Pediatric and Neonatal Surgical Prophylaxis Guidelines

PURPOSE:

These guidelines are intended to provide practitioners with a standardized approach to the optimal, safe, and effective use of antimicrobial agents for the prevention of surgical site infection based on currently available clinical evidence.

- When placing orders for surgical prophylaxis, the indication should include surgical prophylaxis.
- Patients receiving therapeutic antimicrobials for a remote infection before surgery should **also** be given antimicrobial prophylaxis as described below before surgery to ensure adequate pre-op serum and tissue levels.
- The antimicrobial agent should be started within 60 minutes before surgical incision (120 minutes for vancomycin or fluoroquinolones).
- Acceptable rationale for vancomycin use includes:
    - Cephalosporin allergy. Note: cefazolin has a unique side chain not shared by other penicillins and cephalosporins and may be considered for most beta-lactam allergies.
    - Known colonization or history of infection with MRSA.

• It is recommended to schedule the first post-op dose based on the peri-op administration time and the interval of the post-op antibiotics. For example, initial post-op cefazolin IV q8h dose should be scheduled 8 hours from the last peri-op dose.

DEFINITIONS/ABBREVIATIONS

CrCl: Creatinine clearance
ERCP: Endoscopic retrograde cholangiopancreatography
HENT: Head, ears, nose, throat
IBW: Ideal body weight
ICD: Implantable cardioverter defibrillator
IV: Intravenous
MRSA*:* Methicillin-resistant *Staphylococcus aureus*

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CARDIOTHORACIC					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Cardiothoracic Surgery Cardiac Catheterization	Cefazolin[1]	Cefazolin[1] AND Vancomycin	Aztreonam AND Vancomycin		*Open chest cardiac surgery, including cardiac transplant:* 48 hours post-surgery or 24 hours post sternal closure, whichever is longer *Cardiac catheterization/ balloon/ stent; new pacemaker/ICD/VAD*: 24 hours *Cardiac catheterization without device/balloon, noncardiac thoracic procedures, video-assisted thorascopic surgery, ECMO cannulation:* NONE
[1]If open chest cardiac surgery AND g-tube present, cefazolin should be replaced by cefepime.					

CENTRAL LINE PLACEMENT					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Central line placement (Broviac, port, central venous catheter)	NONE				

GASTROINTESTINAL					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Low risk[2]: elective or laparoscopic procedures	NONE **Note: If patient has VP shunt and is having a low risk GI procedure, follow organ specific recommendations below**				NONE *VP shunt present: 24 hours*
Esophagus Gastroduodenal Hepatobiliary ERCP	**Note: consider no antimicrobials if no entry into the GI tract**				
	Cefazolin	Cefazolin AND Vancomycin	Gentamicin AND Vancomycin		
Laparoscopic Appendectomy	NONE (therapeutic antimicrobials only) **Note: If patient has VP shunt, antimicrobial prophylaxis is recommended. Follow open appendectomy recommendations below.**				

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GASTROINTESTINAL					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Small intestine: non-obstructed	Cefazolin	Cefazolin AND Vancomycin	Gentamicin AND Vancomycin		NONE *VP shunt present: 24 hours*
Small intestine: obstructed Colorectal Open Appendectomy	Cefazolin AND Metronidazole	Cefazolin AND Metronidazole AND Vancomycin	Gentamicin AND Metronidazole AND Vancomycin		
[2]Risk factors that increase infectious complications: emergency procedures, American Society of Anesthesiologists classification of 3 or greater, diabetes, long procedure duration, intra-operative gallbladder rupture, conversion from laparoscopic to open cholecystectomy, episode of colic within 30 days, reintervention in less than one month for noninfectious complication, acute cholecystitis, bile spillage, jaundice, nonfunctioning gallbladder, pregnancy, immunosuppression, and insertion of prosthetic device					
HEAD AND NECK					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Clean procedures (lymph node excisions), clean-contaminated without risk factors[3] (tonsillectomy), or functional endoscopic sinus procedures	NONE				
Clean with placement of prosthetic device or cochlear implant	Cefazolin	Cefazolin AND Vancomycin	Vancomycin		NONE
Clean-contaminated with risk factors[3], orthognathic surgery, palate repair	Ampicillin-sulbactam OR Cefazolin AND Metronidazole	Vancomycin AND either Ampicillin-sulbactam OR Cefazolin AND Metronidazole	Vancomycin AND Gentamicin AND Metronidazole		NONE
[3]Risk factors include past HENT radiation, incision made in the hypopharyngeal mucosa or inferior, free tissue transfer including cartilage graft, exposed airway cartilage and/or concern for blood supply compromise					

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NEUROSURGERY					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
All neurological procedures	Cefazolin	Cefazolin AND Vancomycin	Vancomycin		Not routinely recommended (Maximum 24 hours)
Note: Post-operative prophylaxis is not recommended for external ventricular drains.					

ORTHOPEDIC					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Clean procedures (excluding spine and hip) without implant	NONE **Note: Antimicrobial prophylaxis is not recommended for patients undergoing clean orthopedic procedures, including knee, hand, and foot procedures, arthroscopy, and other procedures without instrumentation or implantation of permanent foreign materials**				
Implantation of permanent internal fixation devices or arthroscopy with implantation of foreign material	Cefazolin	Cefazolin AND Vancomycin	Vancomycin		NONE
Spinal procedures with and without instrumentation Open hip surgery, including hip fracture repair	Cefazolin	Cefazolin AND Vancomycin	Vancomycin		24 hours

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PLASTICS					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Clean	NONE				
Clean-contaminated: non HENT procedure	Cefazolin	Cefazolin AND Vancomycin	Vancomycin AND Gentamicin		NONE
Clean-contaminated HENT procedures with risk factors[4], orthognathic surgery, palate repair	Ampicillin-sulbactam OR Cefazolin AND Metronidazole	Vancomycin AND either Ampicillin-sulbactam OR Cefazolin AND Metronidazole	Vancomycin AND Gentamicin AND Metronidazole		NONE
Placement of prosthesis Insertion of tissue expander Pectus excavatum	Cefazolin	Cefazolin AND Vancomycin	Vancomycin		24 hours

[4]Risk factors include past HENT radiation, incision made in the hypopharyngeal mucosa or inferior, free tissue transfer including cartilage graft, exposed airway cartilage and/or concern for blood supply compromise

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UROLOGIC					
Procedure	**Preferred Regimen**	**MRSA Colonized**	**Cephalosporin Allergy**		**Post-operative Doses**
			Without MRSA Colonization	**With MRSA Colonization**	
Clean without entry into urinary tract	**Note: prophylaxis for Clean procedures is optional – consider incision site & patient factors that increase infection risk**				
	Cefazolin	Cefazolin AND Vancomycin	Vancomycin		NONE
Clean-contaminated without entry into large bowel	Cefazolin	Cefazolin AND Vancomycin	Gentamicin AND Vancomycin		NONE
Clean-contaminated with entry into large bowel	Cefazolin AND Metronidazole	Cefazolin AND Metronidazole AND Vancomycin	Gentamicin AND Metronidazole AND Vancomycin		NONE
Implantation of Prosthetic Device	Cefazolin AND Gentamicin	Gentamicin AND Vancomycin			NONE
Percutaneous upper tract instrumentation	Cefazolin	Cefazolin AND Vancomycin	Gentamicin AND Vancomycin		24 hours
	Note: Add metronidazole if surgeon is obtaining percutaneous access				
Ureteroscopy	Cefazolin	Cefazolin AND Vancomycin	Gentamicin AND Vancomycin		NONE
Lower tract instrumentation	Cefazolin	Cefazolin AND Vancomycin	Gentamicin AND Vancomycin		NONE
	Note: prophylaxis is not recommended unless risk factors are present, such as abnormalities of the urinary tract associated with stasis or abnormal storage pressures, anticipated mucosal disruption, or patient factors that increase infection risk				

PEDIATRIC ANTIMICROBIAL DOSING RECOMMENDATIONS						
Antimicrobial	**Pre-Operative**		**Intra-Operative[1]**	**Post-Operative**		
	Dose	**Maximum dose**	**Dosing Interval**	**Dose**	**Maximum dose**	**Renal Impairment Dose**
Ampicillin-sulbactam[2]	50mg/kg	3g	3h	50mg/kg	3g	CrCl 15-29mL/min: 50mg/kg Q12h CrCl < 15mL/min: 50mg/kg Q24h
Aztreonam	30 mg/kg	2 g	4 h	30 mg/kg IV Q8h	2 g	CrCl 10-29mL/min: 15 mg/kg Q8h CrCl < 10mL/min: 7.5 mg/kg Q12h
Cefazolin	30 mg/kg	≤ 120kg: 2g > 120kg: 3g	3h	30mg/kg IV Q8h	2g	CrCl 10-29mL/min: 30mg/kg Q12h CrCl < 10mL/min: 30mg/kg Q24h
Cefepime	50mg/kg	2g	3h	50mg/kg IV Q12h	2g	CrCl < 50mL/min: 50mg/kg Q24h
Gentamicin[3]	5mg/kg	N/A	N/A	N/A	N/A	N/A
Metronidazole	15mg/kg	500mg	6h	10mg/kg IV Q8h	500mg	No adjustments needed
Vancomycin	15mg/kg	2g	8h	15mg/kg IV Q8h	1.5g	CrCl 30-49mL/min: 15mg/kg Q12h CrCl 10-29mL/min: 15mg/kg Q24h CrCl < 10mL/min: based on serum levels

[1]For patients with major blood loss (>20 mL/kg or 1.5 L), give additional dose ofantibiotic after fluid replacement; give the same dose as the initial/pre-op dose.

[2]Ampicillin-sulbactam is dosed based on the ampicillin component.

[3]Gentamicin dose should be based on actual body weight (ABW) unless ABW is greater than 130% of ideal body weight (IBW), use adjusted body weight (AdjBW); If IBW > ABW, use ABW.

ADDITIONAL PROCEDURES FOR ANTIMICROBIAL SURGICAL PROPHYLAXIS IN NEONATAL PROCEDURES				
Procedure	**Example Procedure**	**Recommended Regimen**	**MRSA Colonized**	**Post-Operative Doses**
Clean	Circumcision Ovarian cyst Neonatal testicular torsion Inguinal hernia	NONE		
	Gastroschisis/omphalocele Operative closure; without sutures	Cefazolin	Cefazolin AND Vancomycin	24 hours
	Silo placement	Cefazolin	Cefazolin AND Vancomycin	24 hours after closure
Clean-contaminated	Biliary tract/choledochal cyst Congenital diaphragmatic hernia	Cefazolin	Cefazolin AND Vancomycin	NONE
Contaminated	Duodenal/jejunal/ileal atresia Esophageal atresia (EA)	Cefazolin	Cefazolin AND Vancomycin	24 hours
	Tracheoesophageal fistula (TEF) repair Ostomy closure	Cefazolin AND Metronidazole	Cefazolin AND Metronidazole AND Vancomycin	24 hours
	Anal repair Hirschsprung disease pull-through Posterior sagittal anorectoplasty (PSARP)	Cefazolin AND Metronidazole	Cefazolin AND Metronidazole AND Vancomycin	72 hours

NEONATAL ANTIMICROBIAL DOSING RECOMMENDATIONS

Antimicrobial	Pre-operative Dosing	Post-operative dosing
Ampicillin/sulbactam	50 mg/kg IV	Gestational age (weeks) / Dose (mg/kg) / Interval (hours) ≤37 / 50 / 12 >37 / 50 / 8
Aztreonam	30 mg/kg IV	Gestational age (weeks) / Post Natal Days / Dose (mg/ kg) / Interval (hours) <34 / ≤7 / 30 / 12 <34 / >7 / 30 / 8 ≥34 / ≤7 / 30 / 8 ≥34 / >7 / 30 / 6
Cefazolin	30mg/kg IV	Weight (kg) / Post Natal Days / Dose (mg/ kg) / Interval (hours) All / ≤7 / 30 / 12 All / >7 / 30 / 8
Gentamicin	5mg/kg IV	Weight (kg) / Post Natal Days / Dose (mg/ kg) / Interval (hours) <1 / ≤14 / 5 / 48 <1 / >14 / 5 / 36 1-2 / ≤7 / 5 / 48 1-2 / >7 / 5 / 36 >2 / ≤7 / 4 / 24 >2 / >7 / 5 / 24
Metronidazole	Weight < 1.2kg: 7.5mg/kg/dose IV Weight ≥ 1.2kg: 15mg/kg IV	PMA (weeks) / Dose (mg/kg) / Interval (hours) <34 / 7.5 / 12 34-40 / 7.5 / 8 >40 / 10 / 8
Vancomycin	15mg/kg IV	PMA (weeks) / Post Natal Days / Dose (mg/ kg) / Interval (hours) ≤29 / 0 to 14 / 15 / 18 ≤29 / >14 / 15 / 12 30 to 36 / 0 to 14 / 15 / 12 30 to 36 / >14 / 15 / 8 37 to <45 / 0 to 7 / 15 / 12 37 to <45 / >7 / 15 / 8

RESOURCES AND REFERENCES

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