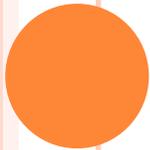
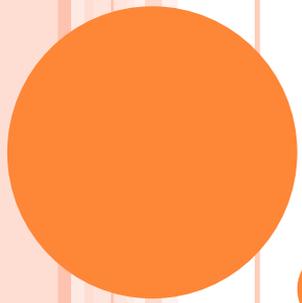


PAEDIATRICS

Elis Lee

Resident

KK Hospital



CASE 1

James, a 4-year old Chinese boy, is brought to the Children's Emergency Department by his mother. He presents with a two-day history of limping, and complains of pain in his right leg when he stands on it.

- 1. Given the above complaint, briefly list the 4 MOST relevant items of information you will ask for, when taking history.**



James, a 4-year old Chinese boy, is brought to the Children's Emergency Department by his mother. He presents with a two-day history of limping, and complains of pain in his right leg when he stands on it.

1. **Given the above complaint, briefly list the 4 MOST relevant items of information you will ask for, when taking history.**

From the question:

- (1) Acute onset (two-day history)
- (2) One limb (right leg)
- (3) Pain



APPROACH TO LIMB PAIN/LIMPING CHILD

○ Trauma v.s. Non-trauma

Joint pain (Arthralgia)	Non-joint pain (bone/muscle/soft tissue)
<ul style="list-style-type: none">•Transient synovitis•Infection: septic arthritis•Inflammation: JIA, SLE, IBD•Mechanical: fracture, sprain, tear (tendon/ligament), overuse•Haemarthrosis	<ul style="list-style-type: none">•Growing pains•Malignancy: primary bone tumors, secondary mets, haematological (leukemia, lymphoma), neuroblastoma•Infection: cellulitis, osteomyelitis•Trauma – fracture etc.•Haematoma•Myositis•MSK manifestations of systemic diseases



James, a 4-year old Chinese boy, is brought to the Children's Emergency Department by his mother. He presents with a two-day history of limping, and complains of pain in his right leg when he stands on it.

1. Given the above complaint, briefly list the 4 MOST relevant items of information you will ask for, when taking history.

- History of trauma
- Joint pain/swelling
- Red flags – nocturnal pain, anorexia, weight loss
- Fever
- Aggravating/relieving factors
- Systemic manifestations
- Past medical history



James, a 4-year old Chinese boy, is brought to the Children's Emergency Department by his mother. He presents with a two-day history of limping, and complains of pain in his right leg when he stands on it.

He has had no recent illnesses, falls or trauma. James has a normal developmental history, and he was well until he started limping 2 days ago for the first time.

On examination, his temperature is 37.9°C, heart rate is 110 beats/min, respiratory rate is 25 breaths/min, blood pressure is 86/55 mmHg, and oxygen saturation is 98% on room air. His growth parameters are on the 50th percentile. Capillary refill time is 1 second. The cardiovascular and respiratory examinations are normal. His abdomen is soft and non-tender, with no organomegaly or palpable masses. There are no abnormal signs on examination of his neurological system and spine. The range of motion of the joints of his lower limbs (hips, knees and ankles), is full. There is no evidence of swelling or redness around any of these joints. When he is placed in a standing position, he starts to cry, and complains of pain in his right leg.

- 2. List the 2 MOST appropriate investigations you will perform, given the above clinical picture.**

MOST APPROPRIATE INVESTIGATIONS

- From the clinical picture:
 - Previously well child
 - Acute onset of right leg pain, no joint involvement
 - No trauma
 - Physical exam unremarkable

What **TWO** tests to prioritize?

- Right lower limb X-Ray
 - Bony lesions (Malignancy), fractures (trauma)
 - Soft tissue involvement
- FBC
 - Leucocytosis: marker for inflammation/infection
 - Anemia: possible chronic disease
 - All 3 cell lines: if abnormal, suspicious for malignancy



James, a 4-year old Chinese boy, is brought to the Children's Emergency Department by his mother. He presents with a two-day history of limping, and complains of pain in his right leg when he stands on it.

You review the following investigations:

Investigation	Result	Normal range
Full Blood Count		
Haemoglobin	10.1 g/dL	11.0 – 14.0 g/dL
White blood cell	28.0 x 10 ⁹ /L	5.0 – 15.0 x 10 ⁹ /L
Neutrophils	5.9 x 10 ⁹ /L	1.5 – 8.0 x 10 ⁹ /L
Lymphocytes	10.1 x 10 ⁹ /L	6.0 – 9.0 x 10 ⁹ /L
Platelet	270 x 10 ⁹ /L	200 – 490 x 10 ⁹ /L
Inflammatory Markers		
Erythrocyte sedimentation rate	15 mm/hour	<12 mm/hour
C-Reactive Protein	5 mg/L	0-10mg/L
X-ray		
X-rays of both lower limbs	Normal	

- List 2 further investigations that would be MOST appropriate to perform at this stage

FURTHER INVESTIGATIONS

- What is abnormal?
 - TW raised +++ (esp. lymphocytes)
 - Low Hb
 - Inflammatory markers not particularly significant

Further investigations? Malignancy!!!

- PBF: blast cells
- LDH, uric acid: markers of high cell turnover
 - If biochemical tests consistent with (haematological) malignancy, will need to confirm diagnosis with BMA and trephine biopsy*



James, a 4-year old Chinese boy, is brought to the Children's Emergency Department by his mother. He presents with a two-day history of limping, and complains of pain in his right leg when he stands on it.

Further investigations yield the following results.

Investigation	Results	Normal Range
Peripheral Blood Film		
Peripheral blood film	Leukoerythroblastic picture with circulating blasts	
Serum lactate dehydrogenase (LDH)		
Serum LDH	2740 U/L	250-580 U/L
Full Blood Count		
Haemoglobin	10.1 g/dL	11.0 – 14.0 g/dL
White blood cell	$28.0 \times 10^9/L$	$5.0 - 15.0 \times 10^9/L$
Neutrophils	$5.9 \times 10^9/L$	$1.5 - 8.0 \times 10^9/L$
Lymphocytes	$10.1 \times 10^9/L$	$6.0 - 9.0 \times 10^9/L$
Platelet	$270 \times 10^9/L$	$200 - 490 \times 10^9/L$
Inflammatory Markers		
Erythrocyte sedimentation rate	15 mm/hour	<12 mm/hour
C-Reactive Protein	5 mg/L	0-10mg/L

4. What is the MOST likely diagnosis for this child?

5. What 3 things would you do in the immediate management for this child?



ACUTE LEUKEMIA

- Most common: acute lymphoblastic leukemia (ALL)
 - Acute leukemia: most common childhood cancer
 - Clinical presentation: manifestations of pancytopenia (anemia, petechiae), bone pain, LOA/LOW, LAD, organomegaly
 - Treatment: chemotherapy
- Oncological Emergencies
 - Tumor lysis syndrome
 - Hyperleucocytosis
 - Neutropenic sepsis (after chemotherapy started)



3 THINGS IN IMMEDIATE MANAGEMENT

- Stabilize the child
- Close monitoring: parameters, strict IO, electrolytes (UECr, PO₄/Ca, uric acid)
- Tumor lysis prevention/management
 - Hyperhydration (no potassium/phosphate in drip)
 - KIV allopurinol/rasburicase if indicated
 - Manage electrolyte abnormalities

Other issues to note:

- If low Hb/platelet and unstable: consider transfusion
- Refer to haem-oncology for further evaluation to confirm diagnosis, pre-chemo work-up, counseling



TUMOR LYSIS SYNDROME

- Massive tumour cell destruction
- Predisposing factors: renal impairment, hyperleucocytosis (>100), high cell turnover
- **Metabolic derangements (2 or more)**
 - Hyperuricaemia, hyperkalaemia, hyperphosphataemia, hypocalcaemia
- **Clinical manifestations**
 - Acute renal impairment (urate, phosphate deposits)
 - Cardiac arrhythmias
 - Seizures, tetany



James, a 4-year old Chinese boy, is brought to the Children's Emergency Department by his mother. He presents with a two-day history of limping, and complains of pain in his right leg when he stands on it.

James presents a few weeks later with fever. You find out that he has been undergoing chemotherapy. His latest cycle of chemotherapy was 1 week ago. He has been home for the last few days. There is no history of contact with anyone who has been unwell. On examination, temperature is 38.9°C, heart rate is 150 beats/min, respiratory rate is 30 breaths/min, blood pressure 90/50 mmHg and oxygen saturation on room air is 98%. He is sweaty. Capillary refill time is 2 seconds. Heart sounds are normal. Chest examination reveals a portacath (central venous access device) in-situ. The rest of the examination is unremarkable. Blood counts done the day before are as follows:

Full Blood Count		
Investigation	Result	Normal range
Haemoglobin	11.0 g/dL	11.0 – 14.0 g/dL
White blood cell	$0.85 \times 10^9/L$	$5.0 - 15.0 \times 10^9/L$
Neutrophils	$0.40 \times 10^9/L$	$1.5 - 8.0 \times 10^9/L$
Platelet	$210 \times 10^9/L$	$200 - 490 \times 10^9/L$

6. What is the MOST likely diagnosis?

7. List the 5 MOST appropriate management steps you would do for the child at this stage.



INFORMATION FROM THE QUESTION

- Child is febrile with no clear source
- Recent chemotherapy, no travel/sick contact
- Vitals: What is normal for a 4 year old?
 - HR 95-140, RR 20-30, SBP min 70 + (age x 2)
- Investigations results: Neutropenia, ANC 0.4

- **Diagnosis: Neutropenic sepsis**



NEUTROPENIC FEVER

- Definition: significant fever with neutropenia
- Hx and physical exam: look for cause of fever
- Physical exam:
 - High index of suspicion: inflammation attenuated
 - Occult sources: mouth (mucositis), port/central line, perineum (fissure), BMA sites
 - Opportunistic infections: e.g. RD in PCP infection
- Investigations: Septic work-up



5 APPROPRIATE MANAGEMENT STEPS

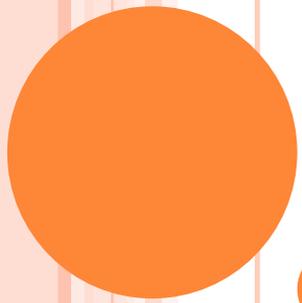
- Stabilize the patient
- Close monitoring of parameters
- **Early initiation of broad-spectrum abx**
- Supportive:
 - Transfusion where necessary (PCT, platelets)
 - Correct electrolyte imbalances
- Stop ongoing chemotherapy if necessary
 - However, if patient is on steroids, do not discontinue abruptly, as sepsis may trigger an adrenal crisis



LEARNING POINTS

- Approach to the limping child
- Diagnosing the “New Leuk”
- Oncological emergencies
 - Tumor lysis syndrome
 - Neutropenic sepsis





CASE 2

Beng Hoe, a 4 year-old boy who was previously well, presents to Children's Emergency with a two-day history of fever (maximum of 39° Celsius), a maculo-papular rash all over his body, swollen lips and sore throat. He complains of non-specific arthralgia. On examination, he is alert and well perfused. There are palpable lymph nodes in his neck. There is hepatomegaly measuring 2cm. There is no history of recent travel, and he has not been on any medications.

- 1. List 5 differential diagnoses. (5 marks)**



FROM THE QUESTION

- 4 year old, previously well
- Significant signs/symptoms
 - Acute fever (2 day duration)
 - Rash
 - Sore throat with swollen lips
 - Arthralgia
 - Cervical lymphadenopathy
 - Mild hepatomegaly (2cm)
- Significant negatives: no travel, no medications



DIFFERENTIAL DIAGNOSES?

- Approach to child with fever and rash
- Given acute 2-day history, infection most likely
 - Drug reaction possible ddx but hx states no meds
 - Lower down: early presentation of inflammatory/autoimmune conditions, malignancy
- Possible list:

Infection	<u>Viral:</u> Viral exanthem, Measles, Rubella (check vaccination) <u>Bacterial:</u> Strep – scarlet fever, Staph – impetigo, Mycoplasma infection
Drugs	Allergy, Drug reaction
Early presentation	Inflammatory disorders: e.g. systemic JIA Malignancy



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He is prescribed oral cloxacillin, following a clinical diagnosis of impetigo. He presents again, 4 days later, with ongoing fever. He still has the rash, red tongue, sore throat and arthralgia. His eyes are red, and his neck is swollen with a 2.5cm lymph node on the right side. There are no signs of meningism.

2. What is the diagnosis? (1 mark)



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2. What is the diagnosis? (1 mark)

Features present now?

- Fever >5 days
- Rash
- Red tongue
- Non-purulent conjunctivitis
- Cervical LN (unilateral, >1.5cm)



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2. What is the diagnosis? (1 mark)

- Kawasaki Disease

Fever >5 days

4/5 of diagnostic criteria



KAWASAKI DISEASE

- Multisystem small and medium sized vasculitis
- Common age group: <5 years old
- **Diagnostic criteria**
 - Fever persisting for 5 days or more AND at least 4/5:
 - Changes in peripheral extremities
 - Initial: puffy; convalescent: desquamation from nail bed
 - Polymorphous exanthem
 - Bilateral non-suppurative conjunctivitis
 - Red lips, strawberry tongue, diffuse oropharyngeal mucosa injection
 - Cervical lymphadenopathy (LN 1.5cm or larger)



KAWASAKI DISEASE

- Clinical course

Acute (7-14 days)	Fever, acute inflammatory changes
Subacute (10-28 days)	<ul style="list-style-type: none">•Resolution of fever and rash•Desquamation at nail bed•Coronary artery dilation, thrombocytosis
Convalescent (4-10 weeks)	Until acute phase reactants normalize

- Complications

- Much higher risk of coronary artery lesions if not treated (dilation, aneurysm, thrombosis, MI, death)

- Other atypical manifestations

- CNS: aseptic meningitis, encephalitis
- Cardiopulmonary: CCF, pleural effusion/infiltrates
- GI: GB hydrops, hepatic dysfunction
- MSK: Arthritis



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A diagnosis of Kawasaki disease is made at this point.

3. What 8 investigations would you consider in view of the diagnosis? (8 marks)



INVESTIGATIONS?

- KD diagnostic criteria is base on clinical presentation
- **No diagnostic/confirmatory tests**
- However, some investigation findings are associated with KD.

Labs	Imaging
FBC: anemia, thrombocytosis (2 nd week) CRP, ESR LFT: transaminitis, low albumin UECr: Mild hypoNa Sterile pyuria	2DE (D14 and 6-8 wks) •Coronary artery dilation, aneurysm or thrombosis, stenosis •Pericardial effusion •Valvular regurgitation •Perivascular changes



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3. What 8 investigations would you consider in view of the diagnosis? (8 marks)

- Full blood count
- C-reactive protein
- ESR
- LFT
- UECr
- UFEME
- Urine culture
- Blood culture (ddx: infection/sepsis)
- 2DE, CXR +/- ECG



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Beng Hoe is admitted, and is prescribed anti-pyretics for his fever.

4. What 2 specific medications can you prescribe for his condition? (2 marks)



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- IVIG
- Aspirin



PRINCIPLES OF TREATMENT

- IVIG 2g/kg, single infusion (8-12h)
 - Should be given within 10 days of illness
 - If inflammatory signs still present after 10 days, IVIG still indicated
 - Counsel parents on complications: chills/rigors, hypotension, drug reaction, anaphylaxis; cost
- Aspirin
 - Anti-inflammatory dose 80-100mg/kg/day
 - Anti-platelet dose 3-5mg/kg/day
 - Low dose aspirin once inflammation resolved



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Beng Hoe clinically improves after treatment with intravenous immunoglobulins.

- 5. What 2 cardiac complications will you need to monitor Beng Hoe for, when you follow him up after the acute phase? (2 marks)**



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- Coronary artery dilation/aneurysm/stenosis/thrombosis
- Myocardial involvement: ischemia, inflammation



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On a follow-up visit 4 weeks later, Beng Hoe's mother tells you that he has not had his MMR vaccination due to previous concerns about the association with autism (which is untrue). In light of his recent illness, she is keen to have him immunized to protect him from further infections.

6A. What ONE piece of advice will you give his mother? (1 mark)

6B. Give the reason for this piece of advice. (1 mark)

Beng Hoe, a 4 year-old boy who was previously well, presents to Children's Emergency with a two-day history of fever (maximum of 39° Celsius), a maculo-papular rash all over his body, swollen lips and sore throat. He complains of non-specific arthralgia. On examination, he is alert and well perfused. There are palpable lymph nodes in his neck. There is hepatomegaly measuring 2cm. There is no history of recent travel, and he has not been on any medications.

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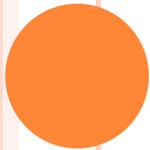
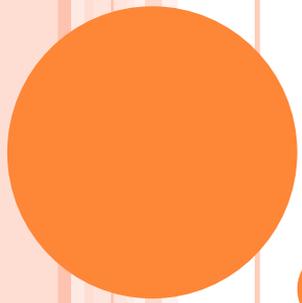
- MMR vaccine at least 11 months after IVIG
- Efficiency of live virus vaccines decrease post IVIG. IVIG especially suppresses response of measles vaccine for a long time.



LEARNING POINTS

- Approach to child with fever and rash
- Kawasaki Disease
 - Diagnostic criteria
 - Supporting investigations (not diagnostic)
 - Treatment
- IVIG and MMR Vaccine





THANK YOU.