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Clinical Reviews

Nonconvulsive Status Epilepticus: A Review for Emergency Clinicians

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□ **Abstract—Background: Status epilepticus is associated with significant morbidity and mortality and is divided into convulsive status epilepticus and nonconvulsive status epilepticus (NCSE). Objective: This review provides a focused evaluation of NCSE for emergency clinicians. Discussion: NCSE is a form of status epilepticus presenting with prolonged seizure activity. This disease is underdiagnosed, as it presents with nonspecific signs and symptoms, most commonly change in mental status without overt convulsive motor activity. Causes include epilepsy, cerebral pathology or injury, any systemic insult such as infection, and drugs or toxins. Mortality is primarily related to the underlying condition. Patients most commonly present with altered mental status, but other signs and symptoms include abnormal ocular movements and automatisms such as lip smacking or subtle motor twitches in the face or extremities. The diagnosis is divided into electrographic and electroclinical, and although electroencephalogram (EEG) is recommended for definitive diagnosis, emergency clinicians should consider this disease in patients with prolonged postictal state after a seizure with no improvement in mental status, altered mental status with acute cerebral pathology (e.g., stroke, hypoxic brain injury), and unexplained altered mental status. Assessment includes laboratory evaluation and neuroimaging with EEG. Management includes treating life-threatening conditions, including compromise of the airway, hypoglycemia, hyponatremia, and hypo- or hyperthermia, followed by rapid cessation of the seizure activity with benzodiazepines and other antiseizure medications. Conclusions: An understanding of the presentation and management of NCSE can assist emergency clinicians in the care of these patients. Published by Elsevier Inc.**

□ **Keywords—neurology; status epilepticus; nonconvulsive status epilepticus; NCSE; seizures**

Introduction

Seizures comprise a heterogeneous condition associated with morbidity and mortality. There are a variety of causes for seizure (1–4). If left untreated or if a seizure continues, patients can experience status epilepticus (SE), a condition associated with severe morbidity and mortality (1,2). There are two forms of SE: convulsive SE, marked by prominent motor activity, and nonconvulsive SE (NCSE) without prominent or clinically obvious motor activity (1,3,5,6). There are numerous challenges with NCSE in the ED setting, including the risk of misdiagnosis and failure to initiate treatment, leading to morbidity and mortality (4,7–10). Underdiagnosis is often due to the lack of overt motor signs and symptoms of seizure in the setting of other findings such as altered mental status or coma (4,6,10–13). Thus, it requires a high level of suspicion, considering risk factors and clinical features, many of which are not specific for NCSE. There is also limited agreement on the diagnostic criteria, forms of NCSE, and management. Finally, currently used diagnostic measures

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are not 100% specific, including electroencephalogram (EEG) (4,5,12–17). This emergency medicine review will evaluate NCSE for emergency clinicians, with a focus on epidemiology, presentation, evaluation, and management.

Methods

The authors searched PubMed and Google Scholar for articles using search terms including "nonconvulsive" OR "non-convulsive" OR "non-convulsive status epilepticus" OR "nonconvulsive status epilepticus" in PubMed. Articles were limited to English-language, peer-reviewed publications. The search was conducted for studies published from 1951 to November 16, 2022. The initial search terms yielded 1008 articles for review. Authors evaluated case reports and series, retrospective and prospective studies, systematic reviews and meta-analyses, and other narrative reviews. Authors also reviewed guidelines and supporting citations of included articles. The literature search focused on the emergency medicine and critical care literature focusing on its epidemiology, diagnosis, and management. Authors decided by consensus which studies to include for the review. When available, systematic reviews and meta-analyses were preferentially selected. These were followed sequentially by randomized controlled trials, prospective studies, retrospective studies, case reports, and other narrative reviews when alternate data were not available. A total of 93 articles were selected for inclusion in this narrative review.

Discussion

Definition

Status epilepticus is defined by the International League Against Epilepsy as a condition associated with failure of mechanisms resulting in termination of a seizure or initiation of mechanisms that lead to prolonged seizures (1,3,5). The broad definition of NCSE is a change in cognitive/mental processes from baseline with no overt convulsive activity, but electrographic abnormalities on EEG (3,10,12,18). Prior definitions included continuous nonconvulsive seizure activity for at least 30 min or multiple nonconvulsive seizures over a period of 30 min and no recovery of baseline neurologic function (11,19). Recently, this definition has been modified to 10 min rather than 30 min (1,20). This is different from the definition of convulsive SE, which utilizes a duration of seizure activity of 5 min or no return to baseline mental status in between seizure activity (1,3,5).

Importantly, in patients with baseline mental status changes such as coma, the American Clinical Neurophysiology Society (ACNS) defines NCSE as seizure activity for over 10 continuous min or over 20% of 1 h (12 min) on EEG monitoring (21). The ACNS divides NCSE in the critically ill patient into electrographic status epilepticus and electroclinical status epilepticus (21). Definition of electrographic NCSE is based on EEG findings. Electroclinical NCSE includes a patient with clinical pattern of signs and symptoms (eye deviation, nystagmus, facial twitching) over a set period of time with EEG abnormality, or EEG and clinical improvement with administration of antiseizure medication (5,6,12,21).

Classification

NCSE may occur in noncomatose and comatose patients (Table 1) (1,22). Comatose NCSE accounts for one category, but patients who are not comatose can be classified as generalized/absence, focal/lateralization, and autonomic (1,22). The type of NCSE affects prognosis, as the comatose NCSE form is associated with worse outcomes as compared with the noncomatose forms (1,5,22).

Epidemiology

NCSE may occur with any condition that results in supratentorial abnormalities/injury or disruption of homeostasis, and it accounts for up to 47% of all cases of status epilepticus in patients admitted to the intensive care unit (ICU) (5,7,10,23,24). The prevalence of NCSE is up to 30% in ICU patients who are altered (23–25). Another study found 37% of patients with unexplained altered mental status demonstrated evidence of NCSE on EEG, though a 2013 study using only a 30-min EEG found a rate of 6%, which may have underestimated the true prevalence due to the limited EEG duration (26,27). NCSE affects 12–33% of patients after cardiac arrest and 8–35% of patients with traumatic brain injury in the ICU (5,22,28,29). Despite these data, specific numbers regarding the incidence and prevalence are lacking, as large population-based studies are scarce (19,22,29).

The data concerning implications, morbidity, and mortality are not clear. Overall, NCSE is associated with poor prognosis, but the underlying cause of NCSE is the major determinant of patient morbidity and mortality (5,19,24,29). One study found approximately half of patients who survived NCSE experienced a new neurologic deficit, and 25% returned to their baseline neurologic status (24). Mortality rates ranged between 15% and 52% in elderly patients in one study (30). Those with pre-existing seizure disorder have a lower mortality compared with those with NCSE associated with an acute medical condition (3% vs. 27%) (4,19,29,31,32). Mortality increases with longer duration of NCSE and delays to diagnosis, though it is difficult to distinguish brain damage due to the primary condition from damage associated with the

Table 1. NCSE Coma vs. Without Coma Classification

NCSE with Coma
NCSE without coma
Generalized
Typical absence
Atypical absence
Myoclonic absence
Focal
No impairment in consciousness (aura continua, with autonomic, sensory, visual, olfactory, emotional/experiential/psychic, auditory, gustatory symptoms)
Aphasic status
With impaired consciousness
Unknown if generalized or focal
Autonomic

NCSE = nonconvulsive status epilepticus.

seizure activity (4,19,29,31,32). Although much of the mortality due to convulsive status epilepticus is related to prolonged convulsions (respiratory failure, rhabdomyolysis, liver damage, lactic acidosis, etc.), these complications are not as prevalent in NCSE. However, sustained neuronal excitation in NCSE can lead to cerebral injury (12,19,29).

There are a variety of causes and conditions associated with NCSE, including epilepsy, cerebral pathology or injury, any systemic insult such as infection, and drugs or toxins (5,12,19,22,29). NCSE is most commonly associated with previously diagnosed epilepsy, and up to 50% of NCSE cases are the result of inadequately treated convulsive status epilepticus or due to subtherapeutic levels of antiseizure medications secondary to drug interactions or medication nonadherence (4,23,24,33). Acute brain injury is another leading cause of NCSE, particularly ischemic stroke, which accounts for 15% of patients with NCSE who are comatose, whereas subarachnoid hemorrhage and intracerebral hemorrhage account for 20% and 18% of patients with NCSE, respectively (34–39). Approximately 30% of patients experience NCSE within 3 days of their injury (34–39). Encephalitis is a significant risk factor, with 57% of patients experiencing NCSE (5,40). Autoimmune causes of encephalitis, in particular, are a common cause of NCSE, though the exact prevalence remains uncertain (5,12,41). NCSE in the setting of hypoxic encephalopathy is associated with worse outcomes, as the damage is typically irreversible (5,19,29). Acute systemic insult such as alcohol, toxic ingestion, metabolic derangements, infection resulting in sepsis, and autoimmune disease such as systemic lupus erythematosus are also causes (5,6,19,22,29). Medications associated with NCSE include baclofen, busulfan, cephalosporins, cisplatin, cyclosporine, fluoroquinolones, ifosfamide, ketorolac, L-asparaginase, methotrexate, naltrexone, opioids, and tacrolimus (5,19,29,42–49).

Presentation

NCSE can present with a variety of signs and symptoms, many of which are subtle, making it challenging to diagnose in the clinical setting. Presentation includes negative and positive signs and symptoms (5,6,12,19,29,50). Negative signs and symptoms include amnesia, anorexia, aphasia, catatonia, coma/confusion, lethargy, and staring without response. Positive signs and symptoms include agitation, aggression, blinking, crying, delirium, delusions, echolalia, eye deviation or nystagmus, unresponsive laughter/crying, nausea and vomiting, perseveration, psychosis, and tremors (5,6,12,19,29,50,51). The most common symptom is altered or impaired mental status, occurring in 82%, followed by disturbances in speech at 15%, myoclonus in 13%, change in behavior in 11%, anxiety/agitation/delirium in 8%, and extrapyramidal signs in 7% (5,6,12,19,29,50). Altered mental status ranges from mild confusion to coma. Of note, up to 75% of patients with NCSE have no other discernable finding other than decreased responsiveness (5,12,19,29,50). Automatisms, including lip smacking or subtle motor twitches in the face or extremities, can be suggestive but have low specificity (44%), whereas abnormal ocular movements or findings have a specificity approaching 86% (52,53). Ocular findings can include subtle blinking or twitching of the eyelids, dilatation of the pupils, gaze deviation, or nystagmus. One study found the combination of remote risk factors for seizure and abnormal ocular movements demonstrated a sensitivity of 100% and specificity of 55% (52). Autonomic disturbances such as hypertension, flushing, mydriasis, and diaphoresis may

Table 2. NCSE Considerations

Risk factors
History of seizures or epilepsy
History of remote or acute cerebral injury (stroke, traumatic brain injury, prior neurosurgery, infection/meningitis/encephalitis, dementia, tumor)
Elderly
Acute metabolic cause of encephalopathy (liver disease, sepsis, toxic ingestion)
Medication change or antiseizure medication withdrawal
Features suggestive of NCSE
Seizure/convulsion with prolonged altered mental status and no return to normal mental status
Change in mental status
Abnormal ocular movement (blinking, eyelid twitching, gaze deviation, nystagmus)
Automatisms (non-purposeful, repetitive, stereotypic movements like lip smacking, orofacial twitching, arm/hand movements like picking)
Autonomic changes: mydriasis, hypertension, diaphoresis, flushing
Speech disturbance (aphasia, mutism, echolalia, stuttering)
Head deviation
Hemispatial neglect
Sensory changes: abnormalities in hot/cold sensation, hallucinations (auditory, visual, olfactory, gustatory)
Psychiatric abnormalities (mood abnormality, psychosis, agitation) especially if no prior history of psychiatric disease

NCSE = nonconvulsive status epilepticus.

occur (5,12,19,29,50,52). NCSE can also present with mood disturbance, irritability, delusions, isolated fear, and paranoia (52,54–58).

Due to the spectrum of signs and symptoms and nonspecific presentation, emergency clinicians should consider NCSE in those with altered sensorium and abnormal ocular movements such as sustained eye deviation or nystagmus, automatisms such as lip smacking, or subtle motor twitches in the face or extremities, and those with a history of seizures/epilepsy or a medication history with an antiepileptic (5,12,19,29,50). Persistent abnormal mental status or postictal state after a convulsive seizure is concerning for NCSE (5,12). Prolonged confusion in the setting of cerebral injury or unexplained altered mental status with no other cause are also suggestive of NCSE, as is the sudden development of isolated psychiatric symptoms but no prior history of psychiatric disease (5,12). Risk factors and features suggestive of NCSE are demonstrated in Table 2.

Evaluation

ED evaluation focuses on assessing for other life-threatening treatable conditions. Rapid assessment of serum glucose and electrolytes (including calcium and magnesium) is recommended (59–61). Other testing includes complete blood count, liver and renal function, urinalysis, pregnancy test if the patient is a reproductive-aged female, and electrocardiogram (1,5,6,12,59–61). If the patient is on antiseizure medications, serum levels should be assessed. Lumbar puncture with cerebrospinal fluid analysis should be performed if the patient is febrile or has other evidence of infection (59–61). Neuroimaging with head computed tomography (CT) without contrast is recommended to evaluate for a structural cause of altered mental status or other neurologic deficit (59–61). Perfusion CT can assist in differentiating acute stroke from focal seizure activity that is the result of NCSE (62). Magnetic resonance imaging should be performed during inpatient admission, particularly if initial head CT reveals no clear etiology. Diffusion, perfusion, and metabolic magnetic resonance imaging may demonstrate indirect evidence of neuronal hyperactivity and damage (63–65). Unfortunately, the data are unclear regarding the diagnostic accuracy of various imaging modalities.

Definitive diagnosis of NCSE typically includes EEG per guidelines, but this is not possible in the majority of ED settings (5,6,12,15,66,67). Thus, emergency clinicians should base consideration of this disease on the history, examination, and treatment response to benzodiazepines and other antiepileptics. Newer devices allowing for rapid EEG have been developed for use in the ED setting, but these require further validation prior to widespread adoption (15–17,66,67). EEG is rec-

Table 3. Indications for EEG

Prolonged abnormal mental status after convulsive status epilepticus with no return to patient normal mental status
Acute cerebral injury and altered mental status
Unexplained altered mental status without known acute cerebral injury
Critically ill altered patient who remains altered with no other explanation
Pharmacologic paralysis and sedation and risk for seizures present or if patient intubated for continued seizures
Clinical events with seizure-like movements

EEG = electroencephalogram.

Table 4. EEG Criteria for NCSE Diagnosis

Criteria for NCSE without known epileptic encephalopathy
Epileptiform discharges (spikes, poly spikes, sharp-waves, sharp-and-slow-wave complexes) > 2.5 Hz OR
Epileptiform discharges ≤ 2.5 Hz or rhythmic delta/theta activity (> 0.5 Hz) AND one of the following:
Clinical and EEG improvement after intravenous anti-seizure drugs or
Subtle clinical ictal phenomena during the EEG patterns mentioned above or
Typical spatiotemporal evolution
Criteria for NCSE with epileptic encephalopathy
Frequent or continuous generalized spike-wave discharges that increase in profusion or frequency compared with baseline EEG with change in clinical state OR
Clinical or EEG improvement with intravenous benzodiazepines

EEG = electroencephalogram; NCSE = nonconvulsive status epilepticus.

ommended in patients with fluctuating or unexplained change in behavior or mental status, acute cerebral pathology with altered mental status, persistent change in mental status after treatment of convulsive seizures, critically ill patients who are altered, recent seizure without return to patient baseline from postictal state after 1–2 h, and coma after hypoxic brain injury (Table 3) (1,5,12,21,68–71).

As discussed, NCSE can be defined as electrographic or electroclinical. Electrographic NCSE diagnostic criteria incorporate EEG findings, demonstrated in Table 4 , which is based on the Salzburg Consensus Criteria (21,69–76). Seizure activity should be continuous for over 10 min or occur over 20% of the time over an hour (21,69–75). There are two forms of EEG: routine and continuous. Continuous EEG is more commonly used in the ICU setting and is recommended for patients who fail to return to baseline function after treatment with antiepileptics and for those with unexplained altered mental status or coma (21,76–78). Continuous EEG may be better able to detect discharges compared with repeated routine EEG with higher sensitivity, though a reduction in mortality has not been demonstrated with continuous vs. routine EEG (79–81). Of note, a significant proportion of patients require over 24 h of monitoring to definitively diagnose seizures (5,37).

Management

Management should first focus on diagnosing and treating life-threatening conditions, including compromise of the airway, hypoglycemia, hyponatremia, and hypo- or hyperthermia, followed by rapid cessation of the seizure (1–3,5,7,12). The underlying disorder (e.g., sepsis, encephalitis, intoxication, stroke, intracerebral hemorrhage) should be addressed (1–3,5,12). If meningitis is suspected or confirmed with lumbar puncture, antibiotics and dexamethasone should be administered. Benzodiazepines are the recommended first-line treatment for NCSE, and patients with suspected NCSE should receive a benzodiazepine (lorazepam, diazepam, or midazolam) by the oral, intramuscular, or intravenous route (1–3,5,7,19,29,82). Administration of a benzodiazepine can serve as a diagnostic indicator and treatment measure, as the NCSE may resolve and the patient improve (e.g., regain normal mental status). Unfortunately, patients may be resistant to treatment with a benzodiazepine,

Table 5. Medications for NCSE

Medication	Dose/Route	Consideration
Fosphenytoin	20 phenytoin equivalent units/kg i.v.; maximum 2000 mg; up to 150 mg/min; may give additional 5 mg/kg i.v. if patient is still seizing	- Can result in hypotension or dysrhythmia - Can be administered i.m.
Lacosamide	10 mg/kg i.v. over 5–10 min, maximum 400 mg; may give additional 5 mg/kg over 5 min if patient is still seizing	- Can prolong PR interval or induce tachydysrhythmias
Levetiracetam	60 mg/kg i.v. over 15 min; maximum 4500 mg i.v.; administer at maximum 500 mg/min	- Can result in behavioral changes
Phenobarbital	15 mg/kg i.v.; maximum 1500 mg; up to 60 mg/min; may give additional 5–10 mg/kg if patient is still seizing	- Half-life up to 140 h - May cause hypotension
Phenytoin	20 mg/kg i.v.; 50 mg/min; 25 mg/min in patients with known cardiovascular conditions	- Can result in fever, hypotension, rash, dysrhythmias
Topiramate	200–400 mg by mouth	- Can result in metabolic acidosis or renal stones - Associated with oligohidrosis and hyperthermia
Valproate	20–40 mg/kg i.v. over 5–10 min; maximum 4000 mg; may give additional 20 mg/kg i.v. if patients is still seizing	- Can result in hepatotoxicity, hyperammonemic encephalopathy, thrombocytopenia, platelet dysfunction

NCSE = nonconvulsive status epilepticus; i.m. = intramuscularly.

and other agents such as fosphenytoin 20 phenytoin equivalent units/kg, valproate 40 mg/kg, or levetiracetam 60 mg/kg should be administered (Table 5) (5,19,29,82–84). The Established Status Epilepticus Treatment Trial found that each of these agents stopped seizure activity and led to improved mental status in close to half of patients, with similar adverse events (85). The Treatment of Recurrent Electrographic Nonconvulsive Seizures trial evaluated patients with nonconvulsive seizures and found lacosamide was noninferior to fosphenytoin (86). Low threshold to progress to airway protection and endotracheal intubation with sedation is recommended, particularly if seizure activity is suspected and the patient does not improve with benzodiazepines (1–3,5,12). Induction medications including ketamine, propofol, or midazolam may be utilized (1–3,5,12). Recent literature suggests ketamine is effective in status epilepticus and demonstrates synergy with other antiseizure medications including diazepam, propofol, and valproate (87–91). If the patient is intubated and sedated, continuous EEG monitoring is recommended (1–3,5,12). Paralytics will not stop cerebral seizure activity but will stop any visible seizure activity on examination.

Of note, there is a dearth of data regarding optimal treatment of NCSE, and rapid seizure termination remains the primary goal (1–3,5,12,19,29,92). Current recommendations based on poor-quality evidence recommend administering first- and second-line antiseizure medications in patients who are comatose and assessing for response. If these medications do not control seizures or the patient does not demonstrate an improvement in mental status, intubation with a sedative such as propofol or ketamine and paralytic are recommended (1–3,5,12,19,29,92).

Mimics

Due to the nonspecific signs and symptoms associated with NCSE, there are a variety of mimics (Table 6). The most common mimics include postictal state, toxic/metabolic encephalopathy, and catatonia (5,6,12). Postictal state may occur for days in patients with cerebral injury, but EEG will demonstrate slowing or suppression, whereas in NCSE, there will be epileptiform discharges (5,6). Toxic and metabolic encephalopathy can present with severe alterations in mental status, but patients will present with asynchronous and multifocal

Table 6. Mimics of NCSE (6)

Condition	Consideration
Anticholinergic toxicity	- Associated with anticholinergic intoxication/overdose - Presents with cutaneous vasodilatation, nonreactive mydriasis, delirium/lethargy/hallucinations, urinary retention, anhidrotic hyperthermia, anhidrosis, tachycardia - Treat hyperthermia; administer benzodiazepines; cholinesterase inhibition with physostigmine can be diagnostic and improve mental status; administer sodium bicarbonate for prolonged QRS
Autoimmune encephalitis	- Cerebral tissue inflammation primarily due to NMDA receptor antibodies; associated with ovarian teratoma - Presents with viral-like prodrome, followed by psychiatric signs/symptoms, change in mental status, dyskinesia and movement disorders, dysautonomia, lethargy, seizures - EEG may show extreme delta brush pattern - LP demonstrates lymphocytic pleocytosis, oligoclonal bands; diagnosis confirmed with antibodies to NR1 subunit of NMDAR - Imaging with MRI may show abnormalities - Management includes resection of any tumor, steroids, IVIG, plasma exchange
Catatonia	- Syndrome with psychomotor abnormalities, most commonly with apparent unresponsiveness to any external stimuli and inability to move normally in an awake patient - Associated with schizophrenia, bipolar disease, PTSD, encephalitis, seizures, autism - Stupor, catalepsy, waxy flexibility, mannerisms, echolalia, echopraxia - Laboratory and imaging assessment recommended - Management includes benzodiazepines, followed by electroconvulsive therapy if ineffective
Drug withdrawal	- Symptoms depend on underlying substance abused (alcohol withdrawal presents with agitation, tachycardia, nausea/vomiting, tremor, seizures) - Treatment based on cause/substance (benzodiazepines or phenobarbital for alcohol withdrawal)
Mitochondrial disorder	- Genetic condition - May cause focal cortical damage - Lactic acidosis may be present
Neuroleptic malignant syndrome	- Life-threatening emergency associated with neuroleptic agents (most commonly high potency “typical” antipsychotics) - Develops over 1–3 days to even weeks with altered mental status, muscle rigidity (lead pipe), hyperthermia, autonomic instability - CK and LFT elevation, hyperkalemia, hypocalcemia, hypomagnesemia, metabolic acidemia - Treatment includes cessation of causative agent, control of agitation with benzodiazepines, fluid resuscitation, cooling measures - Dantrolene, bromocriptine, amantadine are controversial

(*continued on next page*)

Table 6. (*continued*)

Condition	Consideration
Persistent vegetative state	- Cerebral unresponsiveness with exclusion of other conditions - No automatisms or ocular manifestations of NCSE - EEG will not demonstrate epileptiform discharges
Postictal state	- Impaired consciousness or confusion after a seizure - May also present with amnesia or disturbance in behavior - Duration is minutes to hours - EEG demonstrates suppression or slowing - Benzodiazepines will not improve mental status
Primary psychiatric disorder	- May present with mental status changes depending on the psychiatric disorder, but mood disorder dominates (depression, anxiety, racing thoughts) - Diagnose with history and examination
Psychogenic nonepileptic status (PNES)	- Seizure-like movements/signs/symptoms that mimic epileptic seizures - Not associated with abnormally excessive cerebral activity but instead derived from psychological cause - Lasts longer than 2 min; associated with pelvic thrusting, voluntary eye movement away from examiner, side to side rocking, stuttering/stammering, crying/shrieking, but absent postictal confusion or injury - Evaluate for life-threatening conditions, but diagnosis is based on exclusion of other conditions and seizure with EEG, which can differentiate PNES from seizure - Patients should be told of the diagnosis; psychiatric intervention is primary treatment
Serotonin syndrome	- Produced by any serotonergic medication - Presents more acutely (hours) compared with neuroleptic malignant syndrome - Altered mental status, autonomic instability, hyperthermia, labile blood pressures, clonus, rigidity, tremors, hyperreflexia - Clonus most common finding - Management includes stopping all serotonergic drugs, fluid resuscitation, cooling, benzodiazepines; cyproheptadine may be utilized if other measures fail
Stroke	- Vascular injury resulting in reduced cerebral flow to the brain - Categories include ischemic (thrombotic, embolic, or hypoperfusion etiology) or hemorrhagic (intracerebral or subarachnoid hemorrhage) - Stroke may mimic negative symptoms of NCSE - Cerebral infarction usually presents with sudden onset of motor/sensory symptoms; change in mental status more common in hemorrhagic stroke - Obtain imaging with CT with and without contrast; MRI is the gold standard for detection of ischemic stroke - Management depends on etiology (ischemic stroke may be treated with thrombolytics or thrombectomy; hemorrhagic stroke treated with blood pressure management and anticoagulant reversal if necessary)

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Table 6. (*continued*)

Condition	Consideration
Toxic or metabolic encephalopathy	- Syndrome of global dysfunction in cognition/arousal associated with a variety of causes, including toxic ingestion, shock, sepsis/infection - Presents with disorientation, decreased attention, impaired memory, perceptual problems, speech/language issues - Motor manifestations can be present but are asynchronous, multifocal and usually do not include the perioral region or eyelids; automatisms are usually not present - EEG demonstrates suppression or slowing - Management includes treatment of underlying disorder causing encephalopathy
Transient global amnesia	- Paroxysmal, transient anterograde amnesia; usually lasts several hours - Patients have normal attention but are unaware of memory loss; no localizing neurologic outcomes and no loss of personal identity or trauma - Laboratory and imaging assessment recommended to evaluate for other causes of memory changes - No specific management recommended; symptoms typically resolve within 24 h

NCSE = nonconvulsive status epilepticus; NMDA = *N*-methyl-d-aspartate; EEG = electroencephalogram; LP = Lumbar puncture; NMDAR = NMDA receptor; MRI = magnetic resonance imaging; IVIG = intravenous immunoglobin; PTSD = posttraumatic stress disorder; CK = creatine kinase; LFT = liver function test; CT = computed tomography.

myoclonic movements, compared with the synchronous movements of NCSE (93). EEG will also demonstrate slowing with encephalopathy. Catatonia and NCSE are difficult to differentiate, and NCSE may cause catatonia (5,6). Both conditions improve with benzodiazepines, and thus, EEG and clinical evaluation are necessary to differentiate the conditions. EEG may demonstrate diffuse slowing in catatonia, but in NCSE the EEG will demonstrate epileptiform discharges or frequent or continuous generalized spike-wave discharges (Table 4).

Conclusions

NCSE is a condition associated with prolonged seizure activity and the absence of overt motor activity. It is underdiagnosed due to its variety of nonspecific signs and symptoms. There are multiple causes, including epilepsy, cerebral pathology or injury, any systemic insult such as infection, and drugs or toxins. Morbidity and mortality are related to the underlying condition. The most common presentation is altered mental status, but other signs and symptoms include abnormal ocular movements and automatisms such as lip smacking or subtle motor twitches in the face or extremities. EEG is recommended for definitive diagnosis, but this disease should be considered in patients with prolonged postictal state after a seizure with no improvement in mental status, altered mental status with acute cerebral pathology (e.g., stroke, hypoxic brain injury), and unexplained altered mental status. Laboratory evaluation and neuroimaging are recommended, with EEG. Management includes treating life-threatening conditions and cessation of the seizure activity with benzodiazepines and other antiseizure medications.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Article Summary

1. Why is this topic important?

Nonconvulsive status epilepticus (NCSE) is frequently misdiagnosed in the emergency department (ED) setting but can result in morbidity and mortality.

2. What does this review attempt to show?

This article provides an evaluation of NCSE, including the presentation, evaluation, and management.

3. What are the key findings?

A variety of conditions can cause NCSE, which is associated with morbidity and mortality if undiagnosed. Patients most commonly present with altered mental status, but other signs and symptoms include abnormal ocular movements and automatisms such as lip smacking or subtle motor twitches in the face or extremities. Laboratory evaluation, neuroimaging, and electroencephalogram are recommended, and treatment includes benzodiazepines and antiepileptics.

4. How is patient care impacted?

This article summarizes the epidemiology, presentation, evaluation, and management of NCSE for emergency clinicians.