FARMAKOTERAPI PADA KELOMPOK PEDIATRI

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7 KELOMPOK UMUR DALAM FARMAKOLOGI

Term	Definition
Premature neonate	<36 weeks' gestation
Neonate	≤1 month
Infant	1–12 months
Child	1–12 years
Adolescent	12–20 years
Adult	20-65 years
Aged	>65 years

Toddler =12-36 months
Child = 3-12 years
Adolescent = 12-18 years

From Milsap RL, Hill MR, Szefler SJ. Special pharmacokinetic considerations in children. In: Evans WE, Schentag JJ, Jusko WJ, eds. Applied pharmacokinetics, principles of therapeutic drug monitoring. Vancouver, British Columbia: Applied Therapeutics, 1992:1–32, with permission

Term	Definition
Gestational age	*By dates:* The number of weeks from the onset of the mother's last menstrual period until birth *By examination:* Assessment of gestational maturity by physical and neuromuscular examination; gestational age estimates the time from conception until birth
Postnatal age	Chronologic age after birth
Postconceptional age	Gestational age plus postnatal age
Corrected age	Postconceptional age in weeks minus 40; represents postnatal age if neonate had been born at term (40 weeks' gestational age)
Preterm	<38 weeks' gestational age at birth
Term	38–42 weeks' gestational age at birth
Post-term	≥43 weeks' gestational age at birth
Extremely low-birth-weight	Birth-weight <1 kg
Very low-birth-weight	Birth-weight <1.5 kg
Low birth-weight	Birth-weight <2.5 kg
Small for gestational age	Birth-weight <10th percentile for gestational age
Appropriate for gestational age	Birth-weight between 10th and 90th percentiles for gestational age
Large for gestational age	Birth-weight >90th percentile for gestational age

Dosis yg diresepkan (R/)

Kepatuhan pasien

Dosis yang diminum/diberikan

Faktor FK :
A D M E

Fisiologis
Patologis
Genetik
Usia
Interaksi

Konsentrasi obat di tempat kerja

Faktor FD :
fungsional reseptor

EFEK / RESPON PASIEN

Efek samping

terapi

toxic

FAKTOR BERPENGARUH TERHADAP EFEK OBAT PADA ANAK

- Ketidakrasionalan penggunaan obat pada anak
- Ketidakpatuhan penderita
- Terjadinya interaksi obat
- Faktor fisiologi anak

Pharmacokinetic changes

- Absorpsi
- Distribusi
- Metabolisme
- Ekskresi

Pharmacodynamic changes

Drug-receptor interaction

Pharmachokinetik Factors Affecting Drug Effects on the Infant

I. Drug Absorption

II. Drug Distribution

III. Drug Metabolism

IV. Drug Excretion

Absorption

ABSORBSI DI GIT

Perkembangan :pH lambung, gastric empying, integritas dan motilitas intestinal, kolonisasi bakteri)

Table 1.2: Factors having a bearing on oral absorption of drugs

Physiologic factor	*Newborn*	*Infant*	*Child/ adolescent*
Gastric acid secretion	Reduced	Normal	Normal
Gastric emptying time	Reduced	Increased	Increased
Gastrointestinal motility	Reduced	Normal	Normal
Biliary function	Reduced	Normal	Normal
Microbial flora	Acquiring	Adult pattern	Adult pattern

Gupta, 2014, Pediatric Drug Directory

Absorption

ABSORBSI DI GIT

Perkembangan :pH lambung, gastric empying, integritas dan motilitas intestinal, kolonisasi bakteri)

A. pH asam lambung

- ✓ saat lahir / hr I → kapasitas sekresi HCl <<<, pH=6-7 (netral) perlahan turun sampai pH=1-3
- ✓ Obat yg perlu suasana asam utk absorbsinya / obat yg bersifat asam lemah → bioav ↓→ Tx tdk efektif / butuh pe ↑dosis (phenobarbital, phenytoin, ketoconazole, & itraconazole)
- ✓ Obat yang labil pd suasana asam → bioav ↑ (penicillin, ampicillin)
- ✓ Stl 20 bulan →pH lambung= dewasa

Absorption

B. Gastric emptying memanjang, peristaltik lambat pd infant t.u pd prematur → pengaruh thd mulainya proses absorbsi dan onset obat tanpa mempengaruhi jml yg terabsorbsi

pd usia 6-8 bln = dewasa

Newborn infant: 6-8 hours, Toddlers: 2 hours

C. Motilitas usus halus pd neonates dan infant irregular – sulit memprediksi puncak efek suatu obat oral.

D. Osmolalitas dapat mempengaruhi integritas GIT. Obat dg osmolalitis tinggi dapat merusak integritas GIT, dan meningkatkan resiko *necrotizing enterocolitis* (NEC) pada neonates

E. Sintesis asam bilirubin dan sekresi pancreas <<< → absorbs vit larut lemak Vit D fan E <<<<

F. Absorbsi obat lewat rektum bisa menjadi alternative pilihan

ABSORPTION DERMAL

Skin

- thin dermis and epidermis,
- increased tendency to absorb larger amounts of a topical medication
  - could result in unwanted systemic effects
- Pemberian topikal betamethason → supresi HPA axis
- Keuntungan : topikal nitrogliserin dan teofilin u/preterm.
- percutan injection → absorption >

Absorption I.M INJECTION

Muscle mass

- Reduction small muscle mass with poorly developed peripheral circulation
- decrease the rate of absorption from IM injections
- Limited volume for drug administration (0,5-1mL) pd infant-children

Absorbsi Obat pada Anak

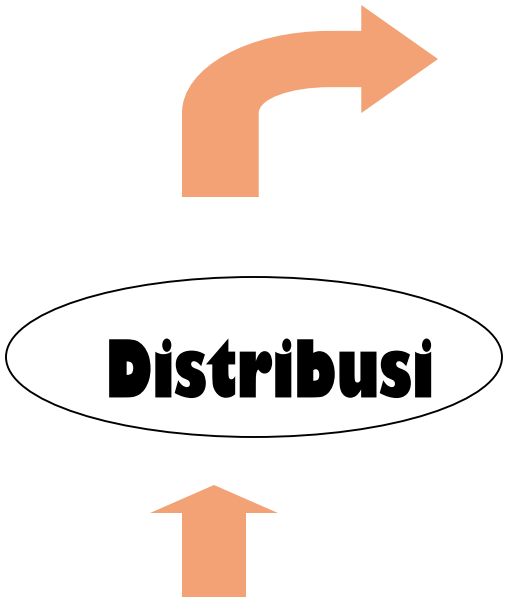
- ✓ Physiological factors
- ✓ Gatric pH
- ✓ Stomach emptying
- ✓ Intestinal motility
- ✓ Blood flow

- ❖ Bayi baru lahir pH lambung ↑, waktu pengosongan lambung lambat, waktu makanan tinggal lebih lama → Absorpsi Ampisilin & Penisilin G ↑ .
- ❖ Salisilat absorpsi ↑ sedang Fenobarbital absorpsinya ↑ di usus halus atau usus besar.
- ❖ Peristaltik usus bayi baru lahir belum teratur, umumnya lambat → jumlah obat diabsorpsi ↑.
- ❖ Pada kondisi diare absorpsi ↓.

Absorbsi Obat pada Neonatus

Drug	Absorbsi pd Neonatus dibanding dewasa
Ampisilin	Meningkat
Diazepam	Normal
Digoksin	Normal
Fenitoin	Menurun
Fenobarbital	Menurun
Gentamisin	Menurun
Nafsilin	Meningkat
Parasetamol	Menurun
Penisilin-G	Meningkat
Sulfonamid	Normal

Distribusi Obat pada Anak



- Komposisi pd neonatal ,total body water= 70-80%, body fat 10-15%
- 1 th, total body water=60%, body fat 20%
- obat water-soluble , Vd ↑ → dosis ↑ (mis aminoglikosida)
- Obat lipofiflik, Vd↓ (mis diazepam)
- Sawar darah otak bayi baru lahir s.d 2th lebih permiabel → mudah ditembus obat dan mikroorganisme
- Ikatan obat-protein plasma rendah pada neonatus → kadar obat bebas lebih tinggi.
- Terjadinya interaksi dengan bilirubin → kernikterus. Misalnya sulfonamid, diazoksida, vitamin K.
- Pemberian injeksi pada malnutrisi menyebabkan konsentrasi obat bebas lebih tinggi dalam sirkulasi.

Faktor yg Mempengaruhi:

- ✓ Organ mass
- ✓ Ratio body water
- ✓ Blood flow
- ✓ Permeability
- ✓ Protein binding
- Physical & chemical properties

Distribution

- Dipengaruhi oleh : komposisi cairan tubuh, lemak tubuh, ikatan protein.
- Pd neonatus, 70-75% BB adalah air, pd preterm 85% pd dewasa 50-60% .
- Pd neonatus total body fat adalah 15%, sdg pada preterm 1%, toddlers 23%, preschooler 8-12%
- Protein binding of drugs is reduced in the neonate. Therefore, concentration of free drug in plasma is increased => increased effect or increase toxicity.
- Drugs (e.g. sulfonamide antibiotics) that displace bilirubin from albumin may cause kernicterus. Conversely, bilirubin may also displace protein-bound drugs (e.g. phenytoin).

Plasma protein binding and distribution some drug in neonatus and adults

Drug	fu		V (l/kg)		Vu (l/kg	
	neonate	adult	neonate	adult	neonate	adult
Phenobarbital	0.68	0.53	1.0	0.55	1.4	1.0
Sulfisoxazole	0.32	0.16	0.38	0.16	1.2	1.0
Sulfamethoxypyrazine	0.43	0.38	0.47	0.24	1.1	0.63
Diazepam	0.16	0.04	1.6	2.4	10	60
Digoxin	0.80	0.70	5-10	7.0	6-12	10
Phenytoin	0.2	0.1	1.3	0.63	6.5	6.3

fu = fraction unbound in plasma
V =Volume of distribution
Vu = Unbound volume of distribution

Drug Metabolism

- Metabolisme sebagian besar obat di hepar
- Aktivitas metabolisme cytochrome P450-dependent mixed-function oxidases ↓ pd neonates (50-70% dari org dewasa).
- Pembentukan glucoronide tidak terjadi s.d usia 3-4 th →clearance & half-lives memanjang.
- Ibu hamil mendapat Tx Phenobarbital → induksi enzim metabolisme neonatus → kemampuan metabolisme pd bbrp obat ↑→ efek ↓

Neonatal Phase I Drug-Metabolizing Enzymes

Enzyme	*Neonatal Substrates*	*Known Developmental Pattern*
CYP1A2	Acetaminophen, caffeine, theophylline, warfarin	Not present to an appreciable extent in human fetal liver. Adult levels reached by 4 months of age and may be exceeded in children 1–2 years of age. Activity slowly declines to adult levels, which are attained at the conclusion of puberty. Gender differences in activity are possible during puberty.
CYP2C9 CYP2C19	Phenytoin, S-warfarin; Diazepam, phenytoin, propranolol	Not apparent in fetal liver. Inferential data using phenytoin disposition as a nonspecific pharmacologic probe suggest low activity in first week of life, with adult activity reached by 6 months of age. Peak activity (as reflected by average values for V_{max}, which are 1.5- to 1.8-fold adult values) may be reached at 3–4 years of age and declines to adult values at the conclusion of puberty.
CYP2D6	Captopril, codeine, propranolol	Low to absent in fetal liver but uniformly present at 1 week of postnatal age. Poor activity (approximately 20% of that in adults) at 1 month of postnatal age. Adult competence attained by approximately 3–5 years of age.

Modified with permission from reference 33.

Neonatal Phase I Drug-Metabolizing Enzymes

CYP3A4	Acetaminophen, alfentanil, carbamazepine, cisapride, diazepam, erythromycin, lidocaine, midazolam, theophylline, verapamil, R-warfarin	Low activity in the first month of life, with approach toward adult levels by 6–12 months of postnatal age. Pharmacokinetic data for CYP3A4 substrates suggest that adult activity may be exceeded between 1 and 4 years of age. Activity then progressively declines, reaching adult levels at the conclusion of puberty.
CYP3A7	Dehydroepiandrosterone sulfate, ethinylestradiol, triazolam	Functional activity in fetus is approximately 30%–75% of adult levels of CYP3A7.

Neonatal Phase II Drug-Metabolizing Enzymes

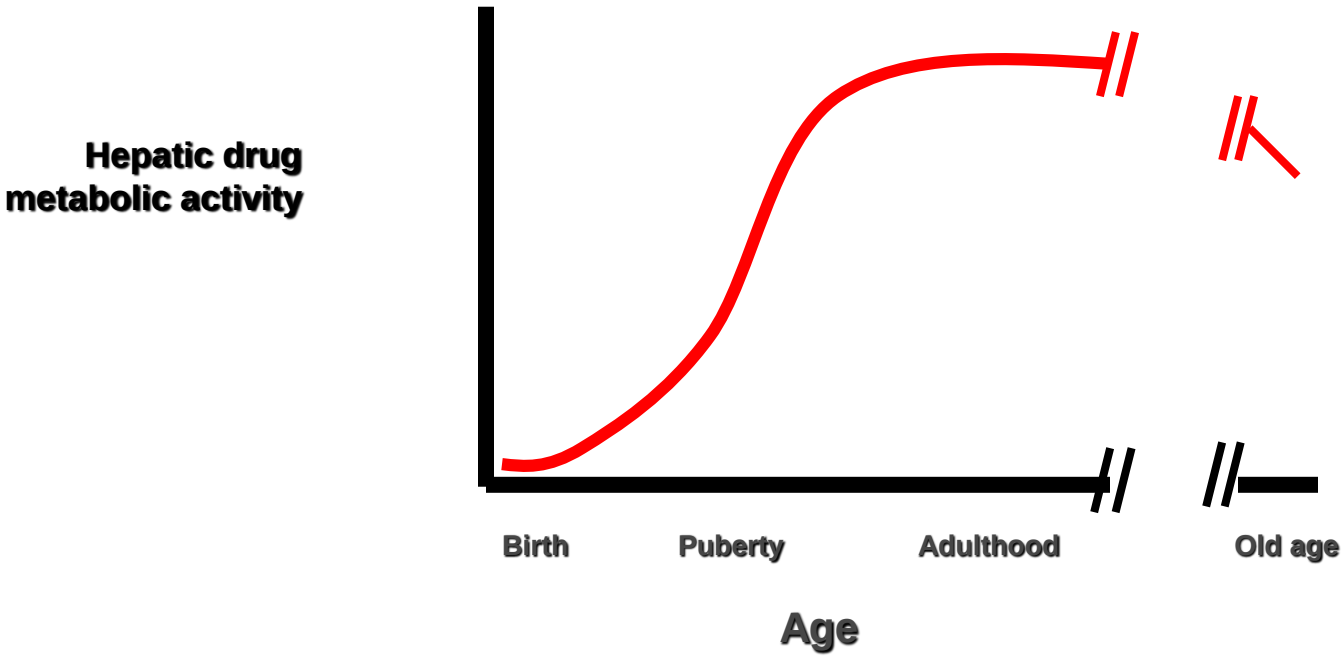
Enzyme	*Neonatal Substrates*	*Known Developmental Pattern*
N-acetyltransferase-2 (NAT2)	Caffeine, clonazepam, hydralazine, procainamide, sulfamethoxazole	Some fetal activity present by 16 weeks. Virtually 100% of infants between birth and 2 months of age exhibit the slow metabolizer phenotype. Adult phenotype distribution reached by 4–6 months of postnatal age, with adult activity present by approximately 1–3 years of age.
Thiopurine methyltransferase	Azathioprine, mercaptopurine, thioguanine	Levels in fetal liver are approximately 30% of those in adult liver. In newborn infants, activity is approximately 50% higher than in adults, with a phenotype distribution that parallels that in adults. In Korean children, adult activity appears at approximately 7–9 years of age.

Modified with permission from reference 33.

Neonatal Phase II Drug-Metabolizing Enzymes

Glucuronosyltransferase (UGT)	Acetaminophen, chloramphenicol, morphine, valproic acid	Ontogeny is isoform specific as reflected by pharmacokinetic data for certain pharmacologic substrates (e.g., acetaminophen or chloramphenicol). In general, adult activity as reflected from pharmacokinetic data seems to be achieved by 6–18 months of age.
Sulfotransferase	Acetaminophen, bile acids, chloramphenicol, cholesterol, dopamine, polyethylene glycols	Ontogeny (based on pharmacokinetic studies) seems to be more rapid than that for UGT; however, it is substrate specific. Activity for some isoforms (e.g., that are responsible for acetaminophen metabolism) may exceed adult levels during infancy and early childhood.

Age and Hepatic Metabolic Activity



Drug metabolism in children

The maturation of different metabolic liver functions

Metabolism Pathway	Age (month)	Drug
Sulfatation	Birth	-
Acetylation	1	Sulfonamides
Glucuronidation	2	Bilirubin Azorubin
Conjugation (glutathione, cysteine, glycine)	3	Bromsulfophthalein

Waktu paruh beberapa obat pada bayi dan dewasa

Obat	Umur	T1/2 anak (jam)	T1/2 dewasa (jam)
Diazepam	-	25-100	15-25
Digoksin	-	60-107	30-60
Fenobarbital	0-5 hari	200	64-140
	5-15 hari	100	
	15-30 hari	50	
Fenitoin	0-2 hari	80	12-18
	3-14 hari	18	
	14-50 hari	6	
Parasetamol		2,2-5	1,9-2,2
Salisilat		4,5-11	2-4
Teofilin	Neonatus	20-30	5-6
	Anak	3-4	

Drug Excretion

- Glomerular filtration is much lower (30-40% of adult) in neonates for the first few days of life. Within a week glomerular filtration and plasma flow increase by 50% and reach adult values within 6-12 months. Drugs that depend on renal flow are eliminated very slowly in the first few weeks of life (penicilins, aminoglycoside antibiotics, digoxin)

Ampicillin

< 7 days old=> 50-100 mg/Kg/d , 2d at 12 hr intervals.

> 7 days old => 100-200 mg/Kg/d, 3d at 8 hr intervals

Gentamicin Dosing Guidelines for Neonates and Infants

Age	*Weight*	*Dosing Regimen*
GA <38 wk	<1000 g	3.5 mg/kg/dose Q 24 hr
PNA 0–4 wk	<1200 g	2.5 mg/kg/dose Q 18–24 hr
PNA ≤7 days	≥1200 g	2.5 mg/kg/dose Q 12 hr
PNA >7 days	1200–2000 g	2.5 mg/kg/dose Q 8–12 hr
PNA >7 days	>2000 g	2.5 mg/kg/dose Q 8 hr

[a]Traditional dosing; see Question 33, Dosage and Route of Administration section for discussion of extended-interval aminoglycoside dosing

GA, gestational age; PNA, postnatal age

Drug Excretion

Urine pH

- more acidic in infants
  - pH remains constant the day and night
- older children & adults more basic pH during day and acidic at night
- results in increased reabsorption of acidic drugs

Functional development of the human kidney

Age	Kidney weight (g)	GFR (ml/min/1.73 m2)	Max tubular excretion capacity (mg/min/1.73m2)
Newborn	22-24	38.5	16.0
2 months	27-30	70.2	49.6
6 months	37-43	110.7	46.0
8 months	55-61	110.0	60.6
12-19 months	69-74	117.5	61.6
3 years	91-94	127.0	73.7
9 years	139-141	127.0	73.7
12 years	143-178	127.0	73.7
Adult	257-323	127.0	79.8

Pharmacodynamic changes

- Jantung neonatus belum memberikan respon yang optimal terhadap obat simpatomimetik. Diperlukan agonis β lebih tinggi untuk memberikan efek yang sebanding.
- Amfetamin menyebabkan stimulasi SSP pada orang dewasa, tetapi pada anak digunakan untuk treatmen hiperaktif.
- Glukokortikoid menyebabkan gangguan pertumbuhan pada bayi dan gangguan kematangan epiphyseal.
- Opioid narkotik menyebabkan infant respiratory distress syndrome.

Beberapa obat yang perlu diwaspadai diberikan pada anak

1. Pemberian tetrasiklin dapat merusak gigi dan mengganggu pertumbuhan tulang.
2. Pemberian antibiotika untuk diare akut tidak beralasan.
3. Kortikosteroid topical secara rutin tidak dianjurkan karena bisa terjadi iritasi kulit dan gangguan pertumbuhan.
4. Obat yang dapat mendesak bilirubin dari ikatannya dengan albumin menyebabkan Ken-ikterus. Misalnya kotrimoksazol, vitamin K.
5. Pemberian aspirin dihindari karena menyebabkan iritasi lambung dan sindroma Reye.
6. Pemberian kloramfenikol pada bayi dapat menyebabkan sindrom Grey.
7. Pemberian dipiron menyebabkan agranulositosis.

Excipients – why they are needed?

- **The goal is to only include excipients at levels that are required to deliver the dosage form to the patient**
  - To improve solubility
    - Solvents, co-solvents, surfactants
  - To ensure physical, chemical and microbial stability
    - Buffers, anti-oxidants, suspending agents, preservatives
  - To improve palatability and patient compliance
    - Flavours, sweeteners, taste modifiers, sensate materials
  - To control release
    - Polymers, coatings
  - To improve manufacturability
    - Glidants, bulking agents

Excipients with Elevated Toxicological Risk for Preterm and Term Neonates and Infants <6 months

Excipient	Administration	Adverse reaction
Benzyl alcohol	Oral, parenteral	Neurotoxicity, metabolic acidosis
Ethanol	Oral, parenteral	Neurotoxicity
Polyethylene glycol	Parenteral	Metabolic acidosis
Polysorbate 20 Polysorbate 80	Parenteral	Liver & kidney failure
Propylene glycol	Oral, parenteral	Seizures, neurotoxicity, hyperosmolarity

PENGHITUNGAN DOSIS ANAK

- **Berdasar umur**

  Formula Young

  $$\text{dosis anak} = \frac{\text{umur (th)} \times \text{dosis dws}}{\text{umur+12(th)}}$$

- **Berdasarkan Berat Badan**

  Untuk menghitung dosis dalam mg/kg

  Formula Clark

  $$\text{dosis anak} = \frac{\text{BB (kg)} \times \text{dosis dws}}{70\ \text{(kg)}}$$

  Pada anak sering menghasilkan dosis yang terlalu kecil karena laju metabolisme beberapa obat lebih tinggi → perlu dosis lebih ↑.

- **Berdasar luas permukaan tubuh**

  $$\text{dosis anak} = \frac{\text{luas permk tbh(m2)} \times \text{dosis dws}}{1{,}73\ \text{(m2)}}$$

  Lebih baik untuk perhitungan dosis pada anak karena fenomena fisik erat kaitannya dengan luas permukaan

BENTUK SEDIAAN OBAT (BSO) UNTUK ANAK

- Puyer/Serbuk
- Tablet kunyah
- Tablet effervecens
- Sirup/Liquid/Suspensi/Drop/Emulsi
- Sediaan Topikal, Pulvis

PULVERES

- BERBENTUK PUYER/SERBUK HALUS, HOMOGEN, KERING
- PEMAKAIAN PERORAL (perlu dicampur dengan bahan cair al. air putih, sirup, atau susu)
- DAPAT DIBERIKAN UNTUK ANAK
- TIDAK COCOK UNTUK BAHAN OBAT YANG HIGROSKOPIS, IRITATIF, DIRUSAK DILAMBUNG, ATAU BERASA SANGAT PAHIT

absorpsi obat dapat cepat

Dipilih bila dokter memerlukan formula obat bentuk racikan

- **PRODUK PATEN DIKEMAS DALAM SACHET (sebagai sediaan oral untuk sekali pakai)**

PULVIS

- berbentuk puyer/serbuk halus, homogen, kering
- pemakaian topikal
- dapat berfungsi sebagai pengering
- disebut : serbuk tabur (pulvis adspersorius)

TABLET KUNYAH
Chewable Tablet
Dulcet

- suatu tablet kempa , bentuk lonjong/bulat,
- rasa enak (manis)
- cara pemberian dengan dikunyah baru ditelan
- macam obat masih terbatas

Erythromycine
Multivitamin

TABLET EFFERVESCENS

- suatu tablet kempa, bulat pipih, ukuran besar
- tablet dpt melepaskan gas / berbuih saat dicampur dg air.
- cara pemberian dilarutkan dulu dalam air
- rasa enak & segar , menarik

Multivitamin

SEDIAAN OBAT BERBENTUK CAIR

SIRUP

- cairan mengandung gula atau bahan pengganti gula
- secara fisik dapat berbentuk larutan atau suspensi atau serbuk kering (dry sirup)

SUSPENSI

- mengandung partikel obat yang terbagi secara halus (terdispersi) dan merata dalam bahan pembawa
- memerlukan suspensator

LIQUID

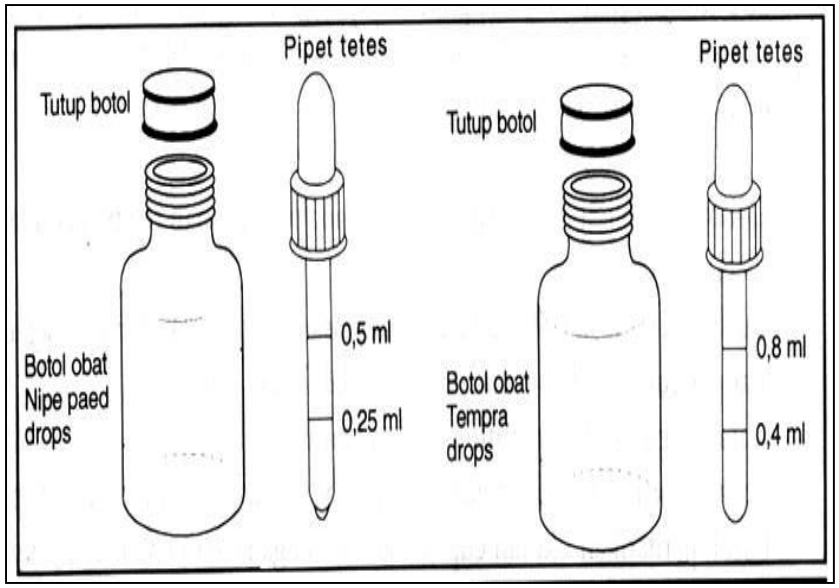
- bahan obat terlarut dalam bahan pembawa yang cocok
- dapat mengandung gula atau bahan pemanis lain
- dikenal dengan nama *Solusio* (untuk oral) & *Lotio* (untuk topikal)

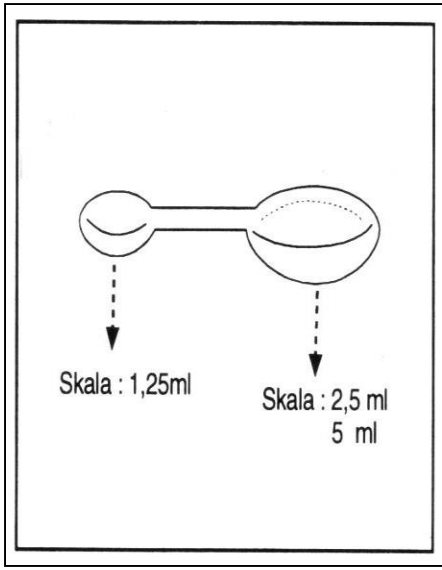
DROP (ORAL DROP)

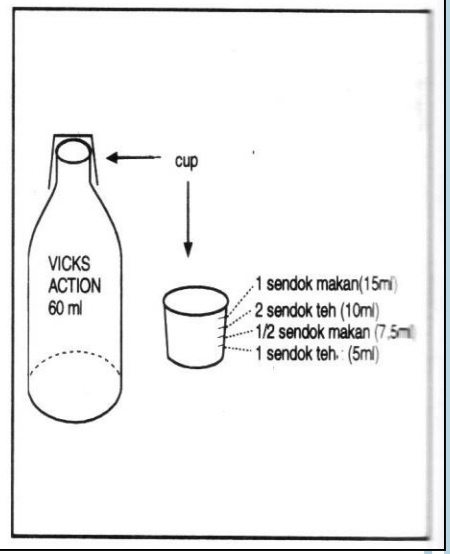
- solutio, sirup, atau suspensi dgn kemasan volume kecil
- cara pemberian dengan menggunakan alat penetes.
- cocok untuk bayi (dosis & volume pemberian kecil)

EMULSI

- Sediaan cair ,mengandung 2 bahan cair yg tak dapat bercampur (mis. minyak & air)
- Memerlukan stabilisator ⟶ emulgator
- Tidak tahan pemanasan
- Untuk bahan obat yg bersifat seperti minyak, absorpsi menjadi lebih baik (mis. minyak ikan, vit A)
- Dpt di+ corigen saporis ⟶ rasa jadi enak







Preferred Dosage Forms for Drug Delivery to Different Pediatric Age Groups

Neonates: 0-4 weeks	???
Infants: 1 month-2 year	Liquids-small volumes (syrups, solutions)
Children: 2-5 years	**Liquids (Liquids and effervescent tablets dispersed in liquids for administration)**
Children: 6-11 years	**Solids (Chewable tablets, orally disintegrating tablets)**
Adolescents: 12-18 years	Solids (typical adult dosage forms –tablets, capsules)

6 years old is generally considered the age that children can safely swallow a solid oral dosage form, although this varies based on the child

Table 1. The KIDs List

Drug	Risk/Rationale	Recommendation	Strength of Recommendation	Quality o
Atazanavir[51]	Kernicterus	Caution in neonates unless pharmacogenetic testing is used	Weak	Very low
Benzocaine[52–57]	Methemoglobinemia	Avoid in infants for teething or pharyngitis	Strong	High
Camphor[58–60]	Seizures	Caution in children	Weak	Low
Carbinoxamine[61]	Death	Avoid in <1 year	Strong	Low
Ceftriaxone[62,63]	Kernicterus	Caution in neonates	Weak	Very low
Chloramphenicol[64]	Gray baby syndrome	Avoid in neonates unless serum concentration monitoring is used	Strong	High
Chlorhexidine[65]	Chemical burn	Caution in very low birth weight neonates	Strong	Low
Codeine[66–69]	Respiratory depression, death	Avoid in children unless pharmacogenetic testing is used	Strong	High
Darunavir[70]	Seizures, death	Avoid in <3 years or <10 kg	Strong	Very low
Daptomycin[71]	Neuromuscular and skeletal adverse events	Caution in <1 year	Weak	Very low
Dicloxacillin[72]	Kernicterus	Caution in neonates	Weak	Very low
Dicyclomine[73]	Apnea	Avoid in <6 months	Strong	Low
Difluprednate[74,75]	Increased intraocular pressure	Caution in children	Weak	Low
Diphenoxylate and atropine[76]	Respiratory depression, death	Avoid in <6 years	Strong	Moderate
Dopamine antagonists Chlorpromazine[77] Fluphenazine[77] Haloperidol[77,78] Metoclopramide[77,81–88] Perphenazine[77] Pimozide[77,78,87] Prochlorperazine[77,79,83,88–90] Promethazine[91–93] Trifluoperazine[77] Trimethobenzamide[94]	Acute dystonia (dyskinesia); increased risk of respiratory depression, extravasation, and death with intravenous use	Avoid in infants Caution in children	Strong: Chlorpromazine Fluphenazine Haloperidol Perphenazine Pimozide Prochlorperazine Promethazine Trifluoperazine Weak: Metoclopramide Trimethobenzamide	Moderate
Gentamicin ophthalmic ointment[95–97]	Severe ocular reactions	Avoid in neonates	Strong	High

Prinsip pemakaian obat pada anak

- Apakah tindakan pengobatan memang perlu dilakukan.
- Pemilihan obat yang tepat.
- Bentuk sediaan yang diperlukan.
- Perkiraan dosis obat untuk anak.
- Lama dan frekuensi pemberian.
- Perlunya informasi pengobatan diberikan.
- Ketaatan minum obat pada anak.
- Pemilihan manfaat dan efek pengobatan.

Prinsip pemakaian antibiotik pada anak

- Tempat dan beratnya infeksi
- Kuman penyebabnya
- Pemilihan antibiotika yang tepat
  - Spektrum antibakteri
  - Sifat farmakokinetikanya
  - Potensi antibiotika
  - Toksisitas dan efek samping
  - Kolompok dengan high-risk

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