



## **Effects of Antimicrobial Resistance on the Incidence of Neonatal Sepsis in Neonatal ICU's at Selected Hospitals in Indore**

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### **Introduction :**

Particularly in underdeveloped areas, neonatal sepsis—a life-threatening infection afflicting newborns—remains a leading cause of newborn morbidity and death. Within its healthcare facilities, Indore, a well-known city in central India, has a major load of newborn sepsis. The growing problem of antimicrobial resistance (AMR), which has drastically changed the incidence, development, and consequences of sepsis in neonates, presents one of the primary difficulties in preventing neonatal sepsis in Indore's neonatal intensive care units (NICUs).

In bacteria causing newborn sepsis, AMR complicates treatment decisions, reduces therapeutic choices, extends hospital stays, and drives up healthcare expenditures. The consequences of antimicrobial resistance on the incidence of neonatal sepsis in NICUs at particular hospitals in Indore are discussed in this paper together with how AMR complicates management strategies, its effects on newborn health outcomes, and the need of using AMR mitigating measures to enhance neonatal treatment.

### **Recognising neonatal sepsis and antimicrobial resistance**

#### **Newborn Sepsis**

Early-onset sepsis (EOS) and late-onset sepsis (LOS) are two forms of neonatal sepsis, a systemic infection in newborns under 28 days old. Usually acquired during delivery, EOS—which occurs during the first 72 hours of life—involves bacteria including *Escherichia coli* and Group B *Streptococcus*. After 72 hours, LOS is more commonly linked to infections picked from the hospital setting like *Klebsiella pneumoniae* and *Staphylococcus aureus*.

Given its broad clinical appearance, newborn sepsis is difficult to identify. Common yet ambiguous symptoms causing delays in diagnosis and treatment are fever, lethargy, respiratory trouble, and feeding problems. These difficulties are exacerbated with AMR on increasing prominence since the delay in efficient antibiotic treatment usually results in negative effects like multi-organ failure and septic shock.

### **Antimicrobial Resistance in Early Sepsis**

Management of newborn sepsis is complicated by antimicrobial resistance, defined as the capacity of microbes to resist the actions of medications meant to kill them. Among the several causes of resistance are overuse and antibiotic abuse in NICUs, extended hospital stays, and inadequate infection control policies. Commonly used medicines including ampicillin, gentamicin, and third-generation cephalosporins have repeatedly shown resistance by pathogens causing newborn sepsis in Indore's hospitals. With less treatment choices and more failure rates, controlling sepsis in newborns is thus becoming an extremely difficult task.

### **Affect of Antimicrobial Resistance on Neonatal Sepsis Outcomes and Incidence**

#### **1. Growing Neonatal Sepsis Incidence**

By allowing bacteria to flourish in hospital settings despite antibiotic treatments, antimicrobial resistance helps to explain the increasing occurrence of newborn sepsis. Crowded NICUs, poor staffing, and sporadic violations in aseptic technique cause Indore's hospitals—like many others in resource-limited environments—great incidence of nosocomial infections. The existence of multi-drug-resistant (MDR) organisms in these environments raises the transmission risk as conventional antibiotics treatments fail. Higher sepsis rates among neonates follow naturally from this increase in AMR-associated illnesses.

#### **2. Delayed Treatments and Complicated Diagnoses**

AMR hinders the rapid detection and treatment of newborn sepsis, hence causing delayed recovery and extended NICU admissions. Empirical antibiotic treatment is started in a newborn displaying symptoms of sepsis before the causal organism is found. These first treatments usually prove useless in environments with high AMR rates, which forces several antibiotic trials and raises the risk of side effects from the medications. Delays in reaching efficient antibiotic therapy help to explain higher bacterial loads, more virulence, and more chance of sequelae such as meningitis or pneumonia.

### 3. Mortality and Morbidity Rates

Because of their still developing immune systems, newborns are more susceptible to the consequences of sepsis and AMR. Research conducted in India, particularly Indore, have revealed that newborn sepsis linked to AMR has a greater death rate than illnesses caused by non-resistant bacteria. Common poor outcomes from multi-drug-resistant infections include septic shock, respiratory trouble, and persistent neurological deficits. Many resistant illnesses are left untreated or require protracted, difficult, and expensive treatments, so the fatality rate in newborns with AMR-associated sepsis is noticeably high.

### 4. Rising Medical Costs

Because resistance extends hospital stays, raises drug costs, and requires expensive supporting treatments including ventilator and nutritional care, AMR in newborn sepsis bears a significant financial burden. Resource constraints in Indore's NICUs accentuate these budgetary difficulties. Second- or third-line antibiotics' high cost strains hospital resources and can lead to unfair access to efficient treatment, therefore disproportionately harming economically poor households.

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## Common Pathogens and Their Indore Resistance Profile

Gram-negative bacteria predominate in newborn sepsis cases, so Indore's hospitals' pathogenicity fits global patterns. The resistance profiles of these species, however, especially worry me:

Among the most often occurring MDR bacteria in Indore's newborn sepsis cases is the Gram-negative bacterium *Klebsiella pneumoniae*. Often resistant to beta-lactam medicines, *K. pneumoniae* shows resistance to third-generation cephalosporins because of the formation of extended-spectrum beta-lactamases (ESBLs). Additionally developing is carbapenem resistance, which limits treatment choices and increases death rates.

A main source of EOS, *Escherichia coli* has shown growing resistance to cephalosporins, gentamicin, and ampicillin, therefore complicating therapy. Especially in preterm infants, resistant strains in NICUs in Indore frequently cause meningitis and septic shock.

Common among LOS cases are both methicillin-sensitive and methicillin-resistant strains (MRSA). Resistant to most beta-lactam antibiotics, MRSA calls for the less effective vancomycin, which might not always be readily available in environments with limited resources.

4. *Acinetobacter baumannii*: *Acinetobacter*, a growing MDR pathogen in Indore most notably in NICUs with regular use of invasive equipment, is known for its environmental resilience. Complicating infection control, this species shows resistance to cephalosporins, carbapenems, and aminoglycosides.

5. *Candida spp.*: Although not a bacteria, developing antifungal resistance, especially to fluconazole, makes *Candida* infections—specifically *Candida albicans*—particularly noteworthy in NICUs. Particularly prone to candidiasis are newborns on continuous intravenous antibiotics.

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## Factors Driving Antimicrobial Resistance in Indore's NICUs

### 1. Antibiotic Overuse and Misuse

A main cause of AMR in NICUs is the uncontrolled antibiotic use there. Resistance results from indiscriminate usage, poor adherence to dose guidelines, and extended empirical treatment without microbiological confirmation. Lack of local AMR surveillance data sometimes results in less than ideal antibiotic choice, hence sustaining resistance cycles.

### 2. Insufficient Control of Infections

In environments with limited resources, insufficient infection control policies help MDR diseases to spread across-wise. Significant risk factors for nosocomial infections are crowded NICUs, inadequate personnel, and hand hygiene techniques gone wrong. Moreover, inadequate sterilising of tools and environmental pollution raise the possibility of AMR dissemination.

### 3. Extended stays in hospitals and invasive interventions

Increased AMR in newborns is linked to prolonged NICU stays and the use of invasive devices such central venous catheters, ventilators, and urine catheters. Invasive technologies break through established barriers to provide access for resistant species. Extended NICU stays also expose newborns to the hospital surroundings, therefore increasing their chance of resistant illnesses.

### 4. Restricted Diagnostic Capacity

Early identification of infections and their resistance profiles made possible by fast diagnostics—which are sometimes limited in Indore's healthcare facilities—allows for Often continued without these instruments, empirical therapy generates selective pressure favouring resistant species. Lack of molecular diagnostic techniques reduces the capacity to identify AMR genes, thereby letting resistant organisms to survive in the NICU surroundings.

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## Approaches to Address Antimicrobial Resistance in Neonatal Sepsis

### 1. Application of Antimicrobial Stewardship Programs (ASPs)

Antimicrobial stewardship is the encouragement of best use of antibiotics to enhance patient outcomes and lower resistance. Standardised treatment plans, encouragement of frequent antibiotic use, and awareness-raising among healthcare professionals regarding resistance help ASPs to be customised to NICUs. Using ASPs will help NICUs in Indore lower wasteful antibiotic use and improve focused therapy, hence decreasing the spread of AMR.

### 2. Improved Controlling and Prevention of Infections

Hospitals have to give strong infection control measures top priority if AMR is not to spread in NICUs. This covers regular hand hygiene, rigorous sterilising of medical tools, and ambient cleaning. For infants with known resistant infections, NICUs should follow conventional precautions and isolation policies. Regular training on infection prevention for the healthcare personnel will help to guarantee awareness and compliance.

### 3. Enhanced Capabilities for Diagnostics

Investing in fast diagnostic technologies such PCR and MALDI-TOF (Matrix-Assisted Laser Desorption/Ionization-Time of Flight) helps early pathogen identification and their resistance profiles. Early identification lessens the need for broad-spectrum antibiotics by allowing rapid, focused therapy. Cooperation will help Indore hospitals fund and apply such devices in NICUs since efficient AMR management depends on fast diagnosis.

#### 4. Encouragement of rational antibiotic prescription writing

It is absolutely vital to teach doctors the value of sensible antibiotic prescribing. Antibacterial dosage, duration, and the risks of overprescription in newborns should all be taught. For empirical treatment, NICUs should adhere to national and international recommendations; they should modify their medications depending on local patient needs and resistance patterns. Including pharmacist participation in antibiotic choosing and dosage will also improve prescription writing.

#### 5. AMR Surveillance System Establishment

AMR surveillance in Indore's hospitals can offer insightful information on local resistance patterns and direct empirical treatment decisions. Monitoring resistance trends helps hospitals maximise antibiotic use and reduce the likelihood of treatment failures. By considering joining regional and national AMR surveillance systems, NICUs in Indore can help to contribute to more general data collecting and gain from revised AMR information.

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### Conclusion :

The frequency and consequences of newborn sepsis in Indore's NICUs have been significantly changed by the emergence of antibiotic resistance. With expensive consequences for families and healthcare facilities, resistant bacteria complicate treatment, slow down recovery, and raise death among newborns. Dealing with AMR in newborn sepsis calls for a multimodal strategy comprising rational antibiotic dosing, enhanced infection control, antimicrobial stewardship, and fast diagnostics.

By ensuring that newborns receive timely, efficient treatment and thereby lowering the incidence of neonatal sepsis in the area, these steps taken in Indore's NICUs assist to mitigate the consequences of AMR. Preserving the effectiveness of current antibiotics, protecting newborn health, and attaining sustained healthcare improvements in Indore and beyond depend on investments in AMR management.

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