National Guidelines on the Empiric Antibiotic Treatment of

Intra-abdominal Infections

Version 1- 22 December 2022

Purpose & Scope:

1.1 The National Antimicrobial Stewardship Committee has compiled this guideline on the empiric antibiotic management of intra-abdominal infections (IAIs) to provide healthcare professionals with evidence-based information and recommendations for the antibiotic treatment of IAIs. The guideline is based on the best current clinical evidence, taking into consideration the antimicrobial resistance patterns and trends in the United Arab Emirates (UAE); however, they can never replace clinical expertise when making treatment decisions for individual patients, but rather help to focus decisions. This guideline is subject to revision and will be modified based on changes in international guidelines and UAE's national antibiogram every three years.

1.2 The National Antimicrobial Stewardship Committee strongly recommends either adopting this guideline or developing/amending a facility-based guideline using this document as a reference tool.

1.3 The committee panel is composed of infectious diseases specialists, infection control practitioners, medical intensivists, epidemiologists, public health specialists, microbiologists, clinical pharmacists, and researchers practicing in government, private and academic sectors.

Policy statement:

2.1. These guidelines are applicable to all patients with suspected/confirmed IAI.

Definitions:

3.1 **Uncomplicated intra-abdominal infections:** infections that are limited to a hollow viscus.

3.2 **Complicated intra-abdominal infections**: infections that extend into a normally sterile area of the abdomen, such as the peritoneal cavity, mesentery, retroperitoneum, another abdominal organ, or the abdominal wall.

3.3 **Hospital-Acquired intra-abdominal infections**: Infection developing greater than 48 hours after initial source control.

3.4 **Source control**: encompasses all those physical measures used to control a focus of invasive infection and to restore the optimal function of the affected area.

3.5 **Sepsis**: defined as life-threatening organ dysfunction caused by a dysregulated host response to infection. Organ dysfunction can be represented by an increase in the Sequential (sepsis-related) Organ Failure Assessment (SOFA) score of 2 points or more. The SOFA score and the quick SOFA score are enclosed in Table 1 and 2

Abbreviations:

1.1 **ASP:** Antibiotic Stewardship Program.

1.2 **CRE:** Carbapenem-resistant enterobacterales.

1.3 **CT**: Computerized tomography

1.4 **E. coli :** Escherichia coli

1.5 **EMR:** Electronic Medical Record.

1.6 **ERCP:** Endoscopic Retrograde Cholangiopancreatography.

1.7 **ESBL:** extended spectrum beta-lactamase.

1.8 **FQ:** Fluoroquinolones.

1.9 **GI:** gastrointestinal.

1.10 **Gm:** grams.

1.11 **HAIs:** Healthcare Associated Infections.

1.12 **IAIs:** Intra-abdominal Infections.

1.13 **ID :** Infectious Disease

1.14 **IT:** Information technology.

1.15 **IV:** Intravenous.

1.16 **Mg:** milligrams.

1.17 **MDR-GNR:** Multidrug resistant gram-negative rods.

1.18 **MPI**: Mannheim Peritoneal Index.

1.19 **MRSA:** Methicillin-resistant Staphylococcus aureus.

1.20 **PCN:** Penicillin.

1.21 **PK-PD:** Pharmacokinetics/Pharmacodynamics.

1.22 **PO:** per oral.

1.23 **SBP:** Spontaneous Bacterial Peritonitis.

1.24 **VRE:** Vancomycin Resistant Enterococci.

Procedure and responsibility:

1.25 The cornerstones of effective treatment of IAIs include early recognition, adequate source control, appropriate antimicrobial therapy, and prompt physiologic stabilization using a critical care environment, combined with an optimal surgical approach. This

document does not aim at clinical presentation, diagnosis or other aspects of management of these patients.

	Procedure sequence	Responsibilities
5.1	Patients with suspected/confirmed IAI should be assessed for the risk of an adverse outcome which is important in the selection of an appropriate antimicrobial regimen. In addition to SOFA Score, there are also patient related factors that can adversely affect outcome. These are listed in Table 3	**Physician**
5.2	Appropriate source control is of utmost importance in the management of IAIs, and can improve patients' outcomes. Moreover, an adequate source control can also shorten the course of antibiotic therapy. There is consensus that without adequate source control, antibiotic therapy may have little if any effect. An operative intervention remains the most viable therapeutic strategy for managing surgical infections in critically ill patients.	**Physician**
5.3	Patients with IAIs should be assessed for the risk of MDR-GNR especially in HAIs and antimicrobial regimen is modified accordingly. Risk factors for MDR-GNR include: • Prior colonization with MDR-GNR • Current hospitalization for more than 48 hours • Recent hospitalization for more than 48 hours in the past 90 days • Recent antibiotics in the past 90 days • Immunocompromised (Table 4) • Presence of indwelling device For the most part, empiric regimens for complicated community acquired overlap therapy for HAIs, but the latter category may also require managing increasingly resistant organisms including CRE, VRE, etc. For these cases, consultation with an Infectious Diseases consultant or other specialists with knowledge or experience in this is encouraged.	**Physician**
4.4	These Guidelines may need to be modified in individual institutions based on local antibiogram.	**Hospital ASP Committee**
4.5	Education of Healthcare providers, dissemination of guidelines and providing easy access to all stakeholders would be necessary in each healthcare facility. This may be accomplished by integration in EMR , links with order sets or available on physician desk tops etc.	**Hospital ASP Committee/IT department**
4.6	Once implemented, compliance and adherence to these guidelines may need outcome measures or other clinical Indicators to be designed and followed.	**Hospital ASP Committee**

Principles of Antibiotic Management in IAI:

A rational and appropriate use of antibiotics is particularly important both to optimize quality clinical care and to reduce selection pressure on resistant pathogens.

1.26 Empiric antibiotic should be initiated as soon as a treatable surgical infection has been recognized, because microbiologic data may not be available for up to 48–72 h to guide targeted therapy.

1.27 Empiric antibiotic therapy for patients with IAI should include agents with activity against aerobic gram-negative bacteria (e.g., enterobacterales), aerobic streptococci, and obligate anaerobic enteric organisms. Coverage of anaerobes is not necessary in most patients with an upper gastrointestinal source of infection.

1.28 Empiric antibiotic therapy should be chosen on the basis of local epidemiology, individual patient risk factors for MDR bacteria and *Candida* spp., clinical severity, and infection source. Most community acquired infections would fall in a low-risk category, but for high risk patients coverage for MDR organisms would be needed.

1.29 Empiric antibiotic therapy should be narrowed once culture and susceptibility results are available and adequate clinical improvement is noted. The appropriateness and need for antimicrobial treatment should be re-assessed daily.

1.30 Empiric anti-enterococcal therapy is recommended for patients with health care-associated intra-abdominal infection, particularly those with postoperative infection, those who have previously received cephalosporins or other antimicrobial agents selecting for Enterococcus species, immunocompromised patients, and those with valvular heart disease or prosthetic intravascular materials.

1.31 Empirical antifungal therapy for *Candida* spp. is typically not recommended for patients with community-acquired IAIs. Consider using empiric antifungal therapy in patients who are critically ill, immunocompromised , neutropenic or on concurrent administration of immunosuppressive agents (such as glucocorticosteroids, chemotherapeutic agents, and immunomodulators).

1.32 In recent years, the resistance of *E. coli* to FQ has risen over time. The increase in FQ resistance among *E. coli* and other Enterobacterales has limited the use of FQ for empirical treatment of IAIs.

1.33 The antibiotic dose should be optimized to ensure that PK-PD targets are achieved. This involves prescribing an adequate dose, according to the most appropriate and right method and schedule to maximize the probability of target attainment. For all patients in septic shock, where possible use adequate loading doses and/or continuous Infusions.

1.34 Once source control is established, short courses of antibiotic therapy are as effective as longer courses regardless of signs of inflammation.

1.34.1 Intra-abdominal infection—4 days are as effective as 8 days in moderately ill patients.

1.34.2 Blood stream infection—5 to 7 days are as effective as 7 to 21 days for most patients. Exceptions include patients with :

1.34.2.1 Persistent bacteremia.
1.34.2.2 Hemodynamic Instability or ongoing signs of inflammation.
1.34.2.3 Neutropenia.
1.34.2.4 Polymicrobial or *Pseudomonas* bacteremia or *Staphylococcus aureus* bacteremia.

1.35 Patients who have ongoing signs of infection or systemic illness beyond 5–7 days of antibiotic treatment normally warrant a diagnostic investigation to determine whether additional surgical intervention or percutaneous drainage is necessary.

1.36 Intraperitoneal specimens for microbiological evaluation from the site of infection are always recommended for patients with hospital-acquired IAIs or with community-acquired IAIs at risk for resistant pathogens and in critically ill patients

1.37 Step down from intravenous to oral therapy should be considered if:

1.37.1 Patient can tolerate oral medications
1.37.2 Improving clinical condition
1.37.3 Susceptibilities (if available) do not demonstrate resistance
1.37.4 The agent is highly bioavailable with demonstrated high concentration at the site of infection

1.38 Patients with low/medium-risk allergy to penicillins and cephalosporins other than cefepime, ceftriaxone, cefpodoxime, and cefotaxime can receive cefepime. For high-risk allergy, other options are provided.

Appendix 1- Acute Appendicitis

Acute Appendicitis		
First Line Therapy	**PCN Allergy**	**Duration/ Comments**
Community Acquired/ No Sepsis/Septic Shock		
Ceftriaxone 2 gm IV daily **+** Metronidazole 500 mg IV every 8 hours	Ciprofloxacin 400 mg IV every 12 hours **+** Metronidazole 500 mg IV every 8 hours	<u>Non-perforated:</u> Discontinue after appendectomy. <u>Perforated:</u> 4 full days after source control. <u>No appendectomy:</u> 10-day duration. See comment 6.2.
Community Acquired with Sepsis/Septic Shock or MDR-GNR Risk		
Piperacillin-tazobactam 4.5 gm loading dose , then 3.375 gms IV every 6 hours +/- Aminoglycoside **OR** Meropenem 1-2 gms IV every 8 hours **+/-** Vancomycin (if hospital acquired infection)	**Low/medium-risk PCN allergy** Cefepime 2 gm IV every 8 hours **+** Metronidazole 500 mg IV every 8 hours **+/-** Vancomycin **High-risk allergy/contraindication to beta-lactams** Aztreonam 2 gm IV every 8 hours **+** Metronidazole 500 mg IV every 8 hours **+/-** Vancomycin	Total Duration 7-14 days. Consider f Piperacillin -tazobactam 4.5 gm IV q6 hours OR continuous Infusion if Pseudomonas suspected. Adjust antibiotics based on organism and susceptibilities See Comment 6.3. See Comment 6.5 regarding enterococcal coverage.
Oral Step Down Therapy		
Amoxicillin-clavulanic acid 1gm PO every 12 hours **OR** Cefuroxime 500 mg PO every 12 hours **+** Metronidazole 500 mg PO every 8 hours	Ciprofloxacin 500 mg PO every 12 hours **+** Metronidazole 500 mg PO every 8 hours	See comment 6.7, 6.12.

Appendix 2- Acute Cholecystitis, Cholangitis

Acute Cholecystitis, Cholangitis		
First Line Therapy	**PCN Allergy**	**Duration / Comments**
Community Acquired/ No Sepsis/Septic Shock		
Ceftriaxone 2 gm IV daily **+** Metronidazole 500 mg IV every 8 hours	Ciprofloxacin 400 mg IV every 12 hours **+** Metronidazole 500 mg IV every 8 hours	In uncomplicated cholecystitis, single doses have the same impact as multiple doses.(ref 11.) Post-operative antibiotic therapy is not necessary if source control is adequate. See comment 6.2.
Community Acquired with Sepsis/Septic Shock, Healthcare Acquired or Risk of MDR		
Piperacillin-tazobactam 4.5 gm IV loading dose, followed by 3.375 gms every 6 hours +/- Aminoglycoside **OR** Meropenem 1-2 gm IV every 8 hours **+/-** Vancomycin (if HAI)	**Low Risk PCN Allergy:** Same as above **High Risk PCN Allergy:** Vancomycin + Aztreonam 2 gm IV every 8 hours + Metronidazole 500 mg PO/IV every 8 hours (If available)	Consider 4.5 gm IV every 6 hours or continuous Infusion if suspected Pseudomonas Total Duration 7-14 days. Successful ERCP: 4 days post-procedure. Most cases of cholangitis need empiric treatment for MDR, see comment 6.3. Adjust antibiotics based on organism and susceptibilities. Extend duration of antibiotics if there is inadequate source control, or ongoing inflammation. See comment 6.10
Oral Step Down Therapy		
Amoxicillin-clavulanic acid 1 gm PO every 12 hours **OR** Cefuroxime 500 mg PO every 12 hours **+** Metronidazole 500 mg PO every 8 hours	Ciprofloxacin 500 mg PO every 12 hours **+** Metronidazole 500 mg PO every 8 hours	Adjust antibiotics based on organism and susceptibilities

Appendix 3 - Acute Diverticulitis

Acute Diverticulitis		
First Line Therapy	**PCN Allergy**	**Duration/ Comments**
Uncomplicated Diverticulitis		
Observe without antibiotics	N/A	If no fever or leukocytosis, immunocompetent, CT findings consistent with acute uncomplicated diverticulitis
Uncomplicated Diverticulitis, Not meeting criteria for Observation		
Ceftriaxone 2 gm IV daily **+** Metronidazole 500 mg IV every 8 hours	Ciprofloxacin 400 mg IV every 12 hours **+** Metronidazole 500 mg IV every 8 hours	If patient is a candidate for antibiotic therapy: 5-7 days (including all IV and PO doses)
Complicated Diverticulitis(abscess, perforation, shock)		
See secondary peritonitis		

Appendix 4 - Esophageal Perforation

Esophageal Perforation		
First Line Therapy	**PCN Allergy**	**Duration /Comments**
Piperacillin-tazobactam4.5 gm IV loading dose followed by 3.375 gms IV every 6 hours **+** Fluconazole 800 mg once , then 400 mg every 24 hours	**Low Risk PCN Allergy:** Cefepime 2 gm IV every 8 hours **+** Metronidazole 500 mg PO/IV every 8 hours **+** Fluconazole* 800 mg once, then 400 mg every 24 hours **High-risk allergy/contraindication to beta-lactams:** Vancomycin **+** Aztreonam 2 gm IV every 8 hours + Metronidazole 500 mg PO/IV every 8 hours + Fluconazole 800 mg once, then 400 mg every 24 hours	ID consultation is highly recommended. Duration of therapy dependents on adequate source control, and clinical picture. In patients with candidemia or who are in septic shock, fluconazole should be substituted with available Echinocandin

Appendix 5 - Spontaneous Bacterial Peritonitis (SBP)

Spontaneous Bacterial Peritonitis (SBP)		
First Line therapy	**PCN Allergy**	**Duration / Comments**
Ceftriaxone 2gms IV q24 hours	Ciprofloxacin 400 mg IV q8	Total duration 5-7 days
Oral Step Down Therapy		
Amoxicillin-clavulanic acid 1gm PO every 12 hours **OR** Cefuroxime 500 mg PO every 12 hours **+** Metronidazole 500 mg PO every 8 hours	**Low /medium risk PNC allergy:** Cefuroxime 500 mg PO every 12 hours **High Risk PNC allergy:** Ciprofloxacin 500 mg PO every 12 hours	Total duration 5-7 days
Prophylaxis of Primary Peritonitis (Cirrhosis and GI bleed)		
Ceftriaxone 1 gm IV every 24 hours	**High-risk allergy/contraindication to beta-lactams receiving fluoroquinolone prophylaxis:** Aztreonam* 1 gm IV every 8 hours + Vancomycin* **High-risk allergy/contraindication to beta-lactams NOT receiving fluoroquinolone prophylaxis:** Ciprofloxacin* 400 mg IV every 12 hours	SBP Prophylaxis is warranted in patients with prior SBP (secondary prophylaxis). SBP Prophylaxis may be warranted in the following situations: • Ascetic protein levels <1.5 g/dL • Diuretic-refractory ascites (requires paracentesis) • Child-Pugh C liver cirrhosis
Oral Step Down Therapy		
Amoxicillin-clavulanic acid 1gm PO every 12 hours	**Low/ Medium Risk PNC allergy:** Cefuroxime 250 mg PO every 12 hours **OR** Cefpodoxime 200 mg PO once daily **High-risk allergy/contraindication to beta-lactams** Ciprofloxacin 500 mg PO daily	Oral step-down is appropriate for the following population: • Patients who are hemodynamically stable • bleeding is controlled (no further procedures or transfusions needed in past 24 hours) after 48 hours of prophylaxis

Appendix 6 - Secondary Peritonitis

Secondary Peritonitis (Infection associated with perforation or spillage of GI pathogens into the peritoneal cavity)		
First Line Therapy	**PCN Allergy**	**Duration/ Comments**
Community Acquired, No Sepsis/Septic Shock		
Ceftriaxone 2 gm IV daily **+** Metronidazole 500 mg IV every 8 hours	**High-risk allergy/contraindications to beta-lactams:** Ciprofloxacin 400 mg IV every 12 hours **+** Metronidazole 500 mg IV every 8 hours **OR** Moxifloxacin 400 mg IV daily	4 days after adequate source control -Longer duration if 1. Inadequate source control 2. Persistent signs and symptoms of sepsis
Community Acquired with Sepsis/Septic Shock or MDR-GNR Risk (High Risk):		
Piperacillin-tazobactam loading dose 4.5 gm IV followed by 3.375 gms every 6 hours +/- Aminoglycoside If Risk for ESBL: Ertapenem 1 gm IV daily If ESBL + Shock: Meropenem 1-2 gm IV every 8 hours	**Low/ Medium Risk PNC allergy:** Cefepime 2 gm IV every 8 hours **+** Metronidazole 500 mg IV every 8 hours **+/-** Vancomycin if patient is critically ill or has risk factors for enterococcus **High-risk allergy/contraindications to beta-lactams:** Aztreonam 2 gm IV every 8 hours **+** Metronidazole 500 mg PO/IV every 8 hours **+/-** Vancomycin (if suspected HAI)	Consider piperacillin -tazobactam 4.5 gm IV every 6 hours if suspected Pseudomonas OR continuous Infusion for septic shock See comment 6.3 Empiric coverage for Candida is not recommended Empiric antimicrobial coverage for VRE is not recommended except in critically ill liver transplant recipients, patients with a previous history of VRE intra-abdominal infection, or patients with septic shock who are colonized with VRE. Evaluate clinically for total duration, generally 7- 14 days. If bacteremic , see comment 6.9 For possible or confirmed CRE, consult ID
Oral Step Down Therapy		
Amoxicillin-clavulanic acid 1gm PO every 12 hours **OR** Cefuroxime 500 mg PO every 12 hours **+** Metronidazole 500 mg PO every 8 hours	Moxifloxacin 400 mg PO daily **OR** Ciprofloxacin 500 mg PO every 12 hours **+** Metronidazole 500 mg PO every 8 hours	

Appendix 7 - Tertiary Peritonitis

Tertiary Peritonitis (Persistent infection associated with recurring GI perforation and/or anastomotic leakage after initial treatment for secondary peritonitis)		
First Line Therapy	**PCN Allergy**	**Duration/ Comments**
Piperacillin-tazobactam 3.375 gm IV every 6 hours If Risk for ESBL: Ertapenem 1 gm IV daily If ESBL + Shock: Meropenem 1 gm IV every 8 hours **+/-** Aminoglycoside	**Low/ Medium Risk PNC allergy:** Cefepime 2 gms IV every 8 hours **+** Metronidazole 500 mg IV every 8 hours **+/-** Vancomycin if patient is critically ill or has risk factors for enterococcus **OR** **High-risk allergy/contraindications to beta-lactams:** Aztreonam 2 gm IV every 8 hours **+** Metronidazole 500 mg PO/IV every 8 hours **+/-** Vancomycin(if HAI or risk factors for enterococcus)	Adjust therapy according to prior cultures and severity of presentation (especially presence of severe sepsis/shock). Both factors may dictate alternative empiric therapies from the above Pre-existing drains are often colonized and should not be cultured. Empiric MRSA coverage: should only be provided to patients with post-operative peritonitis who are known to be colonized with MRSA and discontinued if MRSA is not recovered in culture Empiric Candida coverage: should be considered Fluconazole 800 mg once, then 400 mg IV/PO daily (or Echinocandin if candidemic or in shock) can be considered empirically but should be discontinued if Candida is not identified on culture. For enterococcal coverage see comment 6.5
Oral Step-Down therapy		
Same as for complicated secondary peritonitis	Same as for complicated secondary peritonitis	

Appendix 8 - Acute Pancreatitis

Acute Pancreatitis		
First Line Therapy	**PCN Allergy**	**Duration/ Comments**
Acute Pancreatitis without necrosis or Abscess		
Antibiotic not recommended		
Acute Necrotizing Pancreatitis with Sterile Necrosis		
Antibiotic not recommended		
Acute Necrotizing Pancreatitis in patients with hemodynamic instability OR Suspected Infected Pancreatic Necrosis		
Piperacillin-tazobactam 3.375 gm IV every 6 hours	**Low/ Medium Risk PNC allergy:** Cefepime 2 gms IV every 8 hours **+** Metronidazole 500 mg IV every 8 hours **+/-** Vancomycin if patient is critically ill or has risk factors for enterococcus **High-risk allergy/contraindication to beta-lactams** Ciprofloxacin 400 mg IV every 12 hours **+** Metronidazole 500 mg IV every 8 hours **OR** Aztreonam 2 gm IV every 8 hours **+** Metronidazole 500 mg IV every 8 hours	Confirmation of infected pancreatic necrosis shall be sought whenever possible by fine-needle aspiration or drainage procedure Infected Pancreatic necrosis shall be suspected in patients with worsening clinical condition and/or signs of infection (e.g. increasing leukocytosis, fever) or CT imaging demonstrating presence of gas within necrosis. Highest risk if previous occurs after 7-10 days of conservative therapy. After debridement, consider addition of empiric fluconazole for Candida coverage. Fluconazole should be discontinued if Candida spp is not isolated from fluid, tissue or blood cultures. For enterococcal coverage, see comment 6.5
Acute Necrotizing Pancreatitis with Proven Infection		
As Above	As above	Duration of treatment depends on timing of operative debridement, percutaneous drainage, radiographic resolution of infected fluid collection or necrosis, and improvement in clinical signs and symptoms of infection

Tools/Attachments Forms:

Table 1: sequential Organ failure Assessment Score

Variables	SOFA Score				
	0	1	2	3	4
Respiratory	PaO_2/FiO_2: > 400 SpO_2/FiO_2: > 302	PaO_2/FiO_2: < 400 SpO_2/FiO_2: < 302	PaO_2/FiO_2: < 300 SpO_2/FiO_2: < 221	PaO_2/FiO_2: < 200 SpO_2/FiO_2: < 142	PaO_2/FiO_2: < 100 SpO_2/FiO_2: < 67
Cardiovascular (doses in mcg/kg/min)	MAP ≥ 70 mm Hg	MAP ≥ 70 mm Hg	Dopamine ≤ 5 or ANY dobutamine	Dopamine > 5 Norepinephrine ≤ 0.1 Phenylephrine ≤ 0.8	Dopamine >15 or Norepinephrine > 0.1 Phenylephrine > 0.8
Liver (bilirubin, mg/dL)	< 1.2	1.2-1.9	2.0-5.9	6.0-11.9	> 12
Renal (creatinine, mg/dL)	< 1.2	1.2-1.9	2.0-3.4	3.5-4.9	> 5.0
Coagulation (platelets x $10^3/mm^3$)	≥ 150	< 150	< 100	< 50	< 20
Neurologic (GCS score)	15	13-14	10-12	6-9	< 6

According to Sepsis-3, a new (or presumed new) increase in SOFA score above baseline in the presence of infection makes the diagnosis of sepsis. Increasing SOFA scores are associated with incremental increases in mortality.

Abbreviations: GCS, Glasgow coma scale; FiO_2, fraction of inspired oxygen; MAP, mean arterial pressure; PaO_2, arterial oxygen pressure; SOFA, sequential organ failure assessment (score); SpO_2, oxygen saturation.

From: [WSES/GAIS/SIS-E/WSIS/AAST global clinical pathways for patients with intra-abdominal infections]

Table 2 Quick Sofa Score (qSOFA)

Score > 1 indicates sepsis
From *Annals of palliative medicine, 9 3*, 1037-1044.

Assessment	qSOFA score
Low blood pressure (SBP ≤100 mmHg)	1
High respiratory rate (≥22 breaths/min)	1
Altered mentation (GCS ≤14)	1

Table 3 Risk Factors for Severe IAIs

Baseline characteristics	Infection Related	Epidemiological background
• Age > 70 years • Diabetes mellitus (DM) • Charlson comorbidity index ≥ 3 • Use of corticosteroids • Immunosuppression • Trauma • Malignancy • Organ transplantation • Chronic obstructive pulmonary disease (COPD) • Neutropenia • Recent surgery • Significant cardiovascular compromise • Significant liver disease or cirrhosis • Significant renal disease • Hypoalbuminemia	• Diffuse, generalized peritonitis • High MPI • Delayed initial source control • Inability to achieve adequate source control	• Prior hospital admission (in last 12 months) • Prolonged hospitalization • Transfer from other healthcare facility • Current or prior admission • Local epidemiology, outbreak • Travel from high endemic area with antimicrobial resistance
Recent < 3months) antibiotic therapy	**Prior colonization**	**Indwelling devices**
• Recent aminopenicillins • Recent cephalosporins • Recent carbapenems • Recent aminoglycosides	• Gut colonization with ESBL • Gut colonization with CRE • Gut colonization with MRSA • Colonization with Acinetobacter spp. • Endotracheal colonization with Pseudomonas aeruginosa	• Urinary catheter • Gastrostomy or jejunostomy • Nasogastric tube • Central venous catheter • Mechanical ventilation • Hemodialysis

Table 4 Spectrum of immune compromise

Significantly immunocompromising conditions include:
Hematopoietic stem cell transplant (HCT) within the past two years
Solid organ transplant (SOT) within the past year
Treatment for rejection after SOT
Active leukemia or lymphoma
Generalized malignancy
Aplastic anemia
Graft-versus-host disease
Congenital immunodeficiency
Recent radiation therapy
Significantly immunosuppressive medications
AIDS with low CD4 count
Moderately immunocompromising conditions include:
Chronic hepatic disease (cirrhosis and alcoholism)
Chronic renal disease
Diabetes
Asplenia
Nutritional deficiencies (depending on the nature of the deficiency)
Minimally immunocompromising conditions include:
Chemotherapy for leukemia/lymphoma or cancer more than three months earlier
Malignancy in remission
High-dose steroid use more than a month earlier
Mild steroid use including inhaled, topical, intraarticular, bursal, or tendon injection
HIV with >500 CD4 lymphocytes/mm^3
HCT recipients more than two years post-transplant who are not on immunosuppressive drugs and do not have graft-versus-host disease

Modified from: Kotton CN, et al. Immunocompromised Travelers. In: CDC Health Information for International Travel 2016: The Yellow Book.

Key performance Indicators:

The infection prevention and control measures combined with antimicrobial stewardship programs should be implemented in surgical departments. These interventions and programs require regular, systematic monitoring to assess compliance and efficacy.
Monitoring of antibiotic consumption should be implemented, and feedback provided to all ASP team members regularly (e.g., every 3 to 6 months) along with resistance surveillance data and outcome measures.

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