

# Bacteriological Profile of Neonatal Sepsis: A Hospital Based Study

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## Abstract

**Introduction:** Neonatal sepsis is a major cause of mortality and morbidity in newborn. There are many factors that contribute to neonatal sepsis. The organisms responsible for early onset and late onset sepsis are different. **Objective:** This study was conducted to analyze the organisms responsible for early onset and late onset neonatal sepsis. **Materials and Methods:** A prospective hospital based study over the period of one year was conducted at neonatal intermediate care unit of Kanti Children's Hospital, Maharajgunj, Kathmandu, Nepal. **Results:** Organisms were isolated in 6.1% of the collected blood samples. The male female ratio of culture proven sepsis was 1.9:1. *Escherichia coli* were found to be the most common organism in both early onset and late onset sepsis. *Staphylococcus aureus* was more common in late onset sepsis than early onset sepsis. **Conclusion:** *Escherichia coli* were the most common organism in both early onset and late onset sepsis. *Staphylococcal aureus* was significantly more common in late onset sepsis than early onset sepsis.

**Key words:** Bacteriological profile, early onset sepsis, late onset sepsis, neonate

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## Introduction

Neonatal sepsis is one of the leading causes of hospital admission in Nepal and one of the leading causes of neonatal deaths<sup>1</sup>. Nepal has been working hard to achieve Millennium Development Goal (MDG) on reducing child mortality<sup>2</sup>. One of the components of this goal is reduction of infant mortality rate (IMR). The target IMR in Nepal by 2015 is 34 per 1000 live births. The trend of reduction of neonatal mortality is still not satisfactory. It is obvious that reduction of IMR is not possible without reducing neonatal mortality rate (NMR)<sup>1</sup>. It is estimated that 20% of all neonates develop sepsis<sup>3</sup> and it is responsible for 30-50% of total neonatal deaths in developing countries. The reported incidence of neonatal sepsis varies from 7.1 to 38 per 1000 live births in Asia<sup>5</sup>. However, it is much lower in the developed countries. For instance, it ranges from 1.5 to 3.5 per 1000 for early onset sepsis (EOS) and up to 6 per 1000 live births for late onset sepsis (LOS) in USA and Australia, and it comprise a total of 6-9 per 1000 for neonatal sepsis<sup>5</sup>. Infection can occur either in fetal life,

during birth or after birth. It can be acquired either from the community or at the nursery in the hospital.

There are many additional factors that predispose newborns in developing countries at a greater risk for developing neonatal sepsis compared with newborns in developed countries. These include intrinsic factors and extrinsic factors in the antenatal, intra-partum and the neonatal period<sup>6</sup>. Intrinsic factors in the developing world include higher rates of prematurity, intrauterine growth retardation, birth asphyxia, premature and prolonged rupture of membranes and maternal peripartum infections. Among the most important extrinsic factors contributing to the high risk of sepsis are the lack of antenatal care, unhygienic birth practices and birth attended by an untrained birth attendant. The absence of skilled personnel at delivery also results in a failure to identify and refer high-risk newborns to better centers and a delay in managing complications when they occur.

Neonatal sepsis is broadly divided according to age of onset into 2 types: early onset sepsis (<72hrs) and late onset sepsis (≥72hrs-28 days)<sup>7</sup>. This classification is generally of importance for identification of predominant organisms causing infections during these phases. Early onset sepsis is acquired during fetal life, delivery or at the nursery and *Group B streptococcus*, *Escherichia coli* or *Listeria monocytogenes* happen to be most common organisms<sup>8</sup>. Late onset sepsis is most commonly caused by *Coagulase-negative staphylococci* (CONS), *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella* and *Pseudomonas* and is usually acquired in the neonatal intensive care unit (NICU) or the community<sup>9</sup>.

Periodic evaluation of organisms responsible for neonatal sepsis is essential for the appropriate management of neonates. Therefore, this study was conducted to find out the common organisms causing sepsis in neonates admitted in a tertiary level children's hospital.

## Methodology

This was a prospective study conducted in the neonatal intermediate care unit (NIMCU) of Kanti Children's Hospital (KCH) over one year period (September, 2008 to August, 2009) in neonates with suspected sepsis. There were a total of 1419 neonates admitted in the neonatal wards during this period. Among them blood culture was collected from 1349 neonates. The neonates were suspected having sepsis if they presented with one of the following signs or symptoms: fever (temperature >38°C), Hypothermia (temperature <36°C), decreased sucking, poor sucking or not sucking, lethargy, irritability, seizure, apnea, cough, respiratory distress, abdominal distention. Only those who had positive blood cultures were enrolled in this study. Blood samples were collected by aseptic vein puncture and were subjected to bacteriological culture. Blood sample collected for culture was incubated at 37°C over night and sub-culture on MacConkey agar was done. Growth

negative culture was further incubated for another 3 days watching for growth every 24 hrs. Records of positive blood culture cases were entered in separate record file. Cases were classified as early onset sepsis if they presented at the hospital at less than 72hrs of life and late onset sepsis if at or after 72hrs of life. Data analysis was done using statistical package for social sciences (SPSS) software version 14.0. The level of significance for tests was set at  $p < 0.05$ .

## Results

During the study period there were 1419 neonates admitted in the intermediate ward. Among them blood cultures were done in 1349 cases as a part of septic screening in suspected neonatal sepsis cases. There were 859 (63.7%) male and 490 (36.3%) female neonates among them with the male to female ratio of 1.7:1. The total number of culture positive cases was found to be 82 with the culture positivity rate of 6.1%. Among the culture positive cases there were 54 (65.9%) males and 28 (34.1%) female neonates with the male to female ratio of 1.9:1. The age of culture positive neonates ranged from 12 hours to 28 days with the mean age of 11.2 days. *E coli* constituted the majority of the isolated organisms followed by *Staph aureus*. There were only a few cases of *Klebsiella sp* and *Strep viridans* (Table 1). Late onset sepsis cases were found to be five times higher than early onset sepsis (Fig. 1).

*E coli* were responsible in more than 3/4<sup>th</sup> (76.9%) of the cases in early onset sepsis. It made only 49.2% of the cases followed by *Staph aureus* (44.9%) in late onset sepsis (Fig. 2)

As shown in Table 2, *E coli* were isolated more in both early onset and late onset sepsis, however, *Staph aureus* was more common in late onset sepsis as compared with early onset sepsis and was statistically significant ( $p = 0.046$ ).

**Table 1:** Distribution of isolated organisms (n=82)

Organisms	Number	Percentage(%)
E coli	44	53.7
Staph aureus	33	40.2
Klebsiella sp	3	3.7
Strept viridans	2	2.4
<b>Total</b>	<b>82</b>	<b>100.0</b>

**Table 2:** Comparison of common isolated organisms by type of onset of sepsis (n=77)

	EOS sepsis No (%)	LOS sepsis No (%)	Total cases (n)	P value
E coli	10 (83.3)	34 (52.3)	44	$p=0.06$
Staph aureus	2(16.7)	31 (46.7)	33	$p=0.046$
<b>Total</b>	<b>12</b>	<b>65</b>	<b>77</b>	<b>-</b>

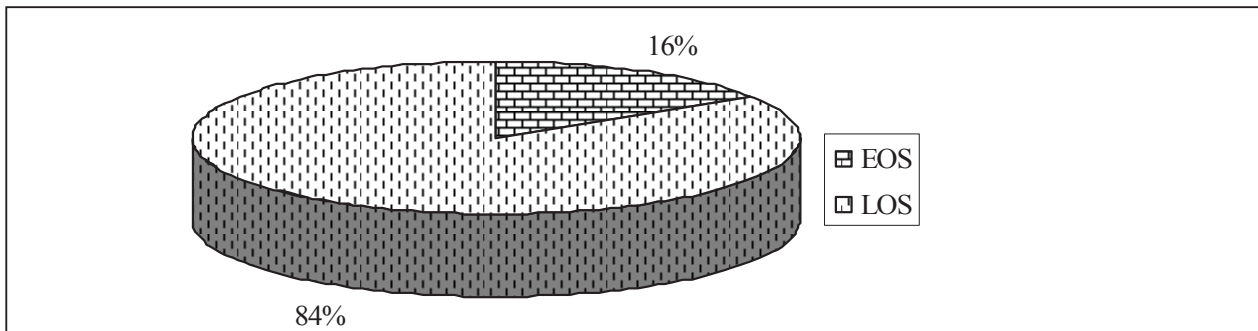


Fig 1: Distribution of cases by type of sepsis

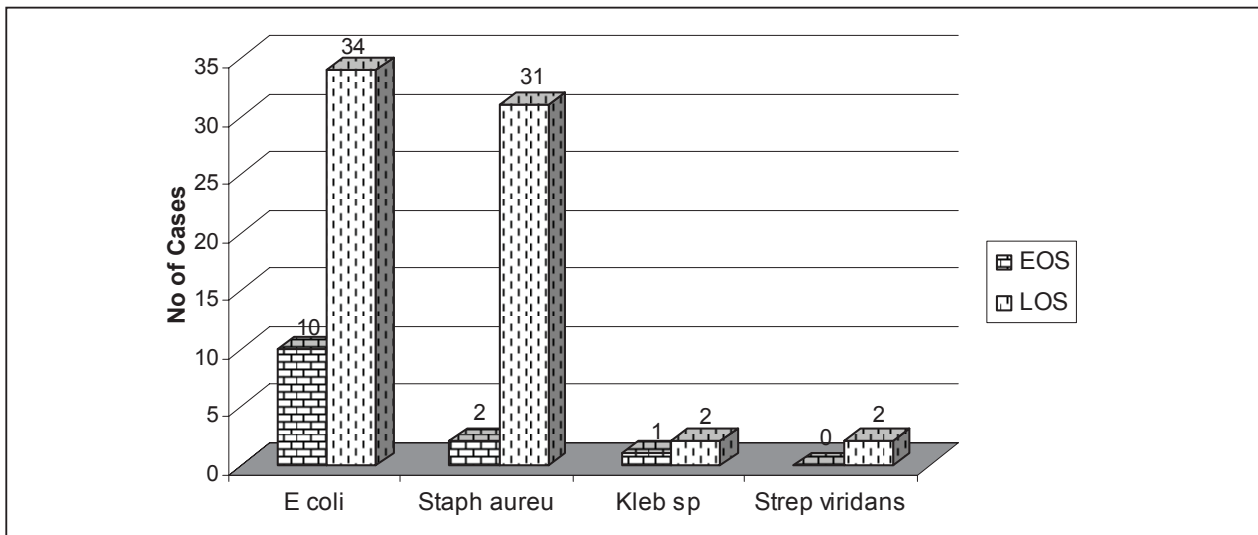


Fig 2: Distribution of pathogens in EOS & LOS

## Discussion

Neonatal sepsis is a leading cause of death among neonates in Nepal, other important causes being prematurity and low birth weight, birth asphyxia and hypothermia<sup>1</sup>. It is believed that appropriate management of neonates with sepsis can reduce neonatal morbidity and mortality and help to achieve Millennium Development Goals. Therefore, periodic evaluation and monitoring of causative organisms responsible for sepsis is of utmost importance in its management.

The culture positivity rate in this study was found to be 6.1%, which is much lower as compared to other studies (56.6% by Jain NK et.al.<sup>10</sup>, 21.0% by Barbara JS et. al.<sup>13</sup> and 13.7% by Shrestha S et. al.<sup>14</sup>). The low yield in our study could be due to the fact that this study was conducted in a tertiary care hospital where most of the cases are referred from other hospitals and health facilities. These babies could have already received antibiotics prior to referral.

This study has shown male female ratio of 1.9:1, which is similar to the findings by Jain NK et. al. (2:1)<sup>10</sup> and by Jia-hong Jiang et. al. (1.4:1)<sup>11</sup>. Probably, this

could be because of the priority given to male babies for medical care in our society.

It was revealed in this study that late onset sepsis constituted more than two third of the cases. This observation was in contrast with the finding by Jain NK et. al.<sup>10</sup>. This is true for the hospital like ours that do not have birthing centre and most of the cases being referred from other health facilities a few days after birth.

*E coli* pre-dominated the organisms isolated in sepsis cases in our study. This is in agreement with some other studies<sup>10,13,14</sup>. Jia-hong Jiang et. al.<sup>11</sup> also reported that there was an increasing trend of prevalence of neonatal sepsis caused by gram negative organisms like *E coli*. It is seen globally that the overall ratio of gram-negative organisms to gram-positive organisms is 2:1.<sup>6</sup> However, a study conducted in South Korea by Youn-Jeong et al found *E coli* only in 9.3% of the cases<sup>18</sup>. It is very surprising that not a single case of *Group B Streptococcus* (GBS) was isolated in our study.

In our study *E coli* constituted more than two thirds of the organisms in early onset sepsis. This was similar

to findings by other studies (Vergnano et. al.<sup>5</sup> Jia-hong Jiang et. al.<sup>11</sup> and Barbara JS et. al.<sup>13</sup>). However, this was in contrast with the finding by Michael Cohen-Wolkowicz et. al.<sup>16</sup> who observed that gram-positive organisms constituted the majority of early onset sepsis. This result could be because of predominance of *Group B Streptococcus* (GBS) in developed countries.

This study showed statistically significant predominance of *Staph aureus* in late onset sepsis as compared to early onset sepsis. Similar finding was also reported from India<sup>17</sup>. *Coagulase negative staphylococcus* (CONS) seemed to be more common in LOS sepsis than *staphylococcus aureus*<sup>11,12,14</sup>. However, a study conducted in eastern part of Nepal showed that both CONS and *Staph aureus* were the commonest organisms causing both EOS and LOS<sup>19</sup>.

## Conclusion

In conclusion, *E coli* were the commonest organism in both early onset and late onset sepsis. *Staph aureus* were significantly more common in late onset sepsis as compared to early onset sepsis.

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**Conflict of Interest:** None

**Permission from IRB:** Yes

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