**Supplemental Figure 1.** Example of hypothetical hospital-onset bacteremia and fungemia (HOB) case scenario developed and presented using a standard format, for expert panel review and preventability rating.

**Supplemental Figure 2**. Distribution of preventability ratings for hospital-onset bacteremia and fungemia (HOB) given for an example scenario (a) and the rater’s individual preventability rating for that scenario (b).

**Supplemental Figure 3**. 4a. Distribution of reviewer preventability scores for all hypothetical hospital-onset bacteremia and fungemia (HOB) scenarios (n=82) following the first round of rating.

4b. Distribution of reviewer preventability scores for all hypothetical HOB scenarios following the second round of rating.

**Supplemental Appendix**. Hospital-onset bacteremia and fungemia rating guide

|  |  |  |
| --- | --- | --- |
| ***Underlying Acute and Chronic conditions guide for assigning intrinsic (patient- related) risk of hospital-onset bacteremia and fungemia***  **Note:**   1. **In patients with multiple conditions, use the highest risk condition to assign intrinsic risk** 2. **The risk for hospital-onset bacteremia is closely related to suspected source of bacteremia, and this should be considered where relevant (see comments section in table below). Unless specifically stated in the comments section, risk applies to most organisms.** 3. **If a patient has multiple “medium” risk conditions, the overall risk for bacteremia may be considered “high”** 4. **If a patient is admitted with a severe or high-risk condition that is improving prior to index bacteremia, the risk rating should be lowered accordingly. e.g., Admitted with shock but resolved or improved in days prior to bacteremia** 5. **From a healthcare quality perspective, greater emphasis is placed on extrinsic preventability than intrinsic risk. Therefore, if clearly preventable conditions are identified as underlying causes of bacteremia/fungemia (see common examples below), intrinsic risk rating should be defaulted to “low” in most cases, or “medium” in very sick patients. Examples include:**    * **Bacteremia following high risk procedures or surgery where antibiotic prophylaxis is indicated and was not administered e.g., ERCP with bile duct obstruction**    * **Bacteremia following “clean” procedure requiring strict asepsis and no known infection at the site e.g., chest tube placement in the absence of empyema, cardiac catheterization, biopsy, arthroscopy etc.**    * **Contaminated blood culture in the absence of overt skin condition**    * **Contaminated blood culture when a blood culture was not clearly indicated or necessary**    * **Decubitus ulcer that developed or worsened during hospital stay**    * **Definite delay in appropriate care, recognition or timely diagnosis, or management e.g., antimicrobial therapy, surgery, drainage etc.**    * **Delay in removal of indwelling urinary catheter or intravascular catheter that could have been removed sooner**    * **Inappropriate antimicrobial therapy i.e., not covering the organism or site of infection**    * **Intervention or procedure required for other healthcare associated harm e.g., surgery for fall in the hospital**    * **Issues identified with vascular catheter maintenance e.g., poor dressing integrity**    * **Traumatic urinary catheterization** | | |
| **Patient Characteristic** | **Intrinsic risk of bacteremia/fungemia** | |
| **A. Acute illness during current admission** | | |
| **Condition** | **Intrinsic Risk** | **Source(s)/Organism(s) where this risk applies; risk applies to most sources and organisms**  **unless otherwise stated** |
| **Active immunosuppressive therapy** | Medium-High |  |

|  |  |  |
| --- | --- | --- |
| **Active IVDU, patient possibly self-injecting** | High |  |
| **Active IV drug use** | Medium-High (high if evidence for ongoing use/IV line access in  hospital) |  |
| **Active malignancy with ongoing chemotherapy** | Medium-High |  |
| **Acute abdomen treated with medical**  **management** | Medium-High (high if clear  GI tract disruption) |  |
| **Acute abdomen requiring surgery** | Medium-High (high if clear  GI tract disruption) |  |
| **Acute Respiratory Distress without mechanical**  **ventilation** | Low |  |
| **Acute Respiratory Distress with mechanical**  **ventilation** | Medium-High (high if  requiring ECMO) |  |
| **Acute viral hepatitis without liver failure** | Low |  |
| **BMT/SCT within 3-6 months** | High |  |
| **BMT/SCT beyond 6 months, no GVHD** | Medium |  |
| **BMT/SCT with GVHD** | High |  |
| **Burns first or second degree** | Low-medium depending on surface area | Skin sources, contaminant, line infections; risk highest  for skin flora but applies to all organisms |
| **Burns (third or fourth degree)** | High | Skin sources, contaminant, line infections; risk highest for skin flora but applies to  all organisms |
| **Cardiac arrhythmia** | Low |  |
| **Cardiorespiratory arrest and received CPR** | Low-medium | Risk applies to 72 h post  event |
| **Cellulitis** | Low |  |
| **Cholecystitis, acalculous – hospital onset** | Medium-High |  |
| **Congestive heart failure** | Low |  |
| **COPD exacerbation, non-ICU admission** | Low |  |
| **Cystic Fibrosis exacerbation** | Low |  |
| **Desquamating skin condition** | High | Skin sources, contaminant, line infections; risk highest for skin flora but applies to  all organisms |
| **Diabetic foot syndrome, acute** | Medium |  |
| **Diabetic hyperglycemia, Diabetic keto-acidosis** | Low |  |
| **Elective surgery** | Low-Medium; consider nature of elective surgery e.g., surgery for cancer, complex or prolonged  surgery requiring post-op |  |

|  |  |  |
| --- | --- | --- |
|  | intensive care may pose  higher risk |  |
| **General medical admission (e.g., COPD**  **exacerbation, pneumonia, cellulitis, DVT)** | Low |  |
| **General pediatric admission (e.g., asthma**  **exacerbation, pneumonia, seizures)** | Low |  |
| **General surgical admission (e.g., appendicitis, cholecystitis, diverticulitis, prosthetic joint or**  **graft infection etc.)** | Low |  |
| **GI bleed, upper, due to perforated peptic ulcer** | Medium-High | GI organisms |
| **GI bleed, upper, due to esophageal varices** | High | GI organisms |
| **GI bleed, upper, NOT due to varices or**  **perforated ulcer** | Low |  |
| **GI bleed, lower (consider severity and need for**  **procedures)** | Low-Medium | GI organisms |
| **GI tract disruption e.g., perforation, fistula, short gut** | Medium-High (depending on severity of disruption and likelihood of restoring intact GI tract, as well as  associated conditions | GI organisms |
| **Kidney Injury, acute (renal failure) requiring new**  **dialysis** | Low |  |
| **Liver (hepatic) failure, acute** | High |  |
| **Liver (hepatic) failure with variceal bleeding** | High |  |
|  |  |  |
| **Myocardial Infarction, acute** | Low |  |
| **Myocarditis/Pericarditis** | Low |  |
| **Neonatal necrotizing enterocolitis** | High |  |
| **Neutropenia** | High |  |
| **Obstructed biliary tract – acute or severe**  **requiring intervention** | High | GI organisms |
| **Obstructed urinary tract requiring intervention** | Medium-high (high if  infected urinary tract) |  |
| **Pancreatitis** | Low-medium (medium if necrotizing with abscess/infected necrosis/enteric  complications) |  |
| **Pneumonia, non-ICU admission** | Low |  |
| **Pneumonia, ICU admission** | Low-Medium |  |
| **Peripheral (limb) ischemia, acute** | Medium |  |
| **Pregnancy uncomplicated** | Low |  |
| **Requiring emergency surgery** | Medium |  |

|  |  |  |
| --- | --- | --- |
| **Shock** | Medium-High; consider severity and extent of ischemia, and if patient improving prior to index HOB, when assigning  medium or high risk |  |
| **Solid organ transplant (> 30 days ago)** | Medium |  |
| **Solid organ transplant (within 30 days)** | High |  |
| **Stroke/CVA** | Low overall, consider medium if significant paralysis and immobility leading to aspiration risk,  requiring Foley, PEG etc. |  |
| **Sub arachnoid Hemorrhage /Intracranial Hemorrhage** | Low overall, consider medium if significant paralysis and immobility leading to aspiration risk,  requiring Foley, PEG etc. |  |
| **Trauma blunt** | Low-Medium |  |
| **Trauma penetrating** | Medium-High (e.g. high if multiple organ involvement, requiring multiple surgical  interventions) |  |
| **Total Parenteral Nutrition** | Medium |  |
| **Urinary tract infection (community acquired)** | Low |  |
| **B. Chronic comorbidity (Underlying Conditions)** | | |
| **Alcohol abuse** | Low | |
| **Asplenia** | Medium | |
| **Asthma** | Low | |
| **Cerebral Palsy** | Low | |
| **Cerebrovascular disease/ Stroke/ TIA** | Low | |
| **Chronic Kidney Disease, no dialysis** | Low | |
| **Chronic Kidney Disease, receiving dialysis** | Medium; consider high if patient with tunneled catheter in  femoral location and no other options | |
| **Chronic ulcer or wound** | Low | |
| **Chronic ventilator dependence** | Low | |
| **Congenital Heart Disease** | Low | |
| **Congestive Heart Failure** | Low | |
| **Connective Tissue Disease (Autoimmune**  **Disease)** | Low-Medium (depending on degree of  immunosuppression) | |
| **Coronary artery disease** | Low | |
| **Cystic Fibrosis** | Low | |

|  |  |
| --- | --- |
| **Dementia/ Chronic Cognitive Deficit** | Low |
| **Diabetes Mellitus with complications** | Low-medium |
| **Diabetes Mellitus without complications** | Low |
| **Epilepsy/seizure/seizure disorder** | Low |
| **Inflammatory Bowel Disease** | Low-Medium depending on disease activity and  immunosuppression |
| **HIV** | Low-medium depending on treatment/CD4/whether  patient has AIDS |
| **Liver Disease, chronic (cirrhosis)** | Low-Medium (medium if decompensated cirrhosis) |
| **Lung disease, chronic** | Low |
| **Malignancy, hematologic** | Medium-High depending on type of malignancy,  chemotherapy, and neutropenia |
| **Malignancy, solid tumor (non-metastatic)** | Low-Medium |
| **Malignancy, solid tumor (metastatic)** | Medium-High |
| **Mental Illness** | Low |
| **Multiple Sclerosis** | Low |
| **Neonate – birthweight < 1500 g** | High |
| **Neonate – birthweight >= 1500 g** | Low-medium |
| **Neurological conditions quadriplegia, paralysis** | Low |
| **Obesity or Morbid Obesity** | Low |
| **Peptic Ulcer Disease** | Low |
| **Peripheral Vascular Disease** | Low |
| **Primary Immunodeficiency** | Low-medium |
| **Sickle cell disease** | Low |
| **Smoking** | Low |
| **Steroid or other immunosuppressive therapy, chronic** | Medium overall but could vary from low to high depending on extent of immunosuppression and activity  of underlying condition |

|  |  |  |
| --- | --- | --- |
| PREVENTABILITY RELATIVE TO EXTRINSIC HEALTHCARE-RELATED RISK and SUSPECTED SOURCE OF INFECTION  ***(Use as a guide but each case should be assessed on its merit)*** | | |
| **Device or invasive procedure** | **Preventability in ideal setting** | **Additional comments** |
| **Source: Endovascular** | | |
| **Any IV access with suspected manipulation by patient** | Low | Manipulation is defined as active intentional access or manipulation of the IV line by the patient, does not include unintentional damage to line or site due to patient condition (e.g., due  to agitation) |
| **Arterial catheter** | High |  |
| **ECMO** | Medium |  |

|  |  |  |
| --- | --- | --- |
| **Implanted Port** | High |  |
| **Intra-aortic balloon pump** | Medium-High |  |
| **Midline** | High |  |
| **Pacemaker or AICD** | High |  |
| **Peripheral IV** | High |  |
| **PICC** | High | If indication is TPN for GI disruption e.g., fistula, or patient has severe skin condition that may be a source for PICC seeding, consider a lower  preventability rating |
| **Temporary CVC** | High | Overall high preventability, particularly if bacteremia occurs within first few days of insertion or line was in place longer than necessary. Consider a lower preventability rating if line could not have been removed sooner/no alternative access, or severe skin  conditions |
| **Tunneled line** | Medium-High | if hematogenous seeding of line suspected (neutropenic patient or GI disruption e.g., enteric fistula in patient receiving TPN) or severe skin condition and no other options for access,  consider a lower preventability rating |
| **Vascular graft** | Medium-High | Depending on graft location and acuity e.g.,  higher risk for groin procedures, emergency repairs) |
| **Ventricular assist device** | Low-medium |  |
| **Source: Gastrointestinal** | | |
| ***C. difficile* colitis** | Medium-High | High if related to unnecessary antibiotics |
| **EGD with procedure (e.g., biopsy, dilation, banding etc.)** | Low |  |
| **EGD without procedure** | High |  |
| **ERCP for obstructed bile duct or abscess/ infection drainage** | Low |  |
| **ERCP without biliary obstruction** | Medium |  |
| **Non-specific bowel compromise leading to gut translocation** | Variable | Depending on cause of bowel compromise e.g., low for neutropenic colitis, low for small bowel  transplant complications |
| **Neutropenic colitis** | Low |  |

|  |  |  |
| --- | --- | --- |
| **Ischemic colitis** | Variable | Depending on preventability of inciting cause of  ischemia |
| **Acalculous cholecystitis** | Low | Consider rating intrinsic risk high, as  preventability not related to patient conditions |
| **Source: Urinary** | | |
| **Cystourethroscopy without manipulation** | High |  |
| **Cystourethroscopy with manipulation** | Low-Medium | Medium if did not get appropriate prophylactic antibiotics |
| **Foley Catheterization** | Medium-High | Medium if catheter necessary for entire duration and no alternative e.g., bladder injury requiring continuous irrigation; high if catheter could have  been removed sooner |
| **Intermittent Catheterization** | Medium-High | High if bladder was not adequately drained with  intermittent catheterization resulting in UTI (e.g., high bladder or urine volumes) |
| **Percutaneous renal surgery (without obstruction or infection)** | High |  |
| **Prostate brachytherapy or**  **cryotherapy** | Medium-High |  |
| **Shock-wave lithotripsy** | Medium |  |
| **Transrectal prostate biopsy** | Low-Medium |  |
| **Traumatic Foley or straight catheterization** | High |  |
| **Ureteroscopy** | Low-Medium | Low for ureteroscopy done in presence of obstructed urinary tract, required manipulation e.g., stent exchange; Medium if did not get  appropriate prophylactic antibiotics |
| **Source: Skin and soft tissue** | | |
| **Contaminated blood culture** | Medium-High | High preventability particularly if drawn from  central line or unnecessary blood culture, and in most patients without overt skin conditions |
| **Infection at drain site** | High |  |
| **Infection at site of previous**  **vascular access device** | High |  |
| **Pressure ulcer developing or worsening during hospital stay** | High |  |
| **Source: Respiratory** | | |

|  |  |  |
| --- | --- | --- |
| **Bronchoscopy with or without biopsy or other intervention** | High |  |
| **Chest tube placement without pre- existing pleural infection** | High |  |
| **Mechanical ventilation complicated by pneumonia** | Medium | If prolonged ventilation could clearly have been avoided then could rate preventability as high e.g., massive aspiration event, unnecessary/prolonged sedation, iatrogenic  pneumothorax or surgical complication etc. |
| **Non-ventilator associated hospital acquired pneumonia** | Low-medium | Medium if attributed to aspiration in setting of sedative use, inadequate management of secretions, or failure to maintain aspiration  precautions |
| **Source: Bone and Joint** | | |
| **Arthroscopy** | High | Diagnostic procedure without known/pre-  existing infection |
| **Surgery** | High | Clean surgery +/- implant |
| **Surgery** | Low | Contaminated/ Dirty |
| **Source: Central Nervous System** | | |
| **Ventriculitis** | High | Following temporary or permanent shunt |
| **Source: Surgical site infections and other surgical complications** | | |
| **Complication from elective surgery** | Medium-high | Re- exploration due to bleeding, leak, anastomotic breakdown etc |
| **Complication after emergency surgery** | Low-Medium |  |
| **Surgical site infection – clean surgery** | Medium-High | Medium if inherently complex surgery requiring prolonged ICU stay, devices etc. NOT as an  unexpected complication from surgery |
| **SSI after clean-contaminated** | Medium-High | Medium if inherently complex surgery requiring prolonged ICU stay, devices etc. NOT as an  unexpected complication from surgery |
| **SSI after contaminated/dirty procedure** | Low-medium | Medium if delay in achieving source control, medium if surgeon elected to close the wound |
| **SSI related to anastomotic leak** | Medium |  |
| **Source: Other** | | |

|  |  |  |
| --- | --- | --- |
| **Any delay in appropriate care related to diagnosis or treatment** | High |  |
| **Patient manipulation of devices or other refusal of care** | Low-medium | Potentially medium if healthcare providers could  have addressed specific social or placement issues |
| **Unknown source** | Low |  |