

Managing Nosocomial Infections

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Nosocomial infections or health-care associated infections (HAI) are inherent dangers of modern therapy especially for the critically ill patient in the ICU.

HAI are infections that were neither present nor in incubation at the time of hospitalization, and which occur after admission to hospital or acquired in the hospital but manifest after discharge. Those manifest within 48 h of admission or 15 days after discharge, are unlikely to be HAI.

The incidence of HAI is relatively low 1.5% in Ob-Gyn and rise to 16% in ICUs. HAI lead to increased morbidity, mortality, costs.

The challenges in the management of HAI include distinguishing infection from non infectious entities, distinguishing colonization from invasion and correctly targeting the susceptibility of hospital organisms which would improve patient outcomes while minimizing the emergence of resistance.

Frequency distribution of major types of HAI:

UTI	28%
Surgical wound infection	19%
Pneumonia	17%
Bacteremia usually with intravascular devices	16%
Others	20%

Any new fever in a hospitalized patient needs careful evaluation beginning with eliciting a history of procedures, blood transfusions, drugs, implanted devices, and examination of skin, lungs, abdomen, calves, incisions, punctures. Knowledge about likely

sites of infections, organisms, and susceptibility is very helpful.

CATHETER RELATED UTI

Although the urinary catheter is vitally important in patient care it violates the normal defense mechanism of voiding. The continuous open channel, biofilm, alkaline urine and encrustation leads to ascending infection and even bacteremia (Table 1).

Table 1: UTI after catheterization

	Short term < 30 d	Long term > 30 d
Prevalence	15%	90%
Bacteria	<i>E.coli</i> , <i>Klebsiella</i> , <i>Pseudomonas</i>	<i>E. coli</i> , <i>Proteus</i> , <i>Providencia</i>
Medical goal	Prevent bacteriuria	Prevent complications of bacteriuria

Antibiotics postpone but do not prevent infection; most bacteriurias resolve after catheter removal even without antibiotics. Antibiotics are appropriate if there is fever or signs of bacteremia. Culture is needed for appropriate antimicrobial therapy.

PNEUMONIA

Pneumonia accounts for 17% of all HAI, but is the most common of fatal HAI (mortality 20-60%). It targets elderly, post-surgical, and mechanically ventilated patients.

Guidelines have been developed by ATS, IDSA 2004 for HAP, HCAP, VAP¹.

Diagnosis is based on X ray chest findings + 2 of fever, WBC alterations, purulent secretions.

Table 2: A combination approach for HAP, HCAP and VAP as proposed by ATS, IDSA 2004

Clinical approach	Bacteriologic approach
Culture of Tracheal aspirate semiquantitative light moderate, heavy -ve, has a good NPV	TA 10^5 or bronchoscopic 10^4 or PSB 10^3 cfu/ml (10 fold less if prior antibiotics) Intracellular bacteria high PPV
Empiric treatment	No empiric treatment
Sensitive but less specific	More specific but less sensitive

A combination approach (Table 2) proposed by ATS, IDSA 2004 entails appropriate treatment in a timely manner as in the clinical approach, but by stopping early, overuse of antibiotics is avoided as is sought in the bacteriologic approach.

When HAP is suspected, the tracheal aspirate is cultured and empiric treatment is started.

For early onset pneumonia <5 days empiric treatment is ceftriaxone or coamoxyclov or FQN or ertapenem

For late > 5 days or if risk factors for MDR are present such as immunosuppressed patient, prior antibiotics, hospitalization in past 3 m, chronic dialysis, wound care, family member with MDR organism, empiric treatment is Anti Pseudomonal cephalosporin or piperacillin tazobactam or carbapenem + FQN or aminoglycoside + or - vancomycin or linezolid.

At day 2-3, check improvement and repeat culture.

If improvement occurs and culture is -ve, consider stopping as it might not be pneumonia, if culture is +ve, de escalate or narrow the therapy as directed by the culture report.

If no improvement occurs and culture is -ve, this could be due to complications, other diagnoses or prior antibiotics.

If culture is +ve, continued treatment is advised.

The duration of treatment may be 7 d for patients who have received initially appropriate therapy, have had a good response and no infection with *Pseudomonas* or *Acinetobacter*.

Central Venous Catheter (CVC) Related Blood Stream Infections

Skin contamination, catheter colonization or infection at any other site should be ruled out.

The severity of illness is assessed.

Empiric treatment is started.

The nature of the organism CONS, *S. aureus*, GNB, Candida and complications like septic thrombophlebitis, infective endocarditis and osteomyelitis determine the further course of action.²

The diagnosis is made if local or systemic manifestations + CVC culture shows 5-10X more cfu than percutaneously obtained culture, differential time to positivity > 2h

Or $>10^2$ from a tunneled catheter without a companion culture from a percutaneous site.

Or >15 semiquantitative or $>10^2$ quantitative from catheter tip.

These features indicate CRBSI with a PPV 60-70% but NPV 98%,

Catheter culture - rules out CRBSI.

If catheter + and percutaneous - The significance is unknown, it may indicate colonization but close monitoring required if the patient has valvular heart disease, neutropenia, *S. aureus* or *Candida*.

Candida infections

Despite frequent isolation from sputum, tracheal secretions and BAL, especially in antibiotic treated patients.

Candida pneumonia is exceedingly rare. It can occur due to aspiration or hematogenous. Dissemination but is part of overall pattern of disseminated candidiasis. It is not diagnosed in isolation but requires histologic demonstration of invasive disease.

Candiduria

There is a frequent dilemma whether to treat or not to treat. It may be a colonizer but can also be the first indication of fungemia and colony counts do not help. Asymptomatic candiduria should be treated if neutropenia, renal transplant recipient, patients due to undergo urologic procedures, LBW infants³.

Candidemia indicates tissue invasion, has high risk of mortality, but sensitivity of blood culture is only 50% Surveillance cultures of blood, oropharynx, stomach, rectum, trachea, urine, catheter tip, surgical drain are probably not cost-effective.

Risk factors for candidemia (adapted from Marr KA) are neutropenia, cytotoxic chemotherapy, HSCT, SOT (liver) steroids, uncontrolled DM, malnutrition, neonatal age extensive burns, IV catheters, disruption of GI or GU barriers. Colonization at multiple sites, receipt of multiple antibiotics. In these situations it may be prudent to consider empiric anti-fungal therapy.

Surgical Wound Infection

Post-operative fever during the first 48 hours is usually due to non-infectious causes. If fever occurs after 96 hours it is much more likely due to infection⁴ (Table 3).

Prediction of infection can be made by the SENIC index which takes into account.

Abdominal Operation

Surgical wound classification: Clean, Clean-Contaminated, Contaminated, Infected; Duration of surgery >2h; Patient with 3 or more diagnoses.

Table 3: Microbial etiology according to time of post-operative infection

<i>Postoperative day</i>	<i>Etiology</i>
1, 2	Strep, Staph
3, 4	Strep, Staph, anaerobes
7	GNB

Preventive measures for post-operative infection are of paramount importance.

These include antibiotic administered at the time of induction of anesthesia. Effective concentration during and at the site of surgery and closure Keep pre-operative

stay in the hospital short. Treat remote infection. Pre-op shower, avoid shaving, hair may be clipped. Pre-op antibiotics as per recommendations. Theater asepsis, surgical technique, drain only if collection is likely.

The focus in infection control program has shifted from the environment to the point of patient contact. Surveillance, post hospital discharge contact are important. Recognition of an outbreak, investigation and control measures have to be undertaken. Antibiotics with narrow spectrum based on susceptibility are preferred.

HAI is a daunting challenge and a multi-pronged approach is needed to prevent sinking in this deadly quicksand. An ounce of prevention is better than a pound of investigations and a ton of treatment.

REFERENCES

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