PHARMACY BULLETIN

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PHARMACY DEPARTMENT,
HOSPITAL SERI MANJUNG

CONTENT

IMPROVING MEDICATION SAFETY

By Miss Noor Azrina bt Sanik, Miss Koay Hui Ying, Miss Amy Tan Szi Sze

TERMINOLOGIES

- **Side-effect:** a known effect, other than that primarily intended, relating to the pharmacological properties of a medication. e.g. opiate analgesia often causes nausea

- **Adverse reaction:** A response to a drug which is noxious and unintended, and which occurs at doses normally used in man for the prophylaxis, diagnosis, or therapy of disease, or for the modification of physiological function. e.g. an unexpected allergic reaction in a patient taking a medication for the first time

- **Adverse event:** an incident in which a patient is harmed
- **Adverse drug event:**
  - May be preventable (e.g. the result of an error) or
  - May not be preventable (e.g. the result of an adverse drug reaction or side-effect)
- **Medication error** may result in
  - An adverse event if a patient is harmed
  - A near miss if a patient is nearly harmed or
  - Neither harm nor potential for harm
- **Medication errors are preventable**

Steps in using medication

These steps may be carried out by health-care workers or the patient (self-prescribing over-the counter medication and self-administering medication at home)

1. Prescribing

2. Administering

3. Monitoring

When it can goes wrong?

1. Prescribing

- Inadequate knowledge about drug indications and contraindications
- Not considering individual patient factors, such as allergies, pregnancy, co-morbidities, other medications
- Wrong patient, wrong dose, wrong time, wrong drug, wrong route
- Inadequate written and verbal communication.
- Incomplete or incomplete documentation
- Mathematical error when calculating dosage
- Incorrect data entry in computerized prescribing for example; duplication, omission, wrong number.

2. Administering

- Wrong patient
- Wrong route
- Wrong time
- Wrong dose
- Wrong drug
- Inadequate documentation

3. Monitoring

- Lack of monitoring for side-effects
- Drug not ceased if not working, or course completed
- Drug ceased before course completed
- Drug levels not measured, or not followed up

Which patients are most at risk of medication error?

- Patients on multiple medications
- Patients with another condition, e.g. renal impairment, pregnancy
- Patients who cannot communicate well
- Patients who have more than one doctor
- Patients who do not take an active role in their own medication use
- Children and babies (dose calculations based on weigh required)

In what situations are staffs most likely to contribute to a medication error?

- Inexperience
- Rushing (ex: peak hour)
- Doing two things at once
- Interruptions
- Fatigue, boredom or being on "automatic pilot" leading to failure to check and double-check
- Lack of checking and double checking habits
- Poor teamwork and/or communication between colleagues
- Reluctance to use memory aids

How can workplace design contribute to medication errors?

- Absence of a safety culture in the workplace (ex: poor reporting systems and failure to learn from past near misses and adverse events)
- Absence of memory aids for staff
- Inadequate staff numbers

How can medication presentation contribute to medication errors?

- Look-alike, sound-alike medications
- Ambiguous or incomplete labeling

Ways to make Medication Use Safer

1. **Tailor prescribing** for individual patients
2. Learn and practice collecting complete **medication histories**
3. **Know the high-risk** medications and take precautions
4. **Be very familiar** with the medications you prescribe
5. Remember the **5 Rs**
6. Develop **checking habits**
7. Encourage **patients** to be **actively involved**
8. Report and **learn from errors**

Ways to make medication use safer

1. Tailor your prescribing for each individual patient

Consider:

- Allergies
- Co-morbidities (especially liver and renal impairment)
- Other medication
- Pregnancy and breastfeeding
- Size of patient

2. Learn and practice collecting complete medication histories

- Include name, dose, route, frequency, duration of every drug
- Ask about recently ceased medications
- Ask about over-the-counter medications, dietary supplements and complementary medicines
- Make sure what patient actually takes matches your list:
    - Be particularly careful across transitions of care
    - Practice medication reconciliation at admission to and discharge from hospital
- Look up any medications you are unfamiliar with
- Consider drug interactions, medications that can be ceased and medications that may be causing side-effects
- Always include allergy history

3. Know which medications are high risks and take precautions

- Narrow therapeutic window
- Multiple interactions with other medications
- Potent medications
  Complex dosage and monitoring schedules
- Examples:
  Oral anticoagulants, Insulins, Chemotherapeutic agents, Neuromuscular blocking agents, Aminoglycoside antibiotics, Intravenous Potassium and Emergency medications (potent and used in high pressure situations)

4. Be very familiar with the medications you prescribe

- Do some homework on every medication you prescribe
- Suggested framework
    - Pharmacology
    - Indications
    - Contraindications
    - Side-effects
    - Special precautions
    - Dose and administration
    - Regimen

Ways to make medication use safer

5. Remember the 5 Rs when prescribing and administering

- Right Drug
- Right Dose
- Right Route
- Right Time
- Right Patient

6. Develop checking habits

- When prescribing and administrering medication
- Remember to;
    - Check for allergies
    - Check the 5 Rs
- Computerized systems still require checking
- Always check and it will become a habit!
- Never administer a medication unless you are 100% sure you know what it is
- Practice makes permanent, perfect practice makes perfect
- Start your checking habits now!

7. Encourage patients to be actively involved in the process

- To provide patient with the following information when prescribing a new medication:
    - Name, purpose and action of the medication
    - Dose, route and administration schedule
    - Special instructions, directions and precautions
    - Common side-effects and interactions
    - How the medication will be monitored
- Encourage patients to keep a written record of their medications and allergies
- Encourage patients to present this information whenever they consult a doctor

HAND, FOOT, MOUTH DISEASE (HFMD)

By Miss Elinaz Jasmine bt Haji Jamaludin

OVERVIEW

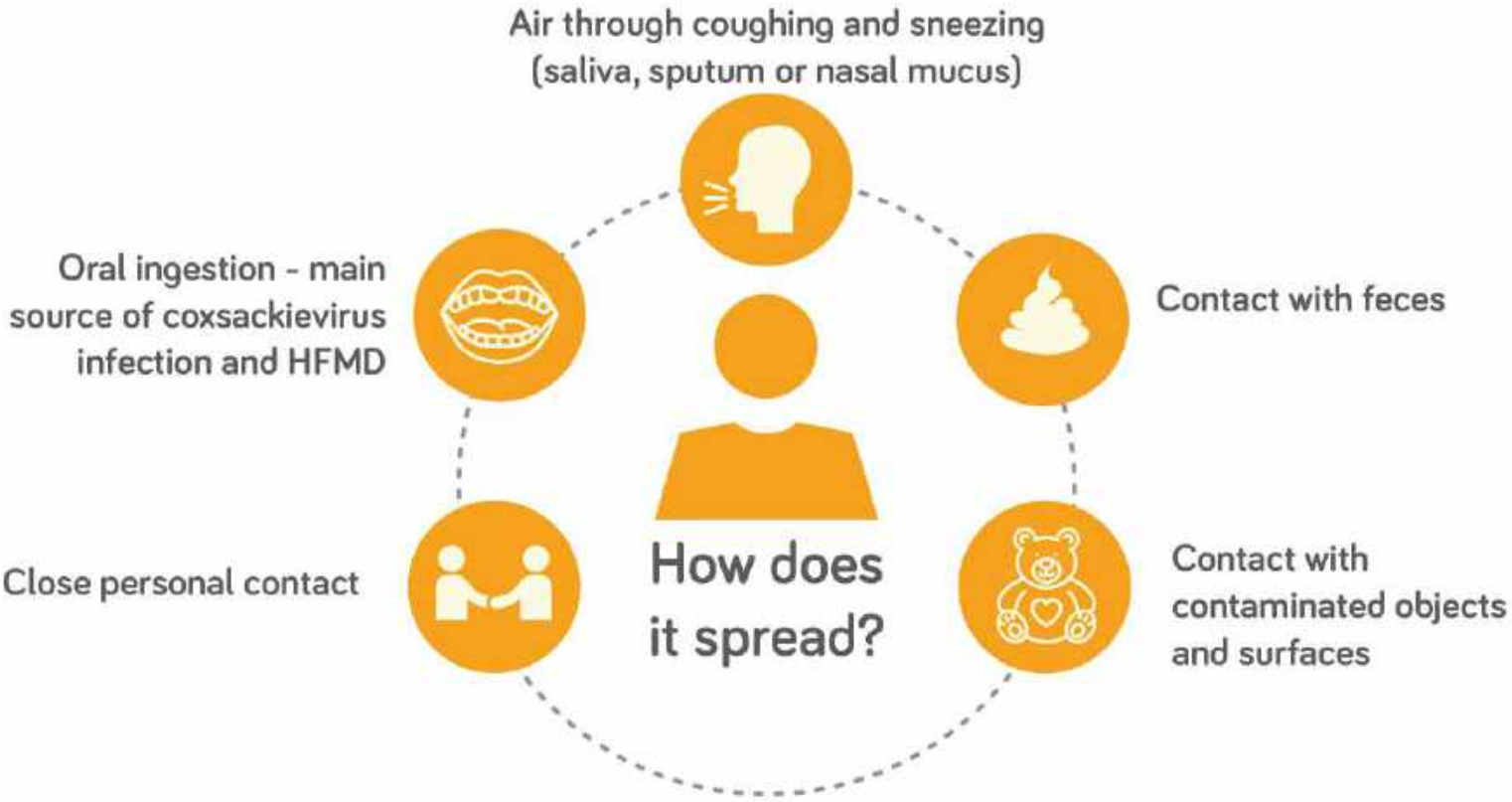
- An illness that causes sores in or on the mouth and on the hands, feet, and sometimes the buttocks and legs.
- A mild, contagious viral infection common in young children.
- It has become an important public health disease due to its tendency to cause large outbreaks and deaths among children and infants.

Causes

- Coxsackievirus A16
- Group A & B coxsackieviruses
- Enterovirus-71 (more severe)

Who are most affected

- Most common in children but can also occur in adults.



- Although child is most contagious with HFMD during the first week of the illness, the virus can remain in his or her body for weeks after the signs and symptoms are gone which means the child still can infect others.
- Some people, particularly adults, can pass the virus without showing any signs or symptoms of the disease.

Signs and Symptoms

Fever for 2-3 days

Runny nose

Sore throat

A red rash, without itching but sometimes with blistering, on the palms, soles and sometimes the buttocks

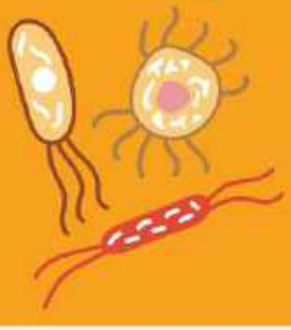
Painful, red, blister-like lesions on the tongue, gums and inside of the cheeks

Loss of appetite

Mouth Ulcers

Malaise

Enterovirus-71 infection may be accompanied by neurologic complications and acute pulmonary edema with or without hemorrhage



HFMD

Complications

- Dehydration
- Viral meningitis
- Encephalitis
- Myocarditis
- Acute flaccid paralysis

HFMD Staging (Stage ≥ 2 - Enterovirus-71 infection)

STAGE	DESCRIPTIONS
I	■ Manifestations: - Oral ulcers - Vesicles on palms, soles, knees &/ buttocks - Herpangina (mouth blisters) with oral ulcers over anterior tonsils, soft palate, buccal mucosa, or uvula ■ Systemic symptoms usually brief ■ Infection is self-limited & patients spontaneously recover within 7 days
II (CNS Involvement)	■ Manifestations: - May be confirmed with CSF analysis & isolation in cell culture or polymerase chain reaction (PCR) - Disturbances in motor function may persist for weeks but will slowly resolve - Viral meningitis does not lead to long-term neurologic or cognitive sequelae; however, viral encephalitis may lead to neurologic sequelae & deaths are rare but may occur. - Acute motor neuron disease may occur ■ Transient muscle weakness is more common than flaccid paralysis ■ Temporary paresis ■ Cranial nerve involvement may result in complete unilateral occulomotor palsy
IIIa (Autonomic Nervous System Dysregulation)	■ Manifestations: - Cold sweating, mottled skin, tachycardia, tachypnea, & hypertension - Patients should be treated with IV immunoglobulin (IVIG)
IIIb (Cardiopulmonary Failure)	■ Manifestations: - Pulmonary edema - Decreased ejection fraction (EF) of left ventricle
IV	■ Recovery phase from cardiopulmonary failure

Treatments

HFMD should go away on its own after 7 - 10 days. There is no treatment for the illness and no vaccine. Symptoms can be eased with:

- **Antipyretic** e.g. PCM if patient is febrile
- **Analgesic** such as ibuprofen or acetaminophen or numbing mouth sprays.
- **Cold treats** like Popsicles, yogurt, or smoothies soothe a sore throat.
- **Anti-itch lotion**, like calamine, can help against rashes.
- Avoid acidic or spicy foods and drinks, such as salsa or orange juice. These foods can make mouth sores more painful.
- If a person cannot swallow enough liquids to avoid dehydration, they may need to receive IV fluid.

Other specific therapy

Anticonvulsants/ Sedatives	- E.g. Midazolam, Phenytoin - May be considered for patients with seizures / frequent myoclonic jerks
IVIG	- Recommended for patients with encephalitis, acute flaccid paralysis & autonomic nervous system dysregulation - May be considered for patients with brainstem encephalitis
Inotropes	- Decreased left ventricular ejection fraction (EF) & cardiopulmonary failure warrants inotropic agent support - E.g. Dobutamine, Dopamine, Epinephrine

Preventions

- Wash hands frequently and thoroughly with soap, especially after using the toilet or changing a diaper and before preparing food and eating.
- Disinfect common areas including shared items like toys, as the virus can live on these objects for days.
- Teach good hygiene to your children.
- Isolate contagious people.
- Stay at home if you are sick. Cover your coughs and sneezes.
- Eat nutritious and balanced diet

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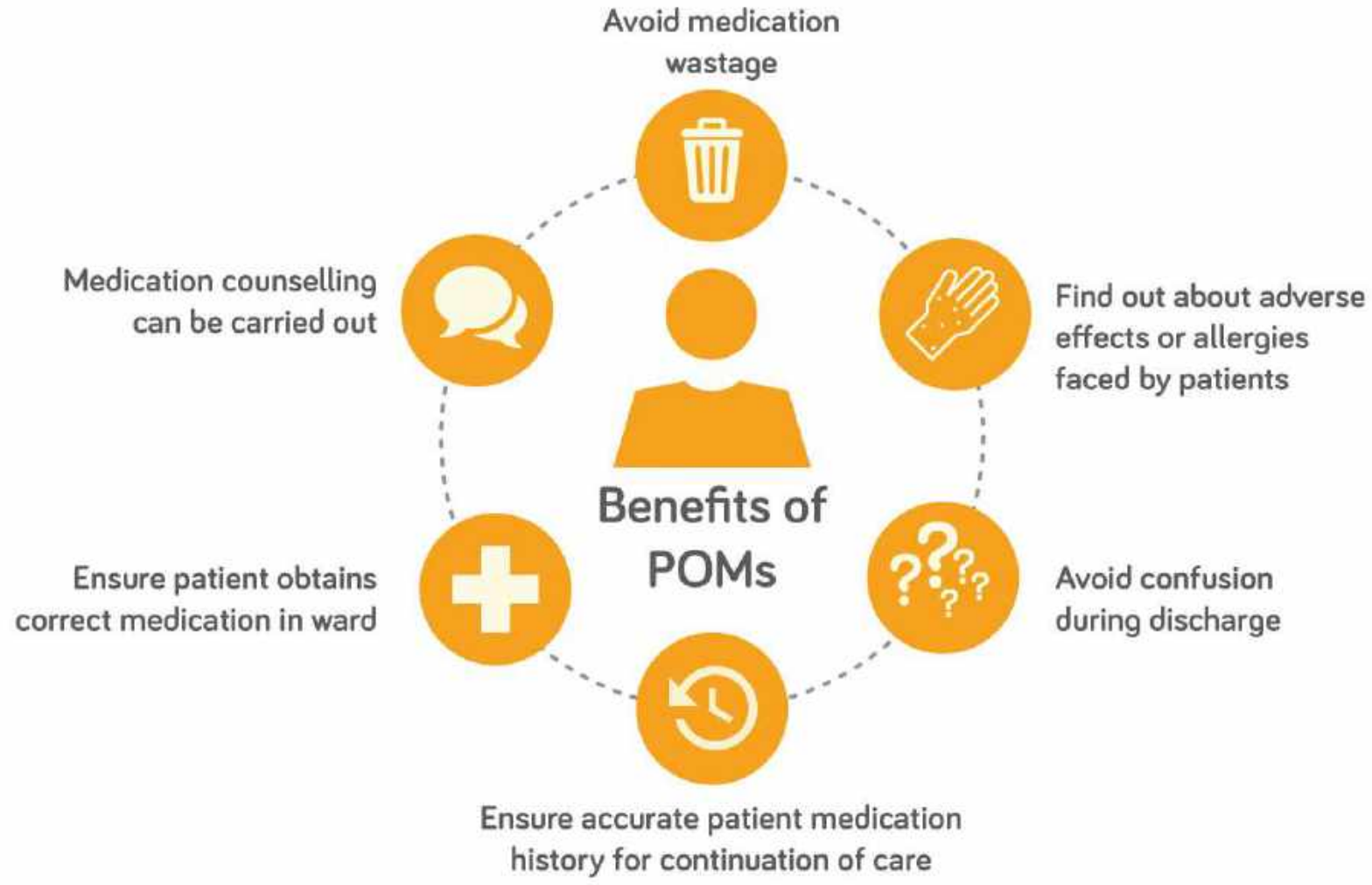
PATIENT'S OWN MEDICATIONS (POMs)

By Miss Chew Ee Wei

Definition

- Patient's medicines which was provided under KKM facility or patient's self-purchase including medications for chronic diseases such as diabetes, hypertension, heart disease etc.
- These medicines are brought together with patients when admitted to hospital for treatment in wards. This is **to ensure healthcare providers could identify patient's medication history accurately for continuation of care.**
- **Complementary medicines** such as traditional medicines and supplements **are excluded** from POMs due to difficulty in identifying the contents and indications.



STEPWISE POMs

1

Receiving POMs

- Information regarding POMs given orally or through printed material.
- POMs are evaluated to ensure the suitability to be re-used.
- Record in CP1 form.

2

Labelling POMs

POMs which are already evaluated will be re-labelled using POMs label (patient's name,R/N, drug generic name, strength and quantity of drug)

3

Storing POMs

- Store medicine at a proper place..
- Fridge items- stored in the refrigerator.
- Psychotropic drugs- stored in a locked cabinet.

4

POMs prescription

Patient's prescription or medication chart should be marked/ cop with the word 'POMs' for those under POMs usage.

5

Supply of medicine

- Prescription labelled POMs will not be provided by Inpatient Pharmacy.
- Prescription without POMs label will be provided accordingly.

6

POMs prescription

- Nurses are responsible to ensure all medicines including POMs would be administered to patients according to latest dose on medication chart.
- Nurses must record on the medication chart after patients took their medicines.

Handling Unused POMs

- Unused POMs should be separated as follows:
  - POMs from KKM facilities returned to Inpatient Pharmacy
  - self-purchased POMs returned back to patients
- Spoilt and expired POMs returned to Inpatient Pharmacy
- For patient/caretaker to inform about the status of unused POMs

Continuation of POMs upon discharged

- Addition of POMs medicine should be given based on the duration on the discharge prescription.
- "POMs√" for sufficient supply of POMs until the next appointment date.
- "POMs +" for POMs which need to be topped up.

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I. Polisi dan Garis Panduan Patient's Own Medicines Edisi Kedua 2018

MEDICATION THERAPY ADHERENCE CLINIC (MTAC)

By Miss Chew Ee Wei

- MTAC was **introduced in 2004** as one of the component of clinical pharmacy. The **objective** of this service is to enhance patient's compliance to medication.
- It involves the collaboration between pharmacists and other healthcare professionals in providing pharmaceutical care for patients.
- MTAC would be **carried out by pharmacists** who provide information to **enhance patient's understanding about their pharmacotherapy treatment and motivate the patients to have a positive perspective about their disease and treatment given.** This service also involves discussion with clinical pharmacists regarding change of dose for certain medications like insulin and warfarin.

Latest Schedule of Medication Therapy Adherence Clinic (MTAC) 2018

MTAC	SCHEDULE	PERSON IN CHARGE
Diabetes Mellitus (DM) **Place**: MOPD and OPD **Time**: 9.00am to 12.00pm	**MOPD** (Thursday- once every two months) **OPD** (every Thursday) September: 6th,13th,20th,27th October: 4th,11th,18th,25th November: 1st,8th,15th,22nd December: 6th,13th,20th,27th	Mdm. Tan Sook Wei Mdm. Sofiyyah bt. Sa'adon Mdm. Siti Naimah bt. Mohd Nor Ms. Tiong Wan Qian Ms. Phuah Rou En Ms. Noor Azrina bt. Sanik Ms. Nur Qatrunnada bt. Mohd Sukhairi
Warfarin **Place**: MOPD **Time**: 11.00am to 1.00pm	**Every Tuesday** September: 4th, 11th, 18th, 25th October: 2nd, 9th, 16th, 23rd November: 6th, 13th, 20th, 27th December: 4th, 11th, 18th, 25th	Ms. Aida Farhana bt. Yusoff Mdm. Chiam Zye Wei Mdm. Yee Yean Foong Mdm. Kwong Chea Ing Ms. Wong Ee Lynn Ms. Koay Hui Ying

MTAC	SCHEDULE	PERSON IN CHARGE
Highly Active Anti-Retro-viral Therapy (HAART) **Place:** MOPD **Time**: 8.00am to 12.15pm	**Every Friday** second week of the month (Specialist visit to HSM). **Other days,** doctors can refer patients any time for pill training or counselling	Mdm. Hu Yi Jie Ms. Noorsidah bt. Md. Yusoff Mdm. Sayangku Aini bt. Tajor Amar Mdm. Ling Yee Fang Ms. Rohayu bt. Ibrahim Ms. Leow Sheh Leng
Psoriasis **Place**: MOPD and OPD **Time**: 9.30am to 1.00pm	**Once per month on a Friday** (according to skin clinic) September: 7th October: 5th November: 16th December: 7th	Ms. Lim Lay Sin Ms. Ling Shiau Hui Ms. Ng Ching Wen Ms. Lai Kai Ling

Schedule for other services provided by HSM Pharmacy 2018

MTAC	SCHEDULE	PERSON IN CHARGE
Tuberculosis Counselling **Place:** Chest clinic and wards	- No fixed schedule. - Newly diagnosed TB from OPD and MOPD will be counselled at chest clinic. - Newly diagnosed TB in wards will be counselled by clinical pharmacists at respective wards.	Ms. Teoh Yee Mun Ms. Wong Ee Lynn Ms. Tiong Wan Qian Mr. Wan Mohd Akmal bin Wan Sabri Mdm. Hu Yi Jie Ms. Siti Nor Syahidah bt. Zulkafli Mr. Rubanathan a/l Ramasamy
Parkinson Counselling **Place:** MOPD **Time:** 8.00am-1.00pm (neurologist visiting)	- Every Thursday third week of the month (neurologist visit every alternate month)	Ms. Angie Chuah Su Ching Ms. Anis Afiqah bt. Abdul Ghani Ms. Foo Yen Li
Home Medication Review (HMR) **Place:** Patient's home (covering Manjung, Pasir Panjang, Sitiawan, Ayer Tawar, Simpang 2, Simpang 3, Simpang 5, Kampung Koh etc) **Time:** 9.00am-1.00pm	- No fixed schedule. Follow patient's home visit date. - Team visit consists of 1 MO from PSY, 2 nurses and 1 pharmacist.	Mdm. Hor Cheah Yen Ms. Amy Tan Szi Sze Mr. Rubanathan a/l Ramasamy Mdm. Murni bt. Mohamed Ariffin

PAMIDRONATE VS ZOLEDRONATE

by Miss Teoh Huimin

	PAMIDRONATE	ZOLEDRONATE
Strength	30mg, 90mg lyophilized powder	4mg/5ml
Route of administration	Intravenous infusion	Intravenous infusion
Mechanism of action	Bisphosphonates which inhibit bone resorption via actions on osteoclasts or on osteoclast precursors; inhibit osteoclastic activity and skeletal calcium release induced by tumors.	
Pharmacokinetics	**Distribution** 30% - 70% over 120 hours **Metabolism** Not metabolized **Excretion** Biphasic; urine (30% - 62% as unchanged drug; lower in patients with renal dysfunction) within 120 hours **Elimination half life** 28 ± 7 hours	**Distribution** Bind to bone **Metabolism** Primarily eliminated intact via kidney; metabolism not likely **Excretion** Triphasic; urine (39% ± 16% as unchanged drug) within 24 hours; feces (<3%) **Elimination half life** 146 hours
Indication	- Treatment of hypercalcemia of malignancy (HCM) - Osteolytic bone metastases of breast cancer and multiple my eloma - Paget's disease	- Treatment of hypercalcemia of malignancy (HCM) - Prevention of skeletal related events in patients with advanced malignancies involving bone

	PAMIDRONATE	ZOLEDRONATE
Recommended dose	**Treatment of HCM:** Moderate hypercalcemia (corrected calcium: 3 – 3.5 mmol/L): 60 – 90mg as a single dose over 2 – 24 hours Severe hypercalcemia (corrected calcium > 3.5 mmol/L): 90mg as a single dose over 2 – 24 hours **Osteolytic bone metastases of breast cancer and multiple myeloma:** Breast cancer: 90mg over 2 hours every 3 to 4 weeks Multiple myeloma: 90mg over 4 hours every 4 weeks **Paget's disease:** 30mg over 4 hours once daily for 3 consecutive days. May re-treat at dose of initial therapy when clinically indicated	**Treatment of HCM:** 4mg as a single dose over 15 - 30 minutes **Prevention of skeletal related events in patients with advanced malignancies involving bone:** 4mg every 3 to 4 weeks
Dosing adjustments	Mild to moderate renal impairment (CrCL > 30 mL/min): No dose adjustment required Severe renal impairment (CrCL < 30 mL/min): Consider reducing initial dose and infuse over 4 – 6 hours	Treatment of HCM: Mild to moderate renal impairment (SCr < 400 umol/L): No dose adjustment required Prevention of skeletal related events in patients with advanced malignancies involving bone: CrCL 50 – 60 mL/min: 3.5mg CrCL 40 – 49 mL/min: 3.3mg CrCL 30 – 39 mL/min: 3mg CrCL < 30 mL/min: Use is not recommended

	PAMIDRONATE	ZOLEDRONATE
Dilution for administration	1. Reconstitute by adding 10mL of SWFI to each vial of lyophilized powder 2. Further dilute in 250 – 1000 mL of NS or D5% (1000mL for HCM, 500mL for bone metastases of multiple myeloma and Paget's disease, 250mL for bone metastases of breast cancer)	1. Further dilute the concentrate solution (4mg/5mL) in 100mL of NS or D5% 2. Infuse over 15 – 30 minutes; not less than 15 minutes
Contraindications	Hypersensitivity to pamidronate, other bisphosphonates, or mannitol	Hypersensitivity to zoledronic acid, to other bisphosphonates or to any of the excipients in the formulation
Pregnancy category	Pregnancy category D Pamidronate should not be used during pregnancy	Pregnancy category D Zoledronic acid should not be used during pregnancy
Lactation	It is unknown if pamidronate is present in breast milk. Therefore, mothers taking pamidronate should not be breastfeed	It is not known whether zoledronic acid is excreted to breast milk. Zoledronic acid should not be used in breastfeeding women
Cost	RM205/vial	RM160/vial

REFERENCES

I. Drug Information Handbook (2015). US: Lexi-Comp Inc. 24 ed.
II. IBM Micromedex Drug Reference
III. Product leaflet BIODRONATE (Pamidronate Disodium for Intravenous Infusion BP)
IV. Product leaflet ZOLEX 4mg (Zoledronic acid Injection 4mg/5ml)

COMPARISON BETWEEN PROTON PUMP INHIBITORS (PPIs)

By Mr Muhamad Haiqal b Mohamad Khair

DRUGS	Dexlansoprazole	Omeprazole	Esomeprazole	Pantoprazole
Brand Names	Dexilant	Ometac Omesec Medoprazole	Nexium Axiago	Vencid Controloc Pantosec
Indication	**Healing of Erosive Esophagitis** - 60mg OD for 8 weeks **Maintaining healing of erosive esophagitis and relief of heartburn** - 30mg OD for 6 months **Treating heartburn associated with symptomatic non erosive gastroesophageal reflux disease (GERD)** - 30mg OD for 4 weeks	**ORAL** **Reflux oesophagitis** 20mg - 80mg 1 – 2 times daily up to 8 – 12 weeks **Helicobacter pylori eradication** 20mg BD in combination with any of the 2 antibiotics (Clarithromycin 500mg BD, Amoxicillin 1g BD or Metronidazole 400mg BD) for 1 – 2 weeks **Benign peptic ulcer not responding to conventional therapy** 20mg OD for 4 - 6 weeks	**ORAL** **Gastro-oesophageal reflux disease** 20mg OD for 4 – 8 weeks **Helicobacter pylori eradication** 40mg OD for 10 days in combination with amoxicillin 1g BD or clarithromycin 500mg BD **IV** **Acute erosive/ ulcerative oesophagitis** 20 – 40mg OD for 2 – 5 days **Non-variceal upper gastrointestinal bleed** 80mg by IV bolus followed by 8mg/hour infusion for 72 hours	**ORAL** **Helicobacter pylori eradication** 40mg BD in combination with any of the 2 antibiotics (Clarithromycin 500mg BD, Amoxicillin 1g BD or Metronidazole 400mg BD) for 1 – 2 weeks **Peptic ulcer disease** 40mg OD for 2 – 4 weeks **Erosive and non-erosive reflux oesophagitis (GERD and NERD)** 20 – 40mg OD on morning for 4 weeks

DRUGS	Dexlansoprazole	Omeprazole	Esomeprazole	Pantoprazole
		Zollinger-Ellison Syndrome Adult: 20 – 120mg OD adjusted according to the patient response Child: 0.4 – 0.8mg/kg/day IV **For all of the indication above:** 40mg IV OD when oral therapy is inappropriate **Endoscopically confirmed peptic ulcer** 40 – 160mg by IV in single or divided doses		**Zollinger-Ellison Syndrome** Initially 80mg OD, dose adjusted according to the patient response **Prevention of NSAID induced gastropathy** 20mg OD. CHILD not recommended IV **Bleeding peptic ulcer and acute stress ulceration** 40mg BD until oral administration can be resumed. CHILD not recommended
Mechanism of Action (MOA)	**Class: Proton Pump Inhibitors (PPIs)** Its work by reducing the production of acid by blocking the enzyme in the wall of the stomach (binds to H+/K+ exchanging ATPase in gastric parietal cells) that produces acid. Acid is necessary for the production of most ulcers in the esophagus, stomach, and duodenum, and the reduction of acid with PPIs prevents ulcers and allows any ulcers that exist in the esophagus, stomach, and duodenum to heal.			
Dosage Form & Strength Available	**Capsule** - 30mg - 60mg	**Capsule** - 10mg - 20mg **Injection** - 40mg	**Tablet** - 20mg - 40mg **Injection** - 40mg	**Tablet** - 40mg **Injection** - 40mg

DRUGS	Dexlansoprazole	Omeprazole	Esomeprazole	Pantoprazole
Absorption	**Time to peak plasma concentration** 1 -2 hour, then 4 -5 hour It has dual delayed-release properties, which means it achieves two plasma concentration peaks. The first peak occurs on 1 - 2 hours after administration, followed by a second peak within 4 -5 hours.	**Biovaiability** - Aproximately 30% - 40% - Rapidly absorbed **Time to peak plasma concentration** 1 – 2 hour The onset of the anti-secretory effect of omeprazole occurs within 1 hour, with the maximum effect occurring within 2 hours. Inhibition of secretion is about 50% of maximum at 24 hours and the duration of inhibition lasts up to 72 hours.	**Biovaiability** - Aproximately 90% on repeated doses - Rapidly absorbed **Time to peak plasma concentration** 1 - 2 hour Peak concentration occurs at approximately 1.5 hour. Drug concentration of esomeprazole decreased by 43% to 53% after food intake compared to fasting condition. Thus, esomeprazole is preferred to be taken at least 1 hour before taking meals.	**Biovaiability** - Aproximately 77% - Rapidly absorbed **Time to peak plasma concentration** - 2 – 2.5 hour Administration of pantoprazole with food may delay its absorption up to 2 hours or longer; however, the concentration and the extent of pantoprazole absorption not altered. Thus, pantoprazole may be taken without regard to timing of meals
Distribution	**Plasma protein binding** Ranged from 96.1% to 98.8% **Vd** 40 L	**Plasma protein binding** Approximately 95% to 96% **Vd** 0.34 – 0.37 L/kg	**Plasma protein binding** Aproximately 97% **Vd** 16 L	**Plasma protein binding** Aproximately 98% **Vd** 11 - 24 L
Metabolism	Hydroxylation mainly by CYP2C19 and oxidation to sulfone by CYP3A4	Hepatic metabolism via CYP2C19 isoenzyme to form hydroxylomeprazole and CYP3A4 to form omeprazole sulfone	Hepatic metabolism extensively via CYP2C19 and CYP3A4	Extensive hepatic metabolism, mainly to desmethylpantoprazole and slightly by CYP3A4, CYP2D6 and CYP2C9 isoenzyme

DRUGS	Dexlansoprazole	Omeprazole	Esomeprazole	Pantoprazole
Elimination	**Half-life Elimination** 1 - 2 hours **Excretion** - Faeces (48%) - Urine (51%)	**Half-life Elimination** 0.5 – 3 hours **Excretion** - Mainly via urine (77%) - Faeces (via the bile) **Dialyzable** No	**Half-life Elimination** 1.2 – 1.5 hours **Excretion** - Faeces (20%) - Urine (80%) **Dialyzable** No	**Half-life Elimination** Aproximately 1 hours **Excretion** - Faeces (18%) - Urine (71%) **Dialyzable** No
Interaction	**Drugs with pH-dependent absorption (e.g., Ampicillin, Digoxin, Ketoconazole)** It may interfere with absorption of drugs for which gastric pH is important for bioavailability. Digoxin need to be monitored for increase in digoxin tocixity. **Warfarin** Patients taking concomitant warfarin may require monitoring for increases in INR and prothrombin time. **Tacrolimus** It may increase serum levels of tacrolimus. **Methotrexate** It may increase serum levels of methotrexate.	**Drugs with pH-dependent absorption (e.g., Ampicillin, Digoxin, Ketoconazole)** It may interfere with absorption of drugs for which gastric pH is important for bioavailability. Digoxin need to be monitored for increase in digoxin tocixity. **Warfarin** Patients taking concomitant warfarin may require monitoring for increases in INR and prothrombin time. **Tacrolimus** It may increase serum levels of tacrolimus. **Methotrexate** It may increase serum levels of methotrexate. **Clopidogrel** Reduce pharmacological activity of clopidogrel	**Drugs with pH-dependent absorption (e.g., Ampicillin, Digoxin, Ketoconazole)** It may interfere with absorption of drugs for which gastric pH is important for bioavailability. Digoxin need to be monitored for increase in digoxin tocixity. **Warfarin** Patients taking concomitant warfarin may require monitoring for increases in INR and prothrombin time. **Tacrolimus** It may increase serum levels of tacrolimus. **Methotrexate** It may increase serum levels of methotrexate. **Clopidogrel** Reduce pharmacological activity of clopidogrel	**Drugs with pH-dependent absorption (e.g., Ampicillin, Digoxin, Ketoconazole)** It may interfere with absorption of drugs for which gastric pH is important for bioavailability. Digoxin need to be monitored for increase in digoxin tocixity. **Warfarin** Patients taking concomitant warfarin may require monitoring for increases in INR and prothrombin time. **Tacrolimus** It may increase serum levels of tacrolimus. **Methotrexate** It may increase serum levels of methotrexate.

DRUGS	Dexlansoprazole	Omeprazole	Esomeprazole	Pantoprazole
Adverse Reaction	PPIs may be associated with an increased risk of Clostridium difficile associated diarrhea, especially in hospitalized patients. This diagnosis should be considered for diarrhea that does not improve. - Nausea - Vomiting - Upper Respiratory Tract Infection - Flatulence			
Pregnancy Categories	B	C	C	C
Renal Impairment	No dosage adjustment needed			
Hepatic Impairment	**Moderate (Child-Pugh Class B)** 30mg/day **Severe (Child-Pugh Class C)** Contraindicated	10 – 20mg/day	**Severe (Child-Pugh Class C)** ≤ 20mg/day	**Oral** Maximum 20mg/day or 40mg on alternate days **Injection** Severe: Maximum 20mg/day

REFERENCES

I. https://www.accessdata.fda.gov/drugsatfda_docs/label/2012/022287s014lbl.pdf (Dexlansoprazole)
II. https://www.accessdata.fda.gov/drugsatfda_docs/label/2012/019810s096lbl.pdf (Omeprazole)
III. https://www.accessdata.fda.gov/drugsatfda_docs/label/2014/022101s014021957s017021153s050lbl.pdf (Esomeprazole)
IV. https://www.accessdata.fda.gov/drugsatfda_docs/label/2012/020987s045lbl.pdf (Pantoprazole)
V. https://www.mims.com/
VI. https://www.medscape.com/

STAFF INFORMATION
(Feb - Sept)

By Mr Muhammad Farhan bin Baharuddin

New Staff

1. Cik Nur Dayana Syafinaz bt Rusli	Pegawai Farmasi Provisional UF41
2. Cik Liew Ka Kei	Pegawai Farmasi Provisional UF41
3. Cik Loh Li Vien	Pegawai Farmasi Provisional UF41
4. Cik Nur Farhah bt Samsuddin	Pegawai Farmasi Provisional UF41
5. Cik Nur Izzati bt Ashaari	Pegawai Farmasi Provisional UF41

Transferred In

1. Pn Kwong Chea Ing	Pegawai Farmasi UF44
2. Cik Klara Anthony a/p Anthony Samy	Penolong Pegawai Farmasi U32
3. Puan Hafiza bt Nawi	Pembantu Tadbir N19

Transferred Out

1. En. Choong Chie Weng	Pegawai Farmasi UF44
2. En. Azrul Nizam b Hussin	Penolong Pegawai Farmasi U32
3. Cik Azreem Izziana bt Abu	Pembantu Tadbir N22