Febrile seizures account for a considerable number of patient visits to pediatric offices and emergency departments. I've always felt pretty good about my understanding of febrile seizures, and the residents can usually give me the answers I'm looking for when I ask them questions about patients with febrile seizures (I'm sure a reflection of my excellent tutelage)...but is there more? Can you have a febrile seizure without a fever? When, exactly, should I worry when they haven't woken up? And, what does the future hold for these families in terms of future episodes? As I was researching this topic, I realized I didn't know as much as I thought I did...

Up to 8% of children will experience a febrile seizure before seven years of age. They have been defined as seizures associated with fever in the absence of central nervous system infection or acute electrolyte imbalance in a young child. Other definitions add that seizures with fever in children who have experienced a previous nonfebrile seizure are excluded. They typically occur between 6 months and 6 years of age, with peak occurrence at 18-24 months. Febrile seizures constitute the most common seizure disorder in children. They are benign and children who have them have normal cognitive development.

Febrile seizures are typically classified as either simple or complex. Simple febrile seizures, which account for the majority of episodes, last less than 15 minutes, occur only once in a 24 hour period, are generalized in nature, and happen in children with no previous neurologic problems (such as CP) between the ages of 6 months and 6 years of age, with complex having the opposite characteristics. There is no evidence to support the theory that rate of rise of the temperature is a causal factor in febrile seizures, and they can occur even before the fever is noted.

Recurrent febrile seizures occur in ~30% of patients. Risk factors for recurrence include:
- Age < 18 months
- Day care attendance
- Lower temperature during the seizure
- Shorter duration of fever
- Family history of febrile seizures

76% of children with all of these risk factors will have recurrent febrile seizures as compared to 4% of those who do not.

Some children with febrile seizures will go on to develop epilepsy. The incidence of this parallels the possible risk factors, which include having a shorter duration of fever, prolonged seizure, focal seizure, multiple seizures in 24 hours, family history of epilepsy, and baseline neurologic abnormality. The more risk factors a child has, the higher the chance of epilepsy. Children with all the features of a complex febrile seizure have a 49% risk of developing ongoing seizure disorders.

Up to 8% of children will experience a febrile seizure before seven years of age.
Clinical Prediction Rule for Identifying Children With Cerebrospinal Fluid Pleocytosis at Very Low Risk of Bacterial Meningitis

Having never seen H. Flu meningitis (or epiglottitis for that matter), I consider myself very fortunate. However, the thought of missing the diagnosis of meningitis, especially bacterial, strikes fear deep in my heart. So, because I am never happy, when I do make the diagnosis, I want to know right away if it is bacterial or viral as, in some cases, that would affect the treatment plan. This group set out to validate a Bacterial Meningitis Score to identify those at very low risk of bacterial meningitis in the era of the conjugate pneumococcal vaccine.

This multicenter, retrospective cohort evaluated 3,295 patients between the ages of 29 days and 19 years with CSF pleocytosis. Of those, 121 (3.7%) had bacterial meningitis and the rest aseptic. Variables applied to the available data included: positive CSF gram stain, CSF ANC ≥ 1000 cells/µL, CSF protein ≥ 80 mg/dL, peripheral blood ANC ≥ 10,000 cells/µL, and history of seizure before or at the time of presentation. Patients were considered very low risk if none of the above mentioned variables were present.

Of the patients with bacterial meningitis, 2 were missed by using the prediction rule. Both patients were between 1 and 2 months of age and both had E. coli meningitis and urinary tract infections with negative urinalyses at the time of presentation. Many would argue that any CSF pleocytosis in this age group puts them at higher risk, and I know of very few people (if any) that would do anything but treat conservatively and with hospitalization and antibiotics pending culture results. This decision rule, I feel, will be most helpful in the school age child and older with CSF pleocytosis and reassuring exam. As with any decision rule, each patient should be treated on a case-by-case basis, but this does provide some guidelines with objective data that will be useful.

Atypical Clinical Features of Pediatric Appendicitis

Only 50% of adults and even less children exhibit the “classic” sequence of symptoms of appendicitis: periumbilical abdominal pain, followed by nausea and RLQ pain, with fever and vomiting developing last. So, I ask myself the question I find on my mind more and more these days: If the patients aren’t going to read the book and present like I expect them to, how in the world am I supposed to know what they have??? This cross-sectional, observational study set out to evaluate the frequency of atypical clinical features in pediatric patients with appendicitis and to identify which of those are the strongest negative predictive factors for appendicitis.

Patients 3-21 years of age presenting to a tertiary care pediatric emergency department with suspected appendicitis as determined by the treating physician were enrolled (n=775). After reviewing several texts, review articles and scoring systems, the authors defined “typical” symptoms as those listed in all of the reviewed material as “common, typical, classic” or “usual”. The “typical” features were as follows:

- Age ≥ 5 years of age
- + history of anorexia, nausea/vomiting, pain migration, gradual onset of pain
- Pain duration of < 48 hours
- Absence of diarrhea
- + physical findings of fever, abdominal guarding, percussive tenderness (or pain with walking or hopping), RLQ tenderness to palpation, Rovsing’s sign, rebound pain, decreased bowel sounds
- WBC ≥ 10,000
- ANC ≥ 7,500

Their study found that 44% of patients with the final diagnosis of appendicitis initially presented with ≥ 6 atypical features with the median being 5. The most common atypical features seen were absence of fever, absence of Rovsing’s sign, normal or increased bowel sounds, absence of rebound pain, lack of migration of pain, lack of guarding, abrupt onset of pain, lack of anorexia, absence of maximal pain in the RLQ, and absence of percussive tenderness. The greatest negative predictors were WBC < 10,000, ANC < 7,500, lack of percussive tenderness, lack of guarding, and absence of nausea/vomiting, with the normal lab values being the strongest. Does this mean I’m going to have to actually care what the white count is now? Just when I had everyone convinced it didn’t matter...
Alternating Antipyretics for Fever Reduction in Children: An Unfounded Practice Passed Down to Parents from Pediatricians
I’ll be the first to admit it...I am guilty of this. I tell parents and caregivers all the time to alternate acetaminophen and ibuprofen. Why do I do it? Maybe I think it will give them something else to think about besides how they are going to get to the emergency department. Maybe I think it really works. Maybe it is what I was taught during my training. But, is it being done correctly? Is it safe? And, am I contributing on a daily basis to the growing fever phobia phenomena?

This study evaluated these questions using a brief survey given to a convenience sample of caregivers in a pediatric emergency department (our emergency department, as a matter of fact...so these aren’t just representative of the patients we all see...these ARE the patients we all see). The vast majority of caregivers felt it was necessary to treat fever (93%), and almost half use both medications in their treatment regimen. 67% reported they alternated medications, and the interval that was used ranged from 2 to 6 hours. 81% stated they had been instructed to do this by a physician, but only 61% received written instructions on how it should be done.

Previous studies have shown that a large number of caregivers will inaccurately dose antipyretics to their child. Reasons for this may include lack of education paired with the multiple strengths and formulations available. Inadvertent overdoses of acetaminophen can lead to significant hepatic toxicity. Even therapeutic doses of ibuprofen can lead to GI bleeding and renal insufficiency. There are also reports of the two medications acting synergistically together to cause renal damage, especially in the setting of dehydration.

The practice of alternating antipyretics is not endorsed by the AAP. This approach to fever management can lead to unintentional overdosing and toxicity.

Other studies have demonstrated the efficacy of using single therapy for fever control. Therefore, it is the opinion of the authors that the practice of alternating antipyretics be stopped. Not all fever is bad, right!

Duration of Fever and Markers of Serious Bacterial Infection in Young Febrile Children
I would have to go back and look to be sure, but I’m not sure one issue of this newsletter had been distributed without an article about the approach to the febrile child. As pediatricians, I think we are all on that search for the proverbial “holy grail” of pediatrics: which child with a fever and no obvious source is the one we need to worry about?

Much of the recent work on this subject has affected my practice in that I do less blood work...urine seems to be the money shot, and the other question is if a lumbar puncture is needed. The majority of children with occult bacteremia are going to clear it on their own, right? This study chose to evaluate the use of laboratory tests, namely WBC, ANC, and CRP, when taking into account the duration of the febrile illness.

This study prospectively looked at children ages 1-36 months presenting to a pediatric emergency department. Patients were eligible to be enrolled if they had fever of \( \geq 39^\circ C \) (102.2°F) and felt to have no attributable source of infection by history and physical performed by the treating physician. Patients were excluded if they had a diagnosis of AOM, pharyngitis, respiratory tract infection, AGE, or had a positive viral study. Also excluded were those who had received antibiotics within the past 10 days, known underlying immunologic disorder, or vaccination in the previous 48 hours. All patients enrolled had a CBC, blood culture and CRP drawn. Other tests were performed at the discretion of the physician. For analysis, the patients were divided into 2 groups: those with fever \( \leq 12 \) hours and those with fever > 12 hours.

Their results showed that a comparable number of patients with fever on both sides of the 12 hour mark had serious bacterial infections, but that the blood markers (especially CRP) showed greater sensitivity and specificity for those with fever > 12 hours. They also showed that CRP was a better predictor of SBI over WBC/ANC in both groups.

So, will this change my practice? I’m not sure, yet...the last night I worked, the CRP machine in the lab wasn’t working, so they had to be transported to UAB (which, surprisingly took 4 hours). I guess my version of the study would have to take into account transport time!
Another distinct entity has been described in the neurology literature. The provoked seizure is defined as an afebrile seizure that occurs in association with an infection that does not usually affect the brain, such as AGE. There may be fever at another time during the illness, but not at the time of the seizure. Most commonly, these are generalized seizures, and it isn’t uncommon for there to be multiple episodes during the same illness.

About 25% of patients with provoked seizures will also have febrile seizures during the same illness, and typically occur prior to the afebrile event.

Several studies have been performed looking at other factors in the development of febrile seizures. Certain respiratory viruses have often been implicated in patients with febrile seizures. Influenza, parainfluenza and adenovirus all carry a similar risk of developing febrile seizures at some point during the illness. In particular, Influenza A has been specifically studied, with reports of 6-40% of patients with the virus experiencing febrile seizures (different study populations being the explanation for the wide range). Children infected with influenza A who have febrile seizures tend to have higher temperatures, shorter amount of time before onset of seizure, higher rate of partial seizures, and longer duration of seizures than those whose viral studies were negative. Those with a history of febrile seizures also carry a higher risk of repeat episodes with influenza infection. It is recommended, then, that children with a propensity for febrile seizures be considered for influenza vaccination during the appropriate seasons.

Some viruses have a higher risk of having provoked (afebrile) seizures. Those include rotavirus, respiratory syncytial virus, and human herpes virus 6. The number of these episodes may be underestimated as they are not classically “febrile” seizures. This will most likely be a topic for future studies.

Another study looked at circadian rhythms of first febrile seizures. They found that most events occur in the PM hours, with the majority happening from 6pm to midnight. The typical diurnal variation of body temperature results in an evening peak in the healthy adult. In children, the circadian rhythms and temperature variations are typically established by 5 years of age, making those younger than that potentially more susceptible to a lower seizure threshold.

Some cases had reported that relative hyponatremia at the time of initial febrile seizure was a risk factor for recurrence. However, another study performed showed that serum sodium levels did not have a role in predicting recurrence of events, and therefore supporting the practice of not routinely checking electrolytes in the face of febrile seizures, which has been the practice parameter endorsed by the AAP.

### Characteristics of Febrile Seizures vs. Provoked Seizures

<table>
<thead>
<tr>
<th>Febrile seizures</th>
<th>Provoked seizures</th>
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<tbody>
<tr>
<td>Febrile</td>
<td>Afebrile</td>
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<tr>
<td>Most commonly with respiratory infections</td>
<td>More likely with gastrointestinal infections</td>
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<tr>
<td>More likely with + family history</td>
<td>Higher likelihood of multiple episodes during the infectious episode</td>
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<tr>
<td></td>
<td>More likely to be focal in nature</td>
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Another issue that arises in the evaluation and treatment of children with febrile seizures is how long do you give them to return to their baseline? One study looked at the incidence and clinical features of those with prolonged unconsciousness and/or delirium. They found that prolonged alteration of awareness occurs more often in those with focal seizures, seizures ≥ 5 minutes in length, and those receiving intravenous diazepam. They also found that in 2/3 of patients, the duration of unconsciousness was 10 minutes or less, and it was rare to last for more than 30 minutes. It is recommended that those with prolonged altered mental status be carefully evaluated for diagnoses other than febrile seizure, such as encephalitis/encephalopathy.

The evaluation of the child with febrile seizures should be aimed at identifying the source of the fever if possible. The occurrence of a simple febrile seizure should not modify your approach. EEGs, along with chemistries (as mentioned above) are rarely indicated, if ever. Imaging is not part of the acute evaluation, although neuroimaging may be indicated in children with underlying developmental abnormalities and febrile seizures at a later date.

Lumbar punctures should be performed in febrile status epilepticus (> 30 minutes), and considered in those < 18 months of age or those with complex febrile seizures, although there are no hard and fast rules regarding these situations. Even though a significant number of patients with meningitis present with seizures (24%), it is rare for those presenting with fever and seizures to have meningitis (0.23%).

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Even though a significant number of patients with meningitis present with seizures, it is rare for those presenting with fever and seizures to have meningitis.
Febrile Seizures

By the Numbers

3-8%:
Number of children up to 7 years of age who will have a febrile seizure

1/3:
Number of children who will have at least one recurrent febrile seizure

24%:
Number of children with febrile seizures that have a + family history

18:
Age in months that is the median age of onset of febrile seizures

4-16%:
Number of febrile seizures that will have focal symptoms

75%:
Percentage of febrile seizures that are simple/typical

0.23%:
Percentage of children presenting with febrile seizures that have meningitis in developed countries

The mainstay of treatment of febrile seizures is reassurance and education to the family and caretakers. Intensive routine use of antipyretics does not reduce the incidence of febrile seizures and, as mentioned elsewhere in this newsletter, may have unfavorable side effects. Parents should be instructed in the intermittent use of antipyretics during the febrile illness. No antiepileptic drugs have been proven to reduce the subsequent development of epilepsy after a febrile seizure, and these drugs have several side effects. Therefore, they are reserved for special situations such as recurrent febrile status epilepticus. Often times phenobarbital or rectal diazepam are used in these situations.

References:

Infant Deaths Associated with Cough and Cold Medications


In the years 2004-2005, over 1,500 children were treated in emergency departments for adverse events associated with cough and cold medications. In 2005, the cause of death in 3 infants < 6 months of age were attributed to these medications, and specifically had high levels of pseudoephedrine (decongestant) in their blood. The source of this was from both prescribed and over-the-counter preparations. Also found were lesser amounts of carbinoxamine (antihistamine) and dextromethorphan (cough suppressant). All of the infants were found dead in their homes and none were found at the time of autopsy to have underlying cardiac abnormality.

For children > 2 years of age, safety and efficacy data are reviewed and contribute to the FDA approval of these drugs. In those < 2 years of age, however, reviews have shown that these medications are not more effective than placebo in treating the cough and other symptoms of upper respiratory infections.

Since fever is the most common chief complaint for urgent office and emergency department visits, it stands to reason that febrile seizures are very common as well. They are not a cause of permanent disability, but they are a definite cause of parental and family anxiety. As with most things we deal with on a day to day basis, consistent communication and reassurance is key in the successful management of this frequently encountered disorder. I can't promise it will always work, but it's worth a try.
The Polhill Report
Volume 3 • Issue 1 • Spring 2007

The first annual Spring Scramble to benefit the Children’s Hospital Weight Management Clinic was held on Saturday March 31st and was a huge success! Under the superb leadership of Dr. Liz Tharpe (3rd year pediatric resident), the Coat of Arms committee hosted the race that attracted over 200 runners from around the country! Several people and organizations donated their goods, services and time to this important endeavor. The overall winner was our own Pat Broderick (2nd year pediatric resident) who finished in a very quick 17:30. Congratulations to all the participants, as everyone who crossed the finish line is a winner! Also winning is the weight management clinic who received more than $1,500.00 as a result of the event. I think this is definitely a step in the right direction when dealing with this increasing problem. Great job to all involved...and hope to see you all next year!!
Dr. Lozano is an Assistant Professor of Pediatrics and Associate Medical Director of the Sleep Disorders Center at the University of Alabama-Birmingham.

**Q:** How many hours of sleep should a child get each night?

**A:** The amount of sleep differs for a child depending on age. For toddlers (1-3 years), a total of 12-14 hours across the day and night is expected. By 18 months, most toddlers have given up their morning nap and are taking one long afternoon nap of 1.5-3 hours. For preschoolers (3-5 years), these children need between 11 and 13 hours of sleep. The number of hours a preschooer sleeps will differ for each child but expect a preschooler to sleep the same amount of time each day. Most preschoolers will stop taking naps between these ages. School aged children need between 10 and 11 hours of sleep per night. Inadequate sleep time is common in this age group. Teenagers (13-18 years) need between 9 and 9 1/2 hours of sleep. Adolescents are notorious for not getting enough sleep. Most teenagers average between 7 and 7 1/2 hours of sleep.

**Q:** What are some important points of good sleep hygiene for children?

**A:** Good sleep hygiene points are as follows:
- Develop a regular sleep schedule.
- Maintain a consistent bedtime routine.
- Have a soothing sleep environment.
- Make the bedroom a sleep only zone.
- Avoid caffeine.
- Turn off televisions, computers, and radios at bedtime. Consider removing these from the bedroom.
- Avoid stimulating activities near bedtime.

**Q:** How common is sleep apnea in children?

**A:** Obstructive sleep apnea (OSA) occurs in approximately 1-3% of children. Primary snoring occurs occasionally in 20% of children and nightly in about 10% (range of 3% to 12%).

**Q:** When does a child need a sleep study?

**A:** Sleep study indications mainly fall into these broad categories:
- **Sleep disordered breathing:** OSA, obstructive hypoventilation syndrome, upper airway resistance. In addition, follow-up studies after adenotonsillectomy may be indicated.
- **CPAP or BiPAP titration:** titrate pressures of BiPAP or CPAP in the treatment of sleep disordered breathing.
- **Limb movements:** assess for abnormal limb movements and associated sleep disruption.
- **Episodic nocturnal phenomena:** evaluate parasomnias that are frequent, violent, atypical, prolonged, or resistant.
- **Unexplained daytime sleepiness**
- **Possible movement disorders:** such as seizures

**Q:** What is an easy way to screen for sleep disorders in a patient?

**A:** A quick tool for screening patients for sleep disorders is BEARS:
- B: bedtime problems
- E: excessive daytime sleepiness or difficult to wake up in the morning
- A: awakenings or unusual behaviors at night
- R: regular sleep schedule and sufficient sleep
- S: snoring or problems breathing while sleeping
The second baby safety shower was held at the Chris McNair health clinic on Saturday March 3rd. Due to the success of the first shower, a waiting list was needed to accommodate all the expectant moms! The attendees were treated to several brief talks on safety issues in infants, and were all given a bag of useful items for when the baby comes home, including outlet covers, poison control information, water heater guidelines, as well as much more! Car seat fittings were also available by certified car seat technicians.

The next shower is scheduled for Saturday May 12th. If you would like to volunteer, or if you are interested in more information regarding this program, please contact Terri Coco at tcoco@peds.uab.edu.