Alder Hey Children's NHS Foundation Trust

GLYCOPEPTIDE GUIDELINE

VANCOMYCIN AND TEICOPLANIN

CONTENTS

This guideline does NOT cover antibiotic indications or intravenous method of administration of medication.

See the relevant guidelines via the Trust intranet DMS

Glycopeptides are nephrotoxic – caution alongside concomitant nephrotoxic drugs – see page 24

TERMS AND ABBREVIATIONS

CGA: Corrected Gestational Age = *gestational age + chronological age*

AdjBW: Adjusted Body Weight (kg)

= 0.35 x (*actual body weight (kg) – ideal body weight (kg)) + ideal body weight (kg)*

IBW: Ideal Body Weight (kg)

Can be determined by measuring height and using that to identify height centile for age using iGrow. IBW is then selected according to weight at the same centile as height in age.

eGFR (estimated glomerular filtration rate) – *using Modified Bedside Swartz as specified in the BNFc*

Child > 1 month: *eGFR (ml/min/1.73m^2) = 35 x height(cm) / serum creatinine(µmol/L)*

Child ≤ 1 month: *eGFR (ml/min/1.73m^2) = 30 x height(cm) / serum creatinine(µmol/L)*

ECMO: Extra Corporeal Membrane Oxygenation

THERAPEUTIC DRUG LEVEL MONITORING

Therapeutic drug monitoring is the process of measuring the levels of medication in the blood. It is important for two reasons:

- To ensure doses are therapeutic and treating infections – low doses increase the risk of resistance.
- To ensure doses are not toxic to patients – high doses increase the risk of side effects.

Pre-dose levels measure the lowest concentration of drug in the bloodstream shortly before another dose is given. Pre-dose levels should be taken 1-2 hours before the next dose is due.

Random levels measure the concentration of drug in the bloodstream at certain times after a dose is given or at a time during a continuous infusion is being administered.

Post-dose levels are not routinely required for glycopeptide monitoring.

Levels may be taken at other times on advice from a Pharmacist.

MULTIDISCIPLINARY ROLES AND RESPONSIBILITIES

All members of the multidisciplinary team (MDT) are responsible for the safe and effective delivery of medication to patients, and appropriate handover to other members of the MDT.

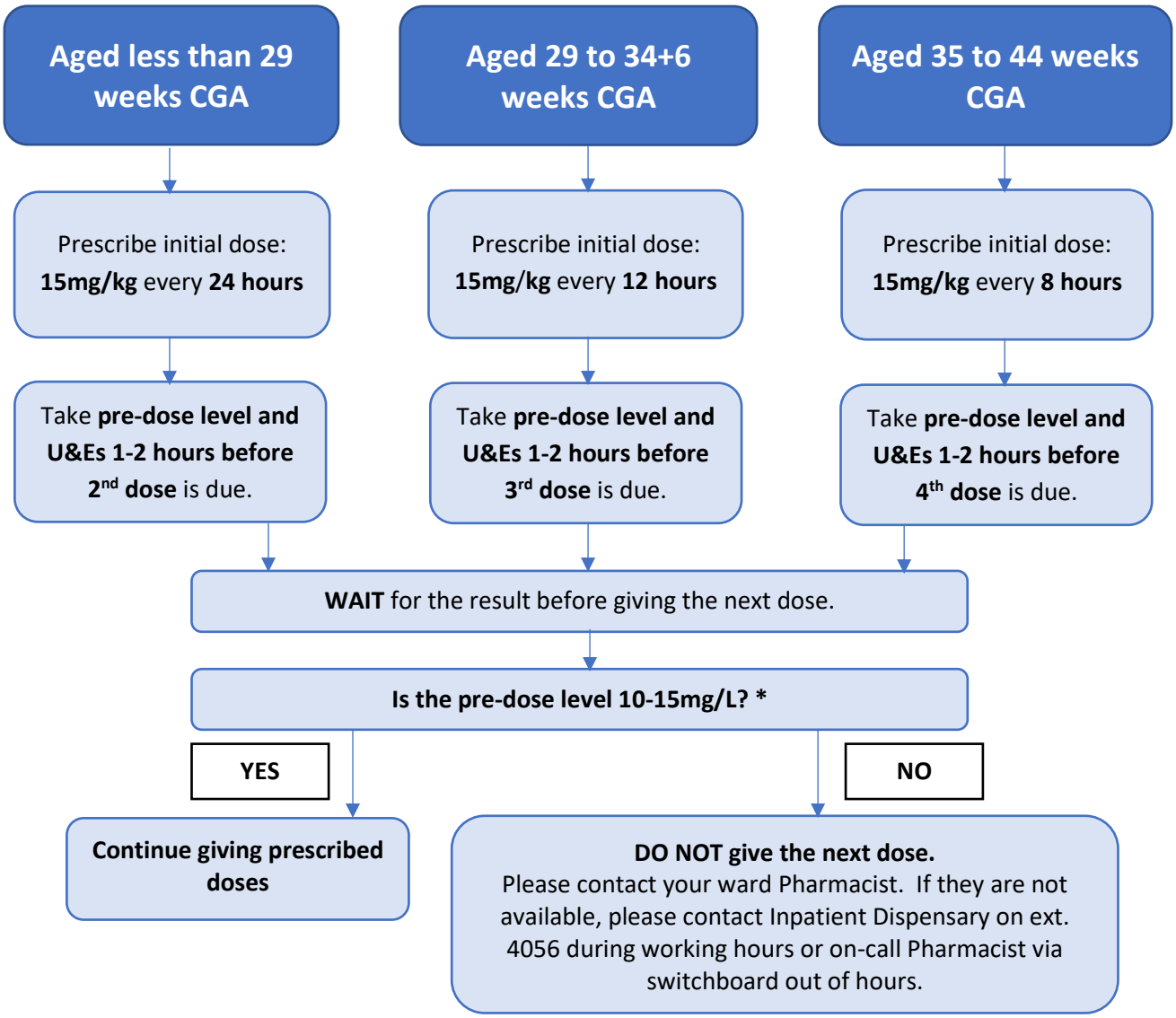
Prescriber responsibilities	Choosing the correct and safe choice of glycopeptide. Prescribing the initial doses. Ordering the initial serum level. Monitoring kidney function. Acting upon reported levels in good time. Prescribing dose changes in response to level results after taking advice from a Pharmacist. Ensuring the duration of treatment is appropriate.
Nurse responsibilities	Being aware of all glycopeptide prescriptions for patients under their care. Taking blood samples at correct times. Checking dosing is correct and safe. Administering doses at correct times. Monitoring fluid balance. Acting upon reported levels in good time.
Pharmacist responsibilities	Being aware of all glycopeptide prescriptions for patients under their care. Checking dosing is correct and safe. Ensuring serum levels are scheduled to be taken at the correct times. Ensuring follow up plans are documented. Advising dose changes to be prescribed if level results are out of the intended target range.

VANCOMYCIN FLOWCHARTS (EXCLUDING RENAL IMPAIRMENT AND PATIENTS ON CRITICAL CARE)

VANCOMYCIN INFUSIONS FOR PATIENTS 44 WEEKS CGA AND LESS

Flowchart for initial dosing and serum level monitoring for patients with eGFR greater than 90mL/min/1.73m^2

See page 24 for further monitoring



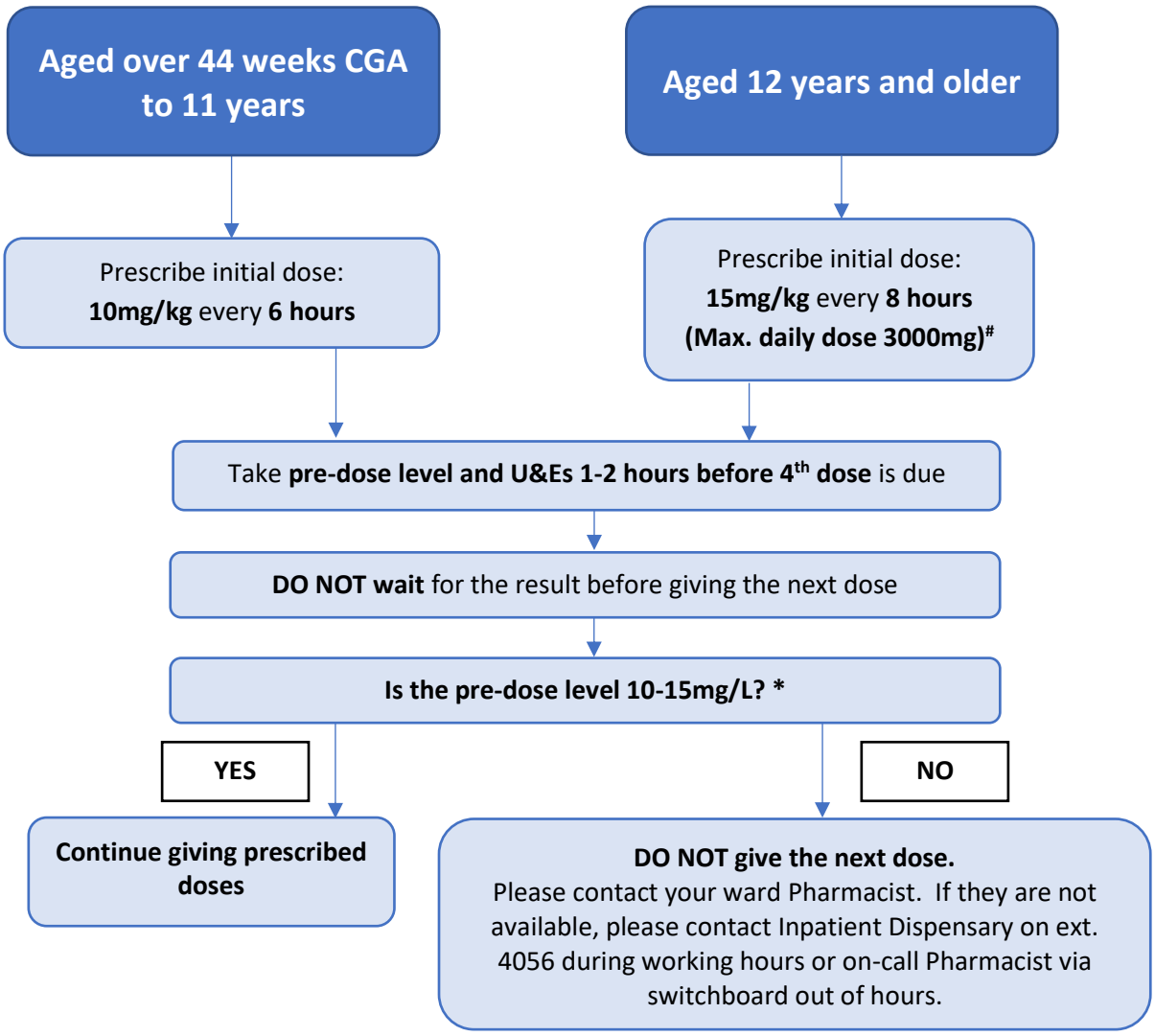
***Target levels**

On the advice of a pharmacist or the Infectious diseases/Microbiology team target levels may be amended to 15-20mg/L for organisms with reduced sensitivity.

VANCOMYCIN FOR PATIENTS OVER 44 WEEKS CGA

Flowchart for initial dosing and serum level monitoring for patients with eGFR greater than 90mL/min/1.73m^2

See page 24 for further monitoring



***Target levels**

On the advice of a pharmacist or the Infectious diseases/Microbiology team target levels may be amended to 15-20mg/L for organisms with reduced sensitivity.

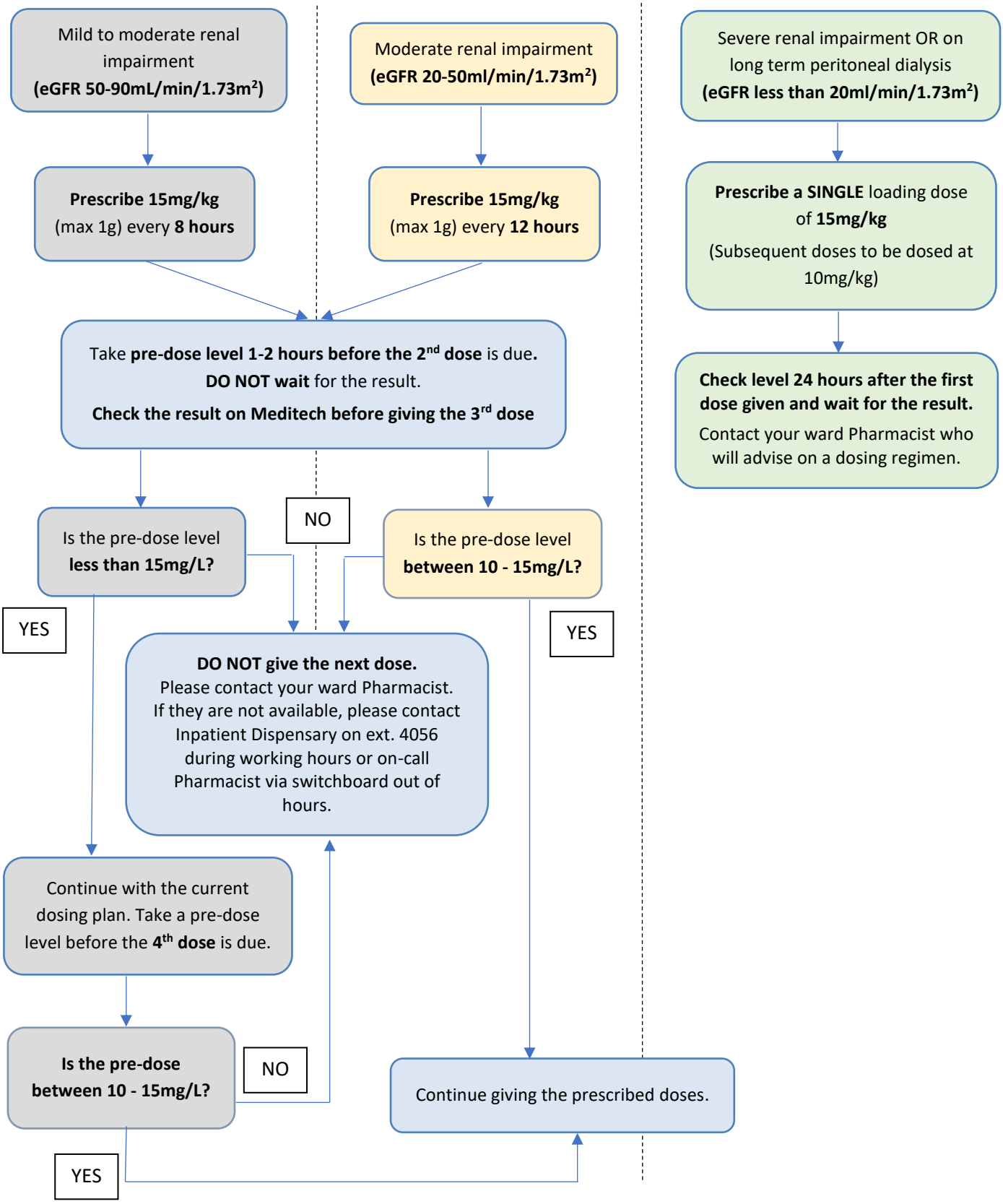
#If total daily dose equals 3000mg/day or more refer to monitoring requirements on page 24.

VANCOMYCIN FLOWCHARTS – PATIENTS WITH RENAL IMPAIRMENT (EXCLUDING PATIENTS ON CRITICAL CARE)

VANCOMYCIN FOR PATIENTS WITH PRE-EXISTING RENAL IMPAIRMENT AGED 44 WEEKS CGA AND OVER

Flowchart for initial dosing and serum level monitoring for patients with eGFR 90mL/min/m^2 or less. Patients less than 44 weeks corrected gestational age that are deemed to be renally impaired should be discussed with Infectious Diseases / Microbiology, Renal Team and Pharmacy. For patients receiving Haemodialysis refer to separate guideline here.

See Page 2 for eGFR definition. See page 24 for further monitoring



VANCOMYCIN CONTINUOUS INFUSION FLOWCHARTS (ALL PATIENTS)

VANCOMYCIN CONTINUOUS INFUSIONS INFORMATION

Indications for continuous infusions of vancomycin include:

- For infections in neonates as recommended in the Antimicrobial Prescribing Guidelines
- Patients who have not achieved therapeutic concentrations following three dose adjustments using intermittent infusion
- Patients who require intermittent vancomycin doses above usual maximum doses
- Where Infectious diseases/Microbiology team advise prolonged exposure of vancomycin for resistant bacteria or deep-seated infections

Potential barriers to using continuous infusions of vancomycin include:

- Extravasation risk due to low pH therefore central access preferred
- Should be administered through a separate line, although some medicines are compatible at the Y-site

Target concentration for continuous infusions = 15-25 mg/L

CONTINUOUS VANCOMYCIN ADMINISTRATION DETAILS

See the Injectable Therapy Guide for more information.

Usual Concentration (5mg/mL)	**Fluid Restricted Patients (10mg/mL)**
250mg in 50mL as standard. If syringe changes become too frequent, consider: 500mg in 100mL 2500mg in 500mL Sodium Chloride 0.9% or Glucose 5%	500mg in 50mL as standard. If syringe changes become too frequent, consider: 1000mg in 100mL 5000mg in 500mL Sodium Chloride 0.9% or Glucose 5%
Given by PERIPHERAL or CENTRAL line	Given by CENTRAL LINE only
When diluting in infusion bags, remove the equivalent amount of fluid from the bag before adding the reconstituted vancomycin.	

Rate of Administration

Usual Concentration (5mg/mL)			**Fluid Restricted Patients (10mg/mL)**		
Daily Dose	**Hourly Dose**	**Initial Rate**	**Daily Dose**	**Hourly Dose**	**Initial Rate**
60mg/kg/day	2.5mg/kg/hour	0.5mL/kg/hr	60mg/kg/day	2.5mg/kg/hour	0.25mL/kg/hr
30mg/kg/day	1.25mg/kg/hour	0.25mL/kg/hr	30mg/kg/day	1.25mg/kg/hour	0.13mL/kg/hr
15mg/kg/day	0.63mg/kg/hour	0.13mL/kg/hr	15mg/kg/day	0.63mg/kg/hour	0.06mL/kg/hr

CONTINUOUS VANCOMYCIN INFUSION RATE ADJUSTMENTS

Target concentration for continuous infusions = 15-25 mg/L

Dose adjustments based on reported vancomycin serum concentrations:

Vancomycin concentration	Suggested dose alteration
Less than 10mg/L	Increase rate in mg/kg/hr by 50%
10 to 14.9mg/L	Increase rate in mg/kg/hr by 25%
15 to 25mg/L	No dose changes required
25.1 to 30mg/L	Decrease rate in mg/kg/hr by 25%
Greater than 30mg/L	Stop infusion for 4 hours and then check level. Reduce rate in mg/kg/hr by 25% and recommence when level less than 25mg/L

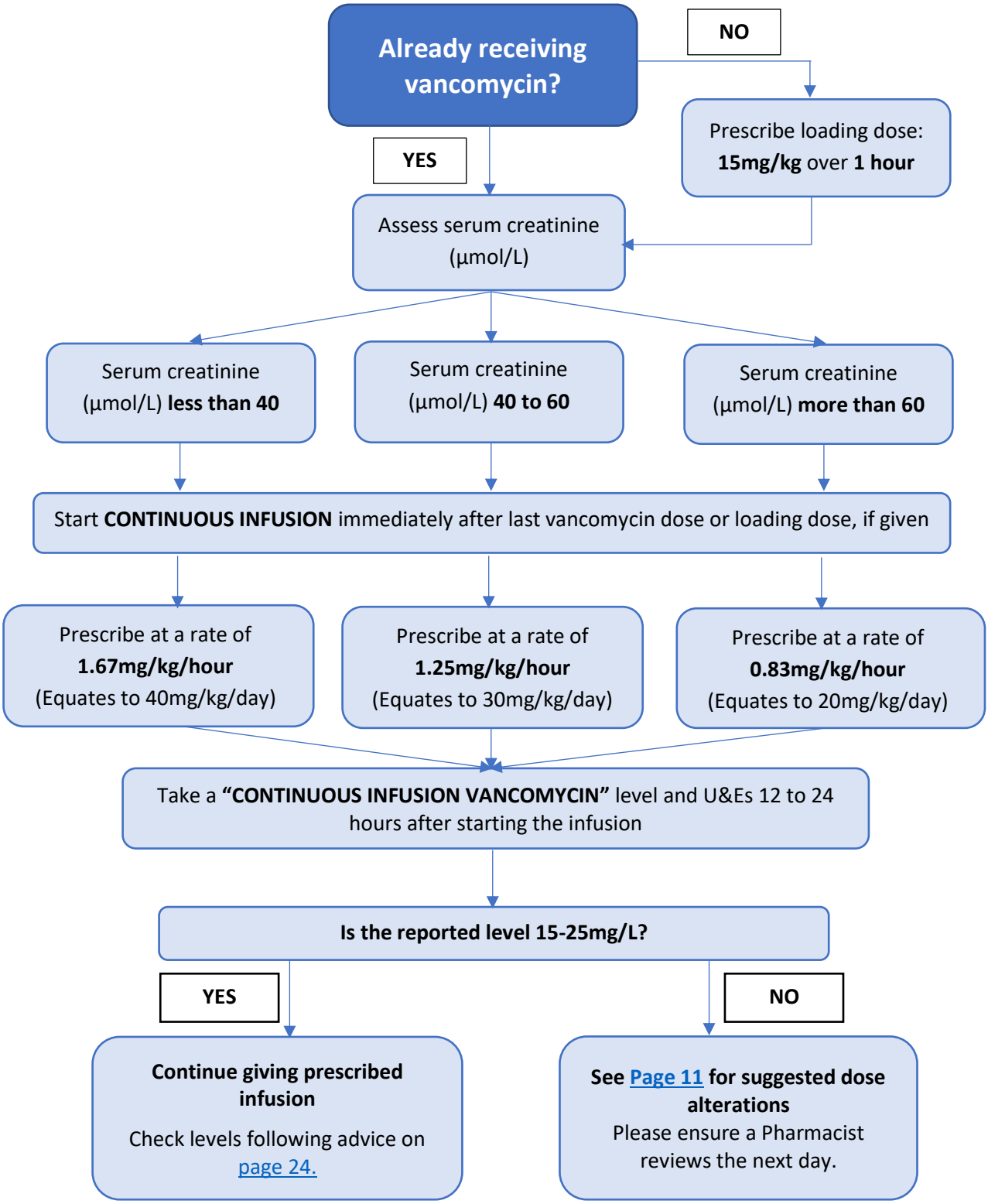
Please contact Pharmacy to discuss when the next level should be taken.

Doses above 80mg/kg/day should be discussed with the Infectious diseases/Microbiology team regarding the appropriateness of vancomycin. Be aware of maximum total daily doses for continuous infusions (3600mg).

VANCOMYCIN CONTINUOUS INFUSION LESS THAN 40 WEEKS CGA

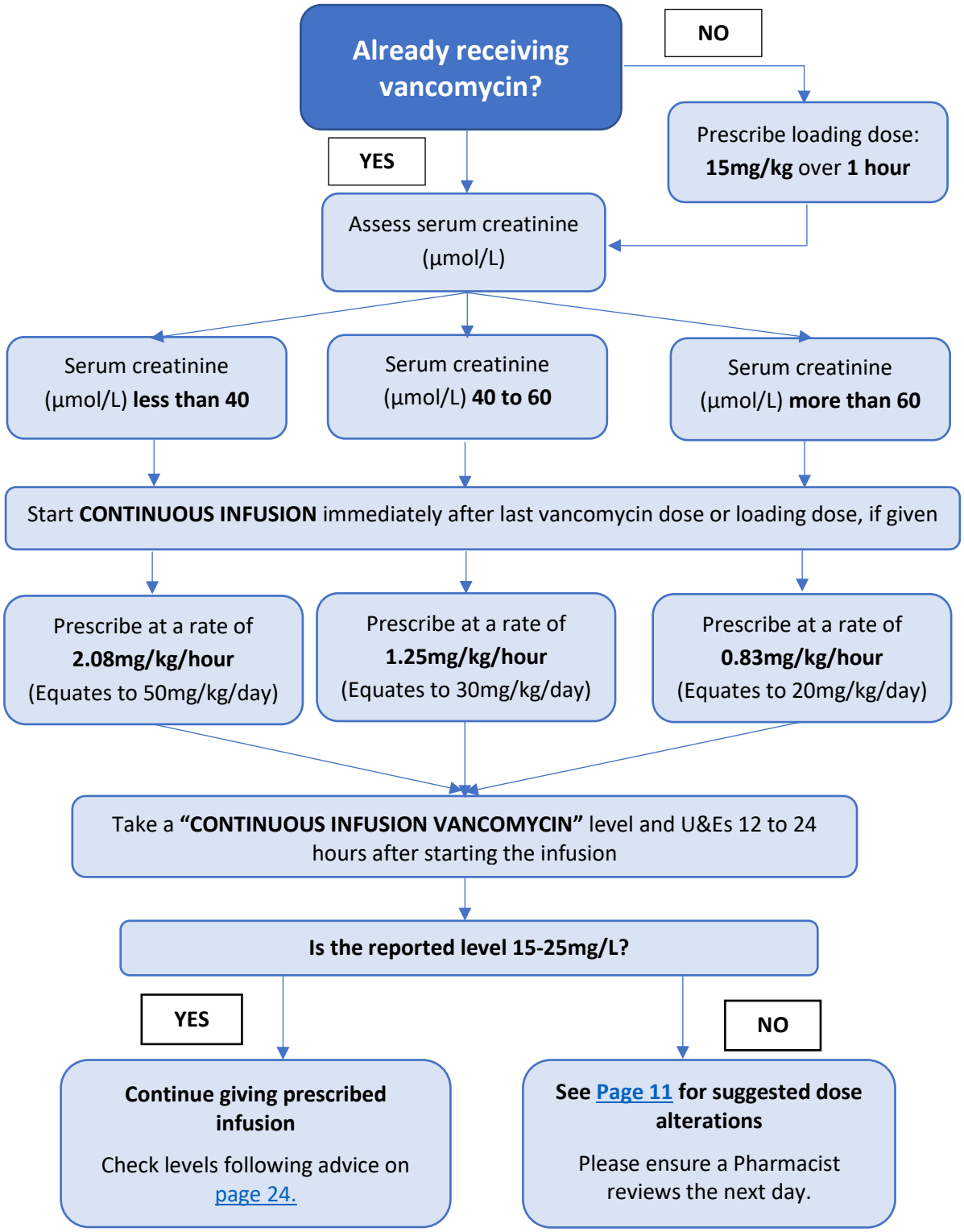
See Administration Details on Page 10 and the Injectable Therapy Guidelines for more information.
See page 24 for further monitoring

Extremely low birth weight, with renal impairment, requiring a dose below 0.83mg/kg/hour (=20mg/kg/day) may require a flow rate less than 0.1mL/hr. In this case please discuss with a pharmacist to ensure appropriate dosing and administration.



VANCOMYCIN CONTINUOUS INFUSION 40 TO 44 WEEKS CGA

See Administration Details on Page 10 and the Injectable Therapy Guidelines for more information.
See page 24 for further monitoring

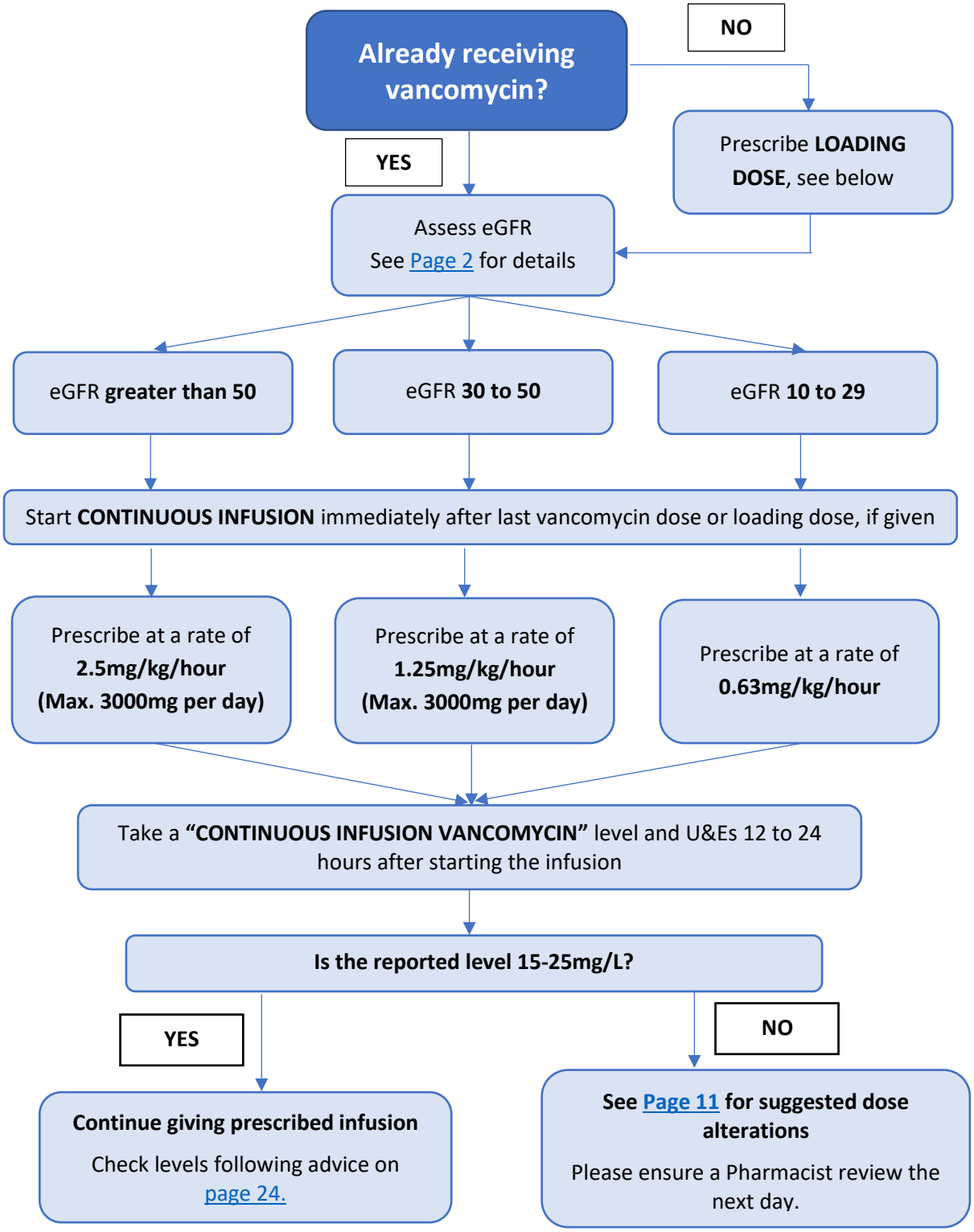


VANCOMYCIN CONTINUOUS INFUSION 44 WEEKS CGA AND OLDER

See Administration Details on Page 10 and the Injectable Therapy Guidelines for more information.

Vancomycin continuous infusions not recommended in patients with eGFR less than 10mL/min/m^2 or receiving renal replacement therapy (e.g. Peritoneal dialysis, Haemodialysis or CVVH/DF).

See Page 2 for eGFR definition. See page 24 for further monitoring



LOADING DOSES

eGFR greater than 30 = 15mg/kg (Max. 2000mg)

eGFR 10 to 29 = 7.5mg/kg

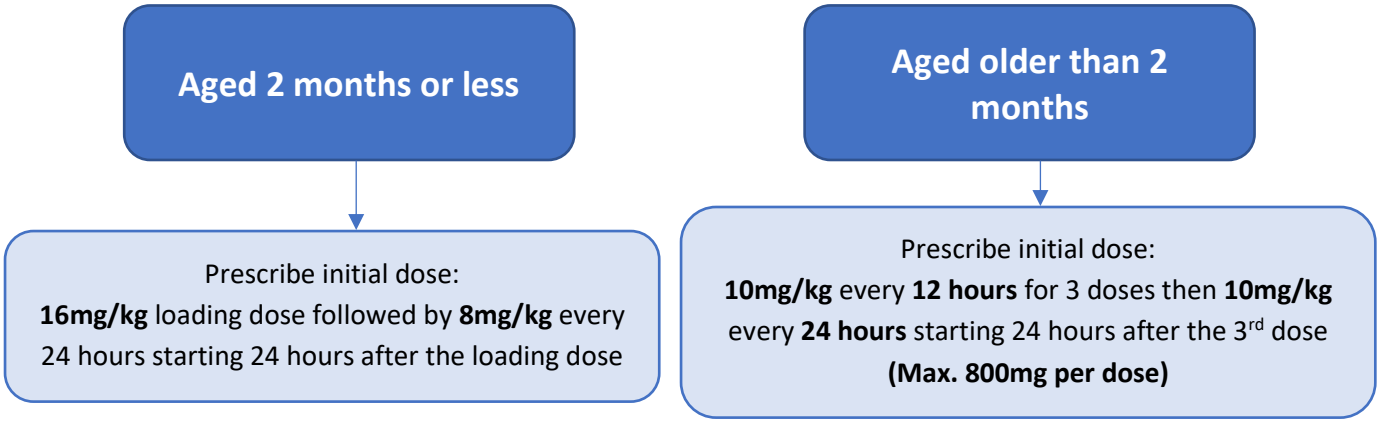
TEICOPLANIN FLOWCHARTS (EXCLUDING CRITICAL CARE)

TEICOPLANIN INITIAL DOSING AND SERUM LEVEL MONITORING – NORMAL RENAL FUNCTION

This flowchart should be used for all patients not on Critical Care with an eGFR greater than 80mL/min/m^2

See page 24 for further monitoring

When prescribing on Meditech ensure Dosing Sets are used to prevent errors. Speak to a pharmacist if you unsure on how to use them.

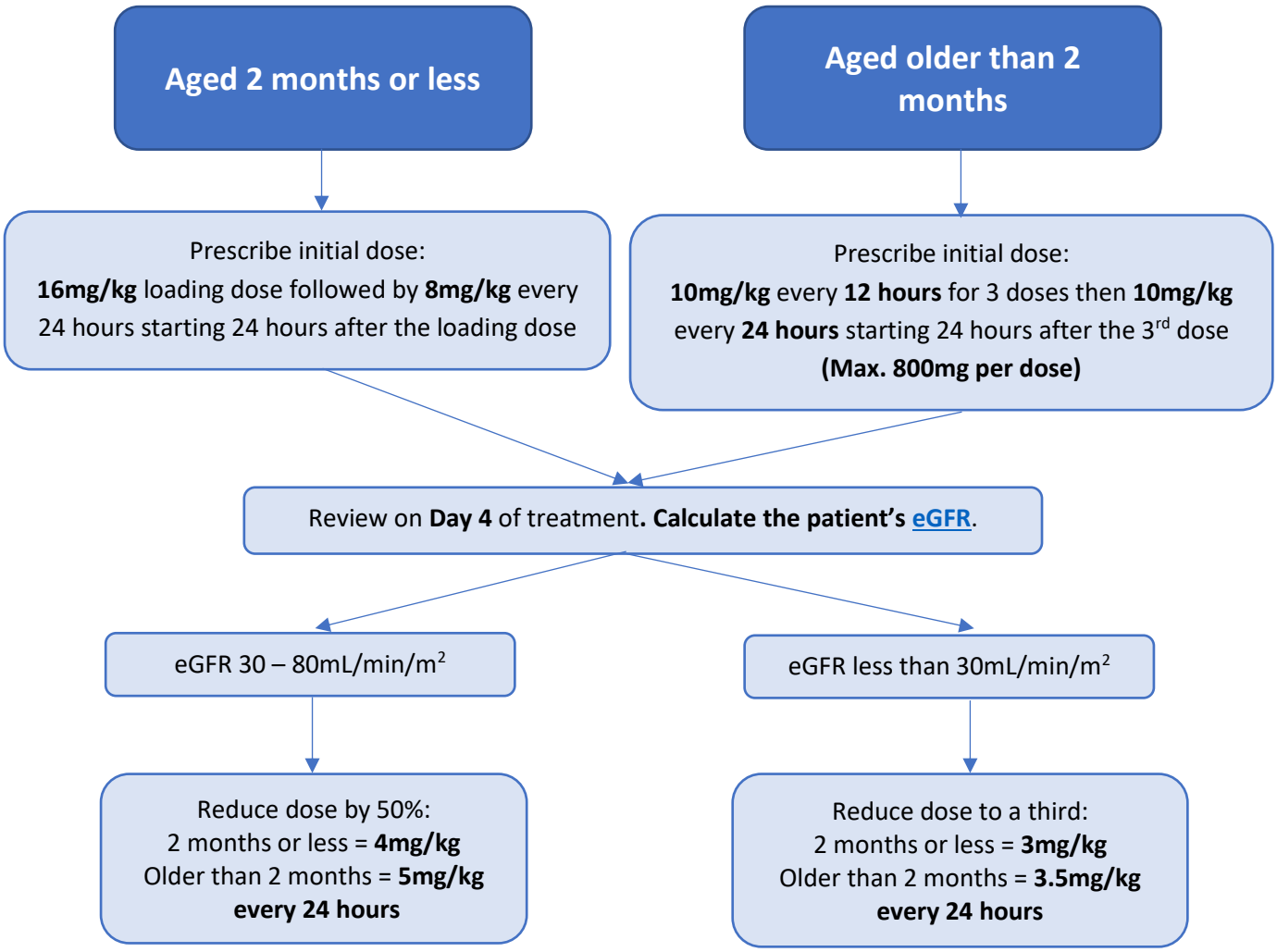


TEICOPLANIN FOR PATIENTS WITH PRE-EXISTING RENAL IMPAIRMENT

Flowchart for initial dosing and serum level monitoring for patients not on Critical Care with eGFR 80mL/min/m^2 or less

See page 24 for further monitoring

When prescribing on Meditech ensure Dosing Sets are used to prevent errors. Speak to a pharmacist if you unsure on how to use them.



VANCOMYCIN FLOWCHARTS ON CRITICAL CARE

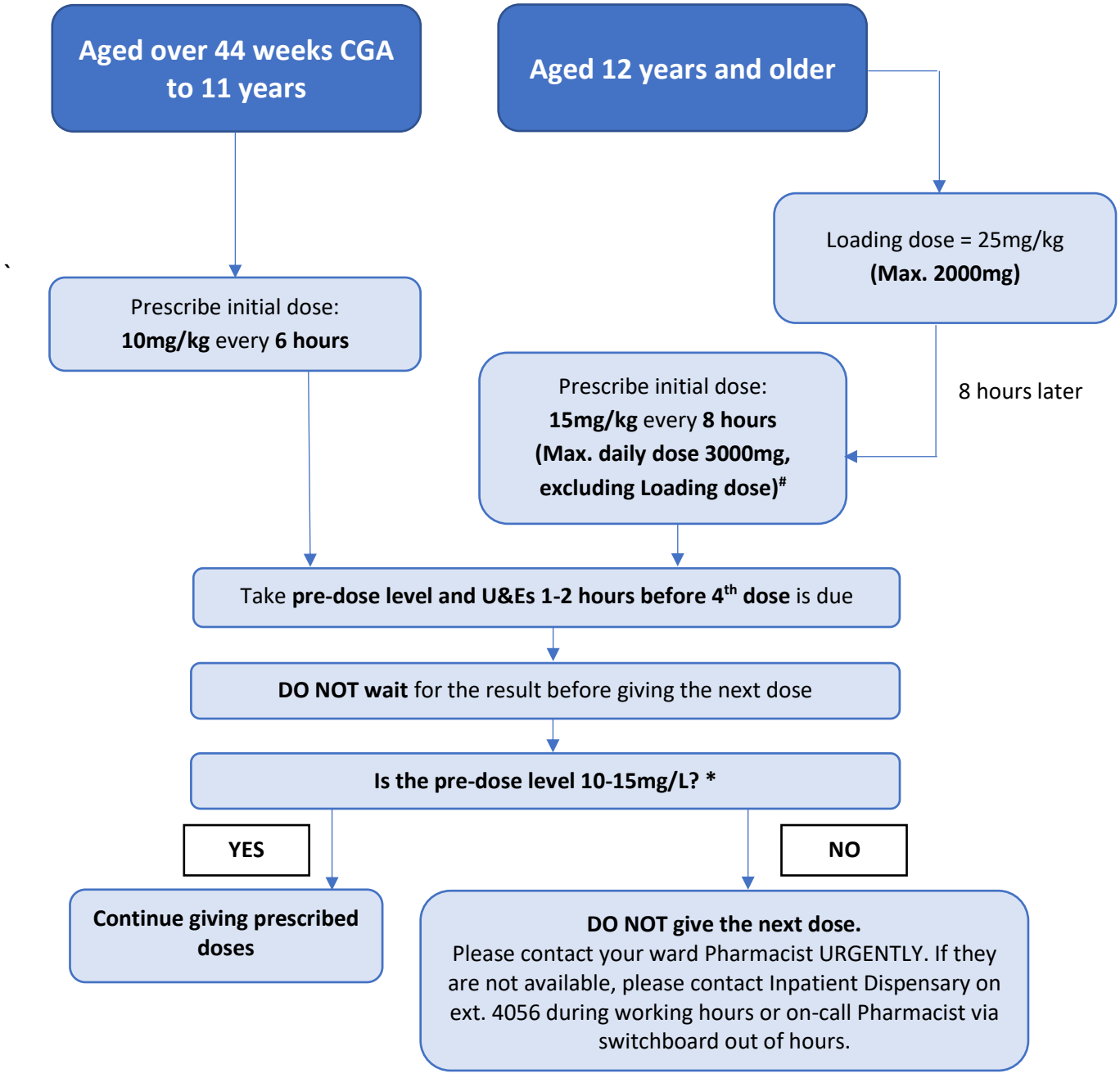
VANCOMYCIN FOR PATIENTS LESS THAN 44 WEEKS CGA ON CRITICAL CARE – NORMAL RENAL FUNCTION

Refer to flowchart on page 5.

VANCOMYCIN FOR PATIENTS OVER 44 WEEKS CGA ON CRITICAL CARE – NORMAL RENAL FUNCTION

Flowchart for initial dosing and serum level monitoring for patients with eGFR greater than 90mL/min/1.73m^2

See page 24 for further monitoring



***Target levels**

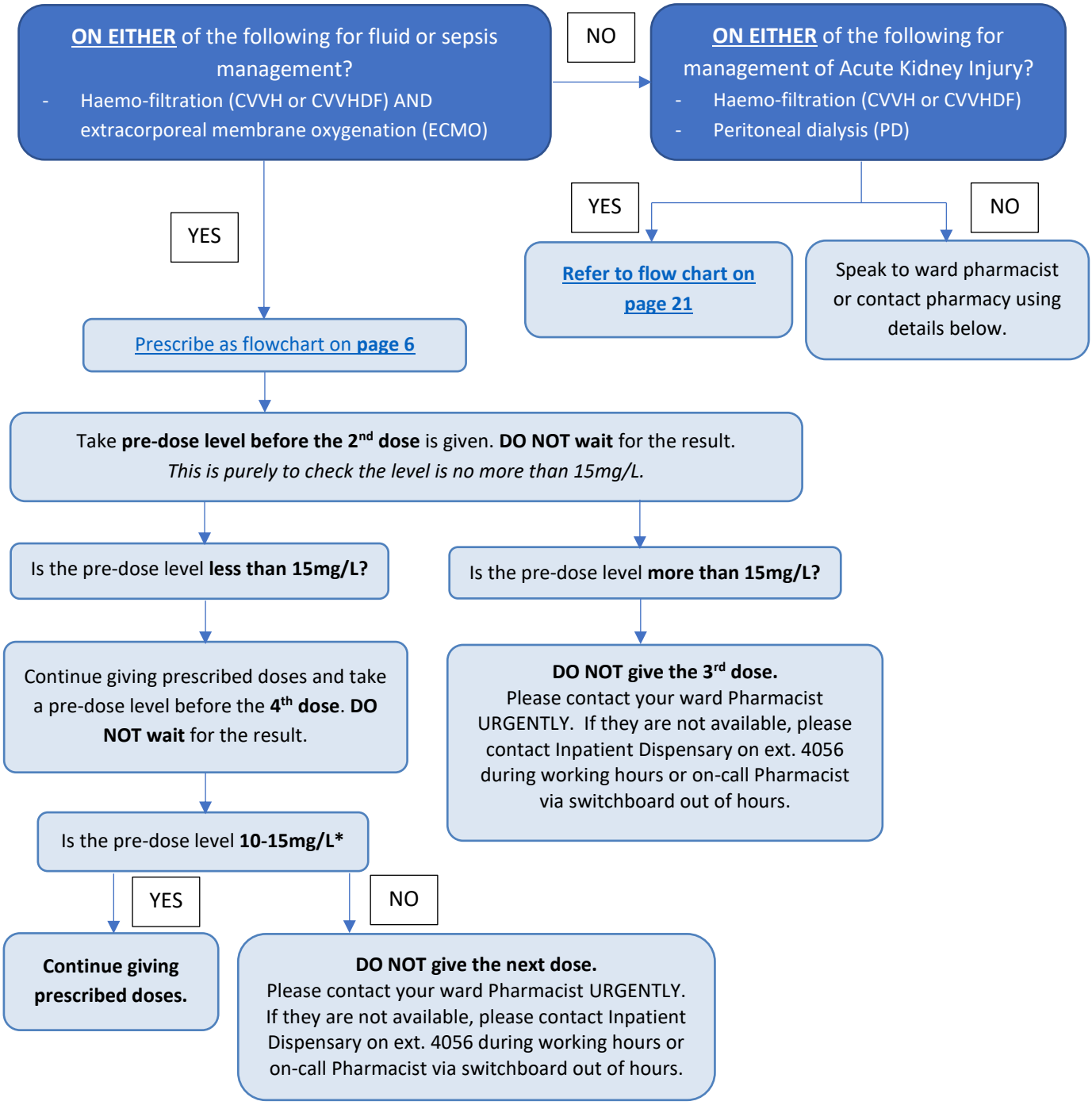
On the advice of a pharmacist or the Infectious diseases/microbiology team target levels may be amended to 15-20mg/L for organisms with reduced sensitivity.

#If total daily dose equals 3000mg/day or more refer to monitoring requirements on page 24.

VANCOMYCIN FOR PATIENTS ADMITTED TO CRITICAL CARE OVER 44 WEEKS CGA ON DIALYSIS

Children under 44 weeks corrected gestational age that are deemed to be renally impaired or admitted to Critical Care for dialysis should be discussed with Infectious Diseases/Microbiology, Renal Team and Pharmacy.

See page 24 for further monitoring

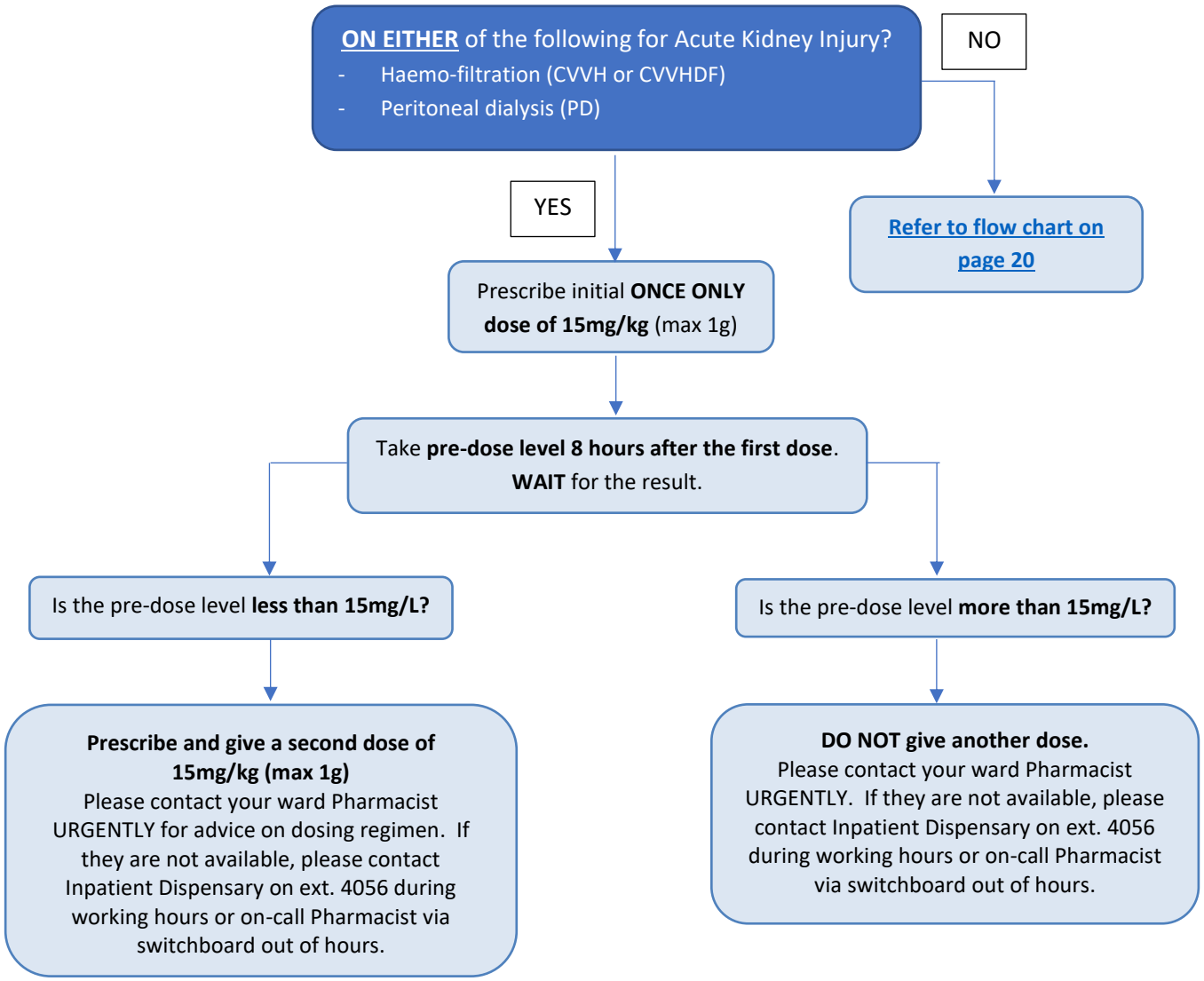


***Target levels**

On the advice of a pharmacist or the Infectious diseases/microbiology team, target levels may be amended to 15-20mg/L for organisms with reduced sensitivity.

VANCOMYCIN FOR PATIENTS ADMITTED TO CRITICAL CARE OVER 44 WEEKS CGA ON DIALYSIS FOR ACUTE KIDNEY INJURY

See page 24 for further monitoring

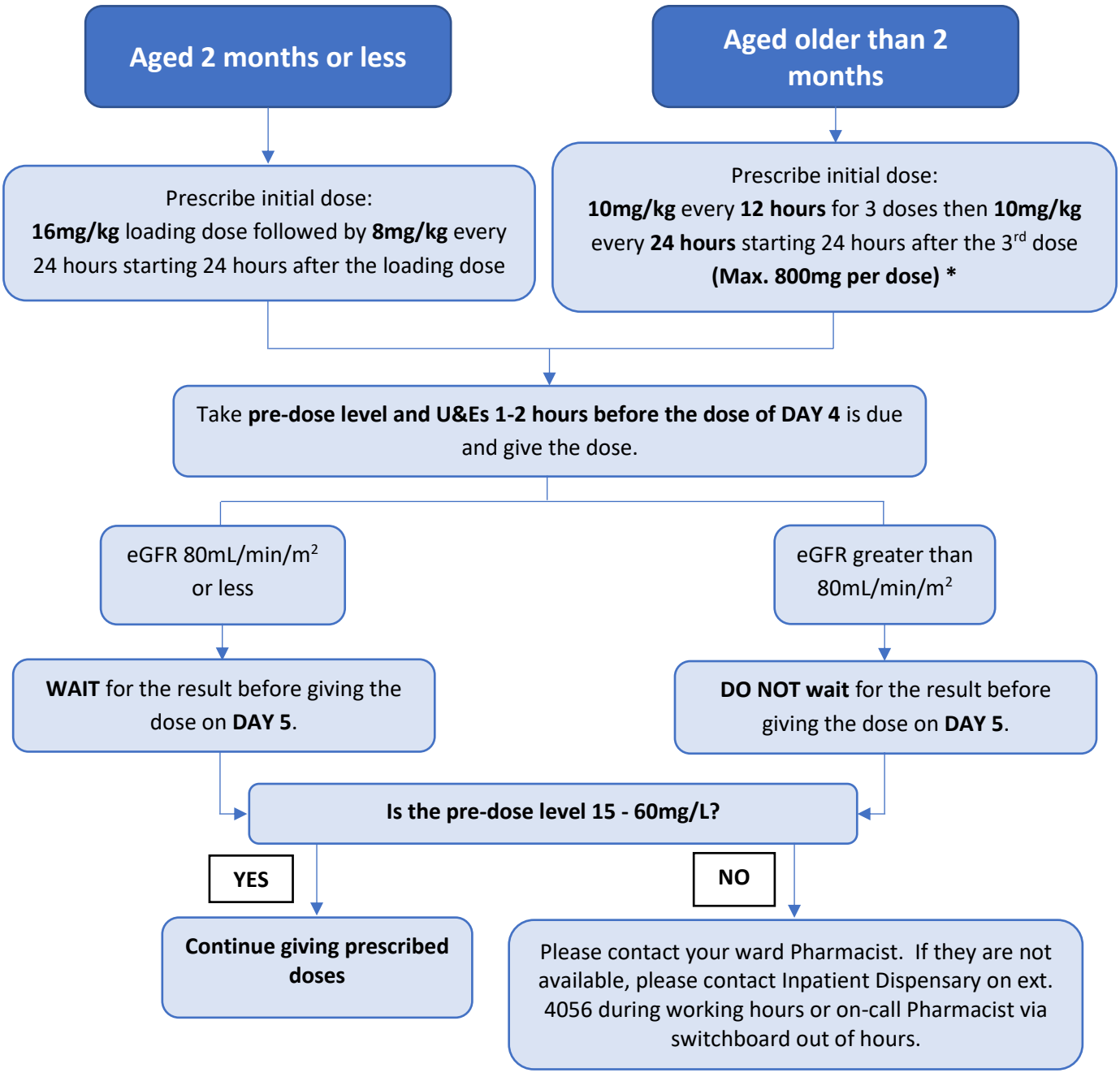


TEICOPLANIN FLOWCHARTS ON CRITICAL CARE

TEICOPLANIN INITIAL DOSING AND SERUM LEVEL MONITORING FOR ALL PATIENTS ON CRITICAL CARE

Critical Care includes PICU and HDU.

See page 24 for further monitoring



Target pre-dose levels may differ depending on indication:

- 15-60mg/L – usual target range
- 20-60mg/L – for deep-seated infections, such as osteomyelitis
- 30-60mg/L – for endocarditis

*Following pre-dose levels doses above 800mg can be used. These require to be given by IV infusion so please refer to Injectable Therapy Guideline

FREQUENCY OF MONITORING FOR ALL PATIENTS

All patients receiving glycopeptides should have:

- Daily monitoring of renal function including: U&Es and fluid balance
- Vancomycin Pre-dose levels as described below
- Teicoplanin Pre-dose levels as described on page 25.

GENERAL MONITORING REQUIREMENTS

Discuss with Nephrology team in the following situations:

- 50% rise in serum creatinine (Acute Kidney Injury (AKI) Stage 1) even if creatinine level is still within normal limits.
- In patients with an AKI alert please follow Trust AKI guidance
- Oliguria (urine output less than 1ml/kg/hr)
- Dose adjustment had led to a disproportionate increase in vancomycin or teicoplanin levels (e.g. 20% dose increase should increase vancomycin or teicoplanin levels by 20%, but if level has increased by 50% this would not be proportional)

VANCOMYCIN

The table below describes how often pre-dose vancomycin levels should be taken, more frequent levels may be needed on the advice of a Pharmacist:

Aged up to 35 weeks corrected gestational age	Before every dose until stable and then every 2 days
Aged 35 to 44 weeks corrected gestational age	Every 2 days
Aged over 44 weeks corrected gestational age with normal renal function	Every 3 days
Aged over 44 weeks corrected gestational age with renal impairment	Before every dose until regimen is established
Patients on continuous infusion	Daily until therapeutic levels established then can be reduced to every 3 days unless directed by a pharmacist

Daily monitoring of vancomycin levels is recommended in the following situations:

- All patients with renal impairment (eGFR < 90ml/min/1.73m^2)
- 25% rise in serum creatinine *(at risk of Acute Kidney Injury)* even if creatinine level is still within normal limits
- Vancomycin doses above 80mg/kg/day or more than 3g/day, whichever is greatest.

Daily monitoring of vancomycin levels should be considered in the following situations:

- Patients prescribed vancomycin alongside at least 1 other drug that can cause nephrotoxicity. See *Table 1 on page 25.*
- Signs of intravascular compromise (including poor cardiac output)
- Dehydration (including due to diarrhoea / vomiting)
- Patient has a low muscle mass.

Discontinuation of vancomycin and alternative therapy should be considered after consultation with the Infectious diseases / Microbiology team if not achieving therapeutic levels despite vancomycin dose being greater than 80mg/kg/day or greater than 3000mg/day.

TEICOPLANIN

The table below describes how often pre-dose teicoplanin levels should be taken, more frequent levels may be needed on the advice of a Pharmacist:

Normal renal function and admitted to Critical Care	Once a week, unless dosing change where a level should be taken on day 4 on new regimen
Impaired renal function	Discuss with Pharmacy

Table 1: Drugs that can cause nephrotoxicity (this list is not exhaustive)

Antibiotics	Amikacin Gentamicin Pentamidine Piperacillin/tazobactam Tobramycin Trimethoprim	**Antifungals / Antivirals**	Amphotericin Aciclovir Cidofovir Ganciclovir Valaciclovir Valganciclovir	**Analgesics**	Celecoxib Parecoxib Ibuprofen Diclofenac
Diuretics	Chlorothiazide Furosemide Spironolactone	**ACE Inhibitors**	Captopril Lisinopril	**Immunosuppressants**	Ciclosporin Tacrolimus
Cytotoxics	Carboplatin Cisplatin Ifosfamide Melphalan Methotrexate				

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Glycopeptide Guideline	
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Date ratified:	23.12.24 (agCA)
Name of originator/author:	Andrew Taylor, Georgina McIntosh, Samiah Awan, Dr Steve McWilliam, Dr Darren Powell, Jordi Saez Dominguez, Louise Simpson, Dr Sally Ogden, Rachel Westhead and Lauren Daniels – Glycopeptide Safety Working Group
Approved by:	Glycopeptide Safety Working Group (v2)
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Version Control Table				
Version	**Date**	**Author(s)**	**Status**	**Comment(s)**
2	Dec 2024	A Taylor	Current	
1	Sep 2024	Glycopeptide Safety Working Group (as above)	Archived	

Review and Revision(s) Log *Record of revision(s) made to documentation since last ratification*			
Section Number	**Page Number**	**Revision(s) made**	**Reason for revision(s)**
	1 + 23	Amendment to title of Teicoplanin in critical care to include "ALL PATIENTS"	Feedback identified missing renal impairment advice
	2	Changed * to x in AdjBW equation Changed "total body weight" to "actual body weight" in line with Meditech nomenclature.	After feedback
	6	Amended maximum dose information. Added Max daily dose and footnote to refer to monitoring requirements.	Clarify information
	8	Added link in introductory paragraph to link to vancomycin HD guidance for separate advice.	After feedback
	10	Added target concentration information	After feedback
	11	Added target concentration information Amended unit to be adjusted from mL/hr to mg/kg/hr	In line with unit used on Meditech prescription
	12-14	Amended advice regarding levels to refer to page 24.	Feedback from wards in line with practice.
	14	Added information to state continuous infusions not appropriate in renal replacement.	After feedback.
	19	Added information regarding maximum daily dose and advice regarding loading dose. Added footnote to refer to monitoring requirements.	After feedback and to add clarity.
	23	Defined what critical care means for teicoplanin advice on critical care. Amended flowchart to include advice regarding those with pre existing renal impairment.	After feedback, noted omission of guidance.
	24	Amended advice for continuous infusion level frequency. Added 3000mg/day to discontinuation advice.	After feedback.