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STATUS EPILEPTICUS

Practical Guidelines in Management

Diagnosis,
Investigations,
Management
and Prognosis

Editor
Ashalatha Radhakrishnan

Foreword
Daniel H Lowenstein

JAYPEE

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2 Prehospital Management of Status Epilepticus

INTRODUCTION

Status epilepticus (SE) is a neurological emergency that requires immediate and vigorous treatment to stop the ongoing seizures to prevent neuronal injury or death. Early recognition and timely intervention, including prehospital treatment, are therapeutically beneficial. Some controversy exists over the optimal management of prehospital seizures, especially regarding medication choice, dosing, and routes of administration. Medication choice and routes of administration also depends on the personnel who are administering the medications.

SE is defined as an epileptic seizure lasting greater than 5 minutes or more than one seizure within a 5-minute period without the person returning to normal between them.[1,2] Depending on whether convulsive activity is present, SE is classified into convulsive status epilepticus (CSE) and nonconvulsive status epilepticus (NCSE). Convulsive SE is the most common and serious form of SE associated with high morbidity and mortality.

"TIME IS BRAIN" IN STATUS EPILEPTICUS

Outcome of SE depends on etiology, duration, treatment, and the age of the patient (children have better outcome than adults).[3-5] Duration of SE is predictive of both treatment success and mortality. As time passes, SE becomes more refractory to treatment.[4,6,7] Prolonged seizures is associated with reduced Glasgow coma scale (GCS) at discharge and prolonged stay in the intensive care unit (ICU) and the hospital.[8]

"Time is Brain" in the management of SE, which means prompt and early treatment, is crucial. Rapid prehospital treatment allows earlier intervention, decreases morbidity, mortality, and decreases costs associated with emergency department (ED) visits. Hence effective and timely treatment of SE has a decisive role for a good prognosis.

INCIDENCE OF SEIZURES IN THE PREHOSPITAL SETTING

Of those presenting with SE, a large proportion of patients have pre-existing chronic epilepsy.[9] In UK, up to 18% of adults with active epilepsy attend the ED annually and 40–60% of these ED visits by people with epilepsy (PWE) resulted in hospitalization.[10] The frequency of complaints relating to seizure in the prehospital setting underscores the need for training of Emergency Medical Service (EMS) personnel on its diagnosis and management.

The single largest identifiable risk factor for generalized CSE was pre-existing epilepsy associated with low levels of antiepileptic drugs (AEDs). Approximately 15–20% of persons with epilepsy have a

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history of at least one episode of SE and 12% present with SE.[11] Cerebrovascular accidents, especially in the elderly, represent the most common etiology for SE.[12] Other causes were discontinuation of AEDs, alcohol withdrawal, anoxia, metabolic disorders, hemorrhage, infection, tumor, drug overdose, and trauma.[13]

PREHOSPITAL DIAGNOSIS OF CONVULSIVE STATUS EPILEPTICUS

Diagnosis of SE in the prehospital setting is purely based on overt clinical manifestations and the duration of convulsive movements in the absence of electroencephalographic (EEG) changes and a response to parenteral AEDs. Generalized CSE is usually easy to diagnose, but an understanding of its evolution from overt convulsions through subtle SE is important in the treatment of SE. Patients may present with an undramatic clinical picture if they have subtle SE at the time of presentation. Many medical and psychiatric conditions can be mistaken for CSE and treating them as SE may be harmful.[14]

Treatment is often inadequate and too late, especially in rural and economically disadvantaged settings where seizures are common and, to a large extent, due to infectious diseases. However, the lack of appropriate medicines, their cost, application procedures, and late intervention hampers effective control of ongoing seizures in developing countries like India.[15]

SPECTRUM OF SEIZURES ENCOUNTERED IN PREHOSPITAL SETTING

Over time, if left untreated or under-treated, seizures can progress from relatively short, isolated incidents to prolonged and often life-threatening events **(Fig. 2.1)**.

1. Isolated seizures—first seizure or rare seizures
2. Cluster seizures
3. Prolonged seizures
4. Status epilepticus—convulsive or nonconvulsive.

Cluster Seizures (Acute Repetitive Seizures)

Cluster seizures have to be differentiated from SE. Cluster seizures are defined as 3 or more seizures within a 24-hour period with a return to baseline between the attacks. Cluster seizures can last anywhere from minutes to up to a day and increases the risk of SE, which is nearly 4 times more common in patients with cluster seizures than those without.

Identifying patients who are at risk of cluster seizures and formulating management strategies reduces the risk of occurrence of SE. Presence of high seizure frequency, more severe epilepsy, extratemporal epilepsy (mainly frontal), longer duration of epilepsy and people with recent worsening of pre-existing epilepsy are at risk of cluster seizures. It is often possible to give these people oral medications between seizures to try to interrupt seizure patterns.

Treatment of Acute Repetitive Seizures (ARS)[16]

- *Mild ARS*:
  - In prehospital setting—using extra doses of usual AEDs and oral benzodiazepines (diazepam or lorazepam or clobazam)
  - In-hospital ARS—rectal diazepam or parenteral benzodiazepines

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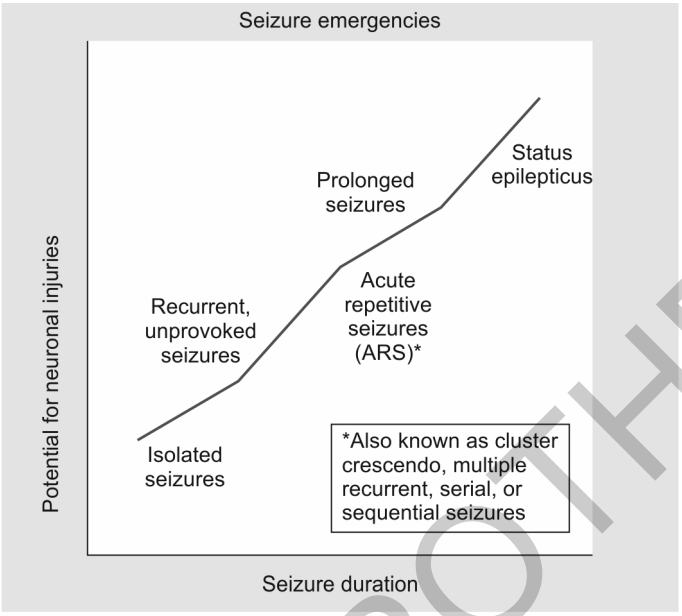

Figure 2.1 Spectrum of seizures in any setting mandating emergency treatment
Source: Pellock J. J Child Neurol. 2007;22(suppl):9S-13S

- *Severe ARS*:
  - Parenteral anticonvulsant effective against multiple seizure types, having a rapid onset of action and minimal adverse effects
  - One which is easily and safely given by caregivers through a rapid delivery system in various settings (home, school, long-term care, first responders) and requiring minimal patient cooperation.

STAGES OF STATUS EPILEPTICUS

Clinical stages of SE are:[17]

1. Premonitory (prodromal or before SE)—consists of confusion, myoclonus and increased seizure frequency
2. Incipient stage (0–5 minutes)—before a short seizure evolves into SE
3. Early stage (5–30 minutes)—continuous seizure activity
4. Transition stage—duration may vary
5. Late stage (30–60 minutes)
6. Refractory (> 60–90 minutes)—include subtle SE or NCSE
7. Postictal stage.

Recognition of early stages of SE (premonitory, incipient and early stages) and early treatment with appropriate medications improves seizure control and outcome of SE in the prehospital setting. Special circumstances may need immediate seizure control in the incipient stage (before a short seizure evolves into actual SE) and are called as "special circumstances" of the early stage. Most of these occur in the hospital setting and in serious medical conditions such as encephalitis and is discussed elsewhere in detail.[18]

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PREHOSPITAL EVALUATION AND MANAGEMENT OF STATUS EPILEPTICUS

Prehospital treatment is effective at stopping SE in many cases before arrival at the ED and thus reduces the risk of cardiorespiratory complications. Early recognition and initiation of rapid and effective treatment is the key in the treatment of SE in the community setting. Educating parents, caregivers and the emergency personnel (Emergency Hospital Services - EHS) to recognize and treat SE would result in reduced morbidity and mortality.

Prehospital management includes both first-aid during seizures, and pharmacotherapy. Inform the EMS (ambulance services or 108 in India) at the onset of SE. Basic life support with maintenance of airway, breathing and circulation (ABC) should be provided as soon as the diagnosis of SE is established. If the seizure fails to stop within 4–5 minutes or if the patient is continuing to seize at the time of EMS personnel arrival, prompt administration of parenteral anticonvulsants may be necessary. Decision about pharmacotherapy must consider the drug and also the route of drug delivery.

Principles of Prehospital Management of Status Epilepticus

- First aid—Airway, Breathing, Circulation (A,B,C)
- Supportive care
- Medications (intranasal; buccal; rectal; intramuscular)
- Inform medical personnel or transfer to hospital.

Instructions for Caretakers Involved in Status Epilepticus Management

- Record all details of seizures (stiffness, falls, convulsions of both sides of the body or not, duration and frequency of seizures)
- Note triggers for seizures—fever, sleep deprivation, etc.
- Note duration of seizures and recovery time
- Assess airway, breathing and pulse (ABC)
- If possible, check blood sugar (particularly in diabetic persons on medications)
- Initiate medications to stop seizures
- If time permits
  - Enquire for prior history of epilepsy, cardiac problems, pregnancy, diabetes, trauma and drug overdosage
  - Enquire for preceding aura, nature of seizure (focal versus generalized)
  - Medication history (anticonvulsants)
  - Drug compliance status
- Do not put fingers or metallic objects in mouth to prevent tongue bite
- In generalized seizures, the gag reflex is suppressed and vomiting may result in aspiration of gastric contents, so if possible, put the person in a left lateral decubitus position.

Risks of Prehospital Management

- No diagnostic facilities (e.g. blood investigations, electrocardiogram)
- No monitoring facilities (e.g. EEG)
- No additional treatment facilities (e.g. ventilator)
- Lack of availability of trained medical personnel (e.g. for administering first, second and third line drugs in SE).

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Benefits of Prehospital Management

- Shortens duration of SE
- May avoid endotracheal intubation and mechanical ventilation later
- Prevents systemic and neurological complications of prolonged seizures
- Reduces ICU stay and complications
- Reduces neuronal loss and damage
- Reduces risk of refractory SE
- Reduces mortality and morbidity (correlates with duration of SE).

Transfer to a Hospital

According to the guidelines, a time-bound critical transfer to a hospital should be undertaken if the patient can safely be moved and any of the following features are present:

- Major ABC problems
- Serious head injury
- Refractory SE (following failed treatment)
- Underlying infection
- Serial seizures (three or more in an hour)
- First SE
- Difficulties monitoring the patient
- All children under one year of age
- First febrile SE in children.

Who can be Managed at Home after SE?

- People with known epilepsy
- Persons who had full recovery after prehospital treatment
- Not at risk of recurrent or refractory seizures
- Have provision at home for adequate supervision.

STEPS IN PREHOSPITAL MANAGEMENT OF STATUS EPILEPTICUS

- Maintain stable vital signs
- Protect the patient's airway and cervical spine
- Minimize trauma
- Provide an accurate description of seizure activity to the emergency physician
- Maintain the airway in the best way possible
- Be alert for violent postictal behavior
- Be alert for postictal neurological deficits
- Be alert to avoid injury to head or spine or fracture or dislocations of bone and immobilize appropriately
- Early treatment with appropriate medications to control seizures.

Airway, Breathing and Circulation

Respiratory failure is an important complication of SE.[19,20] Respiratory failure may be due to a consequence of SE or related to medication side effects. Adequate care of airway, breathing and circulation takes precedence over any pharmacological therapy.

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- *Airway*: It is essential to maintain a patent airway during all stages of management of SE.
  - Clear oral secretions (mouth followed by nose)
  - Keeping the person in lateral position to prevent aspiration
  - Cervical spine should be immobilized, if trauma is suspected
  - In more severe degrees of altered sensorium, use an oral airway to prevent tongue from falling back
  - Endotracheal intubation in which airway is not maintained with above measures.
  - Airway compromise may occur at any stage and can be a complication of prolonged SE or due to respiratory depressant effect of anticonvulsant medications.
- *Breathing*: Respiratory depression, apnea or aspiration and airway obstruction can cause hypoxemia
  - Correct hypoxemia with supplemental oxygen
  - Monitor SPO_2 continuously, if possible
  - Noninvasive or invasive ventilation if indicated
- *Circulation*: Monitor pulse, BP and perfusion in all cases
  - Ensure good venous access (preferably have at least two venous lines); draw necessary blood samples, and start fluids and AEDs as necessary.

Role and benefit of endotracheal intubation and mechanical ventilation to prevent hypoventilation or pulmonary aspiration in SE is unclear. Many patients who are poorly responsive after a seizure will recover quickly without airway and ventilator support. In such patients, endotracheal intubation may pose unnecessary risks and mask clinical signs of recurrent seizures. Previous multicenter studies showed that approximately 15–18% of patients with SE received endotracheal intubation.[21,22] The best practices for airway management in patients with SE are unclear, and there are very few evidence-based guidelines for airway management in SE.[20]

Indications for Mechanical Ventilation in Status Epilepticus[20]

- Glasgow coma scale (GCS) score <8
- Respiratory depression (irregular jerky breathing or apnea) due to CSE or medications
- Fluid-refractory shock
- Raised intracranial pressure
- Difficult-to-maintain airway.

Medications (Anticonvulsants) for Prehospital Status Epilepticus Treatment

A number of anticonvulsants are available and one can choose the drugs based on availability and cost, and the monitoring facilities available.

Benzodiazepines are the drugs of choice in the treatment of SE because of their rapid onset of action. Benzodiazepines bind to the γ-aminobutyric acid A (GABA-A) receptor, enhancing the inhibitory effects of GABA by increasing the frequency of associated chloride channel openings. The three anticonvulsant medications **(Tables 2.1 and 2.2)** most commonly used, especially in the treatment of pediatric seizures are diazepam, midazolam, and lorazepam.

The studies comparing different benzodiazepines in the prehospital setting do not show a definite benefit of one over the other in terms of efficacy. Another prehospital study compared how much the concentration of diazepam, lorazepam, and midazolam had degraded at 30-day intervals when stocked in an ambulance. Diazepam and midazolam showed minimal degradation at 120 days, while

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Table 2.1 Benzodiazepines in prehospital management of status epilepticus

Routes of administration of benzodiazepines	*Diazepam*	*Midazolam*	*Lorazepam*
Rectal	+	–	–
Intranasal	–	+	–
Buccal	–	+	+
Intravenous	+	+	+
Intramuscular	–	+	–

Table 2.2 Properties of various benzodiazepines in status epilepticus treatment

Properties of benzodiazepines	*Diazepam*	*Midazolam*	*Lorazepam*
Dosage recommended	IV—0.15–0.25 mg/kg PR—0.2 mg/kg(least preferred route)	IV—0.1 mg/kg IM—0.2 mg/kg IN—0.2 mg/kg Buccal—0.2 mg/kg	IV—0.1 mg/kg Buccal—0.2 mg/kg
Active metabolite	Desmethyldiazepam (major) Oxazepam (minor) Temazepam (minor)	1-OH midazolam (minor)	None
Distribution half-life	30–60 minutes	IN—2.2 hours (administered with cyclodextrin) IV—1.8–6.4 hours	
Elimination half-life	24–57 hours	1–4 hours	7-26 hours
Lipid solubility index (relative to diazepam)	Diazepam: 1 Desmethyldiazepam: 0.793	1.544	0.482
Bioavailability Oral Rectal Intranasal	 100% Good In trials	 40% Poor Good	 100% Moderate Good

Abbreviations: IV, intravenous; IM, intramuscular; IN, Intranasal; PR, perrectal; 1-OH midazolam, 1-hydroxy midazolam

lorazepam had degraded to 90% and 86% of the original potency at 90 and 120 days respectively, demonstrating significant, progressive degradation over time.[23,24] This may have cost implications when selecting which medication to stock in an ambulance, especially in the setting of nationwide shortages of many medications commonly used in emergencies.

Diazepam

Forms of diazepam for treatment:

- *Oral*: Time to action is long; difficult to use in unconscious persons; high risk of aspiration
- *Intravenous*: Used by EMS personnel and in hospital
  - Watch for hypotension and respiratory depression
  - Requires monitoring
- *Intramuscular*: Unpredictable absorption as it binds to muscle proteins
- *Per-rectal solution*[25]
  - Undiluted diazepam solution available for IV use injected through polyethene tube placed in the rectum 4–5 cm above the anal opening

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  - 0.2–0.7 mg/kg per dose (maximum dose 10 mg)
  - Peak plasma concentrations within 20 minutes
- *Rectal suppositories*[26]
  - Slow peak serum concentrations, takes > 60 minutes
  - Not ideal for emergency situations
- *Rectal gel (Diastat AcuDial)*[27]
  - Gel in a prefilled rectal delivery system (5 mg/mL of diazepam)
  - Bioavailability of rectal diazepam gel is 90%
  - Rapid and complete absorption
  - Plasma level reached in 4 minutes.

Two pivotal trials evaluated the efficacy and safety of rectal diazepam.[28,29] After approval by the FDA in 1997, rectal diazepam became the standard prehospital treatment for cluster seizures and SE. The recommended doses are 0.5 mg/kg for patients aged 2–5 years, 0.3 mg/kg for those aged 6–11 years and 0.2 mg/kg for those aged 12 years or older.

Disadvantages of Rectal Diazepam

- Rectal administration is an embarrassing endeavor, especially in older children and adults, particularly in public places
- Rectal diazepam may be difficult for the caregiver to administer in some situations. Examples include elderly or frail caregivers, overweight patients and patients in wheelchairs
- In addition, some caregivers have concerns about placing themselves at risk of sexual abuse allegations.

As a result, alternative formulations of diazepam such as intranasal diazepam and intramuscular diazepam administration via an autoinjector are under evaluation. 10 mg and 20 mg diazepam prefilled autoinjectors (intramuscular) have shown promising response in various trials.[30] Intranasal diazepam (100 mL/spray) has been successfully used to terminate seizures in various trials.[31] The current information on intranasal diazepam spray is limited.

Midazolam

Midazolam is widely used in the treatment of cluster seizures and early SE in the prehospital setting. Various studies have compared efficacy of IV midazolam, IV diazepam, rectal diazepam and parenteral lorazepam.[32-36] In conclusion, intranasal midazolam is preferable to rectal diazepam in the treatment of emergency seizures, in terms of ease of administration, rapid onset of action, absence of significant effects on respiration and oxygen saturation, and social acceptability. **Figures 2.2 and 2.3** show components of midazolam nasal spray device and how to use it. **Figure 2.4** shows plasma concentrations of 5 mg administration of IV, IM and IN midazolam in 12 voluntary subjects.

Midazolam nasal spray (5 mg/mL): Dosage of midazolam nasal spray is shown in **Table 2.3**.

- Brands available
  - Midaspray; Insed; Midacip (Cost ₹275, ₹240 and ₹280 respectively)
- Dose
  - Each metered dose of 0.1 mL delivers 0.5 mg
  - Metered dose atomizer
- Pharmacokinetics
  - Rapid absorption; avoids first pass metabolism
  - Peak plasma concentration achieved in 20–60 minutes

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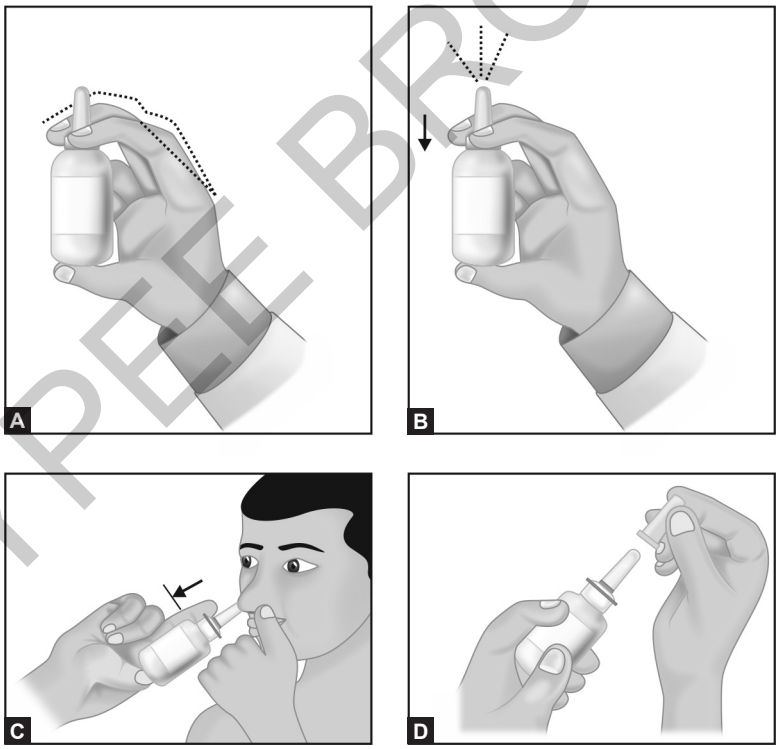
Figure 2.2 Midazolam nasal spray device
Source: From the patient education leaflet of Midaspray–Intas Pharma
(For color version, see Plate)



Figures 2.3A to D How to use midazolam nasal spray: (A) Hold the bottle as shown above with fingers on either side of the nozzle and thumb underneath; (B) Activate the pump by spraying once in the air if using it for the first time or if not used for a week or longer; (C) Insert the nozzle into the nostril as shown with the patient's head upright. Press the pump once. Do not allow patient to tilt his head or sniff while inhaling. Administer one spray at a time into each nostril (as per prescribed dose); (D) Wipe the nozzle, clean with tissue/clean cloth and replace the dust cap after use

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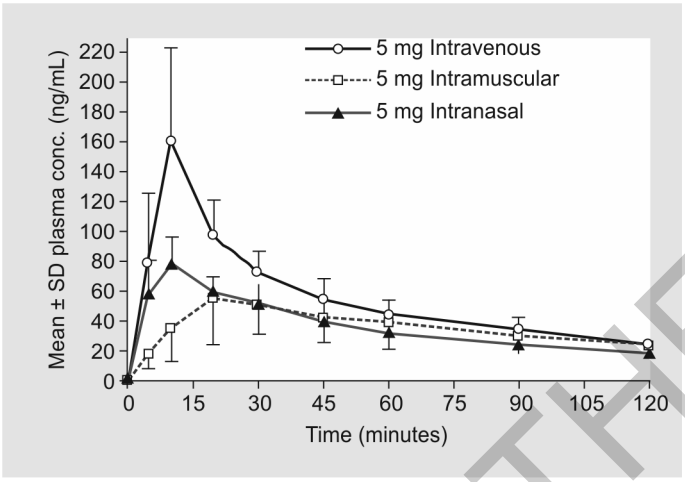

Figure 2.4 Plasma concentrations of midazolam after 5 mg IV, IM, and IN administration. Values are mean (±2SD) for 12 subjects for each dose

Source: Wermeling DP, et al. Anesth Analg. 2006;103:344-9.

Table 2.3 Dosage of intranasal midazolam

Age (years)	*Dose (mg)*	*Metered doses per nostril*
5 months–1 year	2.5	2 or 3
1–5	5	5
5–10	7.5	7 or 8
>10	10	10
Weight (Kg)	*Dose (mg)*	*Metered doses per nostril*
< 16	2.5	2 or 3
16–32	5	5
Over 32	10	10

  - 96% bound to plasma protein
  - Lipophilic
  - Yellowish or white crystalline powder
  - Insoluble in water
  - Soluble in alcohol, acetone and methyl alcohol
- Bioavailability
  - 72% –nasal administration

Buccal midazolam: Buccal midazolam has been compared to rectal diazepam and IV diazepam in various studies. Buccal midazolam was more effective than rectal diazepam.[37] Another trial compared buccal midazolam and IV diazepam in 120 patients who presented to the ED. The convulsive seizures were controlled within 5 minutes in 85% of the buccal midazolam group versus 93.3% of the IV diazepam group, almost comparable.The mean time for controlling seizures after administration

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was significantly shorter with IV diazepam ($p < 0.001$). However, the mean time for initiation of treatment and controlling seizures after diagnosis was significantly shorter with buccal midazolam ($p < 0.001$and $p = 0.004$, respectively).[38]

- Forms
  - Injections labeled for IV or IM use are also suitable for buccal use (glass or plastic packing)
  - Buccolam—Color coded prefilled oromucosal midazolam solution **(Fig. 2.5)**
- Pre-requisites to administer
  - Knowledge of person's epilepsy and a plausible treatment plan
  - First aid certificate (knowledge of midazolam administration)
  - Good knowledge of cardiopulmonary resuscitation (CPR)
  - Knowledge of midazolam protocol
- Note the time of onset of seizure
- Check medication pharmacy chart and midazolam plan
- Check medication name
- Check expiry date
- Check ampule dosage-15mg/3mL (5 mg =1 mL)
- Twist the top of the ampule to break open
- Reposition the patient's head to administer buccal midazolam
- Invert the ampule and administer 50% midazolam dose between lower side of cheek and teeth on one side and 50% on the other side
- Drip slowly at the rate of 1 drop per second
- Do not squirt into the mouth as it needs to be absorbed and not swallowed
- As soon as possible, turn the person on to side in the recovery position or support head if seated to maintain clear airway
- Note the time of stopping of seizures
- Stay with the person all throughout
- Follow standard first aid practice until recovery
- Document in seizure recording sheets and inform emergency medical personnel.

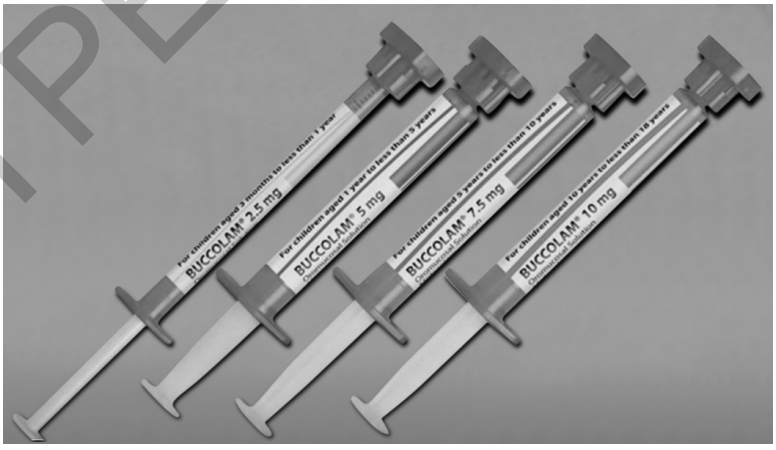

Figure 2.5 Color coded prefilled oromucosal midazolam solution (Buccolam)
Courtesy: Google images *(For color version, see Plate)*

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Intramuscular midazolam: Unlike lorazepam or diazepam, midazolam has properties that make it suitable for intramuscular administration. Intramuscular midazolam has rapid onset of action and can reach peak serum concentrations in 23–41 minutes and has a bioavailability of 87% in healthy adults.[39-41]

Lorazepam

Sublingual lorazepam was compared with rectal diazepam and has been found to be inferior in controlling protracted seizures.[42] Intranasal lorazepam has shown promising results in limited trials.[43]

Levetiracetam

The role of nonbenzodiazepines in the prehospital management of SE or recurrent seizures is not well defined. Adding levetiracetam to prehospital treatment with clonazepam did not improve control of generalized convulsive SE, showed a randomized phase III trial.[44]

EPILEPSY IDENTITY CARD

People with epilepsy (PWE) should carry emergency medical identification cards (ID card) which show people what to do if he/she is experiencing a seizure. ID card should contain personal information of the PWE, emergency contact details and details of the treating doctor and the hospital. Information

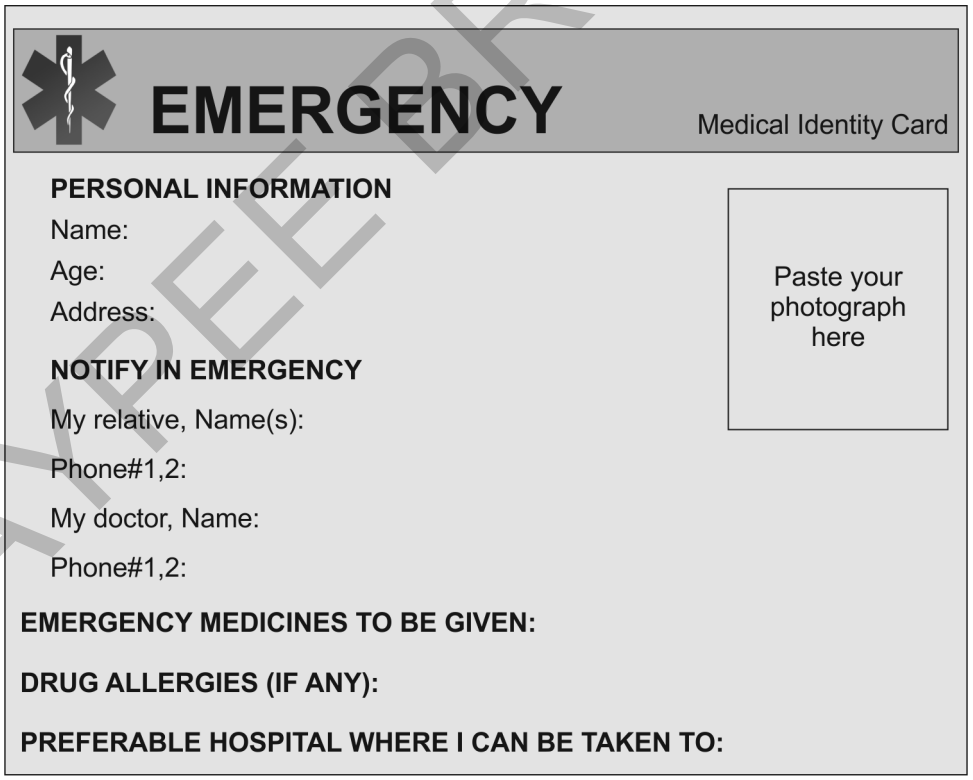

Figure 2.6 Identification card (ID card) for a person with epilepsy

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regarding the details of dose, route of administration and adverse effects of the medications available in the patient pocket for emergency use should be made available in the ID card **(Fig. 2.6)**.

CONCLUSION

Seizures and SE are encountered frequently in the prehospital setting by parents, caretakers and EMS providers. Prompt care influences better patient outcomes in the short and long-term. Benzodiazepines are commonly recommended as the initial therapy for SE in the prehospital setting.

Based on the existing literature, following conclusions can be drawn:

- First, it seems that midazolam and diazepam may be advantageous to lorazepam in the prehospital setting due to their longer shelf-life.
- Second, it is not necessary to obtain IV access
  - May delay time to administration of anticonvulsant medications
  - May be difficult for prehospital providers to perform
  - Medications given via other routes are equally efficacious
  - Specifically, the evidence indicates that the IN, IM, and buccal routes are as effective as the IV route and are not associated with any increased risk of adverse effects.
- Third,when choosing a route of administration of benzodiazepines other than IV, IM midazolam by the EMS, buccal or intranasal midazolam by caretakers, EMS and paramedical personnel is the preferred agent for prehospital treatment of SE. Rectal medications are least preferred since the latter is associated with prolonged time to seizure cessation and more adverse effects.

More research needs to be done to determine optimal dosing and timing, and to determine which non-IV routes of administration are preferable in the prehospital setting.

Status Epilepticus: Think Time

- Status epilepticus (SE) is an emergency.
- Time to treatment needs to be shorter.
- Response to treatment is time-dependent.
- Morbidity and mortality are related to etiology and duration of SE.
- Benzodiazepines are the drug of choice in prehospital treatment of SE.
- Caregivers and persons with epilepsy should have an individualized emergency plan.
- Education of the parents, caregivers and the emergency personnel.
- (Emergency Hospital Services-EHS) in early recognition and treatment of SE is the key to success in prehospital management of SE.

Test Yourself

1. Which of the following drug is approved for use in the prehospital setting as an intranasal preparation in status epilepticus (SE)?

A. Lorazepam B. Diazepam
C. Midazolam D. Thiopentone

Ans: C. Intranasal preparation of midazolam has been approved as a first line drug for SE.

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2. **Cluster seizures are defined as:**
   A. More than 2 seizures with recovery to baseline in between the attacks in 24 hours
   B. More than 3 seizures with recovery to baseline in between the attacks in 24 hours
   C. More than 2 seizures without recovery to baseline in between the attacks in 24 hours
   D. More than 3 seizures without recovery to baseline in between the attacks in 24 hours
   Ans: B. Cluster seizures are defined as more than 3 seizures with recovery to baseline in between the attacks in 24 hours.

3. **The recommended dosage of IV lorazepam for SE is:**
   A. 0.1 mg/kg B. 0.2 mg/kg
   C. 1 mg/kg D. 2 mg/kg
   Ans: A. 0.1 mg/kg of lorazepam at maximum infusion rate of 2 mg/minute is used for treatment of SE.

4. **In the absence of an IV access, which of the following drugs can be given by IM route?**
   A. Lorazepam B. Thiopentone
   C. Diazepam D. Midazolam
   Ans: D. Midazolam can be administered in emergency situations where there is no IV access.

Courtesy
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Ashalatha Radhakrishnan is a neurologist with special interest in epilepsy. After completing her epilepsy fellowship under the stewardship of Professor Sam Berkovic at Melbourne in 2007–08, she joined the R. Madhavan Nayar Center for Comprehensive Epilepsy Care, Department of Neurology at the prestigious Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), Thiruvananthapuram, Kerala, India. She has, to her credit, several scientific publications in various national and international journals, and has authored many chapters in textbooks on epilepsy. Many honors have come her way, including the latest 'BMJ Award of 2015', for the Best Medical Team of Asia for the epilepsy team, in which she plays a significant role. Her interests are management of drug-resistant epilepsies, subjecting them to various surgeries, establishing newer imaging techniques in epilepsy, and managing emergencies in epilepsy. With a vast experience of treating almost 200 patients with status epilepticus since the year 2000, she has accrued immense expertise and a keen interest to channelize her experience in a more creative way—transforming herself into the Editor of this book. Given the heterogeneity and never-ending debates on status epilepticus, only a very astute academician, erudite clinician and, moreover, a well-accomplished writer like her, can only do the job of editing and making such a vast topic into a succinct manual. This monograph is, thus, intended to apprise the physicians and guiding them to manage this emergency in a very practical way, failing which, it can result in major morbidity and mortality.

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