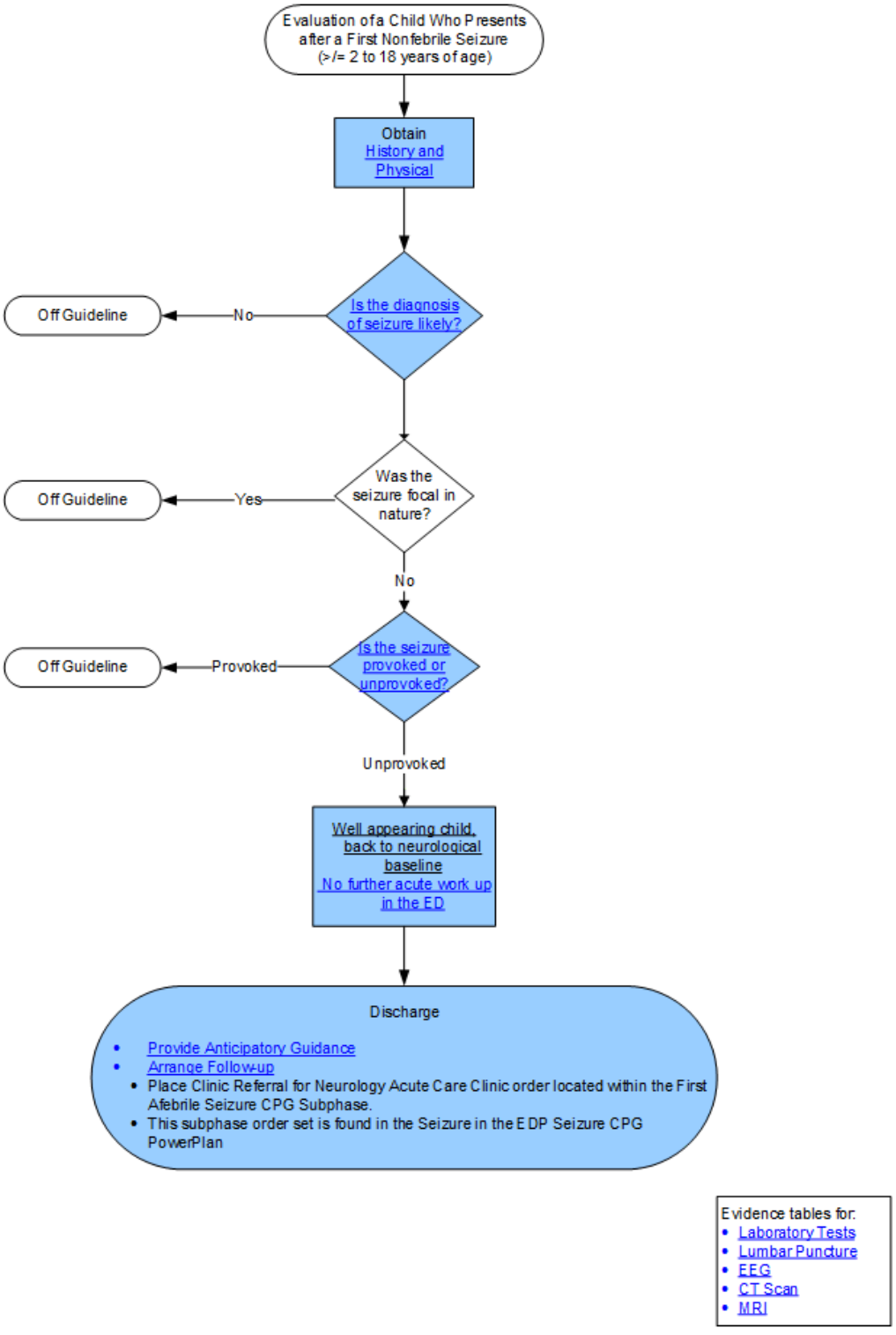
Children's Mercy Hospitals and Clinics
Evidence Based Practice Clinical Practice Guide

First Nonfebrile Seizure Management Clinical Practice Guideline



Epidemiology: (include definition, how diagnosed, risk factors, patterns, causes, effects of disease, affected populations as necessary)

New-onset seizure activity in an otherwise healthy child without fever is a relatively common occurrence in the pediatric population. In fact, every year in the US alone, 25,000-40,000 children experience a first-time nonfebrile seizure and 1/10 people will experience a single seizure in their lifetime. Most of these children are well appearing at the time of presentation with no lateralizing signs on neurological examination and as such, some providers may not be motivated to perform invasive procedures without clear evidence to support such investigation. The primary aim of this CPG was to highlight the evidence regarding diagnostic evaluation and management of these children to help avoid unnecessary testing and imaging, particularly because 75% of these otherwise neuro-developmentally normal children will not experience recurrence. (Hirtz et al., 2003)

Objective of Guideline: The objective of this guideline, besides standardizing care and the benefits associated with care standardization, is to reduce unnecessary testing and assure appropriate follow-up is obtained.

Target Users: ED providers- physicians, fellows, resident physicians, advance practice nurses, and direct care nurses.

Guideline Inclusion Criteria: Children 2 to 18-year-old, presenting after a first-time unprovoked, afebrile seizure.

Guideline Exclusion Criteria: Children who have established epilepsy, children with ongoing seizure activity when they are admitted to the ED, children who were treated with a medication by emergency medical services (EMS), children with atonic or myoclonic seizures, children who are in status epilepticus. For this CPG, status epilepticus is defined as a series of seizure activity that grouped together lasts >30 minutes or a single seizure lasting greater than 5 minutes that has not resolved. This definition was attained by consensus of CM providers.

Clinical Questions Answered by Guideline:

Questions

1. For the child who presents to the emergency department (ED) after a first nonfebrile seizure should laboratory studies be obtained as part of the acute evaluation?
2. For the child who presents to the ED after a first nonfebrile seizure should a lumbar puncture to evaluate CSF be obtained as part of the acute evaluation?
3. For the child who presents to the ED after a first nonfebrile seizure should an electroencephalogram (EEG) be obtained as part of the acute evaluation?
4. For the child who presents to the ED after a first nonfebrile seizure should a computed tomography (CT) be obtained as part of the acute evaluation?
5. For the child who presents to the ED after a first nonfebrile seizure should a magnetic resonance imaging (MRI) be obtained as part of the acute evaluation?
6. For the child who presents to the ED after a first nonfebrile seizure should the child be admitted to the hospital?
7. For the child who presents to the ED after a first afebrile seizure what anticipatory guidance should be offered to families?
8. For the child who presents to the ED after a first afebrile seizure what follow-up should be arranged?

Principles of Clinical Management:

In the evaluation of a child who presents after a first-time seizure the primary goal is to determine whether the event was provoked, as this has implications for estimating recurrence risk. The following elements should be elicited from the history:

- Is there any history suggestive of a possible electrolyte disturbance?

Examples: vomiting, diarrhea, missed feeds or altered concentrations of feeds, known underlying condition with associated electrolyte abnormalities (Type I diabetes, congenital adrenal hyperplasia (CAH), kidney disease, etc)

- Is there any history suggestive of an ingestion?
  Examples: medication overdose, accidental ingestion, new or changed prescriptions, periods of time when a child might have been unattended and around accessible medications
- Is there any history to suggest head trauma?
  Examples: fall, non accidental trauma (NAT), etc
- Is there any underlying history of epilepsy, provoked seizures, or febrile seizures?

The following physical exam findings may also be suggestive of an underlying source of provocation for seizure:

- Stigmata of a neurodevelopmental disorder: dysmorphic features, neurocutaneous markers
- Obvious signs of trauma (bruising, fractures, bleeding, etc)

* Note: This guideline is not intended for children who have ongoing seizure activity at the time of presentation or who fail to return to their neurological baseline

The differential diagnosis for seizure includes the following:

Syncope, convulsive syncope
Complicated migraine or migraine with aura
Gastrointestinal disorders (reflux)
Psychiatric conditions (panic attacks, psychogenic non-epileptic events)
TIA
Movement disorders
Breath holding spells
Sleep disorders (night terrors, cataplexy)
Stereotypies (hand flapping)

If the child's history and/or physical examination are suggestive of a provoked seizure, or the child has been given a medication to stop the seizure, this child goes Off Guideline and work-up will be tailored individually for each clinical scenario. Diagnostic studies could include but are not limited to serum electrolytes, serum drug levels, urine toxicology screen, coagulation profile, troponins, EKG, plain films, CT scans, etc.

Regarding our own experience at Children's Mercy Hospital (Zuccarelli & Hall (2014), 133 patients presenting with a first-time nonfebrile seizure, electrolytes were obtained in 13 of 14 (93%) children with a history suggestive of an underlying abnormality but also in half of children with a reassuring history (62 of 119, 52%). Importantly, no child with an unremarkable history and exam was found to have electrolyte abnormalities falling below levels most likely to be associated with acute symptomatic seizures (Na <115 mEq/L, glucose <40 mg/dL, Ca <5 mg/dL). Using even more conservative reference ranges (Na <135 mEq/L, glucose <60 mg/dL and Ca <8.5 mg/dL), 56 of 62 children (90%) with an unremarkable history and exam had normal results, and abnormal results did not change clinical management for any of these children.

Follow-up- While 75% of otherwise healthy, typically developing children with a first-time nonfebrile seizure will not experience recurrence, 25% of these children may experience another nonfebrile seizure. As such, we recommend all children be referred for outpatient routine EEG to evaluate for an underlying seizure tendency. If the EEG returns abnormal, the child is at a higher risk for seizure recurrence and the family should be counseled regarding antiepileptic therapy. The child may follow-up with their pediatrician if the EEG is normal. Because seizures are common, occurring in 1 in 10 individuals, while epilepsy is much less common, occurring in 1 in

100 individuals, automatic follow-up with a subspecialist, a pediatric neurologist, is not necessarily warranted, particularly if the EEG is normal.

Outcome Measures:
The following outcome measures have been identified:

1. PowerPlan use
2. Laboratory tests obtained
    a. BMP
    b. CBC with Diff
    c. Blood Glucose Monitoring POC
3. Radiologic tests obtained
    a. CT without contrast & CT with + without contrast
    b. MRI without contrast
4. Follow-up EEG order placed
5. Return to ED within 72 hours with same condition
6. Hospital Admission

Potential Cost Implications: The goal of the EDP First Seizure Management CPG is to reduce the cost by decreasing unnecessary interventions for this population. In 1992, a national cost analysis (Nypaver, Reynolds, Tanz, & Davis, 1992) was last performed in this patient population, the average cost per child for laboratory work-up alone was $122, which today would be closer to $200.

Potential Organizational Barriers:
Education
Parental expectations

PowerPlan:

Unique Plan Description: EDP First Nonfebrile Seizure
Plan Selection Display: EDP First Nonfebrile Seizure
PlanType: ED/UCC
Version: 1
Begin Effective Date: 03/11/2016 08:36
End Effective Date: Current
Available at all facilities

EDP First Nonfebrile Seizure
Consults/Therapy
CPG recommendation (NOTE)*
☐ Clinic Referral Neurology Clinic
Neurology Clinic, First-time nonfebrile seizure
☐ EEG Request
This patient was evaluated for a first-time nonfebrile seizure.

*****Report Legend:
DEF - This order sentence is the default for the selected order
GOAL - This component is a goal
IND - This component is an indicator
INT - This component is an intervention
IVS - This component is an IV Set
NOTE - This component is a note
Rx - This component is a prescription
SUB - This component is a sub phase

Guideline Preparation: This guideline was prepared by The Office of Evidence Based Practice (EBP) in collaboration with content experts at Children's Mercy Hospitals and Clinics. Development of this guideline supports the Department of Clinical Effectiveness's initiative to promote care standardization that builds a culture of quality and safety that is evidenced by measured outcomes. If a conflict of interest is identified the conflict will be disclosed next to the team members name.

First Seizure Management in the ED CPG Team Members:

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Guideline development funded by:
No external funding was obtained in the development of this guideline.

Development Process:

The review summary documents the following steps:

1. Review of existing internal and external guidelines and standards
   a. Internal guidelines: None
   b. External guidelines(Adams & Knowles, 2007) and (Hirtz et al., 2000)
2. Review preparation
   a. PICOT questions established
   b. Team leaders confirmed search terms used by the librarians in the Health Sciences Libraries. The team leaders also reviewed article titles and abstracts form the searches and identified the articles to be read and synthesized by the Evidence Based Practice Scholars.
3. Databases searched
   a. AHRQ National Guideline Clearinghouse
   b. Medline
   c. Cochrane
4. Critically analyze the evidence

a. Guidelines
   i. AGREE criteria were used to analyze published clinical guidelines
b. Single studies
   i. The EBP Scholars used the Cochrane Collaborative's electronic software, Review Manager 5 (RevMan), to produce systematic reviews and meta-analysis of the evidence of the effects of healthcare and delivered these documents to the team for review. RevMan allowed the EBP Scholars to build the tables of study characteristics, tables of study biases, and analyze study data in a meta-analysis. . In instances when RevMan could not be used, CASP (Critical Appraisal Skills Programme) tools were utilized to analyze the literature.
c. When a meta-analysis was found in the literature search, or created in RevMan, the GRADE criteria evaluated the literature using the Cochrane Collaborative's electronic software known as GRADEprofiler (GRADEpro). GRADEpro assesses the meta-analysis for:
   1. Limitations in study design and execution
   2. Inconsistency between studies
   3. Indirectness of study outcomes
   4. Imprecision
   5. Publication bias

ii. Table 1 defines how the quality of the evidence is rated and how the recommendation is established based on the type of evidence.

iii.

Table 1. Grading of CPG Recommendations

Grade of Recommendation	Confidence in Clarity of Benefits vs. Harms, Burden, and Cost	Quality of Supporting Evidence	Implications
Strong recommendation High quality evidence	Desirable effects clearly outweigh undesirable effects or vice versa	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies	Recommendation can apply to most patients in most circumstances. Further research is unlikely to change our confidence in the estimate of effect
Strong recommendation Moderate-quality evidence	Desirable effects clearly outweigh undesirable effect or vice versa	Evidence from RCTs with important limitations (inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies	Recommendation can apply to most patients in most circumstances. Further research (if performed) is likely to have an important effect on our confidence in the estimate of effect and may change the estimate.
Strong recommendation Low-quality evidence	Desirable effects clearly outweigh undesirable effect or vice versa	Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence	Recommendation may change when higher-quality evidence becomes available. Further research (if performed) is likely to have an important influence on our confidence in the estimate of effect and is likely to change the estimate.
Strong recommendation Very-low-quality evidence (Very rarely applicable)	Desirable effects clearly outweigh undesirable effect or vice versa	Evidence for at least 1 of the critical outcomes from unsystematic clinical observations or very indirect evidence	Recommendation may change when higher-quality evidence becomes available; any estimate of effect, for at least 1 critical outcome, is uncertain.
Recommended High-quality evidence	Desirable effects closely balanced with undesirable effects	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies	The best action may differ, depending on circumstances or patients or societal values. Further research is unlikely to change our confidence

			in the estimate of effect.
Recommended Moderate-quality evidence	Desirable effects closely balanced with undesirable effects	Evidence from RCTs with important limitations (inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies	Alternative approaches likely to be better for some patients under some circumstances. Further research (if performed) is likely to have an important influence on our confidence in the estimate of effect and may change the estimate.
Recommended Low-quality evidence	Desirable effects closely balanced with undesirable effects	Evidence for at least 1 critical outcome from observational studies, from RCTs with serious flaws or indirect evidence	Other alternatives may be equally reasonable. Further research is likely to have an important influence on our confidence in the estimate of effect and is likely to change the estimate.
Recommended Very-low-quality evidence	Desirable effects closely balanced with undesirable effects	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence	Other alternatives may be equally reasonable. Any estimate of effect, for at least 1 critical outcome, is uncertain.

Adapted from: Schunemann, H. J., Vist, G. E., Jaeschke, R., Kunz, R., Cook, D. J., & Guyatt, G. (2002). Advanced topics in moving from evidence to action: Grading recommendations. In Guyatt, G., Rennie, D., Meade, M. O., & Cook, D. J.(Ed.), *Users' guides to the medical literature: A manual for evidence-based clinical practice* (pp 679-701). New York, NY:McGraw-Hill.

5. Recommendations for the guideline were developed by a consensus process incorporating the three principles of EBP (current literature, content experts, and patient and family preference [when possible])

Approval Process: Guidelines are reviewed by Bradley L. Schlaggar, MD, PhD Neurologist-in Chief, & Adam Ostendorf, MD, Fellow in Pediatric Fellow, both of St Louis Children's, Content Expert Team at Children's Mercy, the Office of EBP, and other appropriate hospital committees as deemed suitable for the guidelines intended use. Guidelines are reviewed and updated as necessary every 3 years within the Office of EBP at CMH&C. Content expert teams will be involved with every review and update.

Disclaimer:
The content experts and the Office of EBP are aware of the controversies surrounding First Seizure CPG When evidence is lacking or inconclusive, options in care are provided in the guideline and the power plans that accompany the guideline.

These guidelines do not establish a standard of care to be followed in every case. It is recognized that each case is different and those individuals involved in providing health care are expected to

use their judgment in determining what is in the best interests of the patient based on the circumstances existing at the time.

It is impossible to anticipate all possible situations that may exist and to prepare guidelines for each. Accordingly, these guidelines should guide care with the understanding that departures from them may be required at times.

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Excluded:

Citation	Reason for Exclusion
(Al-Rumayyan & Abolfotouh, 2012)	Includes febrile seizures, known developmental delay and head trauma
(Kim, Lee, & Kim, 2010)	Includes febrile seizures
(Fallah, Akhavan Karbasi, & Golestan, 2012)	Includes febrile seizures
(Thoman, Duffner, & Shucard, 2004)	Includes febrile seizures
(Hesdorffer, Logroscino, Cascino, & Hauser, 2007)	Includes status epilepticus
(Bernhard, Glaser, Ulrich, & Merkenschlager, 2010)	Does not answer the question
(McIntyre et al., 2005)	Does not answer the question

Author, date, country, and industry of funding	Patient Group	Strength of Evidence (GRADE)	Research design	Significant results	Limitations
Overview of Diagnostic Work up -AAN Practice Parameter					
(Hirtz et al., 2003)	Children and adolescents with first unprovoked seizure	The guideline was reviewed by two team members using the AGREE tool. The consensus was to accept the guideline with alterations	Guideline	The Practice Parameter addresses the following: Laboratory studies- may be obtained when history or clinical findings such as vomiting, diarrhea, or dehydration are present. Lumbar puncture (LP)- should not be obtained unless meningitis is suspected. EEG- should be performed as part of the evaluation of first non-febrile seizure. Timing of the study (within the first 48 hours or later) is not clear. Neuroimaging- CT scan- should not be obtained. MRI- should not be obtained for the child with a first non-febrile seizure who has returned to baseline.	*Concerns with the AAN Guideline (Hirtz et al., 2000) include: The development group did not include Pediatric Emergency Medicine, patient/parent/family representatives Methods for formulating the recommendations, cost implications and conflicts of interest are not reported transparently
Should Laboratory Studies be Obtained?					
(Aydogan, Aydogan, Kara, Basim, & Erdogan,	Children mean age 4 ±3.6 y (range 6 m-13 y) Presenting	Very low	Prospective cohort All subjects with afebrile seizure between Jan 2000 and March	62 subjects were enrolled- 50% male 9 subjects had leukocytosis (14.5%), a second CBC was obtained and leukocytosis did not persist.	Small number of subjects.

Author, date, country, and industry of funding	Patient Group	Strength of Evidence (GRADE)	Research design	Significant results	Limitations
2007) Turkey	with first afebrile seizure		2002 were enrolled	Leukocytosis was more prevalent in children with status epilepticus SE defined as a continuous seizure lasting longer than 30 minutes or repeating seizures last 30 minutes with recovering consciousness between them.	
(Landau, Waisman, & Shuper, 2010) Israel	85 subjects average age 7.5 y (range 0-18 y) who made 104 visits to the ED Excluded febrile seizure or other primary diagnosis	Very Low- inconsistent includes subjects that do not apply to this guideline	Retrospective chart review	Laboratory tests were obtained in 84% of visits. Eight percent provided useful information and < 5% were helpful in diagnosis and management. Only one lumbar puncture was performed. Eight percent of visits had electrocardiography performed and all were normal Seven percent of visit had electroencephalography performed and was consistently useful and was always performed along with a neurology consultation	Mix of children with first seizure and those already on medication for seizure. Only 30 (35%) subjects presented with first seizure.
(Nypaver, Reynolds, Tanz, & Davis, 1992) 1 USA	308 ED charts, 108 febrile (mean age 2.1 years) 200 non febrile seizures. (mean age 5.7 years	Very Low	Retrospective chart review	41 were having their first non febrile seizure. 26 subjects (63%) had at least one laboratory test performed. No changes in therapy were made as the result of the laboratory findings. In 1992 US dollars, the mean cost of the laboratory tests was $122.00 per subject.	Small sample size. Important changes in newborn screening since this study need to be considered, that is the need for lab studies may be even lower.

Author, date, country, and industry of funding	Patient Group	Strength of Evidence (GRADE)	Research design	Significant results	Limitations
	Included lab tests: electrolytes Calcium, magnesium, ammonia, glucose, Dextrostix				
Scarfone 2000 USA	Infants < or equal to 12 months of age presenting to the ED of a tertiary care children's hospital. Serum chemistry results were classified as normal, outside of range normal and clinically significantly abnormal	Very Low	Retrospective chart review	214 patient visits made by infants with febrile and non febrile seizures. 134/214 were non-febrile seizures and 70 of these were a first seizure, or 52% of all presenting non febrile seizures. 51 of 70 had lab drawn 8/51 (16%) had a clinically significant abnormality. Is there a Working Group on Status Epilepticus recommendation that serum chemistries should be obtained for adults and children with status epilepticus?	Would expanded newborn screening change any of this?
(Valencia et	Urban	Very Low	Prospective chart	Total of 107 children met criteria.	

Author, date, country, and industry of funding	Patient Group	Strength of Evidence (GRADE)	Research design	Significant results	Limitations
al., 2003)	hospital, All children unprovoked seizure. Prospective		review Separated out those with history of seizure from those with first seizure	Mean age 6.6 years (range 0.1-20 years). 58% male 42% Black 33% Hispanic 19% White 7% Other 75% (N=80) had previous seizures 68% of these were taking anti epileptic medications For those who had chemistries drawn 2/33 in the previous seizure group had abnormal electrolytes For those who had chemistries drawn 5/21 in the no previous seizure group had abnormal electrolytes. Patients with abnormal electrolytes were significantly younger (mean age 1.7 vs. 7.2 years) symptoms included vomiting or diarrhea, or presented with a changed in mental status.	
Should LP be obtained?					
(Landau, Waisman, & Shuper, 2010) Israel	85 subjects average age 7.5 y (range 0-18 y) who made 104 visits to the ED	Very Low-inconsistent includes subjects that do not apply to this guideline	Retrospective chart review	Laboratory tests were obtained in 84% of visits. Eight percent provided useful information and < 5% were helpful in diagnosis and management. Only one lumbar puncture was performed. Eight percent of visits had electrocardiography performed and all were normal Seven percent of visit had electroencephalography performed and was consistently useful and was	Mix of children with first seizure and those already on medication for seizure. Only 30 (35%)subjects presented with first seizure

<table>
<tr><th>Author, date, country, and industry of funding</th><th>Patient Group</th><th>Strength of Evidence (GRADE)</th><th>Research design</th><th>Significant results</th><th>Limitations</th></tr>
<tr><td></td><td>Excluded febrile seizure or other primary diagnosis</td><td></td><td></td><td>always performed along with a neurology consultation</td><td></td></tr>
<tr><td>(Lateef et al., 2008)

USA</td><td>Children 1- 6 months with new onset seizures
N= 141</td><td>Very Low Cohort study, small number of subjects, not all had results of HSV or enteroviral infection</td><td>Prospective cohort</td><td>Diagnostic standards of infected CSF
• WBC > 6 mm3
• Protein elevation > 50 mg/dl
• Positive bacterial culture
• Herpes simplex virus (HSV) PCR

76/141 (54%) underwent LP.
Age was the greatest factor in obtaining an LP. Subjects aged 1-2 mo 70% LP whereas aged 5-6 mo 33 % LP
There was no relationship between presence of CSF abnormalities and the final diagnosis of seizure. At the time of discharge, 53% of those who had an abnormal CSF were thought to have a seizure, while the remaining 47% were thought to have a non-seizure event.</td><td>LP is only performed on subjects whom the attending provider deems necessary
Small population</td></tr>
<tr><td>(Chan et al., 2010)
Singapore</td><td>Children aged 1 month to 15 years with first afebrile seizure
108 with ≥ 2 afebrile seizure and</td><td>Very Low</td><td>Population Survey</td><td><table><tr><th></th><th>1st SZ</th><th>Epilepsy≥ 2 SZ</th><th>P value</th></tr><tr><td>Develop-mental exam (normal)</td><td>93%</td><td>87%</td><td>P=0.046</td></tr></table></td><td>Population based study that looked at the epidemiology of afebrile seizure.</td></tr>
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<table>
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Appears to be an abstract only</td><td>Retrospective observational cohort</td><td>Video EEG (vEEG) was normal in 75 subjects (59%)
Non-epileptic events were recorded in 8 subjects (6%)
Idiopathic generalized epilepsy was diagnosed in 14 subjects (11%)
Generalized epilepsy with febrile seizure was diagnosed in 2 subjects (2%)
A focal epilepsy was diagnosed in 29 subjects (23%)
Sensitivity= 100
Specificity = 10
(+) predictive value = 85%</td><td>34 subjects had neurodevelopmental problem, 11 subjects had a family history of epilepsy, and 13 had a history of febrile seizure.</td></tr>
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				(-) predictive value= not estimable	
(Hamiwka, Singh, Niosi, & Wirrell, 2007)	Children 1 month -17 years Mean age- 8 years, =/- 5 years N= 127 53% male Seen in clinic 52 +/- 18 days after first encounter Development delay present in 19 children (15%) Abnormal neurological exam was present in 14 (11%)	Very Low	Non randomized prospective cohort study of children seen at a First Seizure Follow-up Clinic	24% events were felt to be non-epileptic (n= 31) Primary event was syncope 74% were felt to be epileptic (n=94) 2% (2) were unclassifiable Results of follow up EEG All 94 children with an epileptic event had an EEG. 44 of these children (47%) had abnormalities present, 53% did not. Thirty children without an epileptic event had EEGs. 93% had normal studies. Over a one year follow up, 42 children (45%) were diagnosed with epilepsy.	Many of the subjects (38%) in this study did indeed have a prior seizure event that was unreported by the referring provider, or unrecognized by the parent/caregiver at the time of the referral.
(Hsieh et al., 2010) USA	317 infant subjects (range 1-24 months) urban population	Low It is a cohort study based on a clinical guideline.	Prospective cohort	EEG (all subjects) abnormalities were found in half CT (298/317 obtained) abnormalities were found in a third MRI (182/ 317 obtained) abnormalities were found in 57% Of the 193 normal CTs, 97 underwent MRI of which 32 (33%) had an abnormal MRI	The majority had more than one seizure upon presentation. The incidence of seizures lasting longer than 20

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					minutes was 8.5% 30 subjects had a history of prematurity. Increased likelihood of obtaining an MRI in younger infants.
(Landau, Waisman, & Shuper, 2010) Israel	85 subjects average age 7.5 y (range 0-18 y) who made 104 visits to the ED Excluded febrile seizure or other primary diagnosis	Very Low- inconsistent includes subjects that do not apply to this guideline	Retrospective chart review	Laboratory tests were obtained in 84% of visits. Eight percent provided useful information and < 5% were helpful in diagnosis and management. Only one lumbar puncture was performed. Eight percent of visits had electrocardiography performed and all were normal Seven percent of visit had electroencephalography performed and was consistently useful and was always performed along with a neurology consultation	Mix of children with first seizure and those already on medication for seizure. Only 30 (35%)subjects presented with first seizure
Should a CT scan be obtained?					
(Hsieh et al., 2010) USA	317 infant subjects (range 1-24 months) urban	Low- It is a cohort study based on a clinical guideline.	Prospective cohort	EEG (all subjects) abnormalities were found in half CT (298/317 obtained) abnormalities were found in a third MRI (182/ 317 obtained) abnormalities were found in 57%	The majority had more than one seizure upon presentation. The incidence of

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	population			Of the 193 normal CTs, 97 underwent MRI of which 32 (33%) had an abnormal MRI	seizures lasting longer than 20 minutes was 8.5% 30 subjects had a history of prematurity. Increased likelihood of obtaining an MRI in younger infants.
Kodaphanhadeh 2006 Iran	125 subjects, children mean age 53 ±48 months (range- 1 month-15 years)	Low	Retrospective case series –no control group. Excluded those with seizures > 30 minutes or electrolyte abnormalities Report on CT scan and MRI within the first hours of arrival	Neuro-imaging was obtained in 119 subjects (95%) Emergent CT was performed in 108 (91%) and MRI in 11 (9%) Neuro-imaging was normal in 107 (90%) of subjects. Clinical significant results were found in 12 subjects (10%) 10 of the 12 subjects with abnormal findings had abnormal neurological examination.	Study design.
Sharma 2003 USA	500 subjects with new-onset afebrile seizure median age	Low	Retrospective	Neuro-imaging was performed in 475/500. 25 subjects were not imaged. Of the subjects who were scanned, CT was performed in 454/475, and MRI was performed in 21/475. 437/475 had neuro-imaging while in the ED. And	5/6 subjects who fell in the low risk group by partition analysis had abnormal findings on

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Normal imaging results were reported in 395/475 subjects. [83%]
Clinically insignificant results were reported in 42/475 [9%]
Clinically significant events were reported in 38/475 subjects [8%]
Using Partition analysis, 3 variables partitioned the subjects into 4 groups
Variables
Presence of pre disposing condition, focality of the seizure and age
Groups
Predisposing condition- High risk
No predisposing condition
Non-focal seizure- low risk
Focal seizure- age dependent
Age > 33 months low risk
Age < 33 months high risk</td><td>physical/neurological exam.
One subject subsequently diagnosed with grey matter heterotopias had a normal physical and neurological exam.
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Rauch 2008	75 children	Very Low-	Retrospective	Below 12 years of age sedated for MRI	There was a 53%

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USA	aged 0-18 years Included those with MRI at admission and afebrile seizure	quality study	cohort – chart review. Excluded genetic anomaly, history of seizure, CNS pathology	71 subjects (95%) had LOS increased by one day for the MRI 13 subjects (17%) had abnormal MRI results; 1/13 had an abnormal neurological exam No changes in treatment based on the MRI occurred.	fall in the number of MRI obtained from the first to second year as the results from the quality project were made known and changed practice.
Sharma 2003 USA	500 subjects with new-onset afebrile seizure median age (16 mo range (0-21 years))		Retrospective	Neuro-imaging was performed in 475/500. 25 subjects were not imaged. Of the subjects who were scanned, CT was performed in 454/475, and MRI was performed in 21/475. 437/475 had neuro-imaging while in the ED. And 13 had neuro-imaging after the ED visit but within 72 hours of the visit. Normal imaging results were reported in 395/475 subjects. [83%] Clinically insignificant results were reported in 42/475 [9%] Clinically significant events were reported in 38/475 subjects [8%] Using Partition analysis, 3 variables partitioned the subjects into 4 groups Variables Presence of pre disposing condition, focality of the seizure and age Groups Predisposing condition- High risk No predisposing condition	5/6 subjects who fell in the low risk group by partition analysis had abnormal findings on physical/neurological exam. One subject subsequently diagnosed with grey matter heterotopias had a normal physical and neurological exam. Retrospective design

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Should the child be hospitalized?					
				No studies found.	
Overview of treatment and anticipatory guidance AAN Practice Parameter 2003					
(Hirtz, et al.), 2003	Children and adolescents with first unprovoked seizure	The guideline was reviewed by two team members using the AGREE tool. The consensus was to accept the guideline with alterations*	Guideline	No evidence that treating a child after a first unprovoked seizure reduced the risk of either subsequent significant injury or sudden death. The burdens of treating outweigh the benefit. The burden of treating after the first unprovoked seizure include • Daily medication • Perception the child is 'sick' • Ability to obtain health insurance • Ability to find day care • In teens, driving privileges • In teens, teratogenicity	*Concerns with the AAN Guideline (Hirtz et al., 2003) include: • The development group did not include Pediatric Emergency Medicine, patient/parent/family representatives • Methods for formulating the recommendations, cost implications and conflicts of interest are not reported transparently
What is the research basis of anticipatory guidance?					
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Results of follow up EEG
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