Child with a fit

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Fits are common in children. About 7% of the children would have had a fit by the age of 7 years. Fits are extremely distressing to witness and cause a lot of anxiety to the parents. Prolonged fits can cause brain damage or even lead to death. Hence prompt control and subsequent management of a fit is very important.

Management of a child with a fit will obviously depend on the cause and the type of the fit and also the age of the child as some types of fits are seen only in certain age groups, and are better controlled by certain anticonvulsants than others. Therefore the child with a history of fit should be evaluated by a detailed history, clinical examination and relevant investigation so as not only to confirm the diagnosis of a seizure disorder but also to exclude non seizure disorders which can mimic seizures and for which anticonvulsants are of no help. A short description of the types of the fits, their causes and method of evaluation is given below before going into the details of management of seizure disorders.

Types of fits : Fits in children can be broadly classified into 2 groups —

- 1) Partial with focal onset
- 2) Generalised without focal onset.

Partial seizures are more likely to be associated with focal brain disease such as a scar, tumour or malformation whereas generalised seizures are more likely to arise from diffuse neuronal instability on either genetic or a pathologic basis. Various types of fits can be recognised under each group as given in Table 1.

Classification of Seizures

1. Partial seizure : a) Simple partial (Consciousness not impaired)
— motor, sensory or Jacksonian.
- b) Complex partial (Consciousness impaired)
— Temporal Lobe epilepsy.

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2. Generalised seizures : a) Tonic or clonic (Grand mal)
- b) Absence seizures (Petit mal)
- c) Atonic seizures

Commission on classification and Terminology of the International League Against Epilepsy (1981) gives a comprehensive classification of seizures.

Cause : The causes of fits in children are many. Some are common, others are rare. Certain age groups tend to have a particular cause which is not seen in other age groups. For example Perinatal asphyxia is the main cause of neonatal seizures while febrile seizures are the commonest in the older age group. Common causes of fits in children are given in Table II

Table II

Neonates	Infants over 1 mo. of age
Perinatal asphyxia	Febrile seizures
Birth trauma, Intracranial bleeding	CNS infections
Metabolic & Electrolyte disturbances e. g. Hypoglycemia, Hypocalcemia etc.	Cryptogenic or Idiopathic
CNS infections - Congenital/acquired	Encephalopathies : toxic, drugs etc.
Inborn errors of metabolism	Metabolic & electrolyte (as in neonates)
Structural brain defects	Head trauma, intracranial bleeding
	CNS malformations, tumours, & degenerative disorders

Evaluation of the child with a fit is done by taking proper history, detailed physical examination and relevant investigations.

History : A detailed history should include :

1. Whether it is the first fit or one of the recurrent fits
2. Type of the fit - focal or generalised
3. Duration of the fit
4. Acute illness prior to the fit e. g. high fever,
5. Any drugs or toxic substances taken by the child
6. Any head injury - past or present
7. Medication the child is taking if known to have a seizure disorder
8. Any family history of seizure disorder

Clinical Examination : should include the assessment of vital signs, neurological status, presence of any systemic disorder, signs of head trauma or raised intracranial pressure, meningeal irritation, hypertension or shock.

Investigation :

Following investigations are routinely done :

1. Complete blood count
2. Blood urea, electrolytes, sugar and calcium
3. C. S. F. examination in all first seizures and those associated with fever unless there is contraindication.
4. Urine routine examination
5. X-ray wrist left (A.P.) view for evidence of Rickets, lead toxicity etc.

The following additional investigations may be needed depending on clinical suspicion. Blood and urine Culture, viral studies of blood and CSF., Blood level ammonia, liver function tests, toxic screen of the blood and urine, anticonvulsant level in the blood, EEG and C. T. scan of the head.

With a detailed history, physical examination and relevant tests the cause of the fit can be found and seizure like non epileptic disorders like breath holding attacks, spasmus nutans, syncope, night terrors, shiverings etc. can be excluded. Anticonvulsants are of no help in these seizure like non epileptic disorders. For a more comprehensive discussion on the different types and causes of the fits seen in children the reader is referred to O'Donohoe (79).

Management : As stated earlier the drug of choice in the management of a seizure disorder will depend on the type and cause of the fit. Table III gives various drugs suitable for different types of the fits. The actual choice will depend on the clinician's experience, cost and availability.

Table III

Type of seizure	Drug of choice
1. Generalised Tonic - Clonic (Grand mal)	Phenobarbitone (3 - 5 mg/Kg/day) Valproate (20 - 60 mg/Kg/day) Phenytoin (5 - 10 mg/Kg/day) Carbamazepine (15 - 20 mg/Kg/day)
2. Absence Seizures (Petit mal)	Ethosuximide (20 - 40 mg/Kg/day) Valproate (as above)
3. Myoclonic Seizures (Infantile Spasms)	ACTH 40 units/day, later to taper off slowly Nitrazepam (0.6 - 1.2 mg/Kg/day) Sodium Valproate (as above)
4. Minor Motor (Akinetic/Atonic)	Sodium Valproate Clonazepam (0.05 - 0.15 mg/Kg/day)
5. Focal & Psychomotor	Carbamazepine Phenobarbitone Phenytoin

Status Epilepticus : Diazepam 0.25 mg/Kg at a rate of 1 mg/min. i. v. repeat same dose
Max. dose 10 mg. after $\frac{1}{2}$ hr. if required.

Phenobarbitone 10 mg/Kg i. v. at a rate of 25 mg/min. repeat $\frac{1}{2}$ the
Max. dose 300 mg. initial dose after 1 hr. if required.

Phenytoin 15 mg/Kg i. v. at a rate of 25 mg/min begin maintenance
Max. dose 1000 mg. in 12 hrs.

Paraldehyde 0.1 - 0.25 ml/Kg i. m, rectal, i. v. or nasogastric.

Lidocaine 0.7-1.4 mg/Kg i.v. initial bolus. 4-8mg/Kg/hr. i.v. maintenance

Specific Management : Children may be brought in a convulsive state or with a history of a recent fit i. e. few minutes or hours ago. Those seen, after the fit has stopped, could be evaluated well before starting therapy while those presenting with major motor seizures require urgent attention.

1. **Generalised tonic - clonic seizures** (Grand mal) are the commonest fits seen in children and are the most serious ones requiring prompt therapy if brain damage or death is to be avoided. Tonic clonic fits lasting more than $1\frac{1}{2}$ - 2 hours can cause damage to amygdala, hippocampal areas of the brain. Evaluation and treatment, therefore, should go together in a co-ordinated manner in managing major fits. The following general and specific measures should be undertaken :

- a. The child is nursed in the lateral position with the head kept at a level little lower than the trunk. Airway is kept clear by suctioning the secretions and vomitus. An airway should be put, if possible.
- b. Oxygen is given by a mask and tepid sponging if the child is febrile.
- c. While the drug to be administered is being made ready, quick general and neurological examinations are performed to assess the cardio - pulmonary status of the child and also to search for any signs of trauma, shock or meningeal irritation.
- d. Diazepam (0.25 mg/Kg) is given intravenously at a rate of 1 mg/min. For practical purposes, Diazepam 5 mg for infants of less than 1 yr. and 10 mg for those above 1 yr. is drawn in a syringe and given undiluted until the convulsion is brought under control, then 1 mg. more is pushed and then stopped.

Sometimes it is difficult to give Diazepam i. v. in chubby infants and in such circumstances it can be given rectally through 1 ml tuberculin syringe and pressing the buttocks together for a few minutes after pushing the drug. The rectal dose is 0.5 mg/Kg.

Absorption of Diazepam after intramuscular administration is erratic although therapeutic blood level has been found after giving i. m. at a dose of 1 mg/Kg. however my preference is to give Diazepam rectally or Paraldehyde deep intramuscularly if i. v. administration is not possible.

One dose of Diazepam promptly stops the fit in most children. The child is then assessed in more detail and if by history and clinical examination, it is a first febrile seizure, then no other anticonvulsant need be given immediately. The child is observed and relevant investigations are sent so as to confirm the diagnosis and give appropriate treatment.

When it is expected that the fit is likely to recur e. g. in meningitis, encephalitis, encephalopathies etc a long acting anticonvulsant should be given and the drug of choice is Phenobarbitone 10 mg/Kg to be given i. m. and to repeat after 12 hours 5 mg/Kg of Phenobarbitone i. m. or oral if the child is conscious. Duration of anticonvulsant therapy will depend on the cause of the fit i. e. short term for meningitis or encephalopathies and long term for epilepsy or recurrent febrile seizures.

If the fit is not controlled by one dose of Diazepam or if the fit recurs soon after, the child should be looked after in a place where proper monitoring of vital signs and active resuscitative measures including intubation and mechanical ventilation can be carried out. The following plan of action is then taken :

1. Blood is taken for investigations (as mentioned above)
2. An i. v. line is started with 5% Dextrose in 0.25 Normal saline at daily maintenance rate. Oxygen is given by a mask and airway is kept clear.
3. Give another dose of i. v. Diazepam (dose and rate as mentioned above)
4. If the fit is not controlled 15 minutes after Diazepam, give 10 mg/Kg of Phenobarbitone i. v. at a rate of 25 mg/min. Respiratory status should be carefully watched and prompt resuscitation with Ambu bag with or without intubation should be started if there is any evidence of respiratory depression.
5. If the fit is not controlled 30 minutes after Phenobarbitone, give Inj. Paraldehyde 0.15 ml/Kg deep i. m.
6. Inj. Phenytoin 15 mg / kg i. v. slowly is to be given at a rate of 50 mg / min. with a careful watch on the heart rate, if the fit is still continuing even after the administration of Paraldehyde.
7. 20% Mannitol (0.5 gm / kg) i. v. is then given in 30 minutes to reduce cerebral oedema and raised intracranial pressure which frequently is the cause of continuing fits and the latter also leads to cerebral oedema and raised intracranial pressure, Mannitol infusion, sometimes, promptly stops the fit.
8. If the fit is still continuing, give another dose of Phenobarbitone 10 mg / kg i. v. slowly.
9. Fits still uncontrolled by above measures, which is rare, should be brought under control with the use of general anaesthesia, intubation, paralysis and mechanical ventilation for which an Anaesthetist should be called for help. While preparing for general anaesthesia a trial of i. v. Lidocaine should be given with proper monitoring

of the heart and respiration. Lidocaine is given i. v. 1 mg / kg as a bolus followed by continuous i. v. infusion at a rate of 4 mg / kg / hr. If there is a good response it is continued at the same rate or higher (max. 8-12 mg / kg / hr) rate for 24 hours and then gradually tapered off. If there is no response to i. v. Lidocaine, the child should be anaesthetised, intubated, paralysed and put on a ventilator.

10. When the results of investigations become available and a specific cause is known, appropriate treatment for the cause e. g. glucose for hypoglycemia, chelation for lead encephalopathy etc, should be started immediately.

The above aggressive treatment is for ongoing generalised tonic-clonic seizure (Grand mal Status Epilepticus). Twitching or contraction of a group of muscles does not require above mentioned aggressive therapy.

Once the fit is controlled at any stage of the above treatment outline, a long acting anticonvulsant preferably Phenobarbitone 10 mg / kg i. m, is given and maintenance dose of Phenobarbitone 5 mg / kg / day is given 12 hours later. Subsequent therapy and choice of long term anticonvulsant drug will depend on the cause and the type of the fit.

I, V, Phenytoin should be chosen as the drug of choice for fits following head trauma as it has very little sedative effect.

A child with an ongoing tonic-clonic fit should never be left alone and vital signs should be checked frequently so that the cardio pulmonary status is well maintained throughout.

Gamstrop ('85) has recommended use of continuous i, v, Diazepam infusion (0.3-0.7 mg / kg / hour) to control Grand mal Status.

Another treatment schedule recommended is to use i, v, Diazepam (0.25 mg / kg) followed immediately by i, v, Phenytoin (18 mg / kg) and if still not controlled then use either i, v, Diazepam or i, v, Phenobarbitone as described above, and if still resistant to administer general anaesthesia intubate, paralyse and mechanically ventilate. (Delgado Escueta et al '82) **Neonatal seizures:** About 1% of all new borns develop a seizure. There is usually an underlying cause and Perinatal Asphyxia is the commonest cause. Because of the immaturity of the new born brain, classical tonic-clonic seizures are rarely seen and seizures manifest as: subtle, tonic-clonic [focal or multi focal], hemiclonic and focal or generalised myoclonic seizures. [Lombroso '82]. Management of neonatal seizures require a certain step wise pattern:

1. Take a sample of blood for sugar, calcium, magnesium, complete blood count and others if indicated.
2. Give 2 ml / kg of 25% Dextrose i. v. and then continue i. v. infusion of 10% Dextrose at the maintenance rate

3. Inj. Phenobarbitone 10 mg / kg is given i, v, slowly. If the fit is not controlled give 5 mg / kg i, v, 30 minutes later. As the half life of Phenobarbitone is very long, there is no need to give another dose for at least 24 hours. Maintenance therapy, then, can be commenced at 5 mg / kg / day in 2 divided doses preferably after checking the Phenobarbitone level.
4. If metabolic, electrolyte, septic or other cause is found appropriate therapy should be started e, g, Calcium for Hypocalcemia, antibiotics for meningitis etc,
5. In prolonged seizures not controlled by Phenobarbitone, one dose of 20% Mannitol [0,5 gm / kg] can be given in 30 minutes if cerebral oedema is suspected specially in babies with severe Perinatal Asphyxia. Dexamethasone can be continued at 0,5 mg / kg Stat and later 0,5 mg / kg / day in 4 divided doses,
6. Inj. Paraldehyde 0,1 ml / kg can be given deep i, m, if the fit is not controlled by Phenobarbitone,
7. Pyridoxine 50 mg i, v, should also be tried in resistant cases as some babies may dramatically respond this therapy,
8. General care of the baby with Oxygen by mask, clearing of the airway and monitoring of the vital signs should be done from the start. Continuous i, v, Diazepam or i, v, Lidocaine has been recommended by Gamstrop [85] to control ongoing neonatal seizures. However there is a risk of hyperbilirubinemia if Diazepam is used as Sodium benzoate the stabiliser preservative in the Diazepam parenteral preparation is a strong uncoupler of bilirubin-albumin complex.

It is important to emphasize that infrequent and mild seizure may not require treatment and more harm may be caused by the side effects of the anticonvulsants than by the fit itself, [Holden and Freeman 1975].

Continuation of the anticonvulsant therapy in the neonate with seizures depend on the cause of the fit. Seizures occurring in the early neonatal period due to Perinatal Asphyxia or metabolic disturbance with no neurological deficit will require a short period of therapy and if the baby remains well it can be discontinued after 3 months. Recurrence of the fits and abnormal E, E, G, record indicate long term anticonvulsant therapy.

Febrile seizures: These are the fits associated with or precipitated by high fever due to extracranial infection. About 3-4 of children develop these fits and are commonly seen in the age group of 6mo, to 5 years. Majority of these children have upper respiratory tract infection as the cause of high fever and present with tonic or tonic-clonic generalised seizure lasting for few minutes only. The child should be sponged well and given Aspirin or Paracetamol to bring down the temperature. This may be adequate to stop the fit in majority of cases but Diazepam i, v, or rectal may be required to stop the fit. There is no need to give long term anticonvulsant therapy in the first febrile seizure but long term therapy is indicated if the child has more than one fit or has two of the following characteristics:

1. History of neurological abnormality before the fit,
2. Fit lasting for more than 15 minutes,
3. Focal fit.
4. Family history of seizure disorder.

The long term therapy should be continued for at least 2 years of seizure free period and then gradually tapered off.

Myoclonic seizures : These are also called infantile spasms or 'Salaam' attacks as the characteristics of the fits being sudden flexion of limbs, head and trunk together. These fits are commonly seen in the age group of 3 months to 2 years. Majority of these children have evidence of brain damage in the Perinatal or Post natal period due to various factors like Perinatal Asphyxia, CNS infection, metabolic or degenerative disorders of the brain etc. These children are grossly retarded and many of them show progressive deterioration. E. E. G. is very characteristic with chaotic high voltage slow waves and random spike (Hypsarrhythmia). These are difficult to treat but respond to daily administration of ACTH 40 units/day until seizures are controlled, then the dosage is gradually reduced over few months. Some may respond to Nitrazepam or Sodium Valproate.

Absence seizures : These are characterised by brief lapses of consciousness or vacant stares lasting for few seconds. The child may get several such episodes in a day. Children in the age group of 3 - 7 years are generally affected. The cause is unknown but probably due to a genetic abnormality. E. E. G. is very characteristic - 3/sec. spike wave activity. These absence attacks can be precipitated by hyperventilation in a number of children - useful clinical test. They respond well to Ethosuximide. Sodium valproate is the second drug of choice specially if there is a history of generalised fit which some of these children develop later on.

Focal seizures : These may manifest as focal motor, sensory or Jacksonian with progression to generalised fit. These may affect any part of the body or spread in a fixed manner. These are secondary to brain insult due to birth trauma, Perinatal asphyxia, CNS infections, vascular accidents etc. EEG will show focal spikes thereby helping in the location of the abnormality in the brain. Phenobarbitone, Carbamazepine or Phenytoin are useful in controlling these fits.

Psychomotor fits (Temporal Lobe Epilepsy) : These are seen in any age group. There is usually a characteristic aura - sensation of fear, epigastric pain, odd smell or taste or visual hallucination followed by smacking of the lips, movements of the tongue, swallowing movements or vague stare. Each individual will have a particular pattern. Many of the children develop generalised seizures as well. The cause mentioned for focal seizures also can cause these types of seizures. EEG will show focal abnormality in the temporal lobe and its connections. Carbamazepine is the drug of choice. Phenobarbitone, Sodium valproate or Phenytoin may need to be added. Occasionally Surgical excision of the affected lobe may be required in resistant fits.

Akinetic seizures : These are not common and are characterised by sudden loss of tone and falling to the ground. These fits respond well to Sodium valproate.

Lennox - Gastaut Syndrome : These are myoclonic seizures seen in older children. Most of these children are grossly retarded and show signs of brain damage due to various insults in the perinatal period or later. Children with this syndrome have violent shock-like contraction of one or more groups of muscles. EEG shows gross abnormal record with atypical spike wave complexes. Phenobarbitone, Valproate, ACTH or corticosteroids singly or in combination may be helpful in controlling these fits. Treatment of the cause, if possible, should be undertaken.

Treatment of some common symptomatic fits : When the precipitating cause of the fit is known specific treatment should be given.

1. **Hypoglycaemia :** Give 2 ml/Kg of 25% Dextrose stat, then continue 10% Dextrose infusion at a rate of 100 ml/Kg/day until the blood sugar is stabilised. Treat the cause of Hypoglycaemia.
2. **Hypocalcaemia :** Give 1 ml/Kg of 10% Calcium gluconate diluted with equal volume of 5% Dextrose i.v. slowly monitoring the heart rate. Continue maintenance Calcium either intravenously (1-2 ml/Kg/day) of Calcium gluconate or oral Calcium salt (200-300 mg/Kg/day) in divided doses. Treat the primary cause of Hypocalcaemia.
3. **Hypertensive Encephalopathy :** Diazoxide 5 mg/Kg i.v. at a fast rate, or Apresoline (Hydralazine) 0.15 mg/Kg i.v. + Reserpine 0.075 mg/Kg i.m. Treat the primary cause of hypertension and continue hypotensive drugs.
4. **Cerebral oedema/or raised intracranial pressure :** 20% Mannitol i.v. 0.5 Gm/Kg in 30 minutes. It can be repeated every six hours but with a careful watch on fluid and electrolyte status of the child. I.V. Dexamethasone 0.5 mg/Kg stat followed by 0.5 mg/Kg/day in 4 divided doses may also be given. Use of hyperventilation or barbiturate coma may be required. Treat the primary cause.
5. **Meningitis :** Specific antibiotics depending on the culture and sensitivity.
6. **Head injuries, Intracranial space occupying lesions** obviously require surgical care in addition to supportive measures like anticonvulsants and agents for reducing cerebral oedema.

Summary : A short description of the various types of the fits seen in children has been presented. A practical approach to the evaluation and management of children with different types of the fits have been discussed. Management of a generalised tonic clonic seizure has been dealt in detail so as to give a clear guideline in approaching this medical emergency.

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