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THE VALUE OF LUMBAR PUNCTURE IN SEPSIS NEONATORUM

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ABSTRACT

Introduction: Lumbar puncture is done in neonates diagnosed with sepsis neonatorum to rule out the possibility of meningitis. However, it is still a question whether the lumbar puncture is a necessary procedure in sepsis neonatorum or a risky one that neonates need not undergo.

Objectives: To determine the significance of lumbar puncture in sepsis neonatorum.

Study Design: Prospective cohort study

Materials and Methods: Forty four full term neonates diagnosed with sepsis neonatorum during the period of September 1-30, 2001 in the Emergency Room at a tertiary care center were subjected to the complete sepsis work up, including the lumbar puncture. Patients who had meningitis were noted. Relative risk was used to determine the association of the risk factors to the occurrence of meningitis.

Results: Five (11.4%) out of the 44 neonates had meningitis. Using relative risk, parity >1 child (RR=2.6), maternal infection (1.5), duration of illness > 1 day (2), birth in a hospital (1.5), presence of seizure (2.3), poor activity (1.6), jaundice (1.3), diarrhea (1.07) and dyspnea (3.7) increased the risk of acquiring meningitis.

Conclusions: We then conclude that in the presence of these risk factors, lumbar puncture is warranted.

INTRODUCTION

The neonate (birth - 28 days), is considered a compromised host because of the immaturity of his immune system. At this time, the infant is exposed to a variety of infectious agents, from the time he was conceived, then delivered, and finally taken to the nursery or the home. Hence, the number and severity of bacterial infections are greater in the newborn than any time thereafter.[1]

Neonatal sepsis is a clinical syndrome of systemic illness accompanied by bacteremia occurring during the first month of life.[2] It is an important cause of morbidity and mortality in the neonatal period. The initial presentation may be limited to one system, or a focal infection, but often, a full clinical and laboratory evaluation would reveal other abnormalities[3]. Thus, cultures from normally sterile sites, such as the blood, urine and cerebrospinal fluid are part of the sepsis work up.

Samples of cerebrospinal fluid is obtained by doing a lumbar puncture. It is needed to confirm the diagnosis of meningitis. Meningitis occurs in 1:2500 live births. It has a mortality rate of 30-60 %, with a high incidence (>50%) of neurologic sequelae in survivors[1]. Its presentation may be nonspecific. Because of its high mortality rate, and the difficulty of ruling out meningitis based on clinical manifestations alone, it has been advocated that meningitis must be included in any infant evaluated for sepsis or infection.

However, it is also a well known fact that the lumbar tap is not a very welcome procedure among parents. Ling, et al noted that about 25% of parents refused lumbar tap in their children who had febrile convulsions.[11] Complications of lumbar tap must also be taken into consideration such as infection, spinal cord and nerve damage and apnea and bradycardia when the infant is being held too tightly during the procedure.

It is still a question whether the lumbar tap is a necessary procedure in patients with sepsis neonatorum or a risky one that neonates actually need not undergo. This dilemma is most glaring in the study by Joshi, et al which showed that Australian neonatologists differ in their approach to neonatal sepsis and lumbar tap: 1.6% performed lumbar tap in term infants with respiratory distress; 51% performed it in preterm with suspected late onset sepsis; 24% did not do the lumbar tap in all preterms with late onset sepsis and 85% did not perform it for laboratory evidence suggestive of sepsis in preterm infants diagnosed with late onset sepsis.[7]

OBJECTIVES

General Objective:

In the setting of a specific tertiary care center, all neonates who are admitted and diagnosed with sepsis neonatorum are subjected to the complete sepsis work up, which includes a lumbar tap. This study aims to determine the significance of lumbar tap in neonates diagnosed with sepsis; and the need to include it in all sepsis work up.

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Specific Objectives :

1. To describe the profile of full term infants diagnosed with sepsis neonatorum admitted to the Emergency Room of a Tertiary Care Center during the period of September 1-30, 2001.
2. To determine the incidence of meningitis in patients diagnosed with sepsis neonatorum based on set criteria.
3. To determine the clinical profile of septic neonates with meningitis.
4. To determine the association of risk factors in the neonate with sepsis and the occurrence of meningitis. Determine the predominant CSF growth in patients with neonatal meningitis.

METHODOLOGY

All neonates (0 – 28 days) admitted to the Pediatric emergency room of a tertiary care hospital within the period of September 1-30, 2001, with either focal or systemic symptoms and in whom the diagnosis of sepsis neonatorum was considered comprised the target population. Full term (37-42 weeks age of gestation on delivery) neonates whose parents consented to lumbar puncture, and were stable enough (i.e. not in cardiorespiratory compromise) at the time of admission to undergo the procedure, were included. Preterm (<37 weeks age of gestation) and postterm (>42 weeks age of gestation) neonates as well as those with congenital anomalies were excluded. Of the 62 neonates diagnosed with sepsis neonatorum, 44 patients met the inclusion criteria. Of those excluded, 7 were too unstable for the procedure, 5 did not have consent, 4 were preterm, 1 was postterm and 1 had a nasoethmoidal meningocoele.

The study design utilized was a prospective cohort study.

A detailed birth and maternal history was taken from the parents of each of the subjects. Septic neonates were classified into early onset sepsis (symptoms occurred during the 1st 7 days of life); and late onset sepsis (symptoms occurred after the 7th day of life). All underwent complete sepsis work up, which included a complete blood count, chest xray, blood culture, urinalysis and urine culture (clean catch), fecalysis and stool culture and the lumbar puncture.

The white blood cell count was categorized as normal (5-21 x 1000 cells/mm3), decreased or increased.

Chest radiograph was read as normal if no infiltrates were seen; and neonatal pneumonia if patchy infiltrates were noted.

Samples of blood, urine and stool were sent for culture, and growth in any one of these were noted

Cerebrospinal fluid (CSF) samples were sent for gram staining and culture, glucose and protein levels and cell count with differentials. Meningitis was diagnosed based on ↑ WBC count with segmenter predominance, ↑ protein levels and ↓ glucose in CSF compared to the normal values[1]:

Protein	84+/-45 mg/dl	
Glucose	46+/-10	
WBC	11+/-10	90th percentile = 22
Segmenters	2.2+/-3.8	90th percentile 6

No growth on CSF culture did not preclude the diagnosis of meningitis.

ANALYSIS OF RESULTS:

To determine the association of risk factors in the septic neonate with the occurrence of meningitis, relative risk was computed. These risk factors include:

1. age at onset of illness
2. age and parity of mother
3. maternal infection during pregnancy
4. place of birth
5. wellbeing at birth
6. duration of illness
7. symptoms manifested
8. WBC picture
9. chest x-ray findings
10. growth in blood, urine and stool

RESULTS

The clinical profile of full term neonates with sepsis, as summarized in Table 1, shows majority of them had late onset sepsis (80%), are male (67%), with maternal age between 19-35 years (80%) and parity of 1-3 (79%).

Of the 44, 5 (11.4%) had meningitis with clinical profile summarized in Table 3. Most of the neonates with meningitis had late onset sepsis (60%), and were male (60%). Maternal age is between 19-35 years (80%), and parity is from 1 to 3 (100%). Most were born in a local hospital (60%), the rest at home (40%). Symptoms during the course of the illness included poor activity (80%), seizure and diarrhea (40% each), fever, jaundice, cough and dyspnea (20% each). Duration of illness was 1-7 days (60%). Laboratory findings in patients with meningitis showed normal WBC count (80%), normal chest xray findings (80%), no growth in blood (100%), urine (100%) and stool (100%).

Table 1. Clinical Profile of Patients Diagnosed with Sepsis Neonatorum

Variable	% of Total Population(n=44)
Age	
Early onset (< or = 7d)	20
Late onset (>7 days)	80
Gender	
Male	67
Female	33
Age of Mother	
<or = 18 years old	98
19-35 years old	0
>35 years old	11
Parity of Mother	
1st child	36
2nd child	20
3rd child	23
4th child	4.5
5th child	4.5
6th child	7.5
7th child	4.5
Maternal Infection	
Present	50
None	50
Place of Birth	
Home	50
Lying in clinic	14
Local Hospital	20
PGH	16
Wellbeing at Birth	
Good suck, cry and activity	80
Poor suck, cry and activity	20
Duration of Illness	
At birth	14
< 1 day	11
1-7 days	61
>7days	14
Symptoms	
Fever	59
Seizures	23
Poor activity	73
Jaundice	16
Diarrhea	39
Cough	30
Dyspnea	7
WBC Picture	
Normal (5-21)	73
Increased with segmenter predominance	23
Decreased	4
Chest Xray Findings	
Normal	77
Neonatal pneumonia	23
Growth in Blood Culture	
Present	9
None	91
Growth in Urine Culture	
Present	4.5
None	95.5
Growth in Stool Culture	
Present	2
None	98

Table 2. Proportion of Meningitis in Patients Diagnosed with Sepsis Neonatorum

Variable	Number	% of Total Population(n=44)
With meningitis	5	11.4
Without meningitis	39	88.6

Table 3. Clinical Profile of Patients Diagnosed with Neonatal Meningitis

Variable	% of Patients with Meningitis(n=5)
Age	
Early onset (< or = 7d)	40
Late onset (>7 days)	60
Gender	
Male	60
Female	40
Age of Mother	
<or = 18 years old	20
19-35 years old	80
>35 years old	0
Parity of Mother	
1st child	40
2nd child	20
3rd child	40
Maternal illness	
Present	60
None	40
Place of Birth	
Home	40
Lying in clinic	0
Local Hospital	60
PGH	0
Wellbeing at Birth	
Good suck, cry and activity	60
Poor suck, cry and activity	40
Duration of Illness	
At birth	20
< 1 day	20
1-7 days	60
>7days	0
Symptoms	
Fever	20
Seizures	40
Poor activity	80
Jaundice	20
Diarrhea	40
Cough	20
Dyspnea	20
WBC Picture	
Normal (5-21)	80
Increased with segmenter predominance	20
Decreased	0
Chest Xray Findings	
Normal	80
Neonatal pneumonia	20
Growth in Blood Culture	
Present	0
None	100
Growth in Urine Culture	
Present	0
None	100
Growth in Stool Culture	
Present	0
None	100

Table 4. Relative Risk of the Risk Factors to the Occurrence of Meningitis

Variable	Relative Risk
Age of mother </> 19-35 years old	1.00
Parity of mother 2 or more	1.33
Maternal Infection	1.49
Hospital-borne	1.50
Duration of illness > 1 day	1.50
Late onset sepsis	0.39
Presence of Fever	0.17
Seizure	2.20
Poor activity	1.60
Jaundice	1.30
Diarrhea	1.06
Cough	0.60
Dyspnea	3.40
Increased or Decreased WBC Picture	0.67
Presence of Pneumonia on Chest X-ray	0.85
Growth in Blood Culture	0
Growth in Urine Culture	0
Growth in Stool Culture	0

Computation of relative risk showed that in the presence of parity >1 child, maternal infection, duration of illness >1day, birth in a hospital, presence of seizure, poor activity, jaundice, diarrhea and dyspnea, there is an increased risk for the occurrence of meningitis (Table 4).

There was no growth on CSF culture in the 5 cases of meningitis.

DISCUSSION

Of the 44 full term neonates in whom sepsis was considered, 20% of these were of early onset, which signifies that the infection was acquired before or during delivery; and 80% were late onset sepsis, which means that the infection came from the community or nursery. This is comparable to a study by Alisago in National children's Hospital were late onset sepsis was also predominant (74.8%).[25] This means that most infants consulting at the emergency room are cases of sepsis neonatorum which are community acquired.

Martius et al noted in their study that risk factors for developing sepsis neonatorum included prematurity, maternal illness and poor APGAR score at 1 minute. Abreu et al adds multiparous mothers, and birth in he hospital as risk factors for sepsis neonatorum.[26] These risk factors were not predominant in our population. In our study, only 50% of the mothers had maternal illness during pregnancy, and most of the subjects had good wellbeing at birth (80%), corresponding to a high APGAR score. Majority of our patients were the 1st-3rd child (79%), and were born at home (50%). Although this may show that our subjects were at the start not prone to developing sepsis, it is still important to note that as a neonate, he is considered a compromised host, owing to the fact that he still has an immature immune system. The neonate has diminished complement, neutophil and natural killer cell activity.

The question of whether or not to do the lumbar puncture arises. Brik et al (1997) tried to find out during which conditions is the lumbar tap warranted.[20] They made use of the Yale Observational Scale and laboratory findings to label the neonate as high risk or low risk for serious bacterial infection. None of the low risk neonates had meningitis. Hence they claimed that low risk infants can be spared of the procedure. Johnson et al (1997). Macintyre et al (1995) and Kumer et al (1995) had come up with the same conclusions in their separate studies - that neonates with maternal risk factors (Grp B streptococcal colonization, maternal fever or leukocytosis. PROM>18 hours, foulsmelling amniotic fluid) but are asymptomatic need not undergo a lumbar tap.[9,10,12] Kumer et al (1995) adds however that symptomatic babies (i.e. poor suck and activity, seizures) should undergo a lumbar tap because there are no reliable clinical or laboratory marker to predict which babies will have meningitis.[12]

In our population, 5 (11.4%) had meningitis. 40% had early onset, 60% had late onset sepsis. This coincides with the findings of Ajayi, et al (1997) which showed that neonates, 72 hours of age accounted for 52% of lumbar puncture done, but no case of meningitis was seen.[11] This validates that, although it occurs, meningitis is rare during the first 3days of life.

The clinical presentation of meningitis may be nonspecific. Barranda-Bautista (1978) noted that most commonly encountered symptoms included fever, poor suck and activity, diarrhea, sensorial changes and seizures.[23] In this study, the abovementioned symptoms were seen and in addition, jaundice, cough and dyspnea were present.

It is important to rule out meningitis because of its complications which include subdural effusion, hydrocephalus, facial nerve palsy and blindness.[2] Neurologic sequelae in neonates affected with meningitis usually involve psychomotor and language delay.[24]

In cohort studies such as this, relative risk is computed.to know if the presence of a variable increases the risk of having the disease. Table 4 shows that parity >1 child (2.6x), presence of maternal infection (1.5x), duration of illness (2x), presence of

seizure (2.2x), poor activity (1.5x), jaundice (1.3x), diarrhea (1.07x) and dyspnea (3.7x) increased the risk of developing meningitis as much times as stated.

Multiparous mothers have been classified as high risk for complications, and this is true for increasing the risk of meningitis as well as seen in our results. Maternal infection can be transmitted to the fetus during pregnancy, or during delivery as well as while the baby is being taken cared of at home. Birth in the hospital exposes the child to more infectious agents than when he is born at home. Longer duration of illness (>1day) would give more time for the infection to travel from initially a focus to the blood, then through the immature blood brain barrier and finally to the meninges. It is at this point that the symptoms probably are serious enough to make the parents seek consult, hence the duration of illness (Table 3) is most commonly 1-7 days.

The presence of seizures and poor activity as stated in previous studies are well-established symptoms of meningitis. Jaundice seen in the cases of meningitis in our study are hyperbilirubinemia secondary to the septic process. Diarrhea may be the primary focus in some cases of meningitis. Dyspnea which has by far the greatest risk at 3.7x, may be a manifestation of a primary focus of infection in the respiratory tract, however, cough, which is also a common symptom in respiratory tract infection did not increase the risk of meningitis (RR=0.60). Altered respiratory patterns such as hyper/hypoventilation could suggest increased intracranial pressure in the patient[3] and this may be the case in our subjects.

It is noteworthy that other laboratory findings do not actually help identify which patients will have meningitis.

In the presence of these risk factors, it is then necessary to do the lumbar puncture, because the neonate has an increased risk for acquiring meningitis.

CONCLUSIONS AND RECOMMENDATIONS

Fortyfour full term neonates were considered to have sepsis neonatorum. Of these, 11.4% had meningitis. Using relative risk, presence of parity >1 child, maternal infection, duration of illness >1day, birth in a hospital, presence of seizure, poor activity, jaundice, diarrhea and dyspnea, there is an increased risk for the occurrence of meningitis hence there is a need for the lumbar puncture.

However, this conclusion holds true for the subjects that this study has. For the conclusion to hold true for the general population of neonates, a bigger sample size is recommended.

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