Int J Infect. 2017 January; 4(1):e36615. doi: 10.17795/iji-36615.

Published online 2016 August 24. **Research Article**

# Incidence of Neonatal Infection in South Sinai, Egypt

Hisham Medhat,[1] Abdelmoneim Khashana,[2,*] and Mohamed El kalioby[1]

[1]Faculty of Medicine, Suez Canal University, Ismailia, Egypt
[2]Department of Pediatric and Neonatology, Suez Canal University Hospital, Ismailia, Egypt

[*]*Corresponding author*: Abdelmoneim Khashana, Department of Pediatric and Neonatology, Suez Canal University Hospital, Ismailia, Egypt. Tel: +20-1006352403, E-mail: Abdelmoneim_khashana@hotmail.com

**Received** 2016 January 25; **Revised** 2016 January 28; **Accepted** 2016 January 29.

## Abstract

**Background:** The incidence of neonatal infection varies from one place to another, and also within the same nursery depending on conditions predisposing to infection.
**Objectives:** The current study aimed to determine the incidence of neonatal infection (NICUs) in South Sinai neonatal intensive care units, Egypt.
**Methods:** The study included 1023 neonates admitted to neonatal intensive care units in the South Sinai state hospitals from January 2010 to September 2014 and scanned for demographic data and the potential risk factors for neonatal septicemia.
**Results:** The Incidence of septicemia in the NICUs of South Sinai state hospitals was 8.6% and mortality rate among sepsis cases (sepsis fatality rate) was about 25%. The percentage of cases with late-onset sepsis (68.2%) was predominant compared to the early-onset sepsis (31.8%). Hospital acquired infections represented 30.7 % of sepsis cases. Male neonates, preterm, low birth weight babies, normal vaginal deliveries, twin deliveries and multipara mothers and premature rupture of membranes were significantly associated with more incidence of sepsis among the study population. There was no statistical significant difference ($P > 0.05$) between sepsis and non-sepsis cases regarding the maternal age, site of delivery and presence of congenital anomalies among the study population.
**Conclusions:** Prevalence of septicemia in neonatal intensive care units in South Sinai state hospitals was about 8.6% due to the abundance of risk factors in this area.

*Keywords:* Septicemia, Neonate, Incidence

## 1. Background

According to the world health organization (WHO), 130 million neonates are born every year. Of those infants, about eight million do not survive till their first birthday, and more than ten million die before the age of five (1). Each year four million neonates die during the first month of life. Developing countries such as Egypt account for the majority of reported worldwide neonatal deaths (2). Neonatal infections are currently the reason for about 1.6 million deaths per year in the developing world, and the first cause of newborn mortality is infection (3, 4).

Bacterial septicemia is the most important cause of neonatal mortality (deaths in the first 28 days of life) (5, 6). It occurs in a range of 1 - 10/1000 live births and despite development in perinatal care, neonatal infection is still a significant cause of long term morbidity and mortality (7).

The incidence of sepsis in the newborn infants is greater than any other period of life and varies from one place to another. Although some studies in the developed countries announced that the incidence of neonatal sepsis ranged from 1 to 5 cases per 1000 live births, some other population-based studies in the developing countries reported septicemia rates ranged 49 - 170 per 1000 live births (8).

Neonatal mortality is about 34, 42 and 17 per 1000 live births in Asia, Africa and Latin America and the Caribbean, respectively (4). The incidence of neonatal bacterial sepsis varies from country to country as well as within the same country. Furthermore, neonatal mortality for different African countries ranges from 68 to 11 per 1000 live births in Liberia and South Africa, respectively (9). Reported infection rates in the neonatal intensive care units vary from 3.2 to 30 per 100 admissions or discharges, illustrating the wide variability among centers. The neonatal intensive care units that admit surgery patients may have higher rates (10).

## 2. Objectives

The current study aimed to determine the incidence of neonatal infection in South Sinai neonatal intensive care units and compare the prevalence of neonatal septicemia in South Sinai and other areas in Egypt.

## 3. Methods

### 3.1. Study Design

The current study was a cross sectional descriptive study.

### 3.2. Study Type

The current study was a retrospective study.

### 3.3. Study Setting

Neonatal intensive care units in the following hospitals:

1-Sharm El-Sheikh International Hospital (10 incubators),

2-Tor Sinai General Hospital (10 incubators),

3-Ras Sudr Central Hospital (eight incubators),

4-Abou Rudees Central Hospital (four incubators),

5-Dahab Central Hospital (four incubators),

6-Nuweiba Central Hospital (three incubators).

### 3.4. Study Population

The study population was 1023 neonates admitted to neonatal intensive care units in the previously mentioned hospitals from January 2010 to September 2014.

### 3.5. Inclusion Criteria

All patients admitted to the neonatal intensive care units in the previously mentioned hospitals from January 2010 to September 2014 disregarding the age (1 - 28 days), days of admission or diagnosis.

### 3.6. Exclusion Criteria

Patients admitted to the neonatal intensive care units in the previously mentioned hospitals for one day diagnostic procedures or therapeutic purpose and discharged on the same day.

### 3.7. Sampling

The sample size was 1023 neonates admitted to the NICUs of South Sinai state hospitals in the time of the study.

### 3.8. Case Diagnosis Criteria

Laboratory-confirmed bloodstream infection (LCBI) should be conducted in neonates with the following criteria:

Patient less than one year old with at least one of the following signs or symptoms: increased body temperature (more than 38°C, rectal), hypothermia (less than 37°C, rectal), apnea or bradycardia.

Signs and symptoms and positive investigation results not related to contamination in another site and common skin contaminants were cultured from two or more blood cultures.

### 3.9. Tools

Patients' records were collected for demographic data and potential risk factors including gender, gestational age in weeks, weight at birth, mode of delivery, site of delivery, presence of twins, presence of congenital anomalies, maternal age, maternal parity, presence of sepsis, age at onset of sepsis, symptoms and signs, perinatal risk factors and outcomes.

Then, comparisons were made between the prevalence of sepsis in South Sinai and other governorate with similar and different geographical and cultural characters using data from the surveillance conducted by central infection control department, ministry Of health, Egypt.

The current study was approved by the local ethical committee of Faculty of Medicine.

### 3.10. Data Management and Statistical Analysis

The data were collected and the results were tabulated and analyzed by SPSS version 20 (IBM Corporation, Armonk, NY, USA).

Categorical data are presented as number and percentage, and intergroup differences were compared using the Pearson Chi-square test. Normally distributed numerical data are presented as mean and SD and between-group differences were compared using the independent-sample T-test. $P < 0.05$ was considered statistically significant.

## 4. Results

The current study measured the incidence of septicemia in the neonatal intensive care units in South Sinai state hospitals, compared the results with the local rates in different Egyptian regions with similar and different geographic and cultural characters from South Sinai, and elicited the risk factors linked to neonatal sepsis in the area. The number of sepsis cases was 88 (8.6%); the late onset sepsis (5.9%) was more frequent than early onset sepsis (2.7%) (Table 1).

**Table 1.** Distribution of the Study Population According to the Type of Sepsis

| Sepsis | No. (%) |
|---|---|
| **No sepsis** | 935 (91.4) |
| **Early onset sepsis** | 28 (2.7) |
| **Late onset sepsis** | 60 (5.9) |
| **Total** | 1023 (100) |

Infected cases developed sepsis inside the hospitals after 48 hours of their admission which means that 30.7 % of sepsis cases were considered hospital acquired infections (Table 2).

**Table 2.** Distribution of Sepsis Cases According to the Time of Diagnosis

| Time of Diagnosis | No. (%) |
|---|---|
| < 48 hours of admission | 61 (69.3) |
| > 48 hours of admission | 27 (30.7) |
| Total | 88 (100) |

Neonatal sepsis fatality rate was about 25% in South Sinai governorate and other governorates (Table 3).

**Table 3.** Distribution of Sepsis Cases According to the Outcomes

| Sepsis Cases | No. (%) |
|---|---|
| Died | 22 (25) |
| Cured | 66 (75) |
| Total | 88 (100) |

South Sinai has the highest prevalence of neonatal septicemia after North Sinai among the tabulated governorates according to the surveillance conducted by the ministry of health, Egypt (2010-2014) (Table 4).

South Sinai has the highest sepsis fatality rate of neonatal septicemia after Aswan among the tabulated governorates according to the surveillance conducted by infection control department, ministry of health, Egypt (2010 - 2014) (Table 5).

## 5. Discussion

Earlier diagnosis of sepsis would enable proper management and low probability of sepsis (11). During the past 20 years, health care delivery systems in Egypt experienced many improvements, with rapid advancement of new technologies, advancement in the procedures, and an increase in provision of services such as neonatal intensive care. These improvements often occurred without the development of safety measures to prevent hospital acquired infections. In addition, the growing Egyptian population exhausted the sector facilities to provide quality services (12).

In the current study, the prevalence of septicemia in the NICUs of South Sinai hospitals, a semi-island having special nature in geography and populations, was 8.6% and sepsis fatality rate was 25%. The incidence of neonatal sepsis varies greatly in different continents, countries, regions and hospitals. The reported incidence of neonatal sepsis is recently reviewed and it varies from 7.1 to 38 per 1000 live births in Asia and 6.5 to 23 per 1000 live births in Africa (4).

By comparison, culture proven sepsis in the USA and Europe was about 2 - 4 per 1000 live births (13). Thapa et al. (14) found that the NICU prevalence of sepsis was 37.12% in their cross sectional study conducted in Paropakar maternity and women's hospital in Kathmandu from October to December 2011. The Mortality due to sepsis was highest (8.06%) among total mortalities (11.29%). Wu et al. (15) found that the incidence of sepsis was 4.06% among all NICU admissions in a Taiwanese medical center. The infection related mortality rates were higher in the early onset sepsis (10%) than the late onset sepsis (7%).

Results of the current study showed that the mortality rate among sepsis cases was about 25% which is considered high and reflects poor management of sepsis cases in the hospitals included in the study, which was due to shortage of well trained staff and poor implementation of infection control programs in the hospitals. Infant mortality is an indicator of health. Approximately two-thirds of all infant deaths was caused by complications arising from preterm births, birth defects, maternal health conditions, complications of labor and delivery, and defect of access to suitable care at the time of delivery (16).

Results of the current study showed that 30.7% of sepsis cases developed sepsis in the hospitals after 48 hours of their admission, which means 30.7 % of sepsis cases are considered hospital acquired infections that need more implementation of infection control programs in the evaluated health care facilities. The results of the current study also showed that the percentage of cases with late-onset sepsis (68.2%) was more predominant than the early-onset sepsis (31.8%) among the sepsis cases. Moore et al. (17) found the time of initial positive blood culture; (64%) were septic in less than 24 hours after birth.

Early-onset sepsis is when manifestations of septicemia appear in the first 72 hours after birth, it has significant morbidity and mortality (18). The cut-off point to differentiate late from early onset varied among authors from 24 hours to seven days (4, 19) A three-day cut-off point was selected in the current study based on a wide range of review articles (20). Early onset is more likely to be of maternal origin, while late onset is more likely to be of hospital origin (21). The results of the current study revealed a high preponderance of late over early onset sepsis, which agrees with the results obtained in southern occupied Palestine (22), but contradicts with another study also conducted in Palestine, where early onset was higher. The cut-off point in their study was 48 hours, which may be the reason for this difference; another explanation may be the enhancement of mother care and delivery environment in the hospital.

### 5.1. Conclusion

In the light of previously mentioned results, the following conclusions were drawn from the study: Prevalence of septicemia in neonatal intensive care units in South

**Table 4.** Comparison Between the Prevalence of Neonatal Septicemia in South Sinai and other Governorates

| Governorate | Admission, No. | Cases With Sepsis, No. | Prevalence of Septicemia, (%) |
|---|---|---|---|
| **South Sinai** | 1023 | 88 | 8.6 |
| **Cairo** | 7023 | 314 | 4.47 |
| **Dakahleya** | 7541 | 193 | 2.56 |
| **Gharbeya** | 6308 | 182 | 2.88 |
| **Matrouh** | 9091 | 435 | 4.78 |
| **Aswan** | 6517 | 181 | 2.78 |
| **North Sinai** | 4862 | 624 | 12.83 |

**Table 5.** Comparison Between Neonatal Sepsis Fatality Rate in South Sinai and Other Governorates

| Governorate | Cases With Sepsis, No. | Sepsis Deaths, No. | Sepsis Fatality Rate, (%) |
|---|---|---|---|
| **South Sinai** | 88 | 22 | 25 |
| **Cairo** | 314 | 77 | 24.5 |
| **Dakahleya** | 193 | 19 | 9.84 |
| **Gharbeya** | 182 | 16 | 8.79 |
| **Matrouh** | 435 | 71 | 16.32 |
| **Aswan** | 181 | 47 | 27.07 |
| **North Sinai** | 624 | 77 | 12.34 |

Sinai governorate was about 8.6% which came in the second place after North Sinai governorate according to the surveillance conducted by the infection control department, ministry of health, Egypt (2010 - 2014). Sepsis fatality rate in neonatal intensive care units in South Sinai governorate was about 25%, which came in the second place after Aswan governorate according to the surveillance by the infection control department, ministry of health, Egypt (2010 - 2014). The significant risk factors associated with neonatal sepsis are rupture of membrane (ROM) > 18 hours, twin deliveries, multipara mothers, normal vaginal deliveries, male gender, low body weight (LBW) and preterm deliveries. There was no statistical significant difference ($P > 0.05$) between sepsis and non-sepsis cases regarding the maternal age, birth place and presence of congenital anomalies among the study population. In light of the current study results, and the above-mentioned conclusions, infection control measures should be centrally designed, monitored and enforced, and also neonatologists and nurses should be perfectly trained to overcome the staff shortage in this remote area.

## Acknowledgments

Authors would like to thank their colleagues for the valuable guidance and advice. Authors also wish to thank the patients who inspired them greatly to work in this research.

## References

1. World Health Organization . World health report 2006: make every mother and child count. Geneva: World Health Organization; 2006.
2. Zupan J. Perinatal mortality in developing countries. *N Engl J Med.* 2005;**352**(20):2047–8. doi: 10.1056/NEJMp058032. [PubMed: 15901857].
3. Lawn JE, Cousens S, Bhutta ZA, Darmstadt GL, Martines J, Paul V, et al. Why are 4 million newborn babies dying each year?. *Lancet.* 2004;**364**(9432):399–401. doi: 10.1016/S0140-6736(04)16783-4. [PubMed: 15288723].
4. Vergnano S, Sharland M, Kazembe P, Mwansambo C, Heath PT. Neonatal sepsis: an international perspective. *Arch Dis Child Fetal Neonatal Ed.* 2005;**90**(3):220–4. doi: 10.1136/adc.2002.022863. [PubMed: 15846011].
5. Motara F, Ballot DE, Perovic O. Epidemiology of neonatal sepsis at Johannesburg Hospital. *Southern Afr J Epidemiol Infec.* 2005;**20**(3):90–3.
6. Movahedian AH, Moniri R, Mosayebi Z. Bacterial culture of neonatal sepsis. *Iranian J Public Health.* 2006;**35**(4):84–9.
7. Shim GH, Kim SD, Kim HS, Kim ES, Lee HJ, Lee JA, et al. Trends in epidemiology of neonatal sepsis in a tertiary center in Korea: a 26-year longitudinal analysis, 1980-2005. *J Korean Med Sci.* 2011;**26**(2):284–9. doi: 10.3346/jkms.2011.26.2.284. [PubMed: 21286023].
8. Thaver D, Zaidi AK. Burden of neonatal infections in developing countries: a review of evidence from community-based studies. *Pediatr Infect Dis J.* 2009;**28**(1 Suppl):3–9. doi: 10.1097/INF.0b013e3181958755. [PubMed: 19106760].
9. Costello A, White H. Reducing global inequalities in child health. *Arch Dis Child.* 2001;**84**(2):98–102. [PubMed: 11159279].
10. Moore D. Nosocomial infections in newborn nurseries and neonatal intensive care units. 3 ed. USA: Lippincott Williams & Wilkins; 2004. pp. 852–83.
11. Polin RA, Randis TM. Biomarkers for late-onset neonatal sepsis. *Genome Med.* 2010;**2**(9):58. doi: 10.1186/gm179. [PubMed: 20828428].
12. Talaat M, Kandeel A, Rasslan O, Hajjeh R, Hallaj Z, El-Sayed N, et al. Evolution of infection control in Egypt: achievements and challenges. *Am J Infect Control.* 2006;**34**(4):193–200. doi: 10.1016/j.ajic.2005.05.028. [PubMed: 16679176].

13. Anderson-Berry AL, Bellig LL, Ohning BL. Neonatal sepsis (emedicine specialities pediatrics: cardiac disease and critical care medicine neonatology) 2009. Available from: http://emedicine.medscape.com/article/978352_overview.
14. Thapa B, Thapa A, Aryal DR, Thapa K, Pun A, Khanal S, et al. Neonatal sepsis as a major cause of morbidity in a tertiary center in Kathmandu. *JNMA J Nepal Med Assoc.* 2013;**52**(192):549–56. [PubMed: 25327225].
15. Wu JH, Chen CY, Tsao PN, Hsieh WS, Chou HC. Neonatal sepsis: a 6-year analysis in a neonatal care unit in Taiwan. *Pediatr Neonatol.* 2009;**50**(3):88–95. doi: 10.1016/S1875-9572(09)60042-5. [PubMed: 19579754].
16. Centers for Disease . CDC Grand Rounds: public health approaches to reducing U.S. infant mortality. *MMWR Morb Mortal Wkly Rep.* 2013;**62**(31):625–8. [PubMed: 23925172].
17. Moore KL, Kainer MA, Badrawi N, Afifi S, Wasfy M, Bashir M, et al. Neonatal sepsis in Egypt associated with bacterial contamination of glucose-containing intravenous fluids. *Pediatr Infect Dis J.* 2005;**24**(7):590–4. [PubMed: 15998998].
18. Basu S, Dewangan S, Shukla RC, Anupurva S, Kumar A. Cerebral blood flow velocity in early-onset neonatal sepsis and its clinical significance. *Eur J Pediatr.* 2012;**171**(6):901–9. doi: 10.1007/s00431-011-1643-y. [PubMed: 22215129].
19. Van Rostenberghe H. Bacteriology of early versus late onset neonatal sepsis. *J Pediatr Infec Dis.* 2009;**4**(3):197–8.
20. Kaufman D, Fairchild KD. Clinical microbiology of bacterial and fungal sepsis in very-low-birth-weight infants. *Clin Microbiol Rev.* 2004;**17**(3):638–80. doi: 10.1128/CMR.17.3.638-680.2004. [PubMed: 15258097].
21. Fernando AM, Heath PT, Menson EN. Antimicrobial policies in the neonatal units of the United Kingdom and Republic of Ireland. *J Antimicrob Chemother.* 2008;**61**(3):743–5. doi: 10.1093/jac/dkm543. [PubMed: 18238883].
22. Al Jarousha AM, El Jadba AH, Al Afifi AS, El Qouqa IA. Nosocomial multidrug-resistant Acinetobacter baumannii in the neonatal intensive care unit in Gaza City, Palestine. *Int J Infect Dis.* 2009;**13**(5):623–8.