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Original Article

Comparison of CSF parameters between traumatic and nontraumatic puncture in term versus preterm neonates

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Abstract

Introduction: Evaluation of the cerebrospinal fluid (CSF) white blood cell (WBC) count and glucose and protein concentrations is used to assess the probability of the presence of central nervous system (CNS) infection. Although normal values are well established for CSF cell counts and protein and glucose contents in children and adults, this is not the case for neonates. The purpose of this study was to evaluate the composition of no infected CSF obtained by nontraumatic lumbar puncture in neonates (age < 28 days), specifically distinguishing CSF profiles of those term babies compared with those premature infants. ***Materials& Methods***: The CSF samples obtained by lumbar puncture from 120 neonates were examined by routine procedures. Results: By comparing CSF parameters between term gestation neonate group with premature neonate one, nontraumatic puncture, there was no statistically significant difference($p<0.05$) in the mean WBC ($p=0.6$)The mean protein concentration was significantly greater in those premature neonates ($p <0.04$). The mean glucose concentration was also analogous in both groups ($p=0.5$)
Conclusion: a prospective study using mortality under developmental follow up will better define the utility of CSF parameters in the premature neonate
***Keywords*:** neonatal CSF, term vs. preterm, traumatic vs. nontraumatic

Introduction

The cumulative incidence of meningitis is highest in the first month of life and is higher in preterm neonates than term neonates.1 It is one of the major causes of morbidity and mortality in neonatal age group. Evaluation of the cerebrospinal fluid (CSF) white blood cell (WBC) count and glucose and protein concentrations is used to assess the probability of the presence of central nervous system (CNS) infection. Although normal values are well established for CSF cell counts and protein and glucose contents in children and adults, this is not the case for neonates.2,3 There is no specific information regarding the range of CSF values in high-risk term and preterm neonates with noninfected CSF obtained by nontraumatic puncture, with no red blood cells (RBC/mm3 = 0). When faced with the need to make therapeutic decisions on the interpretation of CSF parameters, the clinicians often use The Harriet Lane Handbook as their guide. The normal "cutoff" values for CSF parameters in preterm neonates found in this guide are ≤ 25 WBC/mm3, ≥ 24 mg glucose/dL, and ≤ 170 mg protein/dL.4

The purpose of this study was to evaluate the composition of no infected CSF obtained by nontraumatic lumbar puncture in neonates (age < 28 days), specifically distinguishing CSF profiles of those term babies compared with those premature infants, and to compare CSF values between nontraumatic and traumatic puncture up to 500 red blood cells (RBC)/mm3 in term neonates with the preterm ones.

Material and Method

Study design: The CSF samples obtained by lumbar puncture from 120 neonates(randomly selected) were examined by routine procedures

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from January 2012 to December 2012 in Dr.B.C. Roy Post Graduate Institue Of Pediatric Sciences The CSF WBC count was performed in improved Neubauerhaemocytometer, the CSF protein and glucose were measured by enzymatic method in semiautomated biochemical analyser. Inclusion criteria: 1. age up to 28 days, 2a.nontraumatic puncture , or 2b. Traumaticpuncture up to 500 RBC/mm3 and 3.Accessible clinical data. Exclusion criteria: 2.nontraumatic haemorrhagic CSF, 2. Neonateshaving clinical evidence of infection. Standard statistical methods were used in evaluation and p value <0.05 was considered as statistical significant difference. Informed consent was taken from each and every patient before including the patients in our study.

Results

Among the 120 CSF samples obtained by lumbar puncture 25 (term10, preterm15) were excluded according to excluding criteria. Therefore the cytological parameters, protein and glucose values were studied in 90 samples (50 term babies and 45 preterm babies). 10 CSF samples from the term and 5 samples from the preterm neonates were found to be traumatic (RBC <500/cmm).

By comparing CSF parameters (nontraumatic puncture) between term neonate group with premature neonate one, there was no statistically significant difference (p<0.05) in the mean WBC count (p=0.6). The mean protein concentration was significantly greater in those premature neonates (p <0.04). The mean glucose concentration was also analogous in both groups (p=0.5) (Table 1).

By comparing CSF parameters in traumatic puncture with nontraumatic puncture performed on full-term gestation neonates, the mean glucose oncentration was significantly lesser in the traumatic puncture group (p<0.02) (Table2).

Regarding premature neonates, the mean protein concentration was significantly greater in thetraumatic puncture group (p<0.05). The glucose concentration was also lesser in these children but the difference was not significant (Table3).

Table 1: Cerebrospinal fluid parameters in term vs preterm neonates

	Term neonate(n=40) (mean± SD)	Preterm neonate(n=40) (mean± SD)
WBC count / cmm	↑5.5 ± 3.6	5.1 ± 5.2
Protein (mg/dl)	↑ 68.2 ± 15.1	72.6 ± 15.8
Glucose(mg/dl)	55.0 ± 25.6↑	50.3 ± 27.6

Table 2: Cerebrospinal fluid parameters in term neonates- non traumatic vs traumatic

	RBC nil (mean± SD)	RBC < 500/cmm (mean± SD)
WBC count / cmm	5.5 ± 3.6	6.8± 4.1
Protein (mg/dl)	68.2± 15.1	70.5± 22.8
Glucose(mg/dl)	55.0± 25.6	37.6± 22.2

Table3: Cerebrospinal fluid parameters in preterm neonates- non traumatic vs traumatic

	RBC nil (mean± SD)	RBC < 500/cmm (mean± SD)
WBC count / cmm	5.1 ± 5.2	7.2± 6.5
Protein (mg/dl)	72.6± 15.2	102.5± 30.6
Glucose(mg/dl)	50.3± 27.6	45.2± 22.2

Discussion

The proper interpretation of CSF results depends on knowledge of normal values in the group of patients being evaluated.[5] Several authors have pointed out that there is an acceptable variability in the CSF profile, especially CSF WBC count, in neonates.[6] Furthermore, early detection of neonatal meningitis is a continuing concern in the Neonatal Intensive Care unit. [7]

Several studies showed that the average CSF WBC count is 6 to 7 cell/mm^3 in neonates but these studies evaluated healthy neonates[8]; this is very close to the results we found (5.5/mm^3 and 5.1/mm^3). However, greater number of cells may be normal (28 WBC/mm^3). Luz[9], studying a full-term gestation and normal neonate group, found that the CSF WBC count can be up to 12 WBC/mm3 and the protein concentration can be up to 120 mg/dl; although this author studied CSF samples with up to 600 RBC/mm^3, these values are close to ours (Table 1 and 2).

The mean protein concentration was significantly greater in the premature group and this is probably due to the more immature blood-brain barrier in these children when compared with term babies ($p < 0.04$),[10] this parameter in both groups was slightly lesser than those previously reported in the literature[11]. The mean glucose concentration was just the same in both groups.

When we compared traumatic puncture with nontraumatic puncture, we found that the mean glucose concentration was significantly lesser when the puncture was traumatic ($p< 0.02$) in term neonates; in premature neonates the mean glucose concentration was also lesser in the traumatic puncture group but the difference was not significant ($p< 0.20$); it is possible that some of the patients included in the group of traumatic puncture were in fact patients with CNS hemorrhage what could explain the lower glucose concentrations[2]; the mean protein concentration was greater in children who underwent traumatic puncture in the premature neonate group ($p<0.05$). These data show how traumatic puncture, even with RBC up to 500/mm^3, interferes on CSF analysis and changes its parameters .

Conclusion

The CSF profile, like any other laboratory determination, should be evaluated within the clinical context of the individual case. The mean CSF protein concentration is significantly greater in those premature neonates compared with those full-term gestation neonates. Traumatic puncture, even up to 500 RBC/mm^3, interferes on CSF parameters. But there are certain limitations in our study like small number of samples(n=95), short duration, single centre study applied on healthy individuals. A prospective study using mortality and neurodevelopmental follow up will better define the utility of CSF parameters in the premature neonate.

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