Antimicrobial Surgical Prophylaxis

The antimicrobial surgical prophylaxis protocol establishes evidence-based standards for surgical prophylaxis at Nebraska Medicine. The protocol was adapted from the recently published consensus guidelines from the American Society of Health-System Pharmacists (ASHP), Society for Healthcare Epidemiology of America (SHEA), Infectious Disease Society of America (IDSA), and the Surgical Infection Society (SIS) and customized to Nebraska Medicine with the input of the Antimicrobial Stewardship Program in concert with the various surgical groups at the institution. The protocol established here-in will be implemented via standard order sets utilized within One Chart. Routine surgical prophylaxis and current and future surgical order sets are expected to conform to this guidance. **Click here** to jump to antibiotic recommendations for specific surgery types.

Antimicrobial Surgical Prophylaxis Initiation

- **Optimal timing**: Within 60 minutes before surgical incision
  - **Exceptions**: Fluoroquinolones and vancomycin (within 120 minutes before surgical incision)
- Successful prophylaxis necessitates that the antimicrobial agent achieve serum and tissue concentrations above the MIC for probable organisms associated with the specific procedure type at the time of incision as well as for the duration of the procedure.

Renal Dose Adjustment Guidance

The following table can be utilized to determine if adjustments are needed to antimicrobial surgical prophylaxis for both pre-op and post-op dosing.

Table 1 Renal Dosage Adjustment

Antimicrobial	Dosing Regimen with Normal Renal Function	Dosing Regimen with CrCl less than 50 ml/min	Dosing Regimen with CrCl less than 10 ml/min
Ampicillin/Sulbactam	3 g IV q6h	3 g IV q8h (CrCl 30-50) 3 g IV q12h (CrCl <30)	Only administer preop dose 3 g
Aztreonam	2 g IV q 8h	2 g IV q 12h (CrCl <30)	Only administer preop dose 2 g
Cefazolin <120 kg ≥120kg	 2 g IV q8h 3 g IV q8h	 2 g IV q12h 3 g IV q12h	 Only administer preop dose 2 g Only administer preop dose 3 g
Cefoxitin	2 g IV q6h	2 g IV q12h (CrCl <30)	Only administer preop dose 2 g
Clindamycin	900 mg IV 8h	900 mg IV 8h	900 mg IV 8h
Gentamicin ♦ *use actual body weight (ABW) unless the patient is > 20% over their ideal body weight (IBW), then use dosing body weight (DBW=IBW+[0.4(ABW-IBW)]*	Only administer preop dose 5mg/kg IV once	Only administer preop dose 5mg/kg IV once	Only administer preop dose **3mg/kg** IV once
Levofloxacin	500mg IV q24h	Only administer pre-op dose	Only administer pre-op dose
Metronidazole	500 mg IV q8h	500 mg IV q8h	500 mg IV q8h

Trimethoprim / Sulfamethoxazole	Trimethoprim component 160mg IV q12h	Only administer preop dose Trimethoprim 160mg	Only administer preop dose Trimethoprim 160mg
Vancomycin	15mg/kg IV q12h	Only administer preop dose (15mg/kg x 1)	Only administer preop dose (15mg/kg x 1)

¥ Dose adjustments based on renal dosage adjustments in antimicrobial guidebook

Patients Currently Receiving Antimicrobials:

Patients who are currently receiving therapeutic antimicrobials for infections remote to the site of surgery also need surgical prophylaxis to ensure adequate tissue levels at time of surgery. If the spectrum of the therapeutic regimen is appropriate for surgical prophylaxis based on the site of surgery then an additional dose should be given within 60 minutes before surgical incision. Therapeutic agents should be redosed per intra-operative redosing guidance (Table 2). Special attention must be paid to patients on dialysis or with renal failure who are receiving intermittent dosing of therapeutic antimicrobials such as vancomycin and aminoglycosides. Depending on recent doses and drug levels, an additional pre-operative dose may not be necessary. Questions regarding the need for an additional pre-operative dose of these agents should be discussed with the pharmacist.

Allergy to Beta-lactam Antibiotics:

Beta-lactam antimicrobials, including cephalosporins, are the mainstay of surgical antimicrobial prophylaxis and are also the most commonly implicated drugs when allergic reactions occur. Patients should be carefully questioned about their history of antimicrobial allergies to determine whether a true allergy exists before selection of agents for prophylaxis. Alternatives to beta-lactam antimicrobials are based mainly on the antimicrobial activity profiles against predominant procedure-specific organisms and available clinical data. Refer to procedure-specific recommendations for patients with a severe beta-lactam allergy.

Severe penicillin allergy definition:

- Includes Ig-E mediated reactions (anaphylaxis, urticaria, bronchospasm, angioedema) and exfoliative dermatitis (Stevens-Johnson syndrome, toxic epidermal necrolysis)
- These patients should not receive a beta-lactam for surgical prophylaxis

Non-severe penicillin allergy:

- Includes rash and other non-allergic reactions such as GI intolerance
- These patients can safely receive a cephalosporin for surgical prophylaxis

Intraoperative Antimicrobial Readministration Guidelines

In general, antimicrobials should be re-administered at intervals of 1-2 times the half-life of the drug. The following chart can be utilized to determine appropriate re-dosing intervals for antimicrobial surgical prophylaxis.

Note:

- Intraoperative redosing is needed to ensure adequate serum and tissue concentrations of the antimicrobial if the duration of the procedure exceeds two half-lives of the drug (see Table 2) or there is excessive blood loss during the procedure[1]
    - Excessive blood loss classified as >1500mL.
- Redosing interval should be measured from the time of administration of the preoperative dose, not from the beginning of the procedure[1]

Table 2 Intraoperative Redosing Guidance

Antimicrobial	Half-life with Normal Renal Function (h)	Half-life with End-stage Renal Disease (h)	Recommended Redosing Interval in Individuals with NORMAL Renal Function*
Ampicillin/sulbactam	0.8-1.3	unavailable	2 hours
Aztreonam	1.3-2.4	6-8	4 hours
Cefazolin	1.2-2.5	40-70	4 hours

Cefepime	2		4 hours
Cefoxitin	0.5-1.1	6.5-23	2 hours
Ceftriaxone	5.4-10.9		NA
Clindamycin	2-4	3-5	6 hours
Ertapenem	3-5		NA
Gentamicin	2-3	50-70	NA
Levofloxacin	6-8		NA
Meropenem	1-1.5		4 hours
Metronidazole	6-8	7-21; no change	8 hours
Piperacillin/tazobactam	0.7-1.2		2 hours
Trimethoprim/sulfamethoxazole	8-12	20-30	12 hours
Vancomycin	4-6	44.1-406.4	NA

*Recommended redosing intervals marked as "not applicable" (NA) are based on typical case length; for unusually long procedures, redosing may be needed

Alternative dosing strategy (ONLY if needed)

In the event that there is any issue with obtaining a precise and up-to-date weight through use of a scale, the following process should occur in order to prevent the delay of surgical start times.

If there is no documented weight for the current admission, the pharmacist will utilize last weight recorded in patient's inpatient or outpatient chart (if within last 3 months) and make note of the weight used for prophylaxis dose calculation in OneChart. If there is no weight for the current admission **and** no weight can be located in the patient's chart within the last 3 months, then the chart below shall direct dose entry for the surgical prophylaxis regimen.

<table>
<tr><th></th><th colspan="2">Pre-surgery</th><th>Post-surgery</th></tr>
<tr><th>Medication</th><th>No weight recorded in the chart or no recent* weight recorded in the chart</th><th>If urgent surgery necessary and the first option is not feasible</th><th></th></tr>
<tr><td>Cefazolin</td><td>Contact the nurse and ask to have the patient or patient's caregiver estimate his/her weight.
Give 2 grams for patients less than 120kg and give 3 grams for patients greater than or equal to 120kg. For those patients with a reported weight close to the weight cut-off, give 3 grams.</td><td>Use a flat dose of 2 g IV x 1.</td><td>Utilize updated weight for dosing</td></tr>
<tr><td>Gentamicin</td><td>Contact the nurse and ask to have the patient or patient's caregiver estimate his/her weight.
Use the chart below to determine dose:
<table>
<tr><th colspan="2">Weight Range (kg)</th><th>Dose</th></tr>
<tr><td>45</td><td>51</td><td>240</td></tr>
<tr><td>52</td><td>59</td><td>280</td></tr>
<tr><td>60</td><td>67</td><td>320</td></tr>
<tr><td>68</td><td>75</td><td>360</td></tr>
<tr><td>76</td><td>83</td><td>400</td></tr>
<tr><td>84</td><td>91</td><td>440</td></tr>
<tr><td>92</td><td>99</td><td>480</td></tr>
<tr><td>100</td><td>107</td><td>520</td></tr>
</table></td><td>Use flat dose of 300mg IV x 1 for those that are at least 50kg</td><td>No further doses needed for surgical prophylaxis indication</td></tr>
</table>

	108 115 560 116 123 600		
Vancomycin	Contact the nurse and ask to have the patient or patient's caregiver estimate his/her weight.	Use flat dose of **1250mg** IV x 1 for those patients who are at least 50kg	Utilize updated weight for dosing

**Recent is defined as within the past 3 months on an adult patient.*

CLICK HERE TO SEE SURGERY-SPECIFIC PROPHYLAXIS REGIMENS

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Recommendations by Procedure

Procedure	Recommendation
Cardiac: Coronary artery bypass graft (CABG), CABG with valve implant, valve replacement, other cardiac procedures	□ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h Known MRSA colonization: □ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h + vancomycin 15 mg/kg IV q12h x 24h Severe beta-lactam allergy: □ vancomycin 15 mg/kg IV q12h x 24h + gentamicin 5 mg/kg IV once □ vancomycin 15 mg/kg IV q12h x 24h + levofloxacin 750 mg IV once
Cardiac: Pacemaker and cardiac device implants	□ cefazolin 2 g (3 g if greater than 120 kg) IV once Known MRSA colonization: □ cefazolin 2 g (3 g if greater than 120 kg) IV + vancomycin 15 mg/kg IV once Severe beta-lactam allergy: vancomycin 15 mg/kg IV once
Ventricular Assist Device (LVAD/RVAD/BiVAD), Heart Transplant, or Total Artificial Heart	□ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 48h + vancomycin 15 mg/kg IV q12h X 48h Severe beta-lactam allergy: □ vancomycin 15 mg/kg IV q12h x 48h + levofloxacin 750 mg IV q24h X 48h
Orthopedic: Clean procedures of hand, knee, and foot	□ No prophylaxis indicated
Internal fixation of fracture, total joint replacement, any implanted foreign body	□ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h** Known MRSA colonization: □ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h + vancomycin 15 mg/kg IV q12h X 24h** Severe beta-lactam allergy: □ Vancomycin 15 mg/kg IV q12h x 24h** □ Clindamycin 900 mg IV X 24h** **initial infusion should be completed before tourniquet is inflated if used
Neurosurgery: Craniotomy	□ cefazolin 2 g (3 g if greater than 120 kg) IV once Known MRSA colonization: □ cefazolin 2 g (3 g if greater than 120 kg) IV + vancomycin 15 mg/kg IV once Severe beta-lactam allergy: □ Vancomycin 15 mg/kg IV once
Complex craniotomy or placement of prosthetic material (shunts, intrathecal pumps, deep-brain stimulators, etc.)	□ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h Known MRSA colonization:

	☐ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h + vancomycin 15 mg/kg IV q12h x 24h Severe beta-lactam allergy: ☐ Vancomycin 15 mg/kg IV q12h x 24h
Spinal Procedures: Simple (laminectomy, discectomy)	☐ cefazolin 2 g (3 g if greater than 120 kg) IV once Known MRSA colonization: ☐ cefazolin 2 g (3 g if greater than 120 kg) IV once + vancomycin 15 mg/kg IV once Severe beta-lactam allergy: ☐ Vancomycin 15 mg/kg IV q12h once
Complicated procedures or placement of prosthetic material (spinal fusion)	☐ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h Known MRSA colonization: ☐ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h + vancomycin 15 mg/kg IV q12h x 24h Severe beta-lactam allergy: ☐ Vancomycin 15 mg/kg IV q12h x 24h
Thoracic: Non-cardiac	☐ cefazolin 2 g (3 g if greater than 120 kg) IV once Known MRSA colonization: ☐ cefazolin 2 g (3 g if greater than 120 kg) IV once + vancomycin 15 mg/kg IV once Severe beta-lactam allergy: ☐ Vancomycin 15 mg/kg IV once
Vascular: brachiocephalic procedures without prosthetic material, angiogram, vascular stenting, thrombolysis, IVC filter and CVC placement	☐ None
Amputation (lower extremity for ischemia), arterial surgery, graft placement or repair	☐ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h Known MRSA colonization: ☐ cefazolin 2 g (3 g if greater than 120 kg) IV q8h x 24h + vancomycin 15 mg/kg IV q12h X 24h Severe beta-lactam allergy: Vancomycin 15 mg/kg IV q12h x 24h + gentamicin 5 mg/kg IV once
Abdominal: Biliary procedures including high risk laparoscopic cholecystectomy, small bowel surgery, uncomplicated appendicitis, colorectal surgery	☐ cefoxitin 2 g IV once Severe beta-lactam allergy: ☐ Levofloxacin 500 mg IV once + Metronidazole 500 mg IV once
Gastroduodenal: PEG placement, bariatric procedures, gastroduodenal procedures	☐ cefazolin 2 g (3 g if greater than 120 kg) IV once Known MRSA colonization: ☐ cefazolin 2 g (3 g if greater than 120 kg) IV once + vancomycin 15 mg/kg IV once Severe beta-lactam allergy: ☐ Vancomycin 15 mg/kg IV once OR

	□ Clindamycin 900 mg IV + gentamicin 5 mg/kg IV once
General: any implanted foreign body (e.g. hernia patch)	□ cefazolin 2 g (3 g if greater than 120 kg) IV once Known MRSA colonization: □ cefazolin 2 g (3 g if greater than 120 kg) IV once + vancomycin 15 mg/kg IV once Severe beta-lactam allergy: Vancomycin 15 mg/kg IV once
Gynecological: hysterectomy (abdominal, vaginal, or laparoscopic), oncologic procedures not entering the bowel (procedures which involve resection of bowel should use "abdominal")	□ cefazolin 2 g (3 g if greater than 120 kg) IV once Severe beta-lactam allergy: □ clindamycin 900 mg IV + gentamicin 5 mg/kg once
Suction D and C	□ doxycycline 100 mg IV once and 200 mg orally 2 hours after procedure
Urogynecologic procedures	□ clindamycin 900 mg IV + gentamicin 5 mg/kg once
Cesarean section [antibiotics should be administered as for other procedures (within 60 minutes prior to incision); *before* cord clamping]	□ cefazolin 2 g (3 g if greater than 120 kg) IV once □ add azithromycin 500mg for non-elective C-section **only** Severe beta-lactam allergy: □ clindamycin 900 mg IV + gentamicin 5 mg/kg once □ add azithromycin 500mg for non-elective C-section **only**
Head and Neck: Clean procedures (thyroidectomy, etc.)	□ None
Clean with prosthesis placement (neck dissections, parotidetomy)	□ cefazolin 2 g (3 g if greater than 120 kg) IV once Severe beta-lactam allergy: □ clindamycin 900 mg IV once
Clean-contaminated procedures (oropharyngeal mucosa is compromised)	□ cefazolin 2 g (3 g if greater than 120 kg) IV q8h + metronidazole 500 mg IV q8h x24h □ Ampicillin/sulbactam 3g IV q6h x 24h Severe beta-lactam allergy: □ Clindamycin 900 mg IV q8h x 24h
Skull base with dural resection	□ Ceftriaxone 2 g IV q12h + metronidazole 500 mg IV q8h x24h Known MRSA colonization: □ Ceftriaxone 2 g IV q12h + metronidazole 500 mg IV q8h + vancomycin 15 mg/kg IV q12h x 24h Severe beta-lactam allergy: □ Aztreonam 2 g IV q8h + metronidazole 500 mg IV q8h + vancomycin 15 mg/kg IV q12h x 24h

Urologic: Cystoscopy with risk factors for infection or significant manipulation (biopsy, resection, dilation, stent placement, lithotripsy) Trans-rectal Prostate Biopsy	□ Levofloxacin 500 mg PO/IV once □ Ceftriaxone 1g IV once <u>Severe beta-lactam allergy:</u> □ Levofloxacin 500 mg PO/IV once
Urologic: Clean without entry into urinary tract (nephrectomy, radical prostatectomy, prostate brachytherapy) Prosthetic material placed (i.e. penile prosthesis, etc.)	□ cefazolin 2 g (3 g if greater than 120 kg) IV once <u>Severe beta-lactam allergy:</u> □ Vancomycin 15 mg/kg IV once □ cefazolin 2 g (3 g if greater than 120 kg) IV + gentamicin 5 mg/kg once <u>Known MRSA colonization</u>: □ vancomycin 15 mg/kg IV once + gentamicin 5 mg/kg once <u>Severe beta-lactam allergy:</u> □ vancomycin 15 mg/kg IV once + gentamicin 5 mg/kg once
Urologic: Clean contaminated procedures with entry into urinary tract (radical cystectomy, ileal conduit, cystoprostatectomy)	□ cefoxitin 2 g IV once <u>Severe beta-lactam allergy:</u> □ clindamycin 900 mg IV + gentamicin 5 mg/kg once

References:

1. Bratzler DW, Dellinger EP, Olsen KM, et al; American Society of Health-System Pharmacists; Infectious Disease Society of America; Surgical Infection Society; Society for Healthcare Epidemiology of America. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm*. 2013 Feb 1;70(3):195-283. *http://www.idsociety.org/uploadedFiles/IDSA/Guidelines-Patient_Care/PDF_Library/2013%20Surgical%20Prophylaxis%20ASHP,%20IDSA,%20SHEA,%20SIS(1).pdf*
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