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Research Article

### MENINGITIS IN CHILDREN: FREQUENCY OF MENINGITIS WITH FIRST EPISODE OF FEBRILE SEIZURE.

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#### Abstract:

**INTRODUCTION:** Seizures in children related to fever are most frequent type of febrile seizures and most important cause of hospital admissions throughout world. They affect 2-5% of population between the age of 06 months to 05 years. A seizure accompanied by fever without any evidence of intracranial infection, metabolic disturbance or previous history of a febrile seizures is called First simple febrile seizures (FSFS) and present within 12 hours after the seizure in children. The seizures that are generalized lasting less than 15 minutes and occurring once in 24 hours are called simple seizures and focal seizures lasting more than 15 minutes and recurrent in 24 hours are called complex seizures. **OBJECTIVE:** Determination of frequency of meningitis in subjects presenting with first febrile seizure.

**Study Design:** This was a cross sectional study

**Setting:** Pediatric medicine, Peoples Medical College Hospital, Nawabshah. **Duration of Study:** this study was conducted from 7<sup>th</sup> November 2017 to 6<sup>th</sup> may 2018. **Subject and Methods:** Current study was performed next to approval from hospital ethical review committee. The subjects who visited to the department of Paediatrics, Civil Hospital and fulfilling the inclusion criterion were recruited in this study. An informed written consent from parents was obtained. Demographics (name, age and contact) will also be obtained. Temperature of every child was taken from axilla for one minute. The diagnosis of meningitis in subjects was based on clinical presentation (fever and seizure) with CSF examination as per operational definitions. The inclusion and exclusion criterion were followed strictly to control the bias and effect modifiers.

**Results:** Out of the 191 patients, 131 (68.6%) male and 60 (31.4%) were female with mean age 19.5±3.34 months and 31(16.2%) subjects were diagnosed to have meningitis. **Conclusion:** it was concluded that in children who presented with FS the frequency of bacterial meningitis was not high and was more common under age of 18 months.

**Key Words:** Febrile seizure, CSF, Lumbar puncture, Meningitis, Bacterial Meningitis.

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**INTRODUCTION:**

Febrile seizures (FS) are the most common type of childhood seizures, affecting 2–5% of children older than 1 month and most commonly from 6 months–5 years old.<sup>1-3</sup> It is possibly a major cause of pediatric admissions worldwide.<sup>4</sup> FS or First simple febrile seizure (FSFS) are defined as seizures accompanied by fever without evidence of intracranial infection, metabolic disturbance, or a history of previous afebrile seizures [1-5] and present within 12 hours after the seizure in children.<sup>6</sup> They are categorized as either simple (generalized, lasting less than 15 minutes and occurring only once in a 24-hour period) or complex (focal seizure, lasting more than 15 minutes or recurrent in a 24-hour period) [6,7] 16 (14.54%) children with 1st febrile seizure were diagnosed to have meningitis [6].

Seizures in children related to fever are most frequent type of febrile seizures and most important cause of hospital admissions throughout world. They affect 2-5% of population between the age of 06 months to 05 years [1][2][3][4]. A seizure accompanied by fever without any evidence of intracranial infection, metabolic disturbance or previous history of afebrile seizures is called First simple febrile seizures (FSFS) [1][5].

The seizures that are generalized lasting less than 15 minutes and occurring once in 24 hours are called simple seizures and focal seizures lasting more than 15 minutes and recurrent in 24 hours are called complex seizures [6][7].

The word febrile seizure is not projected for usage amongst children with apparent central nervous system infections or underlying seizure activity [7]. Mostly febrile seizures in childhood are benign and self-limiting in nature but such seizures frighten most of parents [8]. The children with FSFS are at increased risk for developing bacterial meningitis remains debatable [6][9].

Although Febrile Seizure induce by age related overexciting of the brain to fever, to determine the reason of the fever is precarious in the assessment of such subjects [6]. Previous literature had supported the association among bacterial meningitis and seizures [10][11]. In infants with fever seizure may be the only feature of bacterial meningitis [12][13]. In 16.7% of children seizures were the first presentation of meningitis and in about one-third of them no signs and symptoms of meningeal irritation were obvious. The occurrence of meningitis in children with febrile seizure is reported in many studies all over the world [1][14]. The main reason of mortality and disability around world in children is related to bacterial

meningitis. Over a million subjects are affected yearly, with an increased frequency in between the growing nations and in some definite geographic areas [15].

The screening method for the diagnosis of bacterial meningitis is CSF examination (including WBC count, Gram stain, glucose and proteins) awaiting culture of the CSF [16]. CSF culture is highly specific but lacks sensitivity, especially when antimicrobials have been given as well as the time needed till results appear [15]. However, some investigators document bacterial meningitis only in patients with positive CSF culture [15][17]. The frequency of meningitis in subjects between the ages of 6 months to 18 months was reported as 20.33% [6].

**Rationale:** In pediatric emergency of any busy hospital duty doctors always come across a number of patients who present with seizures. Seizure due to fever is very common during childhood. It can simply be associated with fever without a focus for infection or can be the presenting sign of localized infections, including central nervous system infections i.e meningitis. Seizures in childhood are the frequent and commonly related to the fever and are called as febrile seizures. Seizures with fever may be the only feature of meningitis in infants, so it is required to rule out the underlying meningitis in these subjects.

Moreover seizures can be tremendously terrifying, expressively traumatic and anxiety producing when observed by relatives and also it is a significant cause of morbidity and mortality in both developed and under developed countries and this makes the strong rationale to conduct this research i.e the frequency of meningitis in children presenting with 1<sup>st</sup> febrile seizure.

**OBJECTIVE:** Determination of frequency of meningitis in subjects presenting with first febrile seizure.

**OPERATIONAL DEFINITION:**

**FEBRILE SEIZURES:** Seizure that occurs between the ages of 6 months to 2 years with fever.

**FEVER:** Subjects with axillary temperature of  $>100.4^{\circ}\text{F}$  or  $38^{\circ}\text{C}$  recorded on a thermometer for  $\geq 1$  day were considered as having fever.

**SEIZURE:** Episodic transient neurologic symptoms such as involuntary muscle movements with voiding of urine for  $\geq 5$  seconds, as expressed or inquired by the guardian during history by the researcher.

**MENINGITIS:** Fever and seizures with abnormal findings in cerebro-spinal fluid (CSF) in a child between the ages of 06 months to 24 months.

**ABNORMAL CEREBRO-SPINAL FLUID:**

Presence of one or more of the following abnormal cerebro-spinal fluid (CSF) findings:

- CSF cells >5/mm<sup>3</sup>
- Protein ≥40 mg%
- Sugar: < 2/3 of blood sugar levels
- Positive gram stain and culture: (Larger quantities of CFU (colony forming units) per mm<sup>3</sup> of CSF intensify the probability of a positive result.)

**MATERIAL AND METHODS:**

**Study Design:** This was a cross sectional study

**Setting:** Pediatric medicine, Peoples Medical College Hospital, Nawabshah.

**Duration of Study:** this study was conducted from 7<sup>th</sup> November 2017 to 6<sup>th</sup> may 2018.

**Sample Size:** WHO software with 95% confidence level was used for sample size calculations. The calculated sample size was 191 subjects obtained by taking prevalence of meningitis by using CSF in children presenting with first seizure and fever using P=14.54%(6) and d=5%.

**Sampling Technique:** Non probability consecutive sampling method was used.

**SAMPLE SELECTION:**

Subjects of either gender between the ages of 06 months to 2 years presenting with first episode of fever with seizures were included in the study, whereas children with any neurologic disease like cerebral palsy (echogenic brain on ultrasound brain), past history of meningitis and subjects taking antibiotics for more than 48 hours as asked from guardian during history were excluded from study.

**DATA COLLECTION PROCEDURE:**

Current study was performed after the authorization by hospital ethical review committee. The patients visiting the department of Paediatric medicine Civil Hospital, fulfilling the inclusion criterion were included in current study. An informed written permission from parents was obtained. Demographics (name, age and contact) will also be obtained. Temperature of every child was taken from axilla for one minute, was considered as having fever when axillary temperature noted at the emergency ≥100.4<sup>0</sup>F. A lumbar puncture was performed if the child having the febrile seizures. CSF samples obtained in two sterile vials and were sent to the institutional laboratory for CSF analyses as per operational definition. Cell counts, differential count, sugar, protein levels, Gram's staining and culture were obtained.

Fever with seizures and CSF findings as per operational definition were based for diagnosis of

meningitis in children. The inclusion and exclusion criterion were followed strictly to control the bias and effect modifiers.

**DATA ANALYSIS PROCEDURE:**

Statistical package for the Social Sciences (SPSS) Version 20 were used for data analysis. Qualitative variables like sex, CSF examination status, meningitis were computed for frequency and percentage. For quantitative variable like age, weight and temperature Mean ±SD were calculated. Gender, age, weight were stratified to analyze the significance of these modifiers on the results using the Chi-square test. P≤0.05 was considered as significant.

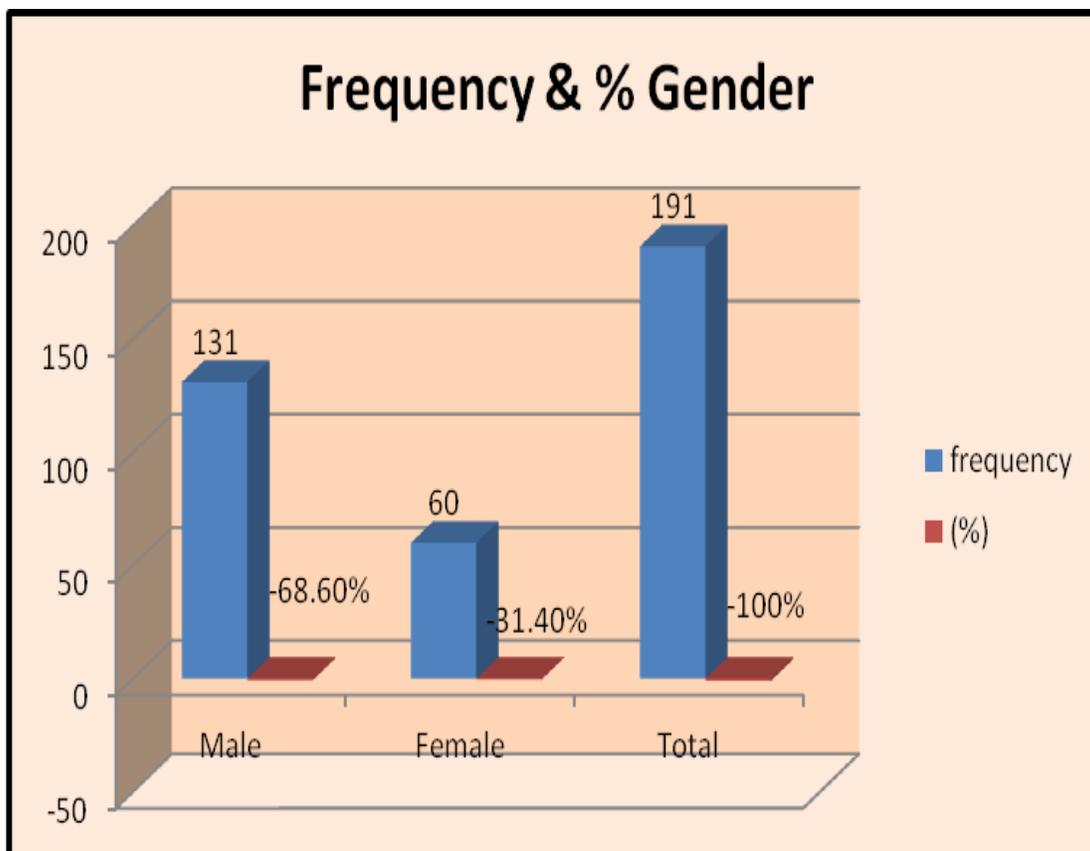
**RESULTS:**

A total of 191 subjects with first episode of febrile seizures were identified. ACSF examination was achieved. Mean age of subjects was 19.5±3.34 months. Mean weight of the patients was 8.6±2.6, mean temperature of the patients was 102±1.2F<sup>0</sup>, mean CSF cells were 6.5±2.2, and mean protein was 44.6±5.4. There were 131(68.6%) male and 60(31.4%) were female patients. All patients undergone CSF examination. CSF cells >5 mm<sup>3</sup> were noted in 21(10.9%), elevated protein levels in 16(8.4%), sugar levels were observed <2/3 of blood levels in 20(10.5%) and positive gram stain and culture was in 26(13.6%) subjects. Meningitis was diagnosed in 31 (16.2%) children. Meningitis was detected more in subjects with age less than 14 months as compared to subjects with age more than 14 months which was statically significant with p < 0.05. In subjects with age between 6 -14 months meningitis was seen in 26.2% (22) where as in age group 15 to 24 months meningitis was present in (09) subjects.

In the age group of 6 – 14 months, 22 (26.2%) had meningitis while in 15- 24 months, 9 out of 107 (8.4%) had meningitis.

There was No statistically significant alteration among gender (male and female) was detected (p = 0.339). In the male group, 19 (14.5%) had meningitis while in female group, 12 out of 60 (20%) had meningitis.

In comparison to normal weight subjects, underweight children were identified to have more frequent meningitis, that was statistically insignificant (p = 0.005). In children with normal weight meningitis was seen in only 5 (6.8%) while in under-weight patients, 26 out of 117 (22.2%) had meningitis.



#### DESCRIPTIVE STATISTICS

Parameters	Mean	Standard deviation
Age(In months)	19.5	3.34
Weight	8.6	2.6
Temperature	102	1.2
Cell(%)	6.5	2.2
protein	44.6	5.4

<b>STRATIFICATION OF MENINGITIS</b>					
<b>STRATIFICATION OF MENINGITIS WITH RESPECT TO AGE</b>					
		Meningitis		Total	
		Yes	No		
Age	6-14 months	22	62	84	P-value= 0.001* (significant)
		26.20%	73.80%	100.00%	
	15-24 months	9	98	107	
		8.40%	91.60%	100.00%	
Total		31	160	191	
		16.20%	83.80%	100.00%	
<b>STRATIFICATION OF MENINGITIS WITH RESPECT TO GENDER</b>					
		Meningitis		Total	
		Yes	No		
Gender	Male	19	112	131	P-value= 0.339** (Insignificant)
		14.50%	85.50%	100.00%	
	Female	12	48	60	
		20%	80%	100.00%	
Total		31	160	191	
		16.20%	83.80%	100.00%	
<b>STRATIFICATION OF MENINGITIS WITH RESPECT TO WEIGHT</b>					
		Meningitis		Total	
		Yes	No		
WEIGHT	Normal	5	69	74	P-value= 0.005* (significant)
		6.80%	93.20%	100.00%	
	Under-weight	26	91	117	
		22.20%	77.80%	100.00%	
Total		31	160	191	
		16.20%	83.80%	100.00%	

### DISCUSSION:

The association among seizures and meningitis is well identified and has been testified in 12–27% of cases [2]. With the institution of universal immunization contrary to bacterial pathogens the opportunity of bacterial meningitis is decreased [2]. In children with inadequate immunization and presenting with first febrile seizure bacterial meningitis is still a main issue. Frequency of meningitis in current study was observed as 04.5% (bacterial and aseptic) and in children presenting with

first febrile seizure bacterial meningitis was 1.6%.Theoutcome of current study is related to the study of Ehsanipour et al which described 3.6% of cases with meningitis and BM with FS was noted in 01.6% of in subjects aged between 6 months to 05 years.[18]

A study conducted by Al-Eissain Saudi Arabia observed the frequency of meningitis with FS as 03.5% and BM was noted in 01.5% of subjects between the ages of 03months to 05 years [19].In

France BM was 01.9% in subjects less than 18 months of age with first febrile seizure [20]. Ghotbi and Shiva noted 04.7% cases of meningitis from 254 subjects with fever and seizure [21].

In children with first febrile seizure BM was noted in 10.2% of Chinese [14] and 10% in subjects from Tunisia with age less than one year [22]. Higher incidence may be due to the increased frequency among these populations [14]. In Nepal 17% children were reported with meningitis and BM was noted in 04.5% children with first FS [23].

On the other hand, the reports of other studies are relatively diverse. Next to the execution of universal immunization it is seen that BM in children had decreased as shown by Carroll and Brookfield who had found BM in subjects with first simple FS 0.23% [9].

Also in children with complex FS Kimia et al analysed BM with frequency of 0.9% [18], similar results were observed by Shaked et al in children between the age of 06–12 months with first simple FS [24]. These reports may be correlated with enhanced immunization in contradiction to frequent pathogens of meningitis in childhood. In current study we observed that meningitis was more common in subjects with age less than 18 months, but no significant association among meningitis and gender was noted.

Joshi-Batajoo [23] and Laditan AA [25] had shown in their study that none of the study subjects with BM had signs of meningeal irritation, our study findings were similar to their study, it is further indicated that the absence of such signs does not eliminate meningitis in children and the care takers should not rely on physical signs as the only diagnostic tool. Majority of study subjects with meningitis in current study had complex seizures this was equivalent to the studies of Ham [3] and Casasoprana [21] which established the likelihood of BM or encephalitis very less in subjects with simple first seizure and a usual physical checkup.

Children aged less than 3 years without neurological signs, a complex seizure may be significant characteristic factor among these subjects with and/or without meningitis [26]. A 0.6% occurrence of BM amongst subjects with complex seizures against 0.2% in simple first febrile seizures was reported by Najafzadeh et al [12]. The paucity previous history of FS may clue to increased doubt of meningitis in all subjects with febrile seizures.

In current study impaired level of consciousness was more marked. Owusu-Ofori found 04.5% BM in

subjects with FS and lethargy in contrast to 34.6% in subjects with neck rigidity and FS [14], age of the subjects plays important role in clinical presentation, neck stiffness is noted more evident in the age up to 15 years. In our subjects no association was noted in subjects with antibiotics pretreatment and occurrence of meningitis. In a study by Ghotbi and Shiva prior use of antibiotics was considered as risk factor of meningitis in subjects with FS [22]. An LP may be considered in subjects with prior use of antibiotics presenting with FS [21] the outcome of our study was dissimilar may be related to the inappropriate augmented use of antibiotics in febrile patients. LP was not performed in all our subjects and few cases of aseptic meningitis were missed (due to insignificant clinical findings).

Our study revealed 48.6% incidence of acute bacterial meningitis among children (6 months to 5 years) with a first episode of febrile convulsion who were subjected to lumbar puncture based on clinical suspicion. We found that high-grade fever; prior antibiotic use, the higher number of antibiotic doses; low hemoglobin and low blood sugar were found to be significant predictors of meningitis among children aged 6-60 months who presented with a first episode of febrile convulsion.

Considering the poor immunization status and lower socioeconomic status, we anticipated that the prevalence of meningitis would be much higher among our study population. Interestingly, we found that almost half (48.57%) of our study subject was found to have meningitis among those subjected to lumbar puncture based on clinical suspicion.

This could probably be explained by our inclusion of study subjects. To answer the research question as to whether lumbar puncture is indicated in all children with meningitis, it would be ideal to subject all children with febrile convulsions to undergo a lumbar puncture. However, owing to ethical consideration, we enrolled only those children who had already undergone a lumbar puncture. The proportion of children who underwent lumbar puncture in our study was 35%. The rate of lumbar puncture is consistent with other studies. [27][28]

It was found that there was a male predominance in our enrolled cases. Majority of children were from the rural background that represents a true picture of the prevalence of meningitis in our society. Most of the parents were educated up to high school and were unskilled workers/unemployed showing low socioeconomic status of the parents of a febrile

convulsing child.

Present study is the initial regular assessment and reevaluations that attempt to enumerate the hazard of BM in diverse subgroups of children with seizure in the perspective of fever, and to assess the usefulness of usual LP in children with a clear first FS. In general danger of BM was little, range from 0.2% in children with an evident first uncomplicated FS to 2.6% in those with a first "seizure and fever". The value of routine LP for diagnosis of CNS infections require instant treatment amongst children with an clear first FS was low: the NNT was 1109 in children with an noticeable first simple FS, and 180 in those with an apparent first complex FS. BM may present as a seizure connected with fever [10] [29][30]

In this revision, 2.6% of children with "seizure and fever" were found to have BM; the diagnosis of BM might be supposed from clinical examination in 95% of children. These numbers illustrate the aptitude of clinical assessment to recognize approximately all children with a first "seizure and fever" who are most likely to profit from LP, thereby avoid avoidable usual LP. Though, given the presentation environment of the common of study, this verdict will need additional clinical justification.

#### LIMITATIONS OF THIS STUDY

There were the little sample size and small study era. Besides this, the physician's choice for attempting a lumbar puncture was prejudiced for predictors of meningitis. The suggestion of the current reading could be to reduce load on laboratory and selection of children who need enveloping analysis like lumbar punctures, so that it might be supportive in discharge of those children in whom the lumbar puncture is not necessary.

#### CONCLUSION:

In conclusion, our results imply that the rate of bacterial meningitis in children who existing with FS is not high. Meningitis is additional widespread in patients less than 18 months old with FS; though, complex features of seizures, first attack of FS or impair realization seem to be important risk factors for meningitis and an LP should be in brain for this condition. It was accomplished that in children who accessible with FS the frequency of bacterial meningitis was not elevated and was extra frequent under age of 18 months.

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#### DISCLOSURE

There is no conflicting interest as declared by the authors for this research.

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#### REFERENCES:

1. Tavasoli A, Afsharkhas L, Edraki A. Frequency of meningitis in children presenting with febrile seizures at Ali-Asghar children's hospital. *Iran J Child Neurol*. 2014;8(4):51-6.
2. Kimia A, Ben-Joseph EP, Rudleo T. Yield of lumbar puncture among children who present with their first complex febrile seizure. *Pediatr*. 2010;126:62-9.
3. Hom J, Medwid K, The low rate of bacterial meningitis in children, ages 6 to 18 months, with simple febrile seizures. *AcadEmerg Med*. 2011;18(11):1114-20.
4. Fetveit A. Assessment of febrile seizures in children. *EurJPediatr*. 1998;167(1):17-27.
5. Subcommittee on Febrile Seizures. Febrile seizures: Guidelines for the neurodiagnostic evaluation of the child with a simple febrile seizure. *Pediatr*. 2011;127(2):389-94.
6. Shrestha SK. Role of CSF Analysis for the First Episode of Febrile Seizure among Children between Six Months to Five Years of Age. *J Nepal Paediatr Soc*. 2010;30;20:90-3.
7. Nelson KB, Ellenberg JH. Predictors of epilepsy in children who have experienced febrile seizures. *NEngl J Med*. 1976;295:1029-33.
8. Fetveit A. Assessment of febrile seizures in children. *Eur J Pediatr*. 2008;167(1):17-27.
9. Carroll W, Brookfield D. Lumbar puncture following febrile convulsion. *Arch Dis Child*. 2002;87:238-40.
10. Dubos F, De la Rocque F, Levy C. Sensitivity of the bacterial meningitis score in 889 children with bacterial meningitis. *J Pediatr*. 2008;152:378-82.
11. Nigrovic LE, Kuppermann N, Macias CG. Clinical prediction rule for identifying children with cerebrospinal fluid pleocytosis at very low risk of bacterial meningitis. *JAm Med Assoc*. 2007;297(1):52-60.
12. American Academy of Pediatrics. Provisional committee on quality improvement,

- subcommittee on febrile seizures. Practice parameter: the neurodiagnostic evaluation of the child with a first simple febrile seizure. *Pediatr*. 1997;769-72.
13. Najaf-Zadeh A, Dubos F, Hue V. Risk of bacterial meningitis in young children with a first seizure in the context of fever: a systematic review and meta-analysis. *PLoS One*. 2013;8(1):e55270.
  14. Owusu-Ofori A, Agbenyega T, Ansong D. Routine lumbar puncture in children with febrile seizures in Ghana: should it continue?. *IntJInfectDis*. 2004;8:353-61.
  15. Fouad R, Khairy M, Fathalah W, Gad T, El-Kholy B, Yosry A. Role of clinical presentations and routine CSF analysis in the rapid diagnosis of acute bacterial meningitis in cases of negative gram stained smears. *J Trop Med*. 2014, article ID 213762, 7 pages.
  16. Tunkel AR, Hartman BJ, Kaplan SL, Kaufman BA, Roos KL, Scheld WM, et al. Practice guidelines for the management of bacterial meningitis. *Clin Infect Dis*. 2004;39(9):1267-84.
  17. Dubos F, Korczowski B, Aygun DA. Distinguishing between bacterial and aseptic meningitis in children: European comparison of two clinical decision rules. *Arch Dis Child*. 2010;95(12):963-67.
  18. 19. Ehsanipour F, Khodapanahandeh F, Aslani Z. The prevalence of meningitis in children with febrile seizure hospitalized at HazratRasoul hospital (1997-2002) *Journal of Iran University of Medical Sciences*. 2004;44:907-912. [PubMed] [Ref list]
  19. Al-Eissa YA, Lumbar puncture in the clinical evaluation of children with seizures associated with fever. *PediatrEmerg Care*. 1995 Dec; 11(6):347-50. [PubMed] [Ref list]
  20. Casasoprana A, Hachon Le Camus C, Claudet I, Grouteau E, Chaix Y, Cances C, Karsenty C, Cheuret E[Value of lumbar puncture after a first febrile seizure in children aged less than 18 months. A retrospective study of 157 cases]. *Arch Pediatr*. 2013 Jun; 20(6):594-600. [PubMed] [Ref list]
  21. Ghotbi F, Shiva F. An assessment of the necessity of lumbar puncture in children with seizure and fever. *J Pak Med Assoc*. 2009 May; 59(5):292-5. [PubMed] [Ref list]
  22. Tinsa F, El Gharbi A, Ncibi N, Bouguerra C, Ben Aissia W, Zouari B, Boussetta K, Bousnina S. [Role of lumbar puncture for febrile seizure among infants under one year old]. *Tunis Med*. 2010 Mar; 88(3):178-83. [PubMed] [Ref list]
  23. Joshi Batajoo R, Rayamajhi A, Mahaseth C. Children with first episode of fever with seizure: is lumbar puncture necessary? *JNMA J Nepal Med Assoc*. 2008 Jul-Sep; 47(171):109-12. [PubMed] [Ref list]
  24. Shaked O, Peña BM, Linares MY, Baker RL. Simple febrile seizures: are the AAP guidelines regarding lumbar puncture being followed? *PediatrEmerg Care*. 2009 Jan; 25(1):8-11. [PubMed] [Ref list]
  25. Laditan AA. Analysis of the results of routine lumbar puncture after a first febrile convulsion in Hofuf, Al-Hassa, Saudi Arabia. *East Afr Med J*. 1995 Jun; 72(6):376-8.[PubMed] [Ref list]
  26. Rossi LN, Brunelli G, Duzioni N, Rossi G. Lumbar puncture and febrile convulsions. *HelvPaediatrActa*. 1986 May; 41(1-2):19-24. [PubMed] [Ref list]
  27. Batra P, Gupta S, Gomber S, Saha A. Predictors of meningitis in children presenting with first febrile seizures. *PediatrNeurol* 2011;44:35-9. †
  28. Kimia AA, Capraro AJ, Hummel D, Johnston P, Harper MB. Utility of lumbar puncture for first simple febrile seizure among children 6 to 18 months of age. *Pediatrics* 2009;123:6-12. †
  29. Ratcliffe JC, Wolf SM (1977) Febrile convulsions caused by meningitis in young children. *Ann Neurol* 1: 285-286.
  30. Samson JH, Apthorp J, Finley A (1969) Febrile seizures and purulent meningitis. *JAMA* 210: 1918-1919.