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FOR COMMENT

This measure has been developed by the American Society of Anesthesiologists® Core Measure Development Group (CMDG), under the direction of the ASA Committee on Performance and Outcomes Measurement (CPOM).

Please provide your comments related to this draft quality measure on the ASA Quality Improvement website.

The public comment survey will close on **November 22nd at 5pm CT**.

3. Intraoperative Antibiotic Redosing

Measure Description
Percentage of patients, aged 18 years and older, who received preoperative antibiotic prophylaxis within 60 minutes prior to incision and undergo a procedure >2 hours' duration OR experience acute intraoperative blood loss >1500mL who received intraoperative antibiotic redosing at a maximum interval of two half-lives of the selected prophylactic antibiotic or within 15 minutes of acute intraoperative blood loss exceeding 1500 mL until anesthesia end time.

Denominator
All patients, aged 18 years and older, who received preoperative antibiotic prophylaxis within 60 minutes prior to incision and undergo a procedure >2 hours' duration OR experience acute intraoperative blood loss >1500 mL

Denominator Definition:
For the purpose of this measure, preoperative antibiotic prophylaxis includes prophylaxis with the following antimicrobial agents:

- *Ampicillin-sulbactam*
- *Ampicillin*
- *Aztreonam*
- *Cefazolin*
- *Cefuroxime*
- *Cefotaxime*
- *Cefoxitin*
- *Cefotetan*
- *Clindamycin*
- *Piperacillin-tazobactam*

Acute Intraoperative Blood Loss: For the purpose of this measure, acute intraoperative blood loss refers to intraoperative blood loss exceeding 1500 mL in the period between the last dose of antibiotics and the next scheduled re-dose

Denominator Criteria:

All patients, aged 18 years and older,
AND
Patient received antibiotic prophylaxis within 60 minutes prior to incision [REGISTRY CODE]

AND

Procedure >2 hours duration [REGISTRY CODE]

OR

Patient experiences acute intraoperative blood loss exceeding 1500mL [REGISTRY CODE]

AND

Patient encounter during the reporting period (CPT): 00100, 00102, 00103, 00104, 00120, 00124, 00126, 00140, 00142, 00144, 00145, 00147, 00148, 00160, 00162, 00164, 00170, 00172, 00174, 00176, 00190, 00192, 00210, 00211, 00212, 00214, 00215, 00216, 00218, 00220, 00222, 00300, 00320, 00322, 00326, 00350, 00352, 00400, 00402, 00404, 00406, 00410, 00450, 00454, 00470, 00472, 00474, 00500, 00520, 00522, 00524, 00528, 00529, 00530, 00532, 00534, 00537, 00539, 00540, 00541, 00542, 00546, 00548, 00550, 00560, 00561, 00562, 00563, 00566, 00567, 00580, 00600, 00604, 00620, 00625, 00626, 00630, 00632, 00635, 00640, 00670, 00700, 00702, 00730, 00731, 00732, 00750, 00752, 00754, 00756, 00770, 00790, 00792, 00794, 00796, 00797, 00800, 00802, 00811, 00812, 00813, 00820, 00830, 00832, 00834, 00836, 00840, 00842, 00844, 00846, 00848, 00851, 00860, 00862, 00864, 00865, 00866, 00868, 00870, 00872, 00873, 00880, 00882, 00902, 00904, 00906, 00908, 00910, 00912, 00914, 00916, 00918, 00920, 00921, 00922, 00924, 00926, 00928, 00930, 00932, 00934, 00936, 00938, 00940, 00942, 00944, 00948, 00950, 00952, 01112, 01120, 01130, 01140, 01150, 01160, 01170, 01173, 01200, 01202, 01210, 01212, 01214, 01215, 01220, 01230, 01232, 01234, 01250, 01260, 01270, 01272, 01274, 01320, 01340, 01360, 01380, 01382, 01390, 01392, 01400, 01402, 01404, 01420, 01430, 01432, 01440, 01442, 01444, 01462, 01464, 01470, 01472, 01474, 01480, 01482, 01484, 01486, 01490, 01500, 01502, 01520, 01522, 01610, 01620, 01622, 01630, 01634, 01636, 01638, 01650, 01652, 01654, 01656, 01670, 01680, 01710, 01712, 01714, 01716, 01730, 01732, 01740, 01742, 01744, 01756, 01758, 01760, 01770, 01772, 01780, 01782, 01810, 01820, 01829, 01830, 01832, 01840, 01842, 01844, 01850, 01852, 01860, 01916, 01920, 01922, 01924, 01925, 01926, 01930, 01931, 01932, 01933, 01935, 01936, 01951, 01952, 01958, 01960, 01961, 01962, 01963, 01965, 01966, 01967, 01991, 01992, 62263, 62264, 62270, 62272, 62273, 62280, 62281, 62282, 62328, 62329, 62350, 62355, 62360, 62361, 62362, 62365, 62370, 63650, 63661, 63662, 63663, 63664, 63685, 63688, 64400, 64405, 64408, 64415, 64416, 64417, 64418, 64420, 64425, 64430, 64435, 64445, 64446, 64447, 64448, 64449, 64450, 64451, 64454, 64461, 64463, 64479, 64483, 64486, 64487, 64488, 64489, 64490, 64493, 64505, 64510, 64517, 64520, 64530, 64600, 64605, 64610, 64620, 64624, 64625, 64630, 64633, 64635, 64640, 64680, 64681

Denominator Exclusions

- Renal failure
- Procedure duration <2 half-lives of selected prophylactic antibiotic

Denominator Exceptions: None

Numerator

Patients who received intraoperative redosing of prophylactic antibiotics at a maximum interval of two half-lives of the selected prophylactic antibiotic or within 15 minutes of acute intraoperative blood loss exceeding 1500 mL until surgery end time

Numerator Note: If multiple redosing windows pass during a procedure, the recommended redosing window is the maximum amount of time that can pass between any two doses in order to meet this measure

Maximum redosing intervals for included antibiotics are listed below:

- Ampicillin-sulbactam: 2 hours
- Ampicillin: 2 hours
- Aztreonam: 4 hours
- Cefazolin: 4 hours
- Cefuroxime: 4 hours
- Cefotaxime: 3 hours
- Cefoxitin: 2 hours
- Cefotetan: 6 hours
- Clindamycin: 6 hours
- Piperacillin-tazobactam: 2 hours

Numerator Criteria:

- **Performance Met:** Patient received intraoperative redosing of prophylactic antibiotics at a maximum interval of two half-lives of the selected antibiotic or within 15 minutes of acute intraoperative blood loss exceeding 1500 mL until surgery end time
- **Performance Not Met:** Patient did not receive intraoperative redosing of prophylactic antibiotics at a maximum interval of two half-lives of the selected antibiotic or within 15 minutes of acute intraoperative blood loss exceeding 1500 mL until surgery end time

Rationale

While much attention has been focused on antimicrobial stewardship and reducing hospital-acquired infections in recent years, appropriate intraoperative redosing of antibiotics remains an acknowledged area for improvement[i]. Maintaining adequate inhibitory antimicrobial concentrations is an important aspect of infection prevention, with procedure length found to be an independent risk factor for developing surgical site infections[ii]. Evidence in the literature has shown wide variation in compliance published recommendations for intraoperative antibiotics, which can be improved through the implementation of multifaceted quality improvement interventions[iii, iv].

Clinical Recommendation Statements

2013 ASHP /IDSA/SIS/SHEA Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery[v]

"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 antimicrobial or there is excessive blood loss (i.e., >1500 mL). The redosing interval should be measured from the time of administration of the preoperative dose, not from the beginning of the procedure."

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Recommended Doses and Redosing Intervals for Commonly Used Antimicrobials for Surgical Prophylaxis

Antimicrobial	Recommended Dose: Adults[a]	Recommended Dose: Pediatrics[b]	Half-life in Adults With Normal Renal Function, hr[19]	Recommended Redosing Interval (From Initiation of Preoperative Dose), hr[c]
Ampicillin–sulbactam	3 g (ampicillin 2 g/ sulbactam 1 g)	50 mg/kg of the ampicillin component	0.8–1.3	2
Ampicillin	2 g	50 mg/kg	1–1.9	2
Aztreonam	2 g	30 mg/kg	1.3–2.4	4
Cefazolin	2 g, 3 g for pts weighing ≥120 kg	30 mg/kg	1.2–2.2	4
Cefuroxime	1.5 g	50 mg/kg	1–2	4
Cefotaxime	1 g[d]	50 mg/kg	0.9–1.7	3
Cefoxitin	2 g	40 mg/kg	0.7–1.1	2
Cefotetan	2 g	40 mg/kg	2.8–4.6	6
Ceftriaxone	2 g[e]	50–75 mg/kg	5.4–10.9	NA
Ciprofloxacin[f]	400 mg	10 mg/kg	3–7	NA
Clindamycin	900 mg	10 mg/kg	2–4	6
Ertapenem	1 g	15 mg/kg	3–5	NA
Fluconazole	400 mg	6 mg/kg	30	NA
Gentamicin[g]	5 mg/kg based on dosing weight (single dose)	2.5 mg/kg based on dosing weight	2–3	NA
Levofloxacin[f]	500 mg	10 mg/kg	6–8	NA
Metronidazole	500 mg	15 mg/kg Neonates weighing <1200 g should receive a single 7.5-mg/kg dose	6–8	NA
Moxifloxacin[f]	400 mg	10 mg/kg	8–15	NA
Piperacillin–tazobactam	3.375 g	Infants 2–9 mo: 80 mg/ kg of the piperacillin component Children >9 mo and ≤40 kg: 100 mg/kg of the piperacillin component	0.7–1.2	2
Vancomycin	15 mg/kg	15 mg/kg	4–8	NA
Oral antibiotics for colorectal surgery prophylaxis (used in conjunction with a mechanical bowel preparation)				
Erythromycin base	1 g	20 mg/kg	0.8–3	NA
Metronidazole	1 g	15 mg/kg	6–10	NA
Neomycin	1 g	15 mg/kg	2–3 (3% absorbed under normal gastrointestinal conditions)	NA

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[a]Adult doses are obtained from the studies cited in each section. When doses differed between studies, expert opinion used the most-often recommended dose.
[b]The maximum pediatric dose should not exceed the usual adult dose.
[c]For antimicrobials with a short half-life (e.g., cefazolin, cefoxitin) used before long procedures, redosing in the operating room is recommended at an interval of approximately two times the half-life of the agent in patients with normal renal function. Recommended redosing intervals marked as "not applicable" (NA) are based on typical case length; for unusually long procedures, redosing may be needed.
[d]Although FDA-approved package insert labeling indicates 1 g,14 experts recommend 2 g for obese patients.
[e]When used as a single dose in combination with metronidazole for colorectal procedures.
[f]While fluoroquinolones have been associated with an increased risk of tendinitis/tendon rupture in all ages, use of these agents for single-dose prophylaxis is generally safe.
[g]In general, gentamicin for surgical antibiotic prophylaxis should be limited to a single dose given preoperatively. Dosing is based on the patient's actual body weight. If the patient's actual weight is more than 20% above ideal body weight (IBW), the dosing weight (DW) can be determined as follows: DW = IBW + 0.4(actual weight – IBW).

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[i] Caruso TJ, Wang EY, Colletti AA, and Sharek PJ. Intraoperative antibiotic redosing compliance and the extended postoperative recovery period: often overlooked areas that may reduce surgical site infections. *Pediatric Anesthesia.* 2019;29(3):290-291.

[ii] Leong G, Wilson J, Charlett A. Duration of operation as a risk factor for surgical site infection: comparison of English and US data. *J Hosp Infect.* 2006:63;255-262.

[iii] Riggi G, Castillo M, Fernandez M, et al. Improving compliance with timely intraoperative redosing of antimicrobials in surgical prophylaxis. *Infect Control Hosp Epidemiol.* 2014;35(10):1236-1240.

[iv] O'Sullivan CT, Rogers WK, Ackman M, Goto M, Hoff BM. Implementation of a multifaceted program to sustainably improve appropriate intraoperative antibiotic redosing. *Am J Infect Control.* 2019;47(1):74-77.

[v] Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Am J Health Syst Pharm.* 2013;70:195-283.