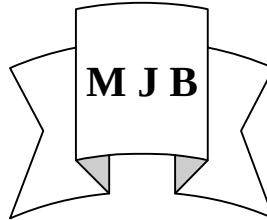


Diagnostic Lumbar Puncture and Associated Risk Factors in Children with Acute Lymphoblastic Leukemia

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Abstract

A study used to determine the risk factors for spontaneous (Bloody) and procedure related (Traumatic) hemorrhagic complications in diagnostic lumbar punctures (LPs) of children with acute lymphoblastic leukemia (ALL) .

In our study age of the patient and platelet count at time of diagnostic LPs are important risk factors for hemorrhagic problems related to the procedure. In the age less than 1 year , 25 procedure performed traumatic and bloody LPs (52% , 36 % respectively). With the low platelet count $< 100 \times 10^9/L$, high incidence of traumatic and bloody LPs (33.3 % , 25.5 % respectively) , and the majority seen in cases with sever thrombocytopenia (platelet count $< 25 \times 10^9$) were traumatic and bloody LPs are (72 % , 27.9 % respectively).

الخلاصة

الهدف من الدراسة لبيان العوامل المسببة للنزف في السائل الشوكي خلال عملية سحب سائل التشخيصية للأطفال مرضى لوكيميا ابيضاض الدم اللمفاوي الحاد من كلا الجنسين .

بينت الدراسة ان عمر المريض وعدد صفيحات تخثر الدم مؤشر مهم لاحتمال حدوث النزف في السائل الشوكي عند اجراء عملية سحب السائل . ففي عمر اقل من سنة اجريت 25 عملية سحب منها نزف بسبب العملية (52%) ونزف تلقائي (36%) . نقص صفيحات تخثر الدم اقل من 10^9 لتر مصحوب بارتفاع نسبة حالات النزف في السائل الشوكي حيث النزف بسبب العملية (33.3%) والنزف التلقائي (25.5 %) وكان 100×10^9 / لتر) حيث نزف بسبب العملية (72%) ونزف تلقائي (27.9%) . معظمها عندما يكون نقص صفيحات التخثر شديد (اقل من 25

Introduction

Lumbar puncture (LP) also called spinal tap , is the procedure doctors use to obtain sample of cerebrospinal fluid (CSF) , the liquid that surround the brain and spinal cord, for tests. Cerebrospinal fluid is formed in special areas of the brain called chroidplexus in the ventricles. It flow down from the ventricles into the area around the spinal cord. CSF is usually clear and contain small amount of protein and sugar (glucose). During Lumbar puncture you either lie on your side (Horizontal) or site upright position (1,2) and the site thoroughly cleaned. Your back is scrubbed with local anesthetic medicine

on the surface of the skin used. When the skin is numb from local anesthetic , a small needle is inserted into your back at the level of the hip bones below the bottom of the spinal cord , in the intervertebral space between vertebrae L4-L5. The needle pushed forward gently until the CSF is found(3). For testing 3-5 milliliter of fluid are removed and put into special sterile tubes. Lumbar puncture is easier to perform if the patient follows positioning instructions completely(2).

Although LP is generally safe, there is a risk of trauma and blood can be introduced into the cerebrospinal fluid(4,5,6). The mechanism of bleeding into the CSF at the

time of LP is not known with certainty, over insertion of the LP needle can lead to CSF contamination with blood , through laceration of vertebral veinous plexus or soft tissue trauma(7).

Blood in the CSF alter the cell count, increase the protein level and can cause false positive cytological and culture results thereby cause diagnostic confusion (8,9,10). Further more circulating leukemic(11,12,13) cells and bacteria(14) can introduced into the CSF and worsening the patients prognosis.

The objective of the study to identify the risky heamorrhagic complications of diagnostic (LP) in children with acute lymphoblastic leukemia.

Material and Methods

Three hundred seventy-eight pediatric patients with newly diagnosed Acute Lymphoblastic Leukemia (ALL) with circulation lymphoblast at the period , February 1998 and October 2006, underwent a diagnostic lumbar puncture (LP) for central nervous system leukemia. For each LP , the patients age , sex , platelet count and number of RBCs per microliter of CSF were recorded.

Traumatic lumbar punctures defined as those in which CSF contained at least 10 RBCs per microliter because this degree of blood contamination of CSF is associated with a worsened prognosis in pediatric patients with ALL and circulating lymphoblast (15).

Bloody lumbar punctures defined as those in which the CSF contained at least 500 RBCs per microliter, this degree of blood contamination causes diagnostic confusion for patients with suspected meningitis and possibly increased risk of introducing bacteria into the CSF when LP is performed on patints with bacteremia (16,17).

Age categories were younger than 1 year and 1 to 18 years because of obvious

differences in risk of study outcomes below and above the age of 1 year for both sex (male and female).

Platelet counts from $1 \times 10^9/L$ to $100 \times 10^9/L$ were categorized in increments of $25 \times 10^9/L$ and considered as a risk factor because of associated abnormal bleeding time and other hemostatic measures (18,19).

Platelet count higher than $100 \times 10^9/L$ comprised a single category because bleeding time and other measures of hemostasis are normal when the paletet count is above this value (18).

Results

The cerebrospinal fluid findings of diagnostic Lumbar punctures (LPs) performed on 378 pediatric patients with newly diagnosed acute lymphoblastic leukemia (ALL) with thrombocytopenia were studied.

Sex , age and platelet count were considered possible risk factors for traumatic and bloody lumber puncture.

Of the 378 (LPs) studied traumatic and bloody LPs (26.4%, 19.31% respectively) table (1). Male patients 192 (51%) and female patients 186 (49%), range in age from 1 month to 18 year (median 4.9 years) table (1).

The relation-ship of age to hemorrhagic complications of LPs in patients with ALL presented (in figure 1) . Age less than one year was associated with high incidence of both traumatic and bloody LPs (52% traumatic and 36% bloody) than other pediatric age groups (childhood and adolescence) table (1) and figure (1).

All platelet count of $100 \times 10^9/L$ or less were associated with increased incidence of traumatic and bloody LPs compared to LPs performed at platelet count of $100 \times 10^9/L$ or more. However all hemorrhagic complications of LPs were more frequent if the procedure was performed on patient with platelet count $< 25 \times 10^9/L$ (72 % traumatic and 27.9% bloody) table (2).

Discussion

The study evaluated an important problem with a common procedure , traumatic and bloody LPs , that may indirectly lead to poor outcome in pediatric patients with newly diagnosed ALL with circulating lymphoblast and thrombocytopenia (15). Moreover , bloody cerebrospinal fluid (CSF) obscure the diagnosis of central nervous system leukemia at the presentation of ALL. Therefore, attempts should be made to reduce the risk of traumatic and bloody LPs (20).

The high proportion of traumatic and bloody LPs observed in this study (26.4 ,19.3 respectively) is more than the range reported in other studies (6-19%)(15,21,22). The increased risk of bloody LPs in infants may be due to technical difficulty in performing the LP that results from smaller intervertebral spaces and the shallow depth of needle insertion required to reach thecal space. Sex had no effect on the procedure (23).

Platelet count is strong predictor of traumatic and bloody LP. Patients in all categories with platelet count of $100 \times 10^9/L$ or less were associated with increased risk . Of the 378 patient with diagnostic LPs , 43 procedure performed at $< 25 \times 10^9/L$ platelet count with (72% traumatic and 27.9% bloody) 69 procedure performed at platelet count $26-50 \times 10^9/L$ with (10.5 % traumatic and 17.3 % bloody) , 86 at platelet count $51-75 \times 10^9/L$ with (3.7% traumatic and 13% bloody) ,72 performed at count $76-100 \times 10^9/L$ with (13.8% traumatic and 19.4% bloody) , and 108 procedure performed at platelet count $> 100 \times 10^9/L$ with (9.2% traumatic and 4.6% bloody) . High incidence of traumatic and bloody LP consistent with other studies (15,19,23) . Furthermore the risk was elevated with sever thrombocytopenia (count $< 25 \times 10^9/L$, for both traumatic and bloody (72% and 27.9%

respectively) . A higher platelet count is needed to reduced such risk in patient with circulating leukemia cells or bacteriemia (23).

In the patients with platelet count $100 \times 10^9/L$ or more there is low incidence of both traumatic and bloody LPs, consistent with the normal bleeding times found in patients with platelet count higher than $100 \times 10^9/L$.

Conclusion

Cerebrospinal fluid examination is a common procedure for the diagnosis of central nervous system leukemia in pediatric patients with newly diagnosed acute lymphoblastic leukemia with circulating lymphoblast.

The data emphasize the importance of a properly performed LPs particularly at time of diagnosis when low platelet count. Diagnostic LPs in ALL should only be done by an experienced physician preferably by the oncologist and this is not the time to teach LPs to our students or residents.

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Table (1) Effect of Sex and age on traumatic and bloody Lumber punctures (LPs) of Pediatric patients with acute lymphoblastic leukemia.

Variable	Number of patients	Traumatic		Bloody	
		No	%	No	%
total	378	100	26.4%	73	19.3%
Sex					
male	192 (51%)	54	28.1%	39	20.3%
female	186 (49%)	46	24.1%	34	18.2%
Age					
< 1 year	25	13	52%	9	36%
1 – 18 year	353	87	24.6%	64	18.1%

Table (2) Effect of platelet count on traumatic and bloody Lumbar Punctures (LPs) of pediatric patients with acute lymphoblastic leukemia.

Variable Platelet count	Number of patients	Traumatic		Bloody	
		No	%	No	%
1-25x10 ⁹ /L	43	31	72%	12	29.9%
26-50x10 ⁹ /L	69	30	43.4%	8	11.5%
51-75x10 ⁹ /L	86	32	37.2%	11	12.7%
76-100x10 ⁹ /L	72	25	34.7%	10	13.8%
Total	270	90	33.3%	69	25.5%
> 100x10 ⁹ /L	108	10	9.2%	4	3.7%
Total	378	100	26.4%	73	19.3%