

Maternal risk factors in early neonatal sepsis at a tertiary care teaching hospital

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ABSTRACT

الأهداف: دراسة عوامل الأمومة الخطرة في مزرعة الدم للحالات المؤكدة الإصابة بتسمم الدم لدى حديثي الولادة ودراسة الجراثيم وحساسية هذه الجراثيم.

الطريقة: هذه حالات لجميع الأمهات اللواتي تم عرضهن من يناير 2008 حتى ديسمبر 2008 وتم تسجيلهن ببرنامج بروفورما المصمم من قبل عن طريق موظفي البيت - الموظفين المقيمين الطبيين - جامعة همداس للطب وطب الأسنان - مستشفى جامعة همداس. تم فحص كل حديثي الولادة في المستشفى بعد الولادة مباشرة ويومياً حتى يتم خروج الأم بعد 2 يوم أو 3 يوم. شملت هذه الدراسة حديثي الولادة المشكوك إصابتهم بتسمم الدم. تم أخذ فحص الدم ومزرعة الدم ومعلومات الزواج مثل الحالة الاجتماعية والتعليم والحمل خلال الولادة، و استعمال المضادات قبل الولادة، كما تم دراسة بداية الولادة ووضع الولادة في مزرعة الدم للحالات المؤكدة الإصابة بالتسمم لدى حديثي الولادة. تم البدء باستخدام المضادات مثل سيفتاكسيم و امكسين في القاعدات التجريبية حتى يتم استلام تقرير المزرعة. في حالات نتائج المزرعة الإيجابية، تم إيقاف المضادات وتواصل استعمالها في حالات أخرى وذلك طبقاً للمزرعة الدم والحساسية لمدة 10 حتى 14 يوم.

النتائج: كان عدد الولادات مستشفى جامعة همداس خلال الفترة يناير 2008 حتى ديسمبر 2008 950 حالة. العدد الإجمالي للحالات المشتبه الإصابة بالإنتان كانت 257 حالة. من بين 257 حالة، كانت مزرعة الدم إيجابية في 113 حالة حديثي الولادة. أن العنقودية الذهبية هي أكثر الأجسام في دراستنا 59.2% و يليها الكلبسيلا الرئوية 19.4% و الانتروكشيبة 19.4%.

خاتمة: تشير هذه الدراسة إلى وجود عوامل الأمومة الخطرة المزدوجة يجعل الطفل معرض أكثر للإصابة بإنتان حديثي الولادة.

Objectives: To study the maternal risk factors in blood culture proven cases of early neonatal sepsis, and study the isolates and the sensitivity of these isolates.

Methods: This is a case series of all mothers admitted from January 2008 to December 2008 and registered on a pre-designed Proforma, by the House Officers, and Resident Medical Officers of Hamdard College of Medicine & Dentistry, Hamdard University Hospital, Karachi, Pakistan. All neonates delivered at the hospital were examined; first immediately at birth, and then daily until the mother was discharged after 2 to 3 days. Neonates with suspected sepsis were included in the study, blood examination, and blood cultures were obtained, maternal information such as social status, education, fever at the time of labor, use of antibiotics before delivery, onset of labor, and mode of delivery were studied in these cultures proven cases of neonatal sepsis. Antibiotics such as cefotaxime and amikacin were started on an empirical basis until final cultures reports were received. In cases of negative cultures, antibiotics were stopped, otherwise, they were continued according to culture and sensitivity for 10-14 days.

Results: The total number of deliveries at Hamdard University Hospital from January 2008 to December 2008 was 950. Neonates with suspected sepsis comprised 257. Among these 257 cases, 113 neonates had positive blood cultures. *Staphylococcus aureus* being the most common organism in our study (59.2%) followed by *Klebsiella pneumoniae* (19.4%) and *Enterococci* (19.4%).

Conclusion: This study indicates that the presence of multiple maternal risk factors makes a child more susceptible to early onset neonatal sepsis.

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Pakistan is one of the countries with a very high neonatal mortality rate in the Eastern Mediterranean region.¹⁻³ Sixty percent of neonatal deaths occur in the first week of life. Sepsis is one of the most common causes of this high neonatal mortality rate.^{4,5} There are many risk factors for this high neonatal mortality due to sepsis. Neonatal sepsis is defined as early neonatal sepsis from birth to 72 hours of life, and late neonatal sepsis after 72 hours of birth. Organisms in cases of early neonatal sepsis are usually transmitted by the mother (vertical transmission), and in cases of late neonatal sepsis from the environment (nosocomial). Maternal factors include chorioamnionitis, infections at the time of labor, prolonged rupture of membranes over 18 hours, and repeated vaginal examinations at the time of labor. Signs and symptoms of the sepsis are often non-specific, babies response to stimuli, the color of umbilicus, respiratory rates, and abnormal heart rate, particularly bradycardia, are the important parameters. Our aim is to study the maternal risk factors in culture proven cases of early neonatal sepsis at Hamdard University Hospital, Karachi, Pakistan, and the type of organisms and sensitivity to various antibiotics and the results of our study were compared to other studies. This is a case series study.

Methods. All mothers admitted from January 2008 to December 2008 were registered on a pre-designed Performa, by the House Officers, Resident Medical Officers of Hamdard College of Medicine & Dentistry, Hamdard University Hospital, Karachi, Pakistan. The Ethical Committee of Hamdard College of Medicine and Dentistry approved this study. Hamdard University hospital is a teaching hospital, with 305 beds centrally located in the heart of the city. The Department of Gynecology and Obstetrics conducts around 1000 deliveries a year, and has 2 Senior Professors, along with Associate Registrars, and House Officers, and the department provides emergency cover round the clock to all the cases of obstetrics. The Department of Pediatrics has 25 beds with 10 incubators/cots in the Neonatal Intensive Care Unit, and separate staff giving cover to all the neonatal cases and older children. Neonates of all mothers delivered at the hospital during the year 2008 were examined; first immediately at birth and then daily until the mother was discharged after 2 to 3 days. Special emphasis was given to the signs and symptoms of suspected neonatal sepsis for example, babies' response to stimuli, the color of umbilicus, respiratory rates and abnormal heart rate, particularly bradycardia, Neonates with suspected sepsis, and with no neonatal risk factors for example, prematurity, congenital and chromosomal anomalies were included

in the study. All premature deliveries and neonates with preexisting neonatal risk factors, as prematurity congenital anomalies, chromosomal anomalies were excluded from the study.

Blood examination and blood cultures were taken in the intensive neonatal unit. In cases of suspected sepsis in a neonate, variables of the mothers for example, age of mother, income of the family, social status of family, (social status was defined as high when the father is executive, or professional, and low in case of skilled or semi skilled worker), mother's education, mode of deliver, and instrumentation at the time of delivery, antibiotics used by the mother in the previous 24 hours, and data of neonate with blood culture proven sepsis was analyzed. Antibiotics, such as cefotaxime and amikacin were started on an empirical bases until final cultures reports were received. In cases of negative cultures, antibiotics were stopped, other wise they were continued according to culture and sensitivity for 10 to 14 days.

Data was analyzed by Statistical Package for Social Sciences version 15 (SPSS Inc., Chicago, IL., USA). Confidence interval and standard error were calculated and other tests were not employed. A $p < 0.05$ was considered statistically significant.

Results. The total number of deliveries at Hamdard University Hospital from January 2008 to December 2008 was 950. Neonates with suspected sepsis comprised 257.

Table 1 - Maternal variables in neonatal blood culture proven sepsis.

Variables	n	P-value
<i>Age of mother</i>		0.045
Under 18	1	
19-30 years	59	
31-40	53	
<i>Social status</i>		0.03
High	46	
Low	67	
<i>Income of family</i>		
Above 25000*	45	
Below 2500*	68	0.03
<i>Maternal education</i>		0.02
Primary	74	
Secondary	39	
<i>Use of antibiotics (24 hours prior to delivery)</i>		
Yes	70	0.02
No	43	
<i>Mode of delivery</i>		0.02
Vaginal	71	
Instrumental delivery	42	

*Pakistani rupees

Table 2 - Isolates in the blood culture.

Organism	Number of cases	(%)
<i>Staphylococcus aureus</i>	67	(59.3)
<i>Enterococci faecalis</i>	22	(19.5)
<i>Klebsiella</i>	22	(19.5)
<i>Pseudomonas</i>	0	(0)
<i>Escherichia coli</i>	2	(1.8)

There were 113 neonates with positive blood cultures admitted to the neonatal nursery (43.96%). It was interesting to note that the incidence of neonatal sepsis was related to the social-economical status of the family, though other parameters in the hospital at the time of delivery were the same. The incidence of neonatal sepsis was significant in the low social-economy group (Table 1). Maternal education had the same impact on neonatal sepsis cases (Table 1). Use of antibiotics prior to the time of delivery had a strong relationship with the neonate suffering from sepsis. *Staphylococcus aureus* is the most common organism in our study followed by *Klebsiella* and *Enterococcus faecalis* (Table 2). The isolates cultured after 72 hours (late onset neonatal sepsis) were *Klebsiella*, *Staphylococcus aureus*, and *Escherichia coli* in our study.

Discussion. Neonatal sepsis is among the common causes of neonatal deaths. Despite excluding neonatal contributing factors for sepsis, for example, low birth weight babies, congenital malformations, and chromosomal abnormalities, the incidence of neonatal sepsis is still high, indicating a high incidence of vertical transmission. Higher income in the family is considered as a symbol of social status in our society, and studies have shown that mothers belonging to lower social income groups have a higher incidence of neonatal sepsis.⁶ Our study has also shown similar results in the 2 groups. Maternal education shows a strong relationship to the incidence of neonatal sepsis, mothers with primary education were significantly different to mothers with secondary education. Use of antibiotics within the 24 hours prior to delivery was considered a risk factor in other studies,⁶ this finding is again significant in our study. The incidence of various organisms causing sepsis in our study is different to other studies.⁷

The common organisms in cases of early neonatal sepsis in other national studies are *Escherichia coli*, *Streptococcus pneumoniae*, and *Listeria*. These organisms are usually vertically transmitted by the mother. Late onset sepsis after 72 hours of life is hospital acquired, and the organisms are different than early onset neonatal sepsis. Instrumentation is a risk factor in neonatal sepsis.⁸

There is significant difference between the modes of delivery, spontaneous versus instrumentation delivery. More males were affected, which is again consistent with other studies.⁹

In our study, the most common organism was *Staphylococcus aureus*, and this finding is consistent with a study in Saudi Arabia,¹⁰ followed by *Enterococcus faecalis*, and *Klebsiella*.¹⁻¹⁷ *Escherichia coli*, which is reported to be the most common organism in other national and international studies¹⁸⁻²⁵ was only present in 1.77% of cases in our study. *Staphylococcus aureus* was resistant to ampicillin, cloxacillin, and third generation antibiotics in 20% cases, and sensitive to vancomycin in 100% cases. *Enterococcus faecalis* was resistant to ampicillin and cotrimoxazole in 90% of cases, and sensitive to quinolone and meropenem in 100% of cases. *Klebsiella* was sensitive to most of the common drugs for example, ampicillin, cloxacillin, first second and third generation antibiotics. The common causes of high neonatal sepsis in Pakistan are economic standards, home deliveries conducted by traditional birth attendants, availability, variation in peri natal risk factors, and high prematurity rates. Self-medication is an important cause of antibiotics before delivery.

Study limitations. Small sample size, limited number of risk factors examined, and late neonatal sepsis was not studied. Also, data on mortality/morbidity was not collected in this study.

In conclusion, neonatal sepsis is a major cause of mortality and morbidity. Maternal risk factors pay an important role in cases of neonatal sepsis. Measures to control the risk factors that would result in the control of neonatal sepsis must be considered in future studies.

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Related topics

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