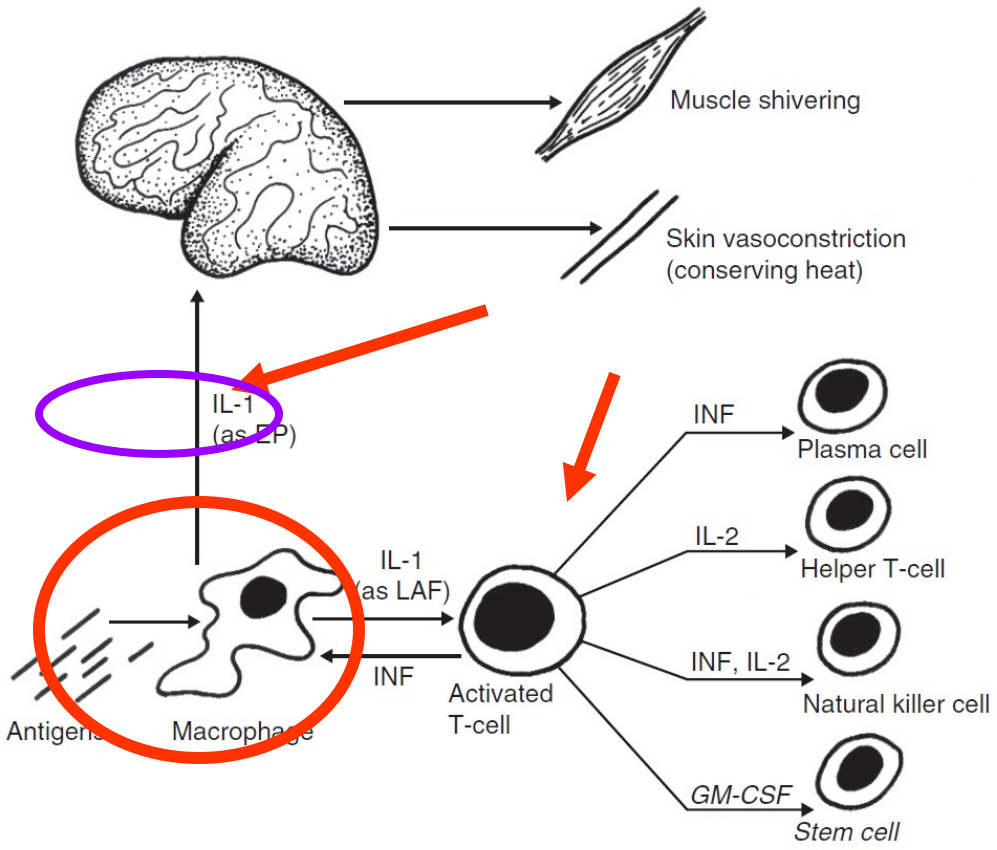
How hot is "high"?

- Dubois, 1949
  - Human upper limit of fever 41 – 42C (105.8-107.6F)
  - Almost never exceeds 42C unless there's a failure in thermoregulation

How hot is "high"?

- McCarty and Dolan, 1976
  - 40C (104F) may be the upper limit of fever in infants <12 weeks old
- Remember that young infants can have infections with normal or lowered body temps

Molecular genesis of fever



ig. 3.1 The mechanisms of fever induction

FEVER

- Studies have shown that fever helps the immune system fight infections.

- Most children are not particularly uncomfortable with fever, particularly if it is lower than 39.5°C (103°F).

Fever Good ?

Increased WBC activity & movement to the site of infection

Fever Harmful?

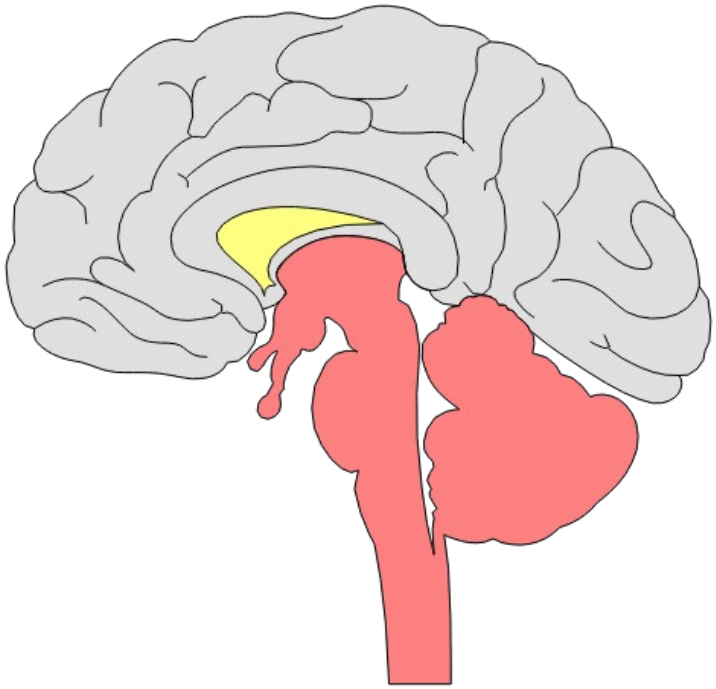
Increases energy & O2 consumption (cardiopulmonary stress)

Discomfort and associated pain

Febrile Seizures

Increase insensible water loss

Fever can cause



damage...

FEVER

Sometimes fever is caused by a serious medical condition, such as:

1. Meningitis
2. Pneumonia
3. Bacterial infection of the blood.

These are true medical emergencies. The initial assessment and focused history findings will usually indicate that the child's condition is urgent

FEVER

- Fevers in a young infant is considered more urgent than fever in an older child.

- Any infant aged three months or younger who has a rectal temperature of 100.4 degrees Fahrenheit or higher should have be evaluated

FEVER

Any child with fever who has decreased ability to fight infection should be considered potentially unstable.

Eg:- 1.Immunocompromise child
2.Child on steroids
3.Child with malignancy

FEVER

If fever is accompanied by:

1. Altered mental status
2. Respiratory distress
3. Signs of shock
4. Seizures
5. Bruise-like or spotty rash on the trunk or extremities
6. A stiff neck

consider the child's condition urgent.

Fact or fiction?

1. T> 105 may cause respiratory alkalosis and occasional electrolyte imbalances

2. T > 105.8 *may* cause cellular swelling and damage in the brain, kidneys and liver

3. Animal studies suggest that a body temp of ≥42C (107.6F) in humans may trigger enough adverse effects on a cellular level to cause death

ETIOPATHOGENESIS

- Infections
- Vaccines
- Biologic agents
- Tissue injuries
- Malignancy
- Drugs
- Autoimmune diseases
- Granulomatus diseases
- Genetic disorder(familial Mediterranean fever)

Infectious

- Systemic
  - Bacteremia, sepsis, meningitis, endocarditis
- Respiratory
  - URI, sinusitis, otitis media, pharyngitis, pneumonia, bronchiolitis
- Abdominal
  - Urinary tract infection, abscess (liver, kidney, pelvis)
- Bone/joint infection
- Hardware infection
  - Central line, VP shunt, G-tube

Inflammatory

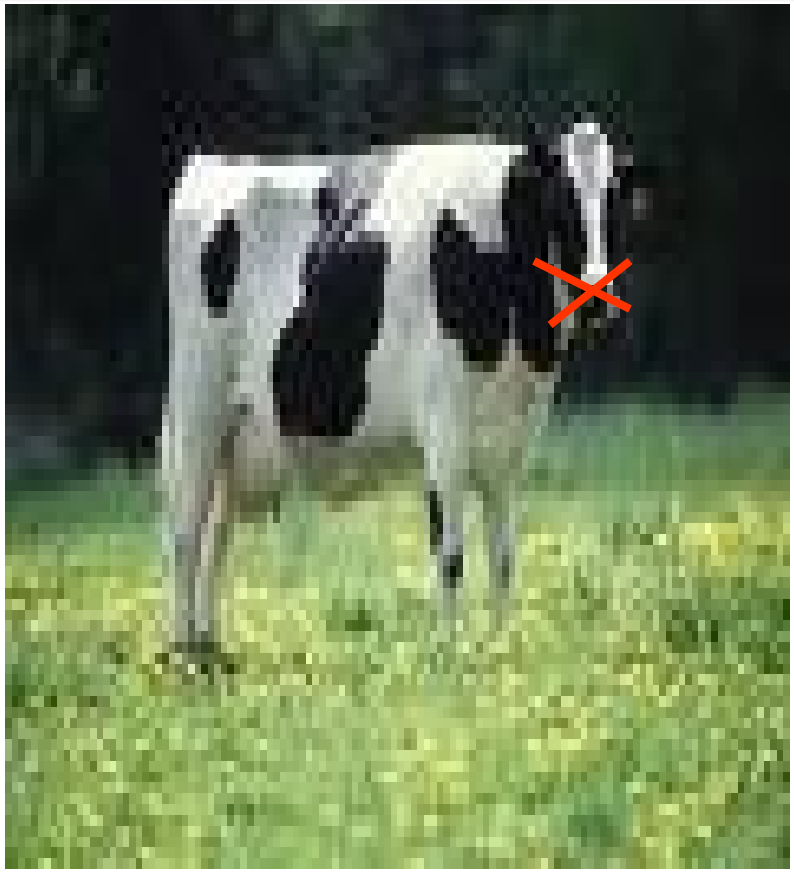
- Kawasaki disease
- Juvenile inflammatory arthritis
- Lupus
- Inflammatory bowel disease
- Henoch-Schonlein purpura

- *Fever*
- *Approach*
- *Clues to the Cause of fever*
- *Management of fever*

EVALUATION OF FEBRILE CHILD

- Fever is a symptom NOT a disease; hence, evaluation for cause is important

Similarities…..?



APPROCH….

- *"Kids are not adults "*
- *Think of the Common Causes*
- *Detailed history & examination*
- *SOS ---- Investigations*
- *Start treatment as appropriate*
- *Identify Serious fevers & refer them early*

Kids are not adults !!

- *80-90% of all cases in children are respiratory and gastrointestinal!!!*
- *Serious infection without high fever*
- *Steroids and antipyretics change fever patterns dramatically*
- *High risk of drug over dosing and side-effects*
- *Febrile seizures !!!*

HISTORY

HISTORY

- *Age*—infants aged 3 months or younger have decreased ability to fight infection and should be evaluated if the temperature is 38°C (100.4°F) or higher

- *Headaches and emesis*— the combination of fever, headaches, and emesis suggests meningitis, particularly if altered mental status is present as well.

HISTORY

- *Seizures*—while febrile seizures are usually brief and do not harm the child, they may be a sign of meningitis.

- *Poisoning*—ingestions involving aspirin, certain antidepressants, and other drugs can cause fever.

HISTORY

- *Heart disease or pulmonary problems*—

children who have a history of heart disease or pulmonary problems may be unable to tolerate tachycardia and tachypnea associated with fever

HISTORY

- *Immunocompromise—*
  children with sickle-cell anemia, HIV, nephrotic syndrome, a history of recent chemotherapy, autoimmune disorders , or a history of splenectomy have decreased ability to fight infection.

HISTORY

- *Increased risk of local bacterial infection due to-*

1. Hydrocephalus with a shunt
2. Congenital heart disease
3. Placement of a central intravenous catheter
4. Home peritoneal dialysis

Examination

General appearance --- most imp

---? Toxic looking

? Level of alertness and responsiveness

Vitals signs ---HR, RR, BP & Temperature

Capillary refill time----State of hydration & perfusion

Oxygen saturation---Dusky tongue

--- s/o severe lung/ heart inv.(bad sign)

Head – to –toe ➔Inspection + Palpation

" Is this a serious fever ? "

- *CNS --- Irritable or dull ---Convulsions*
- *Cardiac--Cold extremities with poor pulses and increased CRT*
- *RS--Breathing --Fast / labored (nasal flare , retractions)*
  Dusky tongue
- *GI/ GU ---Decreased intake / urine output*
- *Bleeding manifestations*
- *Just sick-looking !!!!*

- *Fever ---How ? good or evil ?*
- *Approach*
- *Clues to the Cause of fever--- Viral ? Bacterial? FWLS*
- *Management of fever ---Sponging & Anti-pyretics*

Clues to the Cause of fever

? Viral Infection

- *Many organs involved , esp. URTI*
- *Contact with people with similar symptoms*
- *Usually well-appearing, playful, and interact well*
- *Lymphocytosis (or lymphocytopenia), and thrombocytopenia.*
- *Normal CRP*

Bacterial Infection

- *Often Localized*
- *Toxic look*
- *High fever with rigors*
- *High WBC, CRP, Neutrophilia*

Fever ---- without localising signs

- *Viral*
- *Occult Bacteremias*
- *UTI*
- *Malignancies*
- *Collagen Vascular diseases*
- *Post – Vaccination*
- *Drug related*

Prolonged ---- " PUO "

*Usual labs --- tailor-made*** !!*

- *CBC*
- *Peripheral smear for band cell & toxic granules*
- *Urine –R/M*
- *Blood-culture*
- *Urine-culture*
- *C-reactive protein*
- *X Ray*
- *Malaria --- PS / Rapid Ag*
- *Widal*

Cont……

*Usual labs --- tailor-made*** !!*

Cont……

- *Dengue--- NS1 / IgM*
- *Tuberculin test*
- *USG*
- *Rarely stools --- for parasitic infections*
- *SOS – Lumbar Puncture --- CSF*
- *Liver function test*
- *Renal function test*

Laboratory evaluation

- What would you do if the patient has a high risk for sepsis?
  - Immunocompromised
  - Transplant recipient
  - Oncology patient

  - CBC with differential
  - Blood culture
  - Urinalysis and urine culture

Laboratory evaluation

- What would you do if the patient has hardware (VP shunt, tracheostomy, gastrostomy tube) or central line?
  - CBC with differential
  - Blood culture
  - CSF (tap VP shunt)

Laboratory evaluation

- What would you do for an infant ≤ 3 months of age?
  - CBC with differential
  - Blood culture
  - Catheterized urinalysis and urine culture
  - Lumbar puncture

Fever Treatment

Should we even treat fever?

- *Animal* studies suggest that the fever mechanism is a positive adaptive response

  1. Triggers host immune responses

  2. May stabilize cell membranes

(Why) should we treat fever?

Reasons to treat fever

- Increased metabolic stress and oxygen demand:

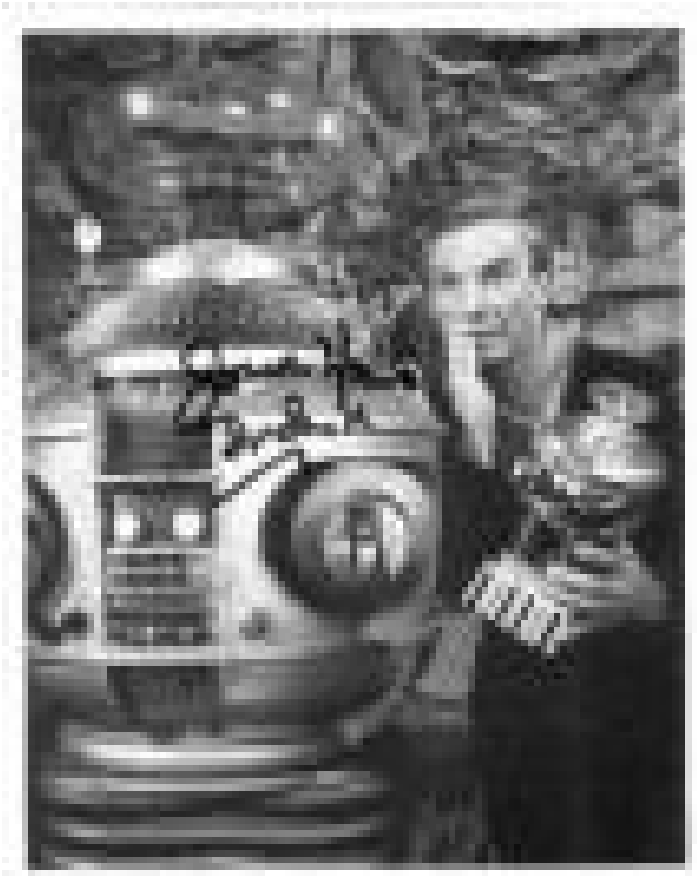
  1. Patients with poor cardiac reserve
  2. Patients with poor pulmonary reserve

- Lowering the "seizure threshold"

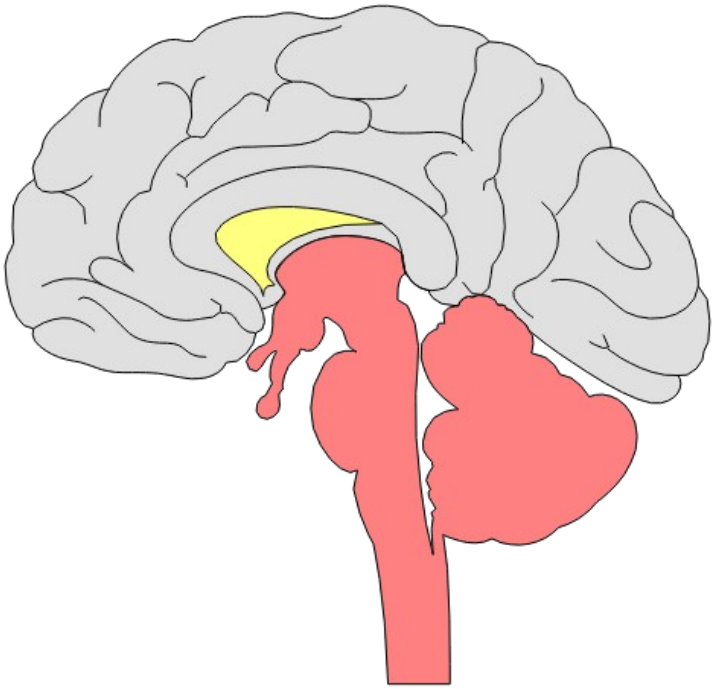
Reasons to treat fever

- Patient comfort
- Parent comfort

Danger!?



Fever can cause



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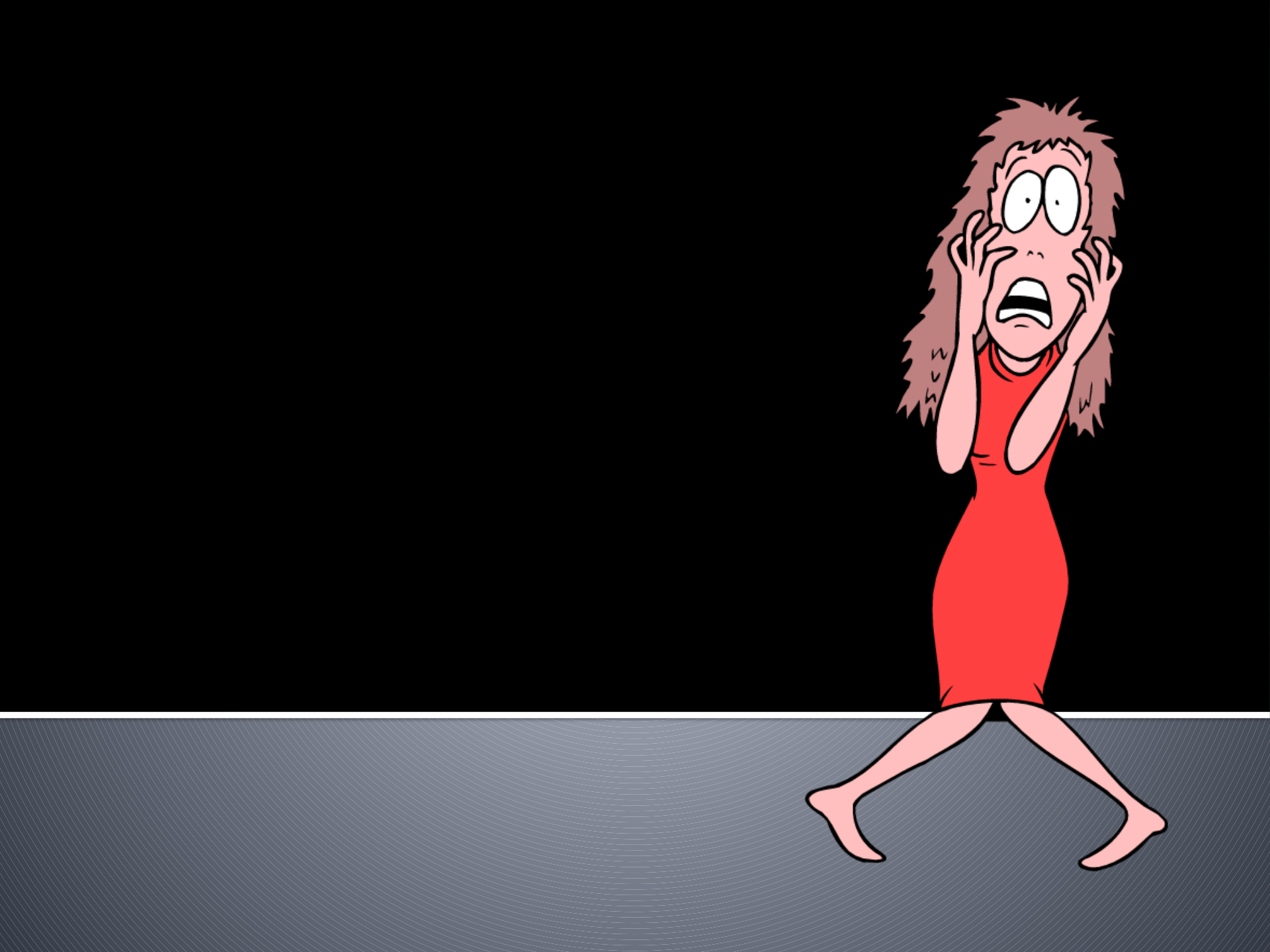


Treatment of fever (Sponging, Antipyretics, Antibiotics)

Light clothing

Blankets -- if shivering

Tepid sponging ---
with lukewarm water OR tap water

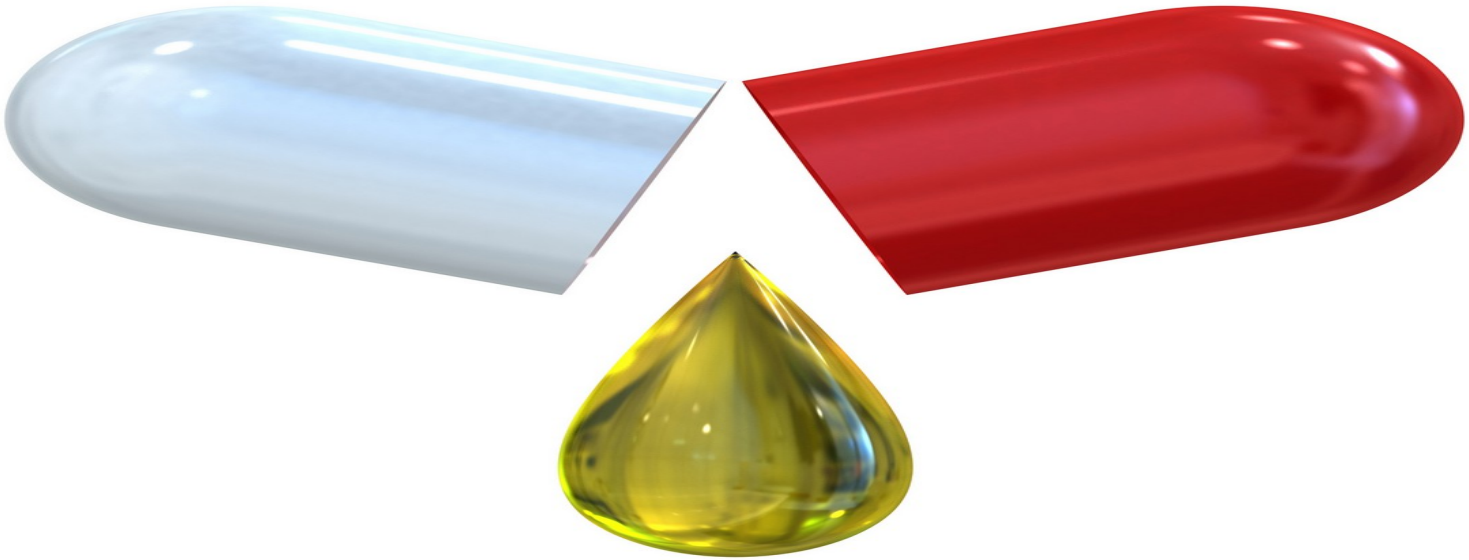
Air cooling
switch on fan

Antipyretics……..

PCM ---	*10- 15mg/k/do— 4-5"/d *****	*Liver necrosis , Hypoglycemia*
Ibuprofen ---	*5-10mg/k/do SOS Max 3"/Day*	*Rash , Liver enzymes,Creat, Thrombo/ Pancytopenia*
Mafenamic acid	*?*	*worse Ibuprofen*
Nimesulide	*?*	*Banned for <12 years. Hepatic failure, Steven Johnson Syn.*

Antibiotics ……..?

If so , which ones to give ……..?



Commonly used Antibiotics...

Drug	*Mg /kg /Day*	*Usual Freq.*	*S/E*
Amoxi+Clav	*20-40*	*2”*	*LM*****, Rash*
Azithro	*10*	*1”*	
Cefixime	*8-10*	*2”*	
Cefpodoxime	*8-10*	*2”*	
Cephalexin	*20-30*	*3”*	
Ciproflox	*10-15*	*2”*	

Drug	Mg/kg/Dose	Usual Freq.	Specific S/E
ceftriaxone – i.m / iv	50	2”	Plt., Biliary
Cloxacillin	25	3-4”	
Oseltamavir	2	2”	Hallucinations
Erythromycin	10-30	3”	ECG
Metro	20-50	3-4”	Metallic taste

Empirical choices

URTI / LRTI-- Amox+ Clavulinic acid Or Azithro Or Cefpodoxime

Otitis Media --- Same

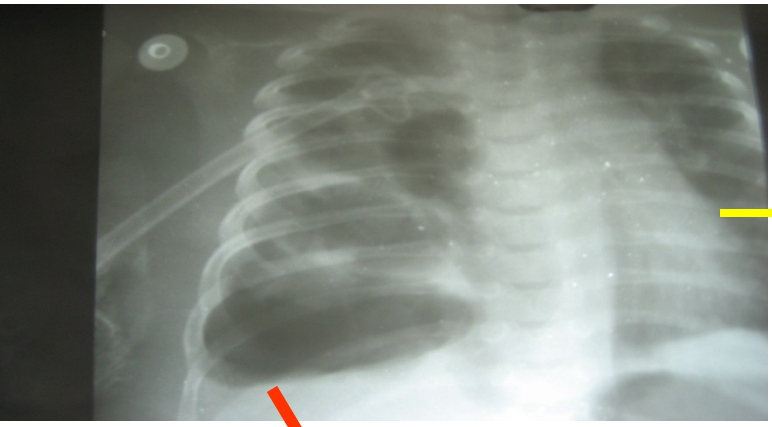
Gastro—Ciprofloxacin/oflox –Or-Septran +/- Metro

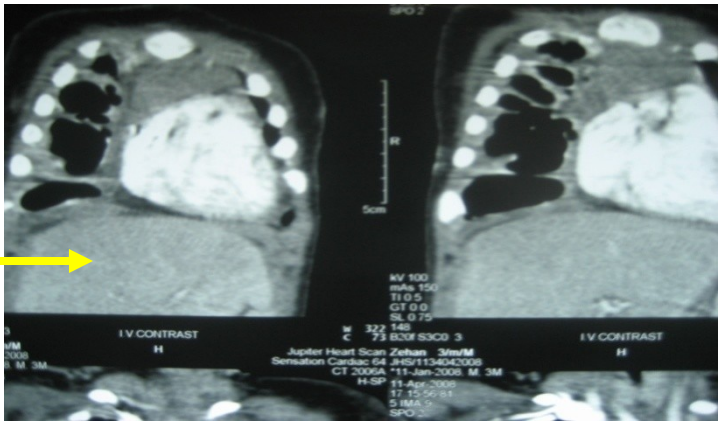
Genitourinary-------Amoxi+Clav ?? Ciproflox Or Septran or cefpodoxime

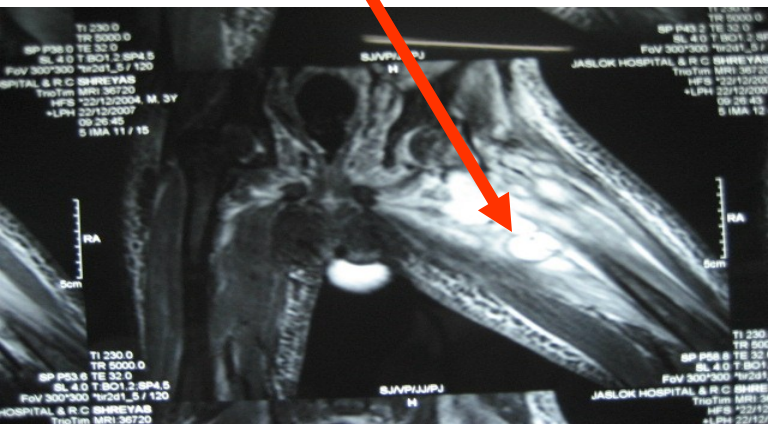
Mild Cellulitis- Cephalexin Or Cloxacillin

Meningitis/ M-skeletal --- Vancocin-CP + Ceftriaxone*

No role of oral drugs

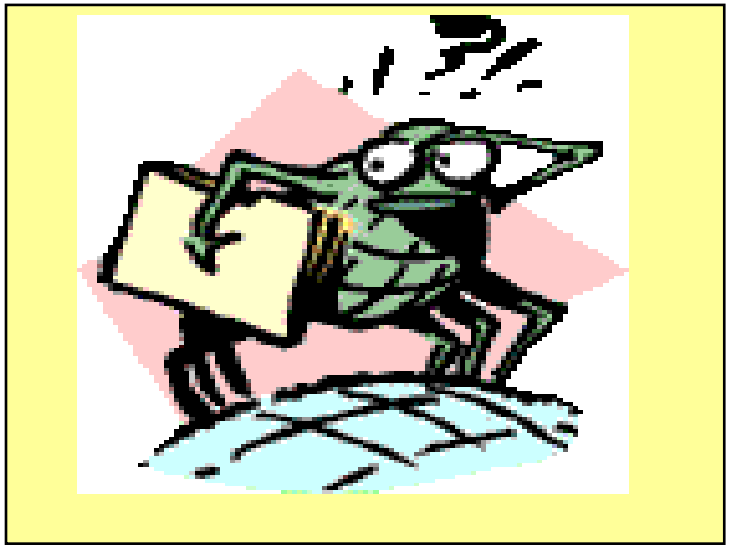






- Modify antibiotics after culture reports

An infection is more dangerous if it gives a high fever or if the fever doesn't come down with treatment…



Hi temp = "bad" infection?

No studies have conclusively proven any correlation between height of temperature and *outcome* of an infection or disease outcome.

Hi temp = "bad" infection?

Several studies suggest that children with temperatures greater than 41°C (105.8°F) have a greater chance of having a serious bacterial illness.

Hi temp = "bad" infection?

Several studies suggest that fever of ≥ 40°C (104 °F) signals increased risk of serious bacterial illness for infants from birth to three months of age.

Poor response to tx = bad?

- Failure of antipyretics to control fever has *not* been proven to correspond with severity of illness.
- Improved *general appearance* after antipyretics may indicate a less severe illness.

SUMMARY

- Since it is not always possible to distinguish a mild infection from a life-threatening condition, any child with fever should be properly evaluated.
- In children with fever, the presence of additional risk factors for infection, such as sickle-cell anemia or HIV, is cause for evaluation, even if all assessment findings are normal.

Take home message

Fever—most common presenting symptom

Infections are the most common cause of fever in children

Thorough clinical examination is a must

Investigations need to be timely and tailor-made

Safe Antipyretics are usually safe

Ensure judicious and correct dose of antibiotics

Important to differentiate well from sick child for referral - - -
Is very often life-saving

Any Question ?

??????????

Thank You.

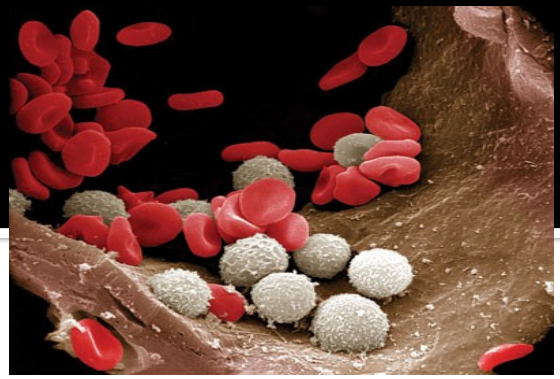
Case 1

- *18 month old boy*
- *Fever 103-104 --- 3-4 times a day*
- *In between-------- 100-101 F*
- *"Decreased oral intake ---- Good urine output "*

On Examination ---

- *No localization*
- *No Organomegaly , skin or M-sk involvement*

Fever WLS----- ? Viral / Bacterial/ Non-infectious



- *TLC--- 17000*
- *70%Polys*
- *Platelets normal*
- *CRP ---- 1.8 (> 0.6)*
- *Lepto / Dengue / RMAg ---- Negative*

Fever without localizing signs!!

UTI

Occult Pneumonia

Occult Bacteremia

Viremia

Non- Infectious --- CRP Positive --- Unlikely

- *Urine ----- 8-10 pus cells*
- *UTI ?*

- *Leucocyte esterase +*
- *Nitrites --- ++*

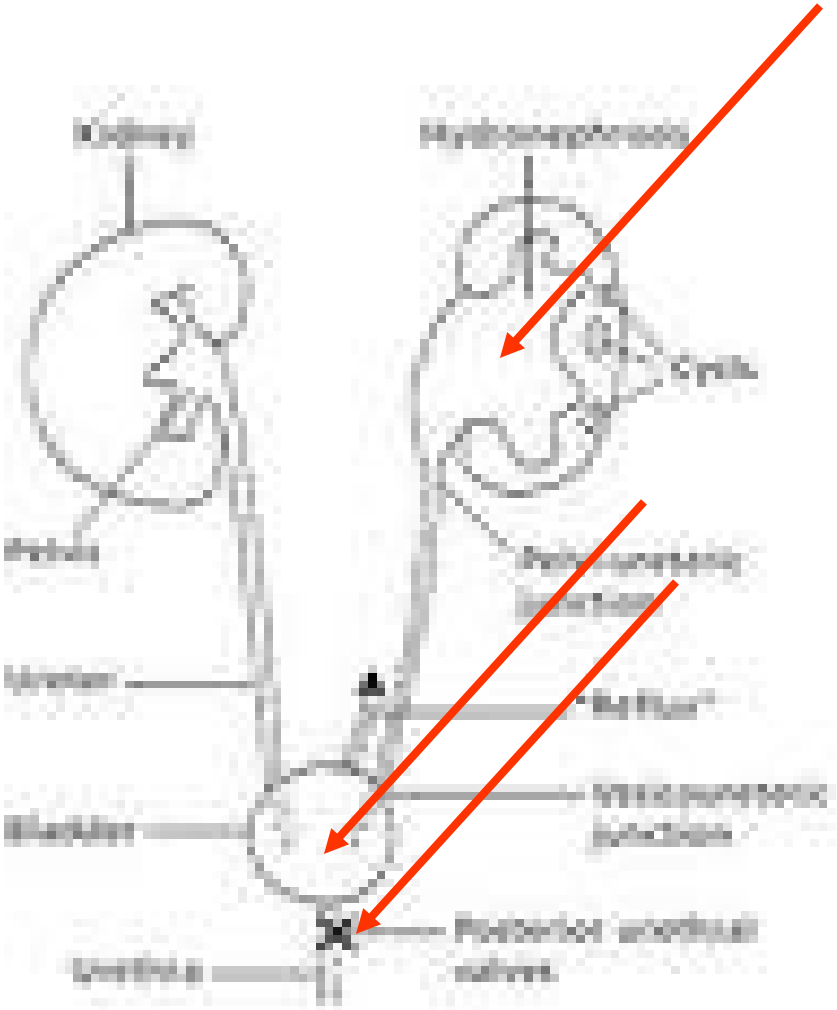
Next step ???

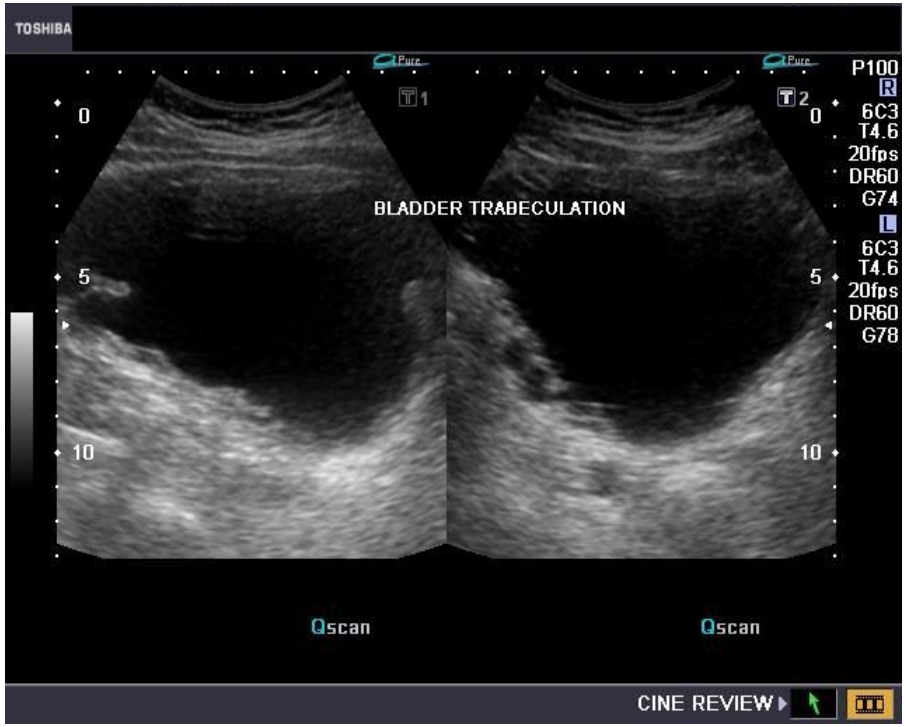
Where is the culprit ???

?

USG--- KUB

Posterior urethral valves



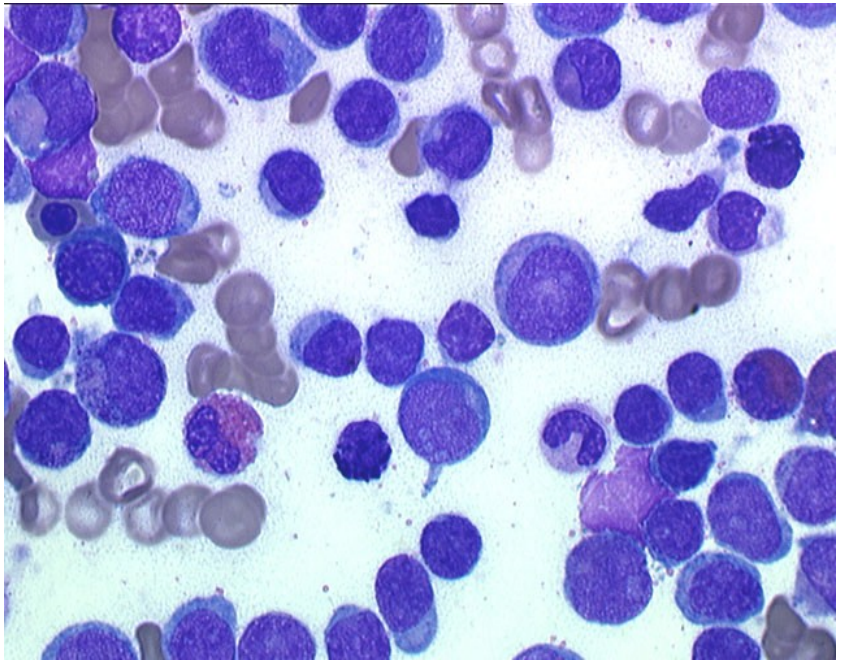


- *Underwent Fulguration of the PU valve f/b prolonged antibiotic course*
- *Is on regular follow-up*

Case- 2

- *11 yr old boy*
- *Fever 99-101 for the last 10-15 days--- on different antibiotics*
- *No localizing signs*
- *Pallor*
- *Spleen --- 1 cm palpable*
- *? Malaria*

- *RMAg ---- negative*
- *Hgb 8*
- *Plt 1.2 lacs*
- *TLC --- 50000*
- *Diagnosis ???*



Acute lymphatic leukemia

- *Fever with pallor , increased counts and HS megaly ---Likely malignancy*

- *Very important not to give steroids --- single dose of Hydrocort can change the picture*

- *Referred to Pediatric hematologist for further care*

……..

Case 3

- *13 yr old boy*
- *1 day high grade fever with rash*
- *Treated as Viral by quack*
- *3RD generation Cephalosporins*
- *Fever and rash worsened over the next 24 hours*

Shown to a GP

1.He was noted to have poor pulses and few petechiae

2. Clinical diagnosis Dengue shock syndrome was made

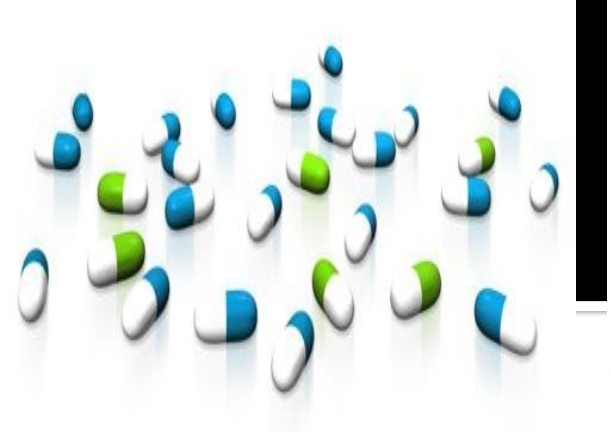
3.Immediately referred

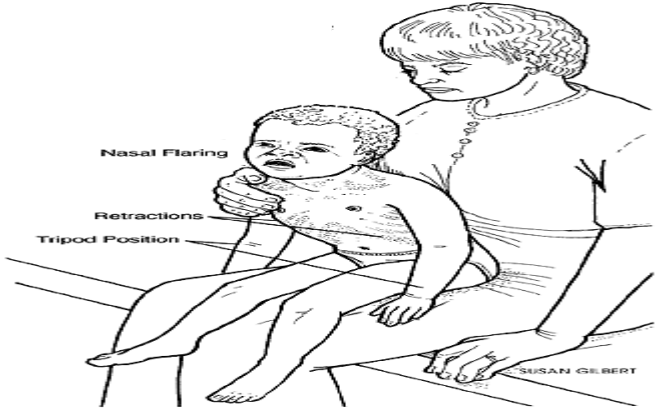
- *Came collapsed*
- *Cyanosed and with Bradycardia + Feeble pulses*
- *Intubated + Short run of CPR*
- *Intravenous access impossible*
- *Vague intra-osseous access*
- *Decided to go with a Central line --- drugs as well as for sampling*

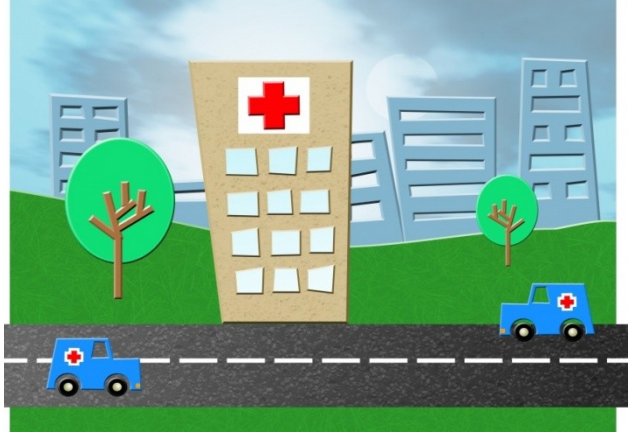
Case- 4

- *2 yr old girl*
- *Immunised for age*
- *C/O cough , cold , fever for 1 day*
- *Difficulty swallowing food*
- *O/E---Congested throat – no exudates*

*? Viral ? Bacterial ***







Started on antibiotics -- fever persisted

By day 3 ,

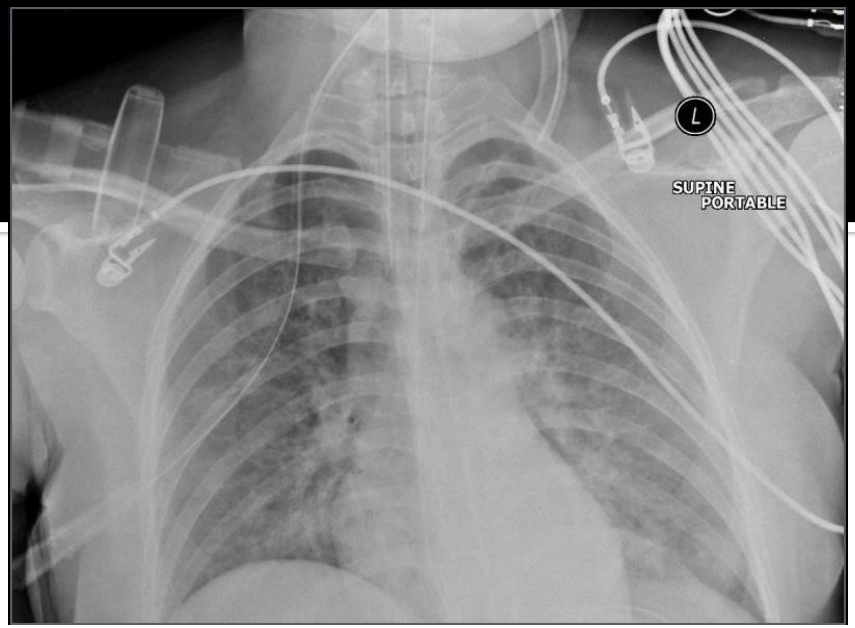
Increased work of breathing and

very poor oral intake

? Bronchiolitis /? Pneumonia

0/E – Bilateral crepts and minimal wheezing

Admitted to Hospital



- *XRC ---- s/o bilateral Pneumonia*
- *Started on Oxygen and Ceftriaxone*
- *However, increased work of breathing*
- *Was electively intubated ---- for next 4 days*
- *Uneventful recovery thereafter*

Repeat pneumonia

After 3 months ---again required ventilatory support

Repeat Pneumonias in children---?

- *Aspirations in CP and Down`s*
- *Foreign Body --- Nuts, Peas etc. in younger children*
- *Tracheo-esophageal fistula*
- *Congenital Malformations of the lung*
- *Immunodeficiency*
- *Cystic fibrosis*

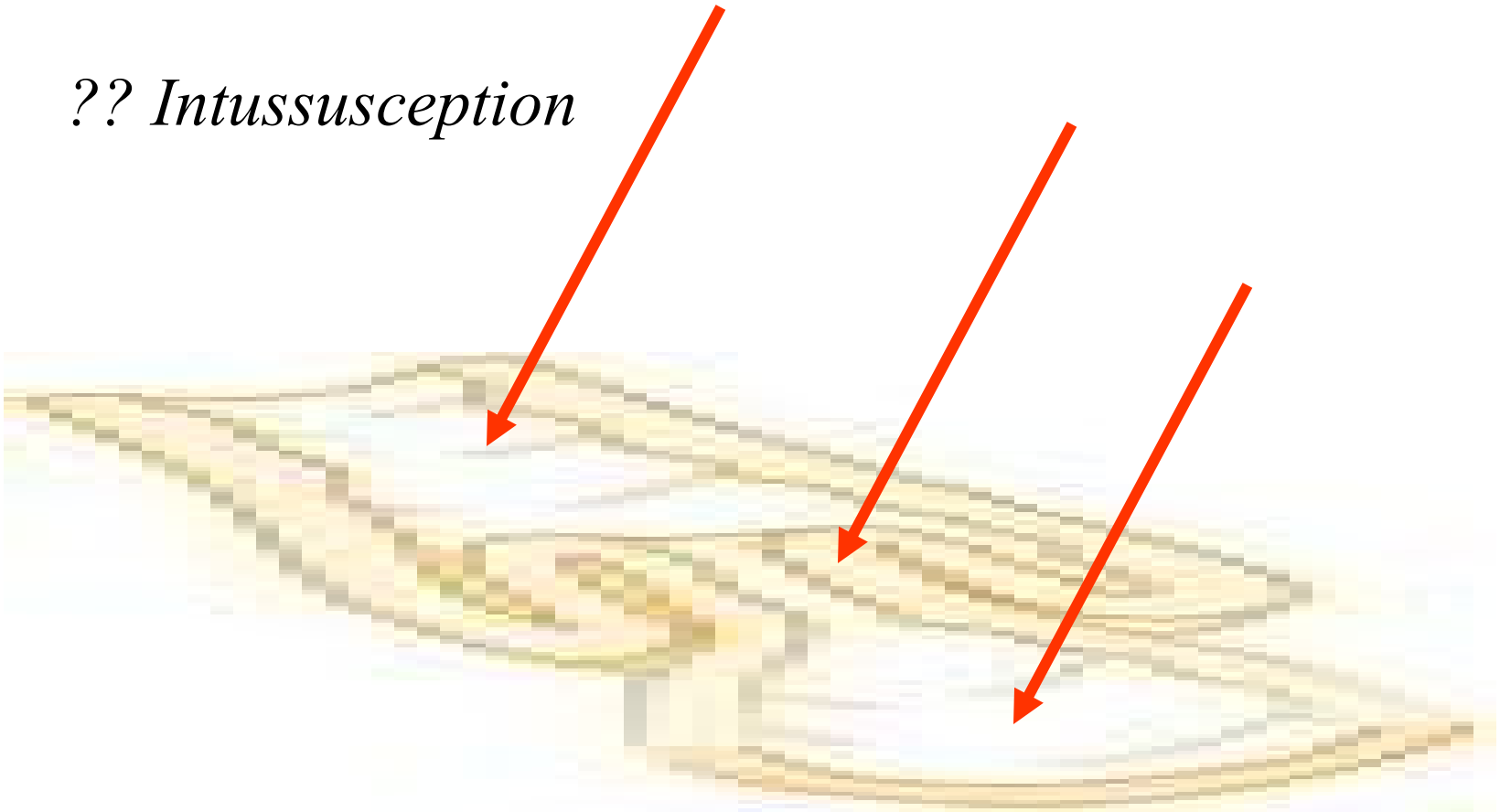
Case--- 5

- *1 yr old boy*
- *Partially top fed*
- *c/o diarrheal illness with some blood in stools*
- *Excessive crying – intermittently*

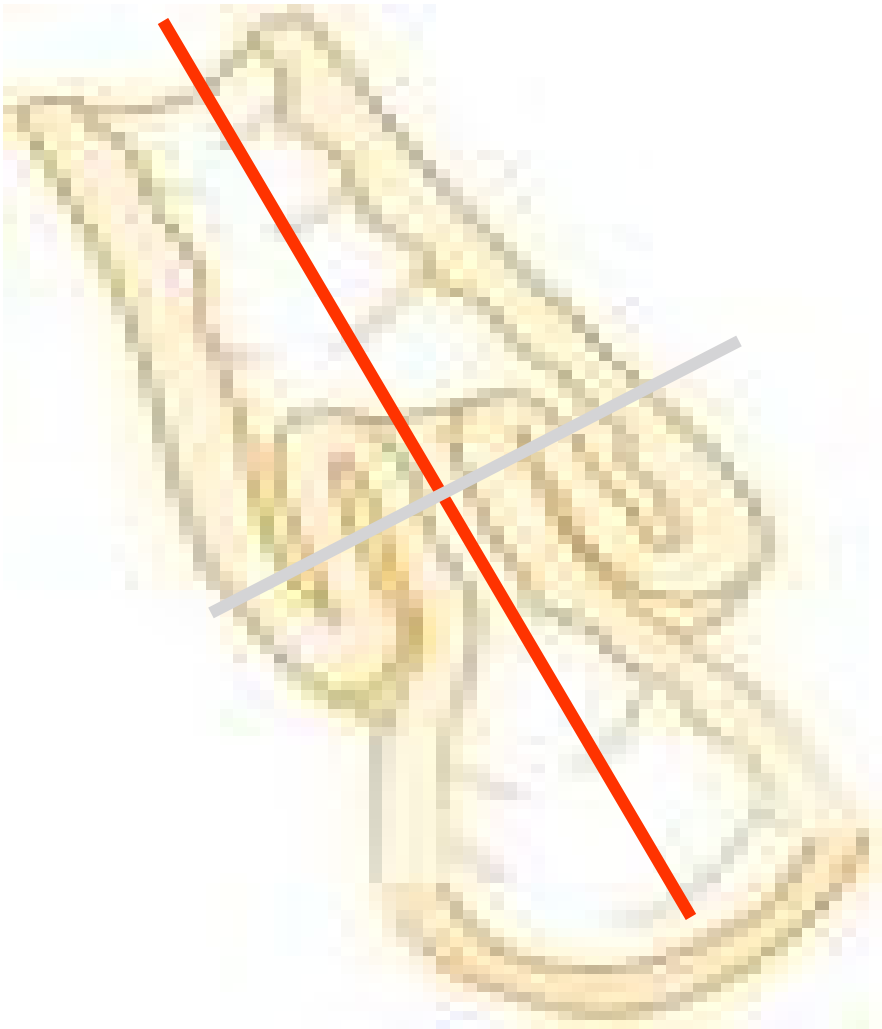
- *Viral v/s bacterial*
- *Started on Norflox + Metro*
- *Increasing crying episodes*
- *Referred to us*

O/E --- abdominal lump

?? Intussusception



USG



GI Complaints

- *GastroEnteritis -- Vomiting is usual + Diarrhea*
- *Intussuception --- Child draws up legs while crying , abdominal mass, cherry red stools*
- *Appendicitis --Pain precedes vomiting.*
  Older children ---- 5-15

- *This particular child was first given reduction enema*

------but then needed definitive surgery


Thank you