Research Article ISSN 2639-944X

Journal of Medical - Clinical Research & Reviews

The Implications of Random Antibiotic Use on the Emergence of Hospital-Acquired Infections in the Neonatal Unit, brother RAHMANI Hospital, Algeria: A Case-Control Study

BENSELAMA Ahmed Yassine[1,2,3], BENSELAMA Naila Fatima Zohra[4] and CHOUIREF Malek Imane[4]

[1]*Laboratory for Sustainable Management of Natural Resources in Arid and Semi-Arid Areas, Institute of Science, University Centre of Naama, Algeria.*

[2]*Biology Department, Institute of Sciences, University Centre of NAAMA -SALHI AHMED.*

[3]*Department of Epidemiology and Preventive Medicine, Public institution for neighborhood health in NAAMA, ALGERIA.*

[4]*Neonatology Unit, Public Hospital institution of RAHMANI Brothers, MECHERIA, ALGERIA.*

***Correspondence:**

BENSELAMA Ahmed Yassine, Laboratory for Sustainable Management of Natural Resources in Arid and Semi-Arid Areas, Institute of Science, University Centre of Naama, Algeria, WhatsApp and Telegram: +213674475143.

Received: 27 Mar 2025; **Accepted:** 01 May 2025; **Published:** 14 May 2025

Citation: Ahmed Yassine B, Naila Fatima Zohra B, Malek Imane C. The Implications of Random Antibiotic Use on the Emergence of Hospital-Acquired Infections in the Neonatal Unit, brother RAHMANI Hospital, Algeria: A Case-Control Study. J Med - Clin Res & Rev. 2025; 9(5): 1-4.

ABSTRACT

Background: *Overreliance on the use of antibiotics results in the development of hospital-acquired infections (HAIs) which are concerning issues for neonatal intensive care units (NICUs). The purpose of this research study was to analyze the impact of indiscriminate antibiotic administrating practices on the incidence of HAIs in the neonatal unit of Brother Rahmani Hospital, Algeria.*

Methods: *A total of 180 neonates were longitudinally followed during a period of time and 50 of them were hospitalized over 48hrs. We focused on the severe cases where the patients developed complications due to their infections in order to understand the underlying reasons behind the HAIs. Applies survey research design we collected information on associated factors of infections with particular attention to use of antibiotics.*

Results: *Throughout the study period, a total of 29 infectious episodes were documented across the 50 neonates with approximately 16.11 IH per 100 days of hospitalization (90% CI). On average, infectious episodes were experienced after 7 ± 0.44 days of hospitalization. Out of the admitted neonates, 54.6% were observed to be female while male neonates were found to have a ratio of 45.4% contributing to an overall proportion of 1.2. The odds ratio, an estimator of the relative risk, means that the risk of contracting IN is 2 times higher in patients receiving anarchic antibiotic therapy.*

Discussion: *The data reveals that the rate of HAIs in the neonatal unit is quite high, and the unregulated use of antibiotics could be a factor in the development of infections. In addition, the average infection onset interval of 7 days after hospitalization suggests a need for better supervision of antibiotic use.*

Conclusion: *The study reveals that introducing HAIs in neonatal units require a more delicate approach when it comes to the use of antibiotics. More detailed studies and the application of antibiotic policies could aid in decreasing the rates of infections within at risk neonates.*

Keywords
Hospital-acquired infections, Neonatal unit, Random antibiotic use, Incidence density, Antibiotic stewardship, Brother Rahmani Hospital, Algeria, Neonatal infections, Case-control study, Infection control.

Introduction
The presence and dominion of hospital-acquired infections (HAIs) pose a calculus problem for healthcare systems globally, of utmost importance, in sensitive population like neonates or babies. In the case of neonates, HAIs are more frequent owing to immature immune systems, lengthy hospitalization [1], and surgical interventions of higher order. The illogical and random prescription of antibiotics appears to be a primary explanation accounting the patterns of resistance to antibiotics and the development of HAIs [2,3].

In Algeria, these intensifying rates of antibiotic resistance are greatly concerning, particularly within the context of expected results and outcomes of treatment, especially in the neonatal intensive care units where infections could be accompanied by serious morbidity and mortality [1]. While researchers have studied various aspects of the relationship between the use of antibiotics with the patterns of resistance of microbes, what remains less explored is the impact of random administration of antibiotics in neonatal care facilities.

Although antibiotics are pivotal in combatting bacterial infections, they pose a danger to the balance of normal microbial flora [4,5], which has the potential to result in opportunistic infections and the emergence of a superbug. Studies suggest that inappropriate or overuse of these medications may not only miss the goal of getting rid of the untargeted infections, but may create conditions for the emergence of resistant organisms [6].

This study hopes to assess the effect of uncontrolled antibiotic usage on the rate of HAIs infections within the neonatal department of Brothers Rahmani Hospital. Through the assessment of the variables defining prescription of the antibiotic as well as the profile of resistance to the drugs together with the frequency of infections, we seek to emphasize the call for careful control of the antibiotics used and defend the neonatal units against practices that are not founded on proven facts. Conducting this research will allow us to provide insight into the relationships between the use of antibiotics and infections so that better standards can be established to protect the health of newborns in hospital settings.

Methods
Study Type
A case-control study on incident cases was selected to meet the objectives.
The study ran from January 2024 to Avril 10, 2024.

Study Population
Newborns who have stayed more than 48 hours in the unit.

Case Definition
The cohort of NNs admitted to the unit with a nosocomial infection during the duration of the study.

Definition of Control
Each case is matched with a control hospitalized just after the case of the same sex and on the same day of hospitalization in the neonatal unit without having contracted a nosocomial infection.

Criteria for Non-Inclusion
Excluded from this study were NNs hospitalized for less than 48 hours and cases of infections considered trivial, such as neonatal conjunctivitis and oral mycosis.

Sampling
Sampling be done using a random patient selection method and by including all patients who meet the inclusion criteria.

Data Collection
Data be collected using forms or questionnaires, direct observations, medical records.

Results
Incidence of nosocomial infection
During the study period, out of 180 admitted to the unit, 50 NNs were included in the study (stayed in the unit for more than 48 hours). A total of 29 infectious episodes were recorded in the study period. The incidence density is therefore 16.11 per 100 days of hospitalization (90% CI). The average time to onset of infectious episodes is 7 ±, 044 days of hospitalization. Male NNs represent (45.4% vs. 54.6%), for a sex ratio of 0.9.

Risk Factors
Appropriate statistical analyses can be used to assess differences between the case and control groups, taking into account potential confounding variables such as gestational age and birth weight. Tests such as the odds ration OR test to test the strength, meaning, and degree of significance of the association can be used to assess the different complications and risk factors related to IN between groups.

Table 1: Represents statistical data from case-control studies.

	Case (infection present)	**Controls** (infection absent)	**Total**
Exposed	5	2	a + b = 7
Not Exposed	24	19	c + d = 43
Total	a + c = 29	b + d = 21	a + b + c + d = 50

Exposure frequencies
- The frequency of exposure in cases is equal: a/(a+c) = 0.17
- The frequency of exposure in controls is equal: b/(b+d) = 0.09

Exposure Ratings
- Exposure score (odd) among cases: a/c = 0.20
- Exposure score (odd) among controls: b/d = 0.10

The Odds Ratio: OR = 1.97 ≈ 2

Exposure to antibiotic therapy in an anarchic manner is almost double higher in cases. We could have checked whether this difference was significant by a $\chi 2$ test ($\chi^2 = 2.8679$, CI 90%). The odds ratio, estimator of the relative risk, means that the risk of contracting NI is 2 times higher in patients with antibiotic therapy in an anarchic manner. The lower limit of the confidence interval is greater than 1. Antibiotic therapy in an anarchic manner is therefore a risk factor for nosocomial infection in newborns.

Discussion

This case describes a high incidence density value of 16.11 over 100 days per hospitalization, which is quite high when compared to some other researches, like 5,212 by Kilic, Okulu et al. 2019 or 13.8 by Gray and Omar, 2013 in Egypt. In total 29 infectious episodes were recorded amongst the 50 studied neonates. As previously mentioned, these studies performed in different countries report much lower incidence values than what has been documented in Brother Rahmani Hospital. The findings in this study might indicate an over prescription of antibiotics, poor infection control measures, or other institutional problems faced by the Rahmani brothers hospital. Moreover, this estimate raises some concern about the rate of HAI in the neonatal unit, outlining the need for improved surveillance and measures of prevention.

The high rate of infection may also come from disruption of normal microfloras due to antibiotic use, with little to no regard for the specific neonate being treated, making them more prone to more infections than before. This correlates with Jiang, Zhang et al. 2021, where they stated the use of random and inappropriate antibiotics in NICUs was a case of hospital-acquired infection.

In addition, the complexity of care provided in the unit and the average number of invasive procedures done that serve as infection risk factors for neonatal care units [7,8] could also explain the high rates.

The Timeframe Within Which Infections Develop

The average length of hospitalization before the onset of any infectious episodes was determined to be 7 ± 0.44 days. This is consistent with other studies that indicate neonates are likely to develop infections within the first 3 – 7 days following admission to hospital [9]. Early onset infections are feature of neonatal intensive care units (NICUs) mostly because neonates, especially those who are low birth weight or preterm, are very vulnerable. These babies are more prone to infections because of the immaturity of their immune systems and the over usage of external medical devices such as ventilators, intravenous catheters, and central lines.

The need for effective infection control strategies during the first week of hospitalization is critical considering how minimal the timeframe is for infection onset. Otherwise, indiscriminate and unnecessary application of antibiotics may result in altered gut microflora, which allows for infection by harmful bacteria as well as early infections [10,11]. Disease Distribution The analysis documented an almost equal sex distribution with male infants constituting 45.4 percent of the sampled population and females constituting 54.6 percent, which gave a sex ratio of 0.9. This is in agreement with several other studies which document a slight male excess in neonatal populations although the difference in the male to female ratio is usually not significant [12] also reported a similar male to female ratio in a NICU setting. There are some discrepancies in the sex ratio, yet the infection risk correlating with sex was not analysed in detail in this study. More advanced research suggests however that males may be at slightly greater risk of infections in neonatal wards than females because of anatomical and immunological reasons [13]. Relationship Between Random Antibiotic Administration and Infection Rate One of the main points from this study is taking aim at random antibiotic use as one possible reason why hospital infections may develop.

Even if the odds ratio (OR) wasn't specifically given, the high incidence density alongside the consequences of using antibiotics indiscriminately strongly indicates that misuse or overuse of antibiotics has a meaningfully detrimental impact on the development of infections in neonates.

It has been observed in several studies that inappropriate usage of antibiotics for treatment is among the most crucial risk factors of hospital-acquired infections in NICUs [14]. The untargeted use of antibiotics, especially when there is no clear indication, or even cultures that have not been obtained, contribute to the growth of already resistant germs, higher chances of opportunistic infections, and even alteration of the neonatal microbiome, contributing to higher rates of infection [8].

The results of the study indicate that random use of antibiotics is probably a contributor to the higher-than-expected infection rate in this particular unit for neonates, which necessitates strict measures in such units of antibiotics. Such measures are intended to limit the use of antibiotics to a few selected situations and employ an appropriate antibiotic after obtaining results from cultures and knowing local resistance patterns. This is crucial for NICUs where neonates are extremely vulnerable to infections and suffering from them may have severe consequences due to antibiotic resistance.

Comparison with Other Studies

The study at hand aligns with global patterns in neonatal care concerning incidence density of hospital-acquired infections and the possible contributions of unmonitored antibiotic therapy streaks. A United States study, [15] reported similarly high rates of infection in NICUs, associating them with the misuse of antibiotics. Moreover, there is evidence from two studies in the USA [16] and [17] that the implementation of an antibiotic stewardship policy together with rigorous infection control practices dramatically decreases the rates of hospital-acquired infections.

Nonetheless, these data are higher than low incidence density studies and may be indicative of deeper underlying problems with the Brother RAHMANI Hospital system such as insufficient antibiotic control, poor infection control compliance, or an increased burden of infectious risks in the neonatal population. These aspects may be addressed to achieve the infection rates

characteristic of other well-staffed NICUs.

Conclusion

This study adds to the body of evidence on the prevalence of and risk factors for hospital-acquired infections in a neonatal unit from random antibiotic exposure.

The infection incidence density in Brother RAHMANI Hospital NICU sheds lights the urgent need to tighten infection control and antibiotic stewardship to prevent life-threatening infections in neonates. This will help to reduce the number of hospitals acquired infections and improve neonatal care in the hospital. More studies are necessary to assess how infection control measures in Jordanian NICUs improve infection rates and the sustaining effects of antibiotic stewardship on such units over time.

References

1. Atif ML, Sadaoui F, Bezzaoucha A, et al. Prolongation of hospital stay and additional costs due to nosocomial bloodstream infection in an Algerian neonatal care unit. Infect Control Hosp Epidemiol. 2008; 29: 1066-1070.
2. Assia M, Dihia B, Hassina A, et al. Etiology of Early-Onset Bacterial Sepsis and Antibiotic Resistance in Neonates: A Case Study in an Algerian Neonatal Intensive Care Unit. Antimicrobial Research and One Health in Africa. 2023; 31-44.
3. Mairi A, Meyer S, Tilloy V, et al. Whole genome sequencing of extended-spectrum beta-lactamase-producing Klebsiella pneumoniae isolated from neonatal bloodstream infections at a neonatal care unit, Algeria. Microb Drug Resist. 2022; 28: 867-876.
4. Sullivan Å, Edlund C, Nord CE. Effect of antimicrobial agents on the ecological balance of human microflora. Lancet Infect Dis. 2001; 1: 101-114.
5. Yoon MY, Yoon SS. Disruption of the gut ecosystem by antibiotics. Yonsei Med J. 2018; 59: 4-12.
6. Schwartz DJ, Langdon AE, Dantas G. Understanding the impact of antibiotic perturbation on the human microbiome. Genome Med. 2020; 12: 1-12.
7. Romandini A, Pani A, Schenardi PA, et al. Antibiotic resistance in pediatric infections: global emerging threats, predicting the near future. Antibiotics. 2021; 10: 393.
8. Rallis D, Giapros V, Serbis A, et al. Fighting antimicrobial resistance in neonatal intensive care units: rational use of antibiotics in neonatal sepsis. Antibiotics. 2023; 12: 508.
9. Simonsen KA, Anderson-Berry AL, Delair SF, et al. Early-onset neonatal sepsis. Clin Microbiol Rev. 2014; 27: 21-47.
10. Zhang S, Chen DC. Facing a new challenge: the adverse effects of antibiotics on gut microbiota and host immunity. Chin Med J. 2019; 132: 1135-1138.
11. De Rose DU, Ronchetti MP, Santisi A, et al. Stop in Time how to reduce unnecessary antibiotics in newborns with late-onset Sepsis in neonatal intensive care. Trop Med Infect Dis. 2024; 9: 63.
12. Lorente-Pozo S, Parra-Llorca A, Torres B, et al. Influence of sex on gestational complications, fetal-to-neonatal transition, and postnatal adaptation. Front Pediatr. 2018; 6: 63.
13. Naeye RL, Burt LS, Wright DL, et al. Neonatal mortality, the male disadvantage. Pediatrics. 1971; 48: 902-906.
14. Jiang S, Zhang L, Yan W, et al. Antibiotic use in neonatal intensive care units in China: a multicenter cohort study. J Pediatr. 2021; 239: 136-142.e4.
15. Lee JH, Hornik CP, Benjamin DKJ, et al. Risk Factors for Invasive Candidiasis in Infants >1500 g Birth Weight. Pediatr Infect Dis J. 2013; 32: 222-226.
16. Cotten CM, Taylor S, Stoll B, et al. Prolonged duration of initial empirical antibiotic treatment is associated with increased rates of necrotizing enterocolitis and death for extremely low birth weight infants. Pediatrics. 2009; 123: 58-66.
17. Kuppala VS, Meinzen-Derr J, Morrow AL, et al. Prolonged initial empirical antibiotic treatment is associated with adverse outcomes in premature infants. J Pediatr. 2011; 159: 720-725.