Post-operative functional neurological symptom disorder after anesthesia

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ABSTRACT

A rare manifestation during the post-anesthetic period may include the occurrence of functional neurological symptom disorder (FNSD). FNSD is described as neurological symptoms that are not consistently explained by neurological or medical conditions. We report a case series consisting of six patients who underwent a general anesthetic at a tertiary referral hospital and experienced FNSD in the immediate post-anesthetic period. Life-threatening causes were excluded based on benign physical exam findings and knowledge of past history. Five of six cases manifested with FNSD only in the immediate post-operative setting after exposure to anesthesia, and never otherwise experienced these symptoms during their normal daily lives. MEDLINE and Google Scholar were searched through October 2019 using a highly-sensitive search strategy and identified 38 published cases of post-anesthetic FNSD. Meta-analysis of pooled clinical data revealed that a significant proportion of patients were females (86%), reported a history of psychiatric illness (49%), reported a prior history of FNSD (53%), and underwent general anesthesia as the primary anesthetic (93%). The majority of patients were exposed to diagnostic studies (66% received radiographic tests and 52% received electroencephalogram) as well as pharmacologic therapy (57%). While no deaths occurred, many patients had unanticipated admission to the hospital (53%) or to the intensive care unit (25%). These data may help inform the anesthesia literature on presentation, risk factors, and treatment outcomes of FNSD in the context of anesthetic administration. We contemplate whether anesthetic agents may predispose a vulnerable brain to manifest with involuntary motor and sensory control seen in FNSD.

KEYWORDS: Functional neurological symptom disorder; anesthesia; peri-operative period; psychogenic coma; psychogenic non-epileptic seizures; conversion paralysis

INTRODUCTION

Emergence and recovery during the immediate post-anesthetic recovery period is a vulnerable and unpredictable stage for every patient. A rare manifestation during this period may include the occurrence of functional neurological symptom disorder (FNSD). According to the American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorders (DSM-5), FNSD is described as neurological symptoms that are not consistently explained by neurological or medical conditions [1]. Specific examples of FNSD include psychogenic non-epileptic seizures (PNES), psychogenic coma, conversion paralysis, functional movement disorder, blindness, and non-dermatomal sensory deficits [1,2]. Our case series and review will focus on PNES, psychogenic coma, and conversion paralysis.

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PNES is often referred to as pseudoseizures and manifests with neurological symptoms similar to an epileptic seizure, although these episodes are not related to abnormal brain electrical activity [3]. The overall prevalence of PNES is between 1/3000 and 1/50,000, and no estimates are reported in the peri-operative setting [4]. Symptoms include abnormal body movements that are waxing and waning typically for a prolonged duration, closed eyes with resistance to eye-opening, positive response to noxious stimuli, and gradual onset of symptoms with abrupt recovery [5]. Releasing the patient's arm over the face will typically show purposeful arm movement by the patient to protect the face [6]. There is resistance to anti-epileptic medication and after organic causes for seizures have been excluded, treatment is primarily psychiatric care including cognitive behavioral therapy (CBT) and potentially adjunctive medications. The effectiveness of CBT varies widely among patients with PNES [7].

Post-operative psychogenic coma manifests with a prolonged period of unresponsiveness without an organic cause [8]. However, it is paramount that the provider should also evaluate and rule out other devastating causes of delayed awakening from anesthesia including cerebrovascular accident, intracranial hemorrhage, metabolic derangements, anesthetic overdose, and inadvertent drug misadministration. Along the same spectrum, conversion paralysis is a psychiatric disorder with symptoms involving motor or sensory function

impairment that cannot be attributed to a neurological condition or other medical condition [9].

These atypical post-anesthetic manifestations remain an obscure topic in the peri-operative setting, and early diagnosis may help prevent iatrogenic injury [6]. The use of hypnotics and anticonvulsants may hinder diagnosis, prolong anesthetic recovery, and importantly introduce potential side effects from unnecessary medications [10]. Furthermore, these symptoms may lead to unanticipated admission to the hospital or intensive care unit (ICU). In here, we described six patients who experienced FNSD following a general anesthetic at a tertiary referral hospital (Mayo Clinic, Rochester, MN). We also performed a systematic review of the literature on papers reporting post-operative FNSD, specifically PNES, episodes of unresponsiveness, or conversion paralysis, in patients after receiving an anesthetic. These data may help inform the anesthesia literature on presentation, risk factors, management, and treatment outcomes of post-operative FNSD in the context of anesthetic administration, and may also facilitate the stratification of patients who are at high-risks for experiencing these spells.

MATERIALS AND METHODS

This study was reviewed by the Mayo Clinic Institutional Review Board and was deemed exempt (IRB #19-004713). This was a case series consisting of six patients who underwent a general anesthetic at a tertiary referral hospital (Mayo Clinic, Rochester, MN) and experienced FNSD in the immediate post-operative period. We excluded studies reporting these symptoms occurring after 24 hours post-anesthesia. Data on clinical presentation, treatment, and outcomes were captured and described in a de-identified fashion (Table 1).

The MEDLINE and Google Scholar databases were searched through September 9, 2019 using a highly-sensitive text word search strategy to find any reports, case series, and observational studies describing other cases of post-operative PNES, psychogenic coma, and conversion paralysis in the immediate post-operative period. Serial searches included the terms "pseudoseizure," "psychogenic non-epileptic seizure," "psychogenic coma," "conversion disorder," "conversion paralysis," "psychophysiologic disorder," "somatoform disorder," "functional neurological symptom disorder," "surgery," "postoperative," "anesthesia," and "anesthesia recovery period" independently and in combination using Boolean operators. Specific outcomes addressed included demographic data, past medical history, history of psychiatric illness, description and duration of spell, type of surgery and anesthetic, diagnostic studies, consultations or referrals to psychiatry and/or neurology, treatment administered for spell, and patient disposition. Psychiatric illness was defined as an axis I illness comprising major depressive disorder, generalized anxiety disorder, bipolar disorder, conversion disorder, or alcoholism [8].

TABLE 1. Description of functional neurological symptom disorder episodes in case series

Case	Age/sex	Surgery type	Anesthesia type	Description of spell	Prior PNES	Seizure history	Treatment for spell	Consults	Disposition
1	21 female	ENT (sinus surgery, endoscopic middle meatal antrostomy, and antral window)	General	Prolonged unresponsiveness, patient flinches to eye stimulation, protecting face from arm during hand-raise drop test	Yes (4 prior spells)	No	Clinical observation	None	Same-day discharge
2	36 female	General (anal fissure surgery, EUA with fistulotomy)	General	Prolonged unresponsiveness, patient squinted his eyes to suctioning and had presence of eyelid reflexes	Yes (2 prior spells)	Yes (takes AED)	Placebo IV saline	Neurology	Same-day discharge
3	20 female	ENT (vocal cord surgery, lysis and collagen injection)	General	Generalized shaking particularly bilateral upper extremity shaking, aphonia for 6 hours	Yes (2 prior spells)	No	1 mg haloperidol IV	Neurology	Same-day discharge
4	42 female	General (breast biopsy)	General	Unresponsiveness, slumped head, would stare but would not blink on command. Patient was found to spontaneously move head when nobody was around her	Yes (>10 prior spells)	Yes (takes AED)	Clinical observation	Psychiatry, neurology	Same-day discharge
5	53 male	General (I and D of back)	General	Unresponsiveness to commands or painful stimulus, occasional clonus in right leg, displayed quadriparesis although patient had consciousness	Yes (1 prior spell)	No	Physostigmine IV	Neurology	ICU admission
6	18 female	GI (EGD and colonoscopy)	General	Unresponsiveness and generalized shaking	Yes (2 prior spells)	No	Clinical observation	Psychiatry	Same-day discharge

ENT: Ear, nose, throat; EUA: Exam under anesthesia; AED: Anti-epileptic drug; IV: Intravenous; I and D: Incision and debridement; GI: Gastroenterology; EGD: Esophagogastroduodenoscopy; PNES: Psychogenic non-epileptic seizures; ICU: Intensive care unit

RESULTS

Case 1 (psychogenic coma)

A 21-year old Iranian female with a history of hypothyroidism, recurrent sinus infections, and dermatographism underwent left sinus surgery under general anesthesia induced with intravenous (IV) propofol, fentanyl, and mivacurium and maintained with sevoflurane and isoflurane. She received a total of 100 mcg IV fentanyl during the case. During emergence, the patient was gagging but did not display purposeful movements and did not follow any commands. She had four robust twitches on train-of-four (TOF) monitor. She was sent intubated to the post-anesthesia care unit (PACU) and was extubated after an hour, although the patient still did not respond to any commands. Neurological exam revealed an intact pupillary response, and it was noted that the patient would flinch her eyes when bright light was shined toward her eyes. Notably, she had a positive hand-raise drop test. She did not respond to noxious stimuli including cold water application to her ears, but did move when a cold hand was placed on her back. After 90 minutes of no improvement, her family was allowed to visit her in the PACU, and then she began to open her eyes and interact with them. The patient reported that she was aware and recalled all events that transpired since extubation. On further discussion, the patient described four similar episodes of unresponsiveness after general anesthesia in Iran. After brief observation in the PACU, the patient was uneventfully discharged.

Case 2 (psychogenic coma)

A 36-year old female with a history of seizures controlled with phenobarbital, depression controlled with venlafaxine, anxiety, paroxysmal nocturnal dyspnea, postural orthostatic syndrome, and rectal fistula underwent an anal fissure surgery and fistulotomy under general anesthesia induced with IV propofol, lidocaine, and morphine and maintained with sevoflurane and vecuronium. She received a total of 4 mg IV morphine during the case. At the conclusion of the case, she was appropriately reversed with four robust twitches on TOF and was uneventfully extubated. After extubation, she was found to be weak and unresponsiveness for about 90 minutes. Her vital signs remained stable during this time, she was spontaneously breathing, and her pupillary light reflex was intact. Noxious stimuli including suctioning of mouth and insertion of nasal trumpet caused the patient to squint. After 30 minutes of no improvement, her anesthesiologist administered a placebo medication (1 mL of normal saline) into the patient's IV line. Within 1 minute, she opened her eyes to command and was able to move her extremities to command. An electroencephalogram (EEG) was unremarkable. Upon further chart review, it was noted that she had experienced two similar episodes of psychogenic coma in the past after an atrioventricular node ablation procedure and during an EEG monitoring test. After brief observation in the PACU, the patient was uneventfully discharged.

Case 3 (PNES)

A 20-year old female with a history of migraines, generalized fatigue, and severe dysphonia from vocal cord problems underwent vocal cord surgery with collagen injection under general anesthesia induced with IV propofol and fentanyl, and maintained under total IV anesthesia (TIVA) with propofol. Jet ventilation was performed during the case. She received a total of 150 mcg IV fentanyl during the case. The case was uneventful and the patient was transferred to the PACU after she displayed spontaneous respirations. In the PACU, she displayed unresponsiveness, hyperventilation, and generalized body shaking that was more prominent in her upper extremities bilaterally and intermittently for a duration of 6 hours. Her vital signs remained stable and she continued to have a patent airway. Due to her hyperventilation, a brown paper bag was placed over the patient's mouth while she was breathing. After 30 minutes of continued hyperventilation and generalized shaking, 1 mg of IV haloperidol was administered. Ten minutes later, the patient was responsive, following commands, and appropriately verbalizing. Further chart review revealed that the patient had experienced two prior PNES episodes after vocal cord surgeries with an uneventful recovery. She was uneventfully discharged the same day.

Case 4 (psychogenic coma)

A 42-year old female with a history of seizures treated with lamotrigine, narcolepsy, depression treated with citalopram, and celiac sprue underwent a breast biopsy under general anesthesia induced with IV propofol and fentanyl and maintained with desflurane and nitrous oxide. She received a total of 250 mcg IV fentanyl during the case. After completion of the case, she was noted to have purposeful movement and thus she was extubated. After extubation, she was unresponsive and did not follow commands. She forcibly resisted eye opening and was noted by the nurses to spontaneously move when nobody was in the room with the patient. An EEG performed in the PACU was unremarkable. These symptoms continued for 2 hours until spontaneous resolution, after which the patient reported she was doing well and did not recall any of the events since extubation. Of note, she reported significant psychosocial stressors in her life. Chart review revealed multiple prior spells of psychogenic coma, with over ten documented prior episodes leading to several emergency department visits. She also reported a history of

seizure disorder, stating she is diagnosed with "visual epilepsy" and takes lamotrigine. She was uneventfully discharged the same day.

Case 5 (PNES)

A 53-year old male with a history of chronic back pain status post-lumbar laminectomy and celiac disease underwent an incision and debridement of a back wound under general anesthesia induced with IV propofol, fentanyl, and cisatracurium and maintained with sevoflurane and nitrous oxide. He received a total of 100 mcg IV fentanyl during the case. At the end of the surgery, he was appropriately reversed with neostigmine and glycopyrrolate, but would not respond to verbal or painful stimuli. He was transferred to the PACU, where he continued to remain unresponsive and occasionally displayed clonus in his right leg. He was administered 2 mg of IV physostigmine with no change in neurological status. Serological studies including arterial blood gas, electrolytes, and glucose were normal. After 2 hours, the patient was slowly able to open his eyes and barely raise his thumb to command. Due to concern for locked-in syndrome, neurology was consulted immediately and he was transferred to the ICU. An EEG was performed which was unremarkable even when the patient experienced right lower extremity clonus. Computed tomography head and angiogram were also negative. Symptoms persisted overnight, however, the patient was noted to have a positive hand-raise drop test. He slowly recovered after 2 days with a normal neurological exam back to baseline with no deficits. On direct encounter, the patient reported a prior episode of speaking incomprehensible words for 5 hours after a surgery under general anesthesia. He was thereafter transferred to the floor and was discharged the following day.

Case 6 (PNES)

An 18-year old female with a history of congenital hip dysplasia, irritable bowel syndrome treated with amitriptyline, and known prior post-operative PNES spells underwent an EGD and colonoscopy under general anesthesia, both induced and maintained with sevoflurane only. At the end of the procedure, she was successfully extubated after return of spontaneous ventilation and regaining consciousness. However, she subsequently displayed generalized shaking and unresponsiveness. During this episode, she had a retained pupillary response to light and no gross neurological deficits. Notably, the anesthesiologist was aware that she had a history of two prior PNES episodes after a hip hardware removal surgery and cholecystectomy surgery, after which EEG was unremarkable. Given this history, the surgery and anesthesia team decided to observe the patient in PACU instead of pursuing additional diagnostic workup. She did not experience any hemodynamic instability or respiratory abnormalities during this spell. After 45 minutes, her symptoms resolved and she was able to verbalize and follow commands. A psychiatry referral was placed and the patient was discharged the same day. Evaluation from the psychiatrist was unremarkable and confirmed a diagnosis of functional spells.

DISCUSSION

Seizure-like activity, unresponsiveness, and new-onset paralysis are some of the most worrisome neurological manifestations in the immediate post-operative period. We reported six cases encompassing PNES or psychogenic coma after receiving general anesthesia. Importantly, life-threatening causes for symptoms were excluded promptly in every case based on benign physical exam findings and knowledge of pertinent past medical history. In most of our cases, we avoided further tests and procedures such as wide-ranging serological studies, radiographic tests, and EEG. Prompt recognition of PNES, psychogenic coma, or conversion paralysis may prevent unnecessary diagnostic studies and invasive procedures and their associated procedural risks, but it is often beneficial to obtain basic serological studies (complete blood count and basic metabolic panel), EEG, and neurology consult.

Collectively, PNES, psychogenic coma, and conversion paralysis in the immediate post-operative setting are rare, with only few isolated case reports and case series reported in the literature. Furthermore, these diagnoses may have alternate medical names, further compounding the rare presentation and delaying prompt recognition. For example, terms referring to PNES include pseudoseizure, hysteria, and psychogenic non-epileptic episodes. Similarly, psychogenic coma may also be known as conversion coma, dissociative stupor, hysterical coma, and hysterical unconsciousness [8].

Our search strategy identified 38 previously reported cases of PNES, psychogenic coma, or conversion paralysis in the immediate post-anesthesia period [6,8,10-34]. The largest case series was published by Reuber et al. in 2000 that described six cases of post-operative PNES that had been misdiagnosed previously with epilepsy and treated chronically with anticonvulsants [10]. Interestingly, even a case of post-operative PNES has been reported in the peripartum period [13] and in the pediatric population [31]. Authors from these previously published case reports recommend that PNES should be highly considered on the differential in patients with histories of multiple episodes of post-operative seizures. These patients are likely not having their psychiatric needs addressed and may be at increased risk for suicide [10].

Regardless, there is still considerable uncertainty in the literature regarding the etiology of FNSD. Traditionally, FNSD

was described as a physical manifestation of psychological distress [2]. Yet, there is limited empirical evidence to support this explanation, and patients may respond negatively to the explanation of a psychiatric cause for their symptoms [35]. Furthermore, while prior research showed that rates of trauma, stress, and psychiatric diseases were higher in patients with FNSD, recent research reveals a low incidence of psychiatric diagnoses in this patient population [36,37]. In addition, neurobiological etiological models have been described for FNSD symptoms [38,39]. A possible explanation may be that patients with FNSD have a decreased sense of control over their actions. For instance, a study comparing patients with FNSD displaying functional tremors versus control patients mimicking tremors demonstrated that there was right temporoparietal junction hypoactivity and decreased functional connectivity between the right temporoparietal junction, limbic region, and sensorimotor cortex [2,40-42]. This suggests that symptoms in FNSD may be perceived to be involuntary even though voluntary motor pathways are being utilized [2]. Notably, 5 of our 6 cases manifested with FNSD only in the immediate post-operative setting after exposure to anesthesia, and never otherwise experienced these symptoms during their normal daily lives at home. We contemplate whether anesthetic agents may predispose a vulnerable brain to manifest with involuntary motor and sensory control seen in FNSD.

Demographic variables and clinical outcome data are displayed in Tables 2 and 3, and in supplemental material. Comparing previously published case reports to our current case series revealed notable similarities that may help the provider recognize this diagnosis. The majority of patients were females (5 of 6, 83% in our cohort; 33 of 38, 87% in published cases) and a high percentage of patients reported a history of psychiatric illness (2 of 6, 33% in our cohort; 18 of 35, 51.4% in published cases), reported a prior history of psychogenic post-anesthetic spell (6 of 6, 100% in our cohort; 15 of 34, 44.1% in published cases), and underwent general anesthesia as their primary anesthetic (6 of 6, 100% in out cohort; 35 of 38, 92% in published cases).

Most cases involved head and neck surgery (2 of 6, 33% in our cohort; 15 of 38, 39% in published cases), either as ear, nose, throat (ENT) cases, dental cases, or ophthalmological cases. Several patients were employed in the medical field (2 of 6, 33% in our cohort; 7 of 34, 21% in published cases). Notably, many patients had a latent period of normal neurological function post-anesthesia prior to the manifestation of their psychogenic spell (1 of 6, 17% in our cohort; 21 of 34, 62% in published cases).

Certain physical exam maneuvers may be utilized to suggest psychogenic etiology of symptoms. A positive "forced eyelid test", referring to when patients tightly shut their eyelids and resist attempts to open them, was present in 6 of 9 patients (67%). A positive hand-raise drop test, referring to when patients avoid hitting themselves when their arm is raised by a provider and then released, was present in 5 of 6 patients (83%).

The majority of patients were exposed to diagnostic studies, including radiographic imaging tests (66%) and EEG (52%), as well as pharmacologic therapy to treat the spell (57%). Currently, there is no evidence that any long-term medication is useful to treat FNSD and it is generally advised that chronic,

TABLE 2. Demographic and clinical history of case series and published cases

Demographic or history category	Median (25^{th} ile–75^{th} ile) or n (%)
Age	33.5 (27.2–41.5)
Sex (female)	38/44 (86.4)
Ethnicity	
Caucasian	4/9 (44.4)
African American	0/9 (0)
Asian	2/9 (22.2)
Other	3/9 (33.3)
Type of spell	
PNES	24/44 (54.5)
Unresponsiveness	14/44 (31.8)
Conversion paralysis/disorder	6/44 (13.6)
History of prior spell (PNES, unresponsiveness, or conversion disorder)	21/40 (52.5)
History of prior mental illness	20/41 (48.8)
Depression	12/41 (29.3)
Anxiety	4/41 (9.7)
Post-traumatic stress disorder	4/41 (9.7)
Personality disorder	3/41 (7.3)
Suicidal ideation	2/41 (4.9)
History of prior seizures/epilepsy	9/42 (21.4)
History of comorbidities	
Coronary artery disease	0/40 (0)
Cerebrovascular accident	1/40 (2.5)
Hypertension	5/40 (12.5)
Hyperlipidemia	1/40 (2.5)
Hypothyroidism	6/40 (15.0)
Chronic pain	6/40 (15.0)
Occupation in medical field	9/40 (22.5)
Type of surgery	
Ear/nose/throat	11/44 (25.0)
Gynecological	11/44 (25.0)
Dental	5/44 (11.4)
General	4/44 (9.1)
Obstetrical	3/44 (6.8)
Orthopedic	3/44 (6.8)
Gastroenterology	3/44 (6.8)
Ophthalmological	1/44 (2.3)
Pain procedure	1/44 (2.3)
Radiological (non-invasive imaging)	1/44 (2.3)
Vascular	1/44 (2.3)
Type of anesthesia	
General	41/44 (93.2)
Monitored anesthesia care	1/44 (2.3)
Regional	2/44 (4.5)
Duration of anesthesia	56.5 (37.5–77.5)

PNES: Psychogenic non-epileptic seizures

TABLE 3. Clinical presentation and outcome of functional neurological symptom disorder episode in case series and published cases

Clinical outcomes	Median±IQR or n/N (%)
Type of spell	
PNES	24/44 (54.5)
Unresponsiveness	14/44 (31.8)
Conversion paralysis/disorder	6/44 (13.6)
Duration of spell (min)	
PNES	82.5 (1798.2)
Unresponsiveness	360 (1177.5)
Conversion paralysis/disorder	4320 (10,380)
Post-anesthetic regain of consciousness or baseline prior to onset of spell	22/40 (55.0)
Neurological exam	
Tongue biting	2/34 (6.2)
Incontinence	0/35 (0)
Retained pupillary reflex	23/23 (100.0)
Resistance to eye closure	6/9 (66.7)
Positive hand-raise drop test	5/6 (83.3)
Focal neurological deficits	7/31 (22.6)
Normoactive reflex	7/9 (77.8)
Response to noxious stimuli	3/5 (60.0)
Presence of hemodynamic instability	1/38 (2.6)
Presence of respiratory abnormality	2/36 (5.5)
Treatment administered for spell	
Any medication	24/42 (57.1)
Benzodiazepine	13/28 (46.4)
Anti-epileptic	8/27 (29.6)
Other sedative	7/28 (25.0)
Placebo	3/28 (10.7)
Observation only	14/42 (33.3)
Serological studies	
Abnormal electrolytes	0/16 (0)
Abnormal complete blood count panel	0/8 (0)
Abnormal glucose	0/12 (0)
Abnormal radiological studies	2/29 (6.9)
Abnormal electroencephalogram	1/23 (4.3)
Consult/referral to psychiatry	15/35 (42.8)
Consult/referral to neurology	19/34 (55.9)
Disposition	
Discharge	7/32 (21.9)
Hospital admission	17/32 (53.1)
ICU admission	8/32 (25.0)

IQR: Interquartile range; PNES: Psychogenic non-epileptic seizures; ICU: Intensive care unit

long-term pharmacological treatment should be avoided due to associated side effects [43]. Depending on the anesthetic course, it is reasonable to administer naloxone or other opioid reversal agents for suspicion of opioid overdose, flumazenil for benzodiazepine overdose, and physostigmine for the possibility of central anticholinergic syndrome and sleep paralysis [44-47]. Notable medication-related side effects in our case series included unanticipated tracheal intubation due to sedation and respiratory depression from parenteral diazepam, chlormethiazole, thiopentone, and alfentanil in one patient [17], and unresponsiveness in an another patient with hypercapnia (arterial blood gas pH of 7.15 and pCO_2 of 65 mm Hg) after administration of 2 mg IV midazolam [11]. In another 22-year old otherwise healthy patient with post-operative conversion paralysis of his left-sided extremities, stroke protocol and treatment were initiated for suspicion of brain infarction [32]. Two patients were also exposed to unanticipated invasive spine surgery as a result of their conversion paralysis mimicking spinal cord pathology: a 37-year old male status-post left laminotomy and L5-S1 diskectomy who experienced conversion paralysis with left-sided lower extremity weakness and subsequently underwent re-exploration of the L5-S1 disc space [18], and a 45-year old female status-post C6-C7 arthroplasty who experienced conversion paralysis with complete left-sided hemiplegia only sparing the face and subsequently underwent re-exploration of the C6-C7 disc space [30].

No deaths were experienced in our cohort and in all published cases. However, the majority of patients had unanticipated admission either to the hospital (53%) or to the ICU (25%). Only 22% of patients were discharged the same day. After exclusion of life-threatening causes and diagnosis of a psychogenic etiology for patient's symptoms, supportive care is primarily recommended with limited diagnostic testing and invasive tests. Consideration of a psychiatry consult or referral is highly recommended to evaluate the patient for an underlying psychiatric illness; this was an under-utilized modality as only 43% of cases underwent evaluation by a psychiatrist after experiencing their post-anesthetic spell. Studies demonstrate that CBT may be beneficial in the treatment of FNSD, and involves educating the patient about the stress response cycle in FNSD, training the patient with behavioral skills and techniques in stress management, and helping patients change harmful and negative thought patterns that reinforce their FNSD symptoms [48].

Future larger-scale observational studies are warranted to further identify risk factors, optimal management, and prognosis in this unique population of patients. Additionally, we defined certain outcomes (e.g prior psychiatric history) as binary variables in our primary analysis; it would be useful to see if chronicity of certain risk factors over time is associated with more post-operative PNES, psychogenic coma, or conversion paralysis.

Our case series and systematic review should be interpreted in the context of multiple limitations. While our size of six cases equates to the largest published case series, future larger-scale observational studies would be beneficial to describe this rare post-operative phenomenon. Given the retrospective nature of the study, there were several missing data points for cases across multiple key variables. We also did not abstract data on the chronicity of certain risk factors (e.g duration of prior psychiatric illness, number of prior post-operative psychogenic spells); this is likely a factor of our institution being a tertiary-referral center where many patients were referred for surgery from an outside institution.

CONCLUSION

PNES, psychogenic coma, and conversion paralysis are an uncommon manifestation in the immediate post-anesthetic period. High suspicion should be given to this diagnosis after excluding life-threatening causes and when physical exam signs are inconsistent with an organic cause, particularly in the presence of risk factors. Potential risk factors include female sex, history of prior psychogenic post-anesthetic spell, psychiatric illness, general anesthesia, and head/neck surgery. Prompt diagnosis and management of this condition can prevent unnecessary diagnostic studies, invasive procedures and their associated potential complications, and hospital cost.

REFERENCES

[1] American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Washington, DC: American Psychiatric Association; 2013. https://doi.org/10.1176/appi.books.9780890425596.

[2] Fobian AD, Elliott L. A review of functional neurological symptom disorder etiology and the integrated etiological summary model J Psychiatry Neurosci 2019;44(1):8-18. https://doi.org/10.1503/jpn.170190.

[3] Abubakr A, Kablinger A, Caldito G. Psychogenic seizures: Clinical features and psychological analysis. Epilepsy Behav 2003;4(3):241-5. https://doi.org/10.1016/s1525-5050(03)00082-9.

[4] Benbadis SR, Allen Hauser W. An estimate of the prevalence of psychogenic non-epileptic seizures. Seizure 2000;9(4):280-1. https://doi.org/10.1053/seiz.2000.0409.

[5] Meierkord H, Will B, Fish D, Shorvon S. The clinical features and prognosis of pseudoseizures diagnosed using video-EEG telemetry. Neurology 1991;41(10):1643-6. https://doi.org/10.1212/wnl.41.10.1643.

[6] Ramos JA, Brull SJ. Psychogenic non-epileptic seizures in the post-anesthesia recovery unit. Rev Bras Anestesiol 2016;66(4):426-9. https://doi.org/10.1016/j.bjane.2013.10.005.

[7] Kamil SH, Qureshi M, Patel RS. Cognitive behavioral therapy (CBT) in psychogenic non-epileptic seizures (PNES): A case report and literature review. Behav Sci (Basel) 2019;9(2):e15. https://doi.org/10.3390/bs9020015.

[8] Downs JW, Young PE, Durning SJ. Psychogenic coma following upper endoscopy: A case report and review of the literature. Mil Med 2008;173(5):509-12. https://doi.org/10.7205/milmed.173.5.509.

[9] Ali S, Jabeen S, Pate RJ, Shahid M, Chinala S, Nathani M, et al. Conversion disorder mind versus body: A review. Innov Clin Neurosci 2015;12(5-6):27-33.

[10] Reuber M, Enright SM, Goulding PJ. Postoperative pseudostatus: Not everything that shakes is epilepsy. Anaesthesia 2000;55(1):74-8. https://doi.org/10.1046/j.1365-2044.2000.01127.x.

[11] Rose GL, Drake A. Psychogenic non-epileptic seizures after general anesthesia. Br J Anaesth 2009;103: Issue eLetters Supplement. https://doi.org/10.1093/bja/el_4249.

[12] Ng L, Chambers N. Postoperative pseudoepileptic seizures in a known epileptic: Complications in recovery. Br J Anaesth 2003;91(4):598-600. https://doi.org/10.1093/bja/aeg201.

[13] Allen G, Farling P. Anaesthesia and pseudoseizures. Br J Anaesth 2004;92(3):451-2. https://doi.org/10.1093/bja/aeh524.

[14] Collard B, Johnson S, Cascarini L, Lee S. Pseudoseizures and surgery. Br Dent J 2010;208(1):3-4. https://doi.org/10.1038/sj.bdj.2010.6.

[15] Lichter I, Goldstein LH, Toone BK, Mellers JD. Nonepileptic seizures following general anesthetics: A report of five cases. Epilepsy Behav 2004;5(6):1005-13. https://doi.org/10.1016/j.yebeh.2004.09.003.

[16] Ney GC, Barr WB, Napolitano C, Decker R, Schaul N. New-onset psychogenic seizures after surgery for epilepsy. Arch Neurol 1998;55(5):726-30. https://doi.org/10.1001/archneur.55.5.726.

[17] Parry T, Hirsch N. Psychogenic seizures after general anaesthesia. Anaesthesia 1992;47(6):534. https://doi.org/10.1111/j.1365-2044.1992.tb02290.x.

[18] Hsieh MK, Chang CN, Hsiao MC, Chen WJ, Chen LH. Conversion paralysis after surgery for lumbar disc herniation. Spine (Phila Pa 1976) 2010;35(8):E308-10. https://doi.org/10.1097/brs.0b013e3181c41bc3.

[19] Weber JG, Cunnien AJ, Hinni ML, Caviness JN. Psychogenic coma after use of general anesthesia for ethmoidectomy. Mayo Clin Proc 1996;71(8):797-800. https://doi.org/10.4065/71.8.797.

[20] Yong CW, Ng WH, Yap SH, D'Souza J, Ow AT. Psychogenic coma after dental surgery under general anaesthesia. Int J Oral Maxillofac Surg 2018;47(12):1613-5. https://doi.org/10.1016/j.ijom.2018.06.012.

[21] Nguyen J, Abola R, Schabel J. Recurrent psychogenic paresis after dural puncture in a parturient. Int J Obstet Anesth 2013;22(2):160-3. https://doi.org/10.1016/j.ijoa.2013.01.006.

[22] Meyers TJ, Jafek BW, Meyers AD. Recurrent psychogenic coma following tracheal stenosis repair. Arch Otolaryngol Head Neck Surg 1999;125(11):1267-9. https://doi.org/10.1001/archotol.125.11.1267.

[23] Maddock H, Carley S, McCluskey A. An unusual case of hysterical postoperative coma. Anaesthesia 1999;54(7):717-8. https://doi.org/10.1046/j.1365-2044.1999.1013v.x.

[24] Adams AP, Goroszeniuk T. Hysteria. A cause of failure to recover after anaesthesia. Anaesthesia 1991;46(11):932-4. https://doi.org/10.1111/j.1365-2044.1991.tb09850.x.

[25] Albrecht RF 2nd, Wagner SR 4th, Leicht CH, Lanier WL. Factitious disorder as a cause of failure to awaken after general anesthesia. Anesthesiology 1995;83(1):201-4. https://doi.org/10.1097/00000542-199507000-00024.

[26] Orr DL 2nd, Glassman AS. Conversion phenomenon following general anesthesia. J Oral Maxillofac Surg 1985;43(10):817-9. https://doi.org/10.1016/0278-2391(85)90345-3.

[27] Hwang JL, Kuo MC, Hsieh BC, Chang CH, Jou LC, Chen WH, et al. An acute psychiatric episode following transvaginal oocyte retrieval. Hum Reprod 2002;17(4):1124-6. https://doi.org/10.1093/humrep/17.4.1124.

[28] Hobaika AB, Cançado CL, Dettogni PL, Guedes VC. Hysterical paraplegia simulating acute transverse myelitis after general anesthesia. Acta Anaesthesiol Scand 2008;52(3):449-50. https://doi.org/10.1111/j.1399-6576.2007.01543.x.

[29] Afolabi K, Ali S, Gahtan V, Gorji R, Li F, Nussmeier NA. Postoperative conversion disorder. J Clin Anesth 2016;30:21-3. https://doi.org/10.1016/j.jclinane.2015.12.002.

[30] Boudissa M, Castelain JE, Boissière L, Mariey R, Pointillart V, Vital JM. Conversion paralysis after cervical spine arthroplasty: A case report and literature review. Orthop Traumatol Surg Res 2015;101(5):637-41. https://doi.org/10.1016/j.otsr.2015.06.001.

[31] Judge A, Spielman F. Postoperative conversion disorder in a pediatric patient. Paediatr Anaesth 2010;20(11):1052-4. https://doi.org/10.1111/j.1460-9592.2010.03401.x.

[32] Nakagawa C, Shiraishi Y, Sato S. A case of conversion disorder showing transient hemiplegia after general anesthesia. J Anesth 2010;24(3):496. https://doi.org/10.1007/s00540-010-0900-y.

[33] Stoddart PA, Gill RS, Lim M. Hysteria: A cause for opisthotonus. Anaesthesia 1992;47(1):1014. https://doi.org/10.1111/j.1365-2044.1992.tb03240.x.

[34] Crabb IJ, Allan L. Opisthotonus and hysteria. Anaesthesia 1993;48(5):445-6.

https://doi.org/10.1111/j.1365-2044.1993.tb07035.x.
[35] Stone J, LaFrance WC Jr, Levenson JL, Sharpe M. Issues for DSM-5: Conversion disorder. Am J Psychiatry 2010;167(6):626-7. https://doi.org/10.1176/appi.ajp.2010.09101440.
[36] Crimlisk HL, Bhatia K, Cope H, David A, Marsden CD, Ron MA. Slater revisited: 6 year follow up study of patients with medically unexplained motor symptoms. BMJ 1998;316(7131):582-6. https://doi.org/10.1136/bmj.316.7131.582.
[37] Wilshire CE, Ward T. Psychogenic explanations of physical illness: Time to examine the evidence. Perspect Psychol Sci 2016;11(5):606-31. https://doi.org/10.1177/1745691616645540.
[38] Reuber M, Brown RJ. Understanding psychogenic nonepileptic seizures-phenomenology, semiology and the integrative cognitive model. Seizure 2017;44:199-205. https://doi.org/10.1016/j.seizure.2016.10.029.
[39] Brown RJ, Reuber M. Towards an integrative theory of psychogenic non-epileptic seizures (PNES). Clin Psychol Rev 2016;47:55-70. https://doi.org/10.1016/j.cpr.2016.06.003.
[40] Voon V, Gallea C, Hattori N, Bruno M, Ekanayake V, Hallett M. The involuntary nature of conversion disorder. Neurology 2010;74(3):223-8. https://doi.org/10.1212/wnl.0b013e3181c00e9.
[41] Aybek S, Nicholson TR, O'Daly O, Zelaya F, Kanaan RA, David AS. Emotion-motion interactions in conversion disorder: An FMRI study. PLoS One 2015;10(4):e0123273. https://doi.org/10.1371/journal.pone.0123273.
[42] Maurer CW, LaFaver K, Ameli R, Epstein SA, Hallett M, Horovitz SG. Impaired self-agency in functional movement disorders: A resting-state fMRI study. Neurology 2016;87(6):564-70. https://doi.org/10.1212/wnl.0000000000002940.
[43] Mayor R, Smith PE, Reuber M. Management of patients with nonepileptic attack disorder in the United Kingdom: A survey of health care professionals. Epilepsy Behav 2011;21(4):402-6. https://doi.org/10.1016/j.yebeh.2011.05.019.
[44] Dawson AH, Buckley NA. Pharmacological management of anticholinergic delirium theory, evidence and practice. Br J Clin Pharmacol 2016;81(3):516-24. https://doi.org/10.1111/bcp.12839.
[45] Anderson JA. Reversal agents in sedation and anesthesia: A review. Anesth Prog 1988;35(2):43-7.
[46] Pani N, Dongare PA, Mishra RK. Reversal agents in anaesthesia and critical care. Indian J Anaesth 2015;59(10):664-9. https://doi.org/10.4103/0019-5049.167484.
[47] Spector M, Bourke DL. Anesthesia, sleep paralysis, and physostigmine. Anesthesiology 1977;46(4):296-7. https://doi.org/10.1097/00000542-197704000-00013.
[48] O'Neal MA, Baslet G. Treatment for patients with a functional neurological disorder (conversion disorder): An integrated approach. Am J Psychiatry 2018;175(4):307-14. https://doi.org/10.1176/appi.ajp.2017.17040450.

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Supplemental File 1: Data Collection from Cases/Case Series Reported in the Literature

Case #1 (Nejad, 21 yo F)	
Age at onset of episode	21
Gender	Female
Ethnicity	Iranian
Description of seizure event	Unresponsive, flinch to eye stimulation, protecting face from arm
Duration of seizure	Improvement in 1 hour and 30 minutes in PACU
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Yes, avoids hitting herself
Neurological exam	No focal deficits, cold water in ears – no response; cold hand to back caused her to move
Treatment given for episode and response	No medications, clinical observation
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Four prior episodes in Iran of being awake but unable to move (hospital in Iran refused to care for her)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General anesthesia
Duration of MAC or general anesthesia	1 hour
Type of surgery (general, ENT, orthopedic, gynecological, etc.)	Sinus surgery (endoscopic middle meatal antrostomy and nasal antral window)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol, fentanyl, mivacurium, isoflurane and sevoflurane
Serological studies	Negative for autoimmune conditions
Radiologic imaging results	Sinus CT unremarkable
Electroencephalogram results	None
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	No
List of other pertinent medications	None
List of allergies	Amide local anesthetics causing anaphylaxis, steroids
PMH	Hypothyroidism on prior levothyroxine for 10 years but not currently, recurrent sinus infections, skin rash/dermatographism, prior desensitization therapy for penicillin V
Other	Cold water in ears – no response; cold hand to back caused her to move
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Discharge

Case #2 (LaForest, 36 yo F)	
Age at onset of episode	36
Gender	Female
Ethnicity	Not reported
Description of seizure event	Unresponsive except squinting to suctioning and presence of eyelid reflexes
Duration of seizure	90 minutes
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Slightly dilated, horizontal nystagmus, eyelid reflexes present
Forced eye closure with resistance to opening?	No
Hand-raise drop test? Attempt to avoid hitting self?	Not attempted
Neurological exam	No focal neurologic deficits, decreased reflexes throughout which resolved
Treatment given for episode and response	Placebo saline in IV (patient responded after injection), clinical observation
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Two prior events: after an AV ablation procedure (similar unresponsive episode with no postictal phase) and EEG monitoring one week later (unresponsive spell during testing with some jerking of extremities seen)
History of epilepsy	Yes
History of mental illness (e.g. depression, anxiety, PTSD)	Yes (anxiety and depression)
Pre-operative prescription meds for mental illness?	Yes (venlafaxine, alprazolam, clonazepam, temazepam)
Pre-operative prescription meds for epilepsy?	Phenobarbital
Risk factors for epilepsy	Already has history of seizures on antiepileptic medications
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	80 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	General (anal fissure surgery; exam under anesthesia with fistulotomy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Lidocaine, midazolam, morphine, vecuronium, propofol, glycopyrrolate, neostigmine, sevoflurane
Serological studies	Not obtained
Radiologic imaging results	Not obtained
Electroencephalogram results	Normal
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes
List of other pertinent medications	pantoprazole, digoxin, metoprolol, tegaserod, pindalol, levothyroxine
List of allergies	meperidine (hypotension), zolpidem (hallucinations), oxycodone (rash), amitriptyline (tremors), midodrine (decreased vision), prochlorperazine (nausea), fentanyl (seizures)
PMH	Postural orthostatic tachycardia syndrome, rectal fistula, severe constipation, nocturnal dyspnea, subtotal thyroidectomy secondary to Graves, SVT, headaches, seizures
Other	Occupation nurse; no postictal confusion after prior PNES
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Discharge

Case #3 (Wisniewski, 20 yo F)	
Age at onset of episode	20
Gender	Female
Ethnicity	White (Caucasian)
Description of seizure event	Aphonia, generalized shaking (particularly upper extremity shaking)
Duration of seizure	6 hours, but shaking and imbalance lasted several days
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Yes
Hand-raise drop test? Attempt to avoid hitting self?	Yes
Neurological exam	No focal neurologic deficits
Treatment given for episode and response	Clinical observation, gave bag to breathe in to prevent hyperventilation, 1 mg Haldol (resolved 10 mins later)
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Two prior PNES episodes (both were prior vocal cord surgeries as well; same meds used in these surgeries including propofol, fentanyl, remifentanil, Versed, vecuronium, Ancef)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (vocal cord surgery, lysis and collagen injection)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol, fentanyl, midazolam, flumazenil
Serological studies	Not obtained
Radiologic imaging results	Not obtained
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes; diagnosed as pseudoseizure, didn't think it was from a lesion
List of other pertinent medications	Isotretinoin, cephalexin, oxycodone
List of allergies	None
PMH	Migraine, fatigue, severe dysphonia
Other	No
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Discharge

Case #4 (Davis, 42 yo F)	
Age at onset of episode	42
Gender	Female
Ethnicity	White (Caucasian)
Description of seizure event	Unresponsive, slump head, stare but would not blink on command; but would spontaneously move head when nobody was around her
Duration of seizure	2 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Unable to be tested (forcibly closed eyes)
Forced eye closure with resistance to opening?	Yes
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	No focal neurological deficits
Treatment given for episode and response	Clinical observation, resolved spontaneously
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes, multiple prior spells of unresponsiveness and staring (multiple >10 episodes requiring several ER visits)
History of epilepsy	Yes (has seizure disorder, termed “visual epilepsy”)
History of mental illness (e.g. depression, anxiety, PTSD)	Depression
Pre-operative prescription meds for mental illness?	Citalopram
Pre-operative prescription meds for epilepsy?	Lamictal
Risk factors for epilepsy	Has a prior history of seizures
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	30 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	General (breast biopsy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Normal CBC and electrolytes
Radiologic imaging results	CT head was normal
Electroencephalogram results	EEG performed in PACU was negative (during brief wakefulness there is 10 Hz alpha activity over posterior head regions; an excess of beta activity is present. Spontaneous variability and reactivity).
Referral for psychiatric evaluation following episode?	Yes (revealed lots of recent stress, lots of ER visits for syncopal episodes)
Referral for neurological evaluation?	Yes (diagnosed as pseudoseizures caught on EEG/video)
List of other pertinent medications	Lamotrigine, modafinil for narcolepsy, iron, vitamin C
List of allergies	None
PMH	Narcolepsy, seizures/pseudoseizures, syncope, celiac sprue
Other	Didn’t remember any of the events; also had prior MAC and general anesthesia that were unremarkable without PNES; occupation is nurse on neurointensive care unit
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Discharge

Case #5 Svoboda	
Age at onset of episode	53 yo
Gender	Male
Ethnicity	Not reported
Description of seizure event	Unresponsive to command or pain, occasional clonus in right leg, quadriparesis though had consciousness
Duration of seizure	Two days to full baseline recovery
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	No
Hand-raise drop test? Attempt to avoid hitting self?	Yes (positive)
Neurological exam	No focal neurological deficits, occasional clonus in right leg
Treatment given for episode and response	Physostigmine (even though reversal received postoperatively and had aggressive four twitches) but no improvement
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes (reports prior prolonged awakening at another surgery where he was unresponsive and was speaking inappropriate made-up words)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	No
Pre-operative prescription meds for epilepsy?	No
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	52 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	General (incision and debridement of back)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Midazolam, cisatracurium, propofol, fentanyl
Serological studies	ABG, electrolytes, and glucose were normal
Radiologic imaging results	CT head and angiogram was normal
Electroencephalogram results	Normal (even when leg was shaking)
Referral for psychiatric evaluation following episode?	No (consideration for psychiatry was given, but was ultimately not obtained because his presentation improved in 2 days)
Referral for neurological evaluation?	Yes (concern for “locked-in” syndrome but ultimately diagnosed as PNES)
List of other pertinent medications	None
List of allergies	Wheat (Celiac disease)
PMH	Chronic back wound and pain s/p laminectomy, celiac disease
Other	No
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	ICU admission

Case #6 (Wakeley)	
Age at onset of episode	18 yo
Gender	Female
Ethnicity	Caucasian
Description of seizure event	Shaking and unresponsiveness
Duration of seizure	45 minutes
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not attempted
Hand-raise drop test? Attempt to avoid hitting self?	Not attempted
Neurological exam	No focal deficits
Treatment given for episode and response	None, observation in PACU (symptoms lasted 45 mins and discharged home)
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None
History of prior PNES	Yes (two prior episodes – right hip hardware removal at age 16 had intermittent shaking episodes lasting 10-20 seconds each and resolving after 8 hours; cholecystectomy also at age 17 had intermittent shaking spells lasting 10-20 seconds and sent to ICU for neurological evaluation and EEG and resolved 12 hours later)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No (has history of irritable bowel syndrome)
Pre-operative prescription meds for mental illness?	None (takes amitriptyline for IBS)
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	30 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	GI (EGD and colonoscopy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Midazolam and sevoflurane
Serological studies	None
Radiologic imaging results	None
Electroencephalogram results	Prior EEG during her second episode a year ago was negative
Referral for psychiatric evaluation following episode?	Yes (negative findings from referral, diagnosed as functional spells)
Referral for neurological evaluation?	No (was obtained in the past during prior PNES episodes)
List of other pertinent medications	Amitriptyline, omeprazole, ondansetron
List of allergies	Propofol (tremors), dairy products, soy, monocryl sutures
PMH	Congenital hip dysplasia, IBD, dyspepsia
Other	Has two other functional syndromes including irritable bowel syndrome and transient functional paresis (functional paresis of right leg in 2015 after she had surgery for right hip dysplasia)
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, unclear duration
Disposition	Discharge

1. Psychogenic non-epileptic seizures after general anesthesia (Gregory Rose)	
Age at onset of episode	32
Gender	Female
Ethnicity	Not reported
Description of seizure event	Arms and neck were rhythmically flexing, eyes tightly shut, apneic with desaturation into 70%
Duration of seizure	Not reported
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported (eyes closed shut)
Forced eye closure with resistance to opening?	Yes
Hand-raise drop test? Attempt to avoid hitting self?	No, but oral airway was attempted which was promptly batted out of position in a purposeful manner
Neurological exam	Unresponsive and post-ictal period present
Treatment given for episode and response	2 mg IV midazolam
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	Apneic and oxygen desaturation to 70%
History of prior PNES	Yes (after previous anesthetics and at home)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Post-traumatic stress disorder after motor vehicle accidence (has experienced pseudoseizures since then)
Pre-operative prescription meds for mental illness?	No
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Prior motor vehicle accident, prior stroke
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (oophorectomy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Midazolam, fentanyl, propofol, rocuronium, desflurane, morphine
Serological studies	Acidemia with pH of 7.15, and a pCO_2 of 65 mm Hg. Serum sodium and glucose levels were normal.
Radiologic imaging results	Not obtained
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	Yes
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Obstructive sleep apnea on CPAP, hypertension, hyperlipidemia, stroke with prior left-sided hemiplegia with no residual deficits
Other	No memory of the event
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 30 minutes of being awake and fully alert
Disposition	Not reported

2. Psychogenic coma following upper endoscopy: a case report and review of the literature (Downs)	
Age at onset of episode	28
Gender	Female
Ethnicity	Caucasian
Description of seizure event	Unarousable when arrived to PACU
Duration of seizure	16 hours of unresponsiveness
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	No
Hand-raise drop test? Attempt to avoid hitting self?	Yes present
Neurological exam	Unresponsive to voice and sternal rub; no decorticate or decerebrate posturing; Doll's eye maneuver was positive; brisk pupillary response to light, without anisocoria. Corneal reflex and gag reflex were preserved. No spontaneous movements were noted, but normal motor tone was present. Deep tendon reflexes were 2+ and symmetric throughout her upper and lower extremities and Babinski's sign was absent
Treatment given for episode and response	40 mcg naloxone IV
Hemodynamic abnormalities during episode	No (pulse 95, BP 128/80)
Respiratory abnormalities during episode	No (RR 14, sat 98% on 2 L nasal cannula)
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Post-traumatic stress disorder, borderline personality disorder
Pre-operative prescription meds for mental illness?	Yes (paroxetine, amitriptyline)
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	No
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	30 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	Gastroenterology (EGD)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol, fentanyl
Serological studies	Normal; pH 7.398, pCO2 38.2, pO2 97, and oxygen saturation 98%. Fingerstick glucose was 153. Serum electrolytes included sodium 142, potassium 3.8, and calcium 8.6. All other serum chemistries, liver associated enzymes, and a complete blood count were within normal limits
Radiologic imaging results	Noncontrast CT head negative
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	No
List of other pertinent medications	paroxetine, amitriptyline, metoclopramide, levothyroxine, Norco
List of allergies	Not reported
PMH	Dysphagia, hypothyroidism
Other	No
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 30 minutes of being arousable and following commands
Disposition	ICU admission

3. Postoperative pseudoepileptic seizures in a known epileptic: complications in recovery (Ng)	
Age at onset of episode	47
Gender	Female
Ethnicity	Not reported
Description of seizure event	Before LMA was removed, patient had generalized convulsion of all four limbs, head, and neck; LMA removed and bag mask ventilated; after midazolam, episode started to recur within minutes for the next 30 minutes with dramatic 20-30 second fast, symmetric, large amplitude, shaking of the head and all four limbs in the sagittal plane in a position of mid-flexion (no tonic phase)
Duration of seizure	3 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	No post-ictal phase and would respond to commands in between episodes
Treatment given for episode and response	10 mg IV midazolam
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None, no desaturations
History of prior PNES	No
History of epilepsy	Yes (history of Jacksonian seizures of the limbs and petit mal epilepsy)
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	No
Pre-operative prescription meds for epilepsy?	Yes, trialed several unspecified anticonvulsants with limited success
Risk factors for epilepsy	Yes, history of seizures already present (risk factors include extensive left upper circulation venous thrombosis extending into cerebral venous sinus requiring anticoagulation, and then subsequently one year later suffering from minor subdural hematoma secondary to poor anticoagulant control)
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	45 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	Ophthamologic (two stage eye procedure for correction of long-standing left-sided quint)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol, fentanyl, ondansetron, isoflurane, nitrous oxide
Serological studies	Not obtained
Radiologic imaging results	Not obtained
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes (her outpatient neurologist was consulted via phone); they questioned her diagnosis of prior Jacksonian seizures and were considering pseudoseizures on the differential
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Venous thrombosis extending into cerebral venous sinus, mild subdural hematoma, Jacksonian seizures, mild petit mal seizures
Other	Healthcare worker
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Not reported

4. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – Case 1	
Age at onset of episode	35
Gender	Female
Ethnicity	Not reported
Description of seizure event	Status epilepticus with generalized tonic-clonic seizure
Duration of seizure	Up to the fourth postoperative day
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Yes
Hand-raise drop test? Attempt to avoid hitting self?	Not tested
Neurological exam	Rolling head and markedly asynchronous limb movements; the patient resisted eye opening; she was not cyanosed. Attacks of unresponsiveness and abnormal movements became gradually less frequent during the patient's postoperative 4-day observation on a ward.
Treatment given for episode and response	IV thiopental 30 mg, IV diazepam 10 mg, IV propofol three boluses of 60 mg each, and IV phenobarbitone 180 mg
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes
History of epilepsy	Yes (history of daily seizures)
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Phenytoin and vigabatrin
Risk factors for epilepsy	Has known history of epilepsy
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (excision of labial sebaceous cyst)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Routine blood tests negative
Radiologic imaging results	Head CT and lumbar puncture were normal
Electroencephalogram results	EEG normal
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes
List of other pertinent medications	Phenytoin, vigabatrin, sulfasalazine, hydroxychloroquine
List of allergies	Not reported
PMH	Seronegative arthralgic and myalgic disorder with reported episodes of arthritis
Other	Former nurse
Regain of consciousness between anesthesia and first spell/episode and duration	Not reported
Disposition	Admitted for observation

5. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – Case 2	
Age at onset of episode	22
Gender	Female
Ethnicity	Not reported
Description of seizure event	Generalized shaking (clenched fists and shaking legs)
Duration of seizure	Not reported
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	clenched fists and shaking legs
Treatment given for episode and response	IV diazepam three boluses of 10 mg, thiopental (dose not specified), atracurium and propofol and was intubated
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Suicidal behavior (two prior suicide attempts)
Pre-operative prescription meds for mental illness?	None
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (excision of Bartholin's abscess)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Normal prolactin after tonic-clonic seizure
Radiologic imaging results	CT head normal
Electroencephalogram results	EEG normal
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Reported Still's disease, asthma
Other	Former nurse
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, interval duration not specified
Disposition	ICU transfer

6. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – Case 3	
Age at onset of episode	31
Gender	Female
Ethnicity	Not reported
Description of seizure event	Generalized tonic-clonic
Duration of seizure	Not reported
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Not reported
Treatment given for episode and response	Not reported
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None
History of prior PNES	No
History of epilepsy	Yes
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Not reported
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecologic (labial abscess drainage)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	Not reported
Electroencephalogram results	Normal
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Not reported
Other	No
Regain of consciousness between anesthesia and first spell/episode and duration	Not reported
Disposition	Not reported

7. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – Case 4	
Age at onset of episode	52
Gender	Female
Ethnicity	Not reported
Description of seizure event	Generalized tonic-clonic seizures
Duration of seizure	Not reported
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Not reported
Treatment given for episode and response	IV diazepam (dose not specified)
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None
History of prior PNES	Not reported
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	No
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Orthopedic (carpal tunnel release)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	Normal CT head
Electroencephalogram results	Normal EEG
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Not reported
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Not reported
Disposition	Not reported

8. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – Case 5	
Age at onset of episode	54
Gender	Female
Ethnicity	Not reported
Description of seizure event	Generalized tonic clonic seizure
Duration of seizure	Not reported
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Not reported
Treatment given for episode and response	IV diazepam
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None
History of prior PNES	Yes
History of epilepsy	Yes
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, nine prior suicide attempts
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Not reported
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	General (breast cyst excision)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Normal prolactin
Radiologic imaging results	Normal head CT
Electroencephalogram results	Normal EEG
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Not reported
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Not reported
Disposition	Not reported

9. Anaesthesia and pseudoseizures (Allen G, Farling P) – Case 1	
Age at onset of episode	48
Gender	Female
Ethnicity	Not reported
Description of seizure event	Gross movements of both arms
Duration of seizure	20 minutes
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Not reported
Treatment given for episode and response	No
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Status-post right retromastoid excision of cerebellar pontine angle meningioma
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	MRI (under general anesthesia due to claustrophobia)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol, isoflurane
Serological studies	Not reported
Radiologic imaging results	MRI head showed a small nodule of residual tumor
Electroencephalogram results	EEG normal
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Facial asymmetry and three year history of right-sided facial sensory disturbance, rheumatic fever, hypothyroidism, HTN
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Discharge

10. Anaesthesia and pseudoseizures (Allen G, Farling P) – Case 2	
Age at onset of episode	33
Gender	Female
Ethnicity	Not reported
Description of seizure event	Grand mal tonic-clonic seizure 4 hours postpartum
Duration of seizure	Not reported
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Not reported
Treatment given for episode and response	Magnesium, then patient induced and intubated with thiopental and succinylcholine, midazolam, and propofol infusion
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None
History of prior PNES	Yes
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Not reported
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Not reported
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	Regional (epidural analgesia)
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Obstetric (vaginal delivery in primigravida female)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported (epidural infusion)
Serological studies	Normal
Radiologic imaging results	CT head normal
Electroencephalogram results	Not performed
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	None
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes (3-4 hours)
Disposition	ICU admission

11. Pseudoseizures and surgery (Collard)	
Age at onset of episode	58
Gender	Female
Ethnicity	Iraqi
Description of seizure event	Ten minutes post-extraction, patient was collapsed on hospital stairwell moaning, crying, and exhibiting generalized asynchronous movements
Duration of seizure	Not reported
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Not reported
Treatment given for episode and response	Supportive care in PACU
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	Not reported
History of epilepsy	Not reported
History of mental illness (e.g. depression, anxiety, PTSD)	Not reported
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Not reported
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	MAC
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Dental (tooth extraction)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	Not reported
Electroencephalogram results	Not reported
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Not reported
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 10 minutes post-extraction
Disposition	Not reported

12. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – Case 1	
Age at onset of episode	30
Gender	Male
Ethnicity	Not reported
Description of seizure event	Violent, generalized shaking
Duration of seizure	40 seconds
Presence of tongue biting	Occasional tongue biting
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Normal
Treatment given for episode and response	Diazepam, heminevrin, phenytoin, clobazam, sodium valproate
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	Yes (experiences about 1 per month)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Depression in early 20s, sleepwalking age 15
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Twin birth, 2.5 months premature, low birth weight, anoxia at birth, TBI at age 26
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Oral surgery
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol, enflurane, isoflurane
Serological studies	Prolactin levels normal
Radiologic imaging results	MRI head: dilated right anterior temporal horn, mild cerebellar atrophy
Electroencephalogram results	EEG normal
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Appendectomy at ag e 17 unremarkable
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 20 minutes
Disposition	Not reported

13. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – Case 2	
Age at onset of episode	39
Gender	Female
Ethnicity	Not reported
Description of seizure event	Loss of awareness for seconds then motionless, then increased tremor in right leg, then collapse and generalized shaking, Shivering and double fit
Duration of seizure	5 minutes
Presence of tongue biting	Not reported
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Resting tremor of right arm and leg
Treatment given for episode and response	No
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	Yes
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Depression, anxiety, self-harm and overdoses in adolescence
Pre-operative prescription meds for mental illness?	Dothiepin and thioridazine for depression
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Twin birth, low birth weight
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecologic (laparoscopic)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Prolactin level normal
Radiologic imaging results	Not obtained
Electroencephalogram results	Normal
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Bendrofluazide for HTN, estradiol for HRT, salbutamol and beclomethasone inhalers for asthma
List of allergies	Not reported
PMH	HTN, asthma
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 1 hour
Disposition	Not reported

14. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – Case 3	
Age at onset of episode	27
Gender	Male
Ethnicity	Not reported
Description of seizure event	Aura, numbness over whole body, rising sensation in stomach, instruction by inner voice to lie on the floor, loss of awareness, then violent and thrashing movements
Duration of seizure	2 minutes
Presence of tongue biting	Yes
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Normal
Treatment given for episode and response	None, supportive treatment
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	None
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	History of febrile convulsions treated with phenobarbital until age 6
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Dental surgery
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	MRI head: old infarct in right trigone
Electroencephalogram results	Normal
Referral for psychiatric evaluation following episode?	Yes (patient developed panic disorder and depression following this onset of seizures and was seen by psychiatrist)
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	None, healthy
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 2 days (seizure occurred on postoperative day 2 after dental surgery)
Disposition	Not reported

15. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – Case 4	
Age at onset of episode	37
Gender	Female
Ethnicity	Not reported
Description of seizure event	Generalized shaking movement
Duration of seizure	1 minute
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Not reported
Treatment given for episode and response	Diazepam, carbamazepine, phenytoin (seizures stopped after administration)
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	No
History of epilepsy	Possible concurrent epilepsy
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, recurrent postnatal psychotic depression treated with ECT
Pre-operative prescription meds for mental illness?	Takes multiple antipsychotic and antidepressant medications (unspecified)
Pre-operative prescription meds for epilepsy?	No
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (vulvar biopsy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	MRI normal
Electroencephalogram results	Routine EEG: during photic stimulation, 2 generalized convulsions with alpha rhythm preserved; sleep EEG: brief run of sharp waves over right anterior temporal region; follow-up sleep EEG less convincing
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	None, otherwise healthy
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Not reported

16. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – Case 5	
Age at onset of episode	31
Gender	Female
Ethnicity	Not reported
Description of seizure event	Aura: excitement and dizziness for 1 hour; sank back in bed, then loss of awareness followed by flailing arms and legs, non-rhythmic movements, arching of back
Duration of seizure	1 minute
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Normal
Treatment given for episode and response	Carbamazepine and sodium valproate (withdrawn after 6 months)
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	No
History of epilepsy	None
History of mental illness (e.g. depression, anxiety, PTSD)	None
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecologic (diagnostic dilation and curettage for menorrhagia)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol
Serological studies	Not reported
Radiologic imaging results	CT head normal
Electroencephalogram results	EEG: 6 EEGs were all abnormal with a great deal of generalized spike and slow wave activity; second EEG was most abnormal; later EEGs: excess of slow activity but less widespread than before; seizure recorded during prolonged EEG (fourth) determined to be non-epileptic
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Healthy
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 2 hours
Disposition	Not reported

17. New-onset psychogenic seizures after surgery for epilepsy (Ney)	
Age at onset of episode	23
Gender	Male
Ethnicity	Not reported
Description of seizure event	Shakes and shocks that involved in the left half of the body
Duration of seizure	Not reported
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Consciousness preserved
Treatment given for episode and response	Not reported
Hemodynamic abnormalities during episode	Not reported
Respiratory abnormalities during episode	Not reported
History of prior PNES	Not reported
History of epilepsy	Yes, seizures occurred 2-3 times per month and involved staring and purposeful movements with the left hand that progressed to convulsions; seizures were refractory to three anti-epileptic drugs
History of mental illness (e.g. depression, anxiety, PTSD)	Generalized anxiety disorder
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Three different unspecified anti-epileptics
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Neurological surgery (left anterior temporal lobectomy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	MRI brain normal
Electroencephalogram results	Normal EEG (left temporal slowing but no spikes)
Referral for psychiatric evaluation following episode?	Yes, psychotherapy
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	GAD
Other	Just one case in this case series met criteria for immediate post-operative PNES/unresponsiveness out of 5 total cases
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Admitted for observation

18. Psychogenic non-epileptic seizures in the post-anesthesia recovery unit (Ramos)	
Age at onset of episode	48
Gender	Female
Ethnicity	Not reported
Description of seizure event	Generalized shaking of extremities and pelvic thrusting (three episodes over 2 hours in the post-operative period)
Duration of seizure	Two hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Yes
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	No focal deficits
Treatment given for episode and response	IV lorazepam (one episode spontaneously resolved, and the other two resolved IV lorazepam)
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None
History of prior PNES	Yes (prior EEG testing with normal brain wave activity in the setting of 4 “seizure spells”
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, depression
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (urinary sling implantation procedure)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Propofol, fentanyl, midazolam as premedication, sevoflurane
Serological studies	Metabolic assay normal
Radiologic imaging results	CT head normal
Electroencephalogram results	EEG normal
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Urinary incontinence, depression, chronic migraines, asthma, kidney cancer s/p nephrectomy, remote history of seizures
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, interval not specified
Disposition	Observation for 1 day

19. Psychogenic seizures after general anaesthesia (Parry)	
Age at onset of episode	29
Gender	Female
Ethnicity	Not reported
Description of seizure event	Violent generalized convulsions
Duration of seizure	Several episodes for about one day (specific duration not specified)
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	No focal deficits
Treatment given for episode and response	IV Diazepam and IV chlormethiazole; phenytoin and phenobarbital were also started; despite these, seizures continued an it was only after infusion of thiopental and alfentanil were commenced that good control of the episode was obtained
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	Yes; subsequent respiratory depression from all the medications caused respiratory depression requiring intubation (respiratory depression likely not from seizure)
History of prior PNES	Possible/questionable prior history
History of epilepsy	Yes (questionable history, had one episode of loss of conscious at age 14 and remained unconscious for 6 days, and was then placed on phenytoin, but has not taken any anticonvulsants for 5 years leading up to this episode)
History of mental illness (e.g. depression, anxiety, PTSD)	Not reported
Pre-operative prescription meds for mental illness?	Not reported
Pre-operative prescription meds for epilepsy?	Was previously on phenytoin but has not taken for 5 years
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Obstetric (termination of 15-week pregnancy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Thiopental, halothane
Serological studies	Lumbar puncture was normal
Radiologic imaging results	CT head normal
Electroencephalogram results	EEG was normal
Referral for psychiatric evaluation following episode?	Not reported
Referral for neurological evaluation?	Not reported
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	ASA2, healthy
Other	Works as a nurse; discharged from hospital at a reduced dose of phenytoin
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 10 minutes
Disposition	ICU admission (due to intubation)

20. Conversion paralysis after surgery for lumbar disc herniation (Hsieh)	
Age at onset of episode	37
Gender	Female
Ethnicity	Not reported
Description of seizure event	Unable to move left leg (big toe extension, ankle flexion and extension, knee extension, and thigh flexion in the left leg were weak; loss of sensation in left calf was noted)
Duration of seizure	Left leg weakness for 7 days
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	As noted above (left leg weakness and decreased sensation)
Treatment given for episode and response	Symptoms were concerning for hemorrhage in the L5-S1 and so patient underwent surgical re-exploration of the L5-S1 disc space but no obvious hemorrhage or compression was found
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Orthopedic (left laminotomy and L5-S1 diskectomy in prone position)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Normal
Radiologic imaging results	MR spine showed left S1 root swelling without mass effect at other lumbosacral levels
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	Yes (transferred to the psychiatric department for treatment of depression and conversion disorder)
Referral for neurological evaluation?	Yes
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Acute L5-S1 disc herniation, hemorrhoidectomy, excision of benign breast mass several years ago
Other	SSEP and MEPs were also obtained; SSEP suggestive of a peripheral sensory conduction defect in both lower limbs; MEP suggested peripheral motor neuropathy in upper limbs but not lower limbs; nerve conduction velocity-electromyography revealed normal nerve conduction
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 1 hour
Disposition	Not reported if hospital or ICU admission but was in hospital for at least 29 days

21. Psychogenic coma after use of general anesthesia for ethmoidectomy (Weber)	
Age at onset of episode	49
Gender	Female
Ethnicity	Not reported
Description of seizure event	Unresponsiveness, coma
Duration of seizure	6 hours of unresponsiveness
Presence of tongue biting	Not reported
Presence of incontinence	Not reported
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Did not open eyes or squeeze her hands to verbal commands but did have intact gag reflex, no focal deficits or abnormal posturing; eyes were open but closed mildly to threat
Treatment given for episode and response	IV flumazenil 0.1 mg twice, physostigmine 0.5 mg IV
Hemodynamic abnormalities during episode	None
Respiratory abnormalities during episode	None (tachypnea to 40s after IV fluamazenil 0.1 mg given)
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, depression, unresolved grief due to the recent death of a family member (death of stepson 6 months previously) leading to apathy, social withdrawal, feelings of helplessness, lethargy, loss of appetite, insomnia, and weight loss
Pre-operative prescription meds for mental illness?	Paroxetine 20 mg daily and trazodone 50 mg at bedtime
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	150 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (microscopic left complete ethmoidectomy, left middle meatal antrostomy, and facial scar revision)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Pre-operative midazolam, intraoperatively received fentanyl, propofol, rocuronium, nitrous oxide, isoflurane
Serological studies	ABG, glucose, and electrolytes were normal
Radiologic imaging results	CT head normal
Electroencephalogram results	EEG normal (alpha rhythm of 9 to 11 cycles per second with no slow or epileptiform waves)
Referral for psychiatric evaluation following episode?	Yes
Referral for neurological evaluation?	Yes
List of other pertinent medications	Estrogen, trazodone, paroxetine, zolpidem
List of allergies	Not reported
PMH	Depression, unresolved grief, sinusitis, cervical myalgia, distant pulmonary coccidioidomycosis; prior surgeries included appendectomy, thoracotomy and lung biopsy, partial hysterectomy, release of Dupuytren's contracture, transfer of ulnar nerve, face-lift, breast augmentation
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Hospital admission for observation for 48 hours

22. Psychogenic coma after dental surgery under general anesthesia (Yong)	
Age at onset of episode	33
Gender	Female
Ethnicity	Asian Indian
Description of seizure event	Did well in PACU and was about to be discharged but then found unresponsive prior to discharge with GCS of 3 and no response to sternal rub, trapezius squeeze, and mandibular pressure
Duration of seizure	27 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Yes, patient avoids hitting herself
Neurological exam	GCS of 3 and no response to sternal rub, trapezius squeeze, and mandibular pressure; pupils equal and reactive to light, and intact eyelash reflex
Treatment given for episode and response	IV flumazenil 0.4 mg, IV naloxone 0.2 mg, 1 gram of levitiracetam twice daily (but was discontinued after EEG was normal)
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes (after a prior normal vaginal delivery of her child)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Victim of domestic abuse who previously attended a psychiatric hospital for psychological trauma
Pre-operative prescription meds for mental illness?	None
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General anesthesia (due to severe dental phobia)
Duration of MAC or general anesthesia	53 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	Dental (dental tooth extraction)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	IV midazolam, IV fentanyl, VI propofol, sevoflurane, IV acetaminophen, IV dexamethasone, IV ondansetron
Serological studies	ABG, electrolytes, lactate, serum glucose, serum creatine kinase, liver function tests, and thyroid function tests were normal
Radiologic imaging results	CT head normal
Electroencephalogram results	EEG normal
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	No
List of other pertinent medications	None
List of allergies	Not reported
PMH	ASA I
Other	Patient reported being aware of what was happening throughout episode despite being in a state of apparent unsconsciousness and had been able to feel pain
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, an hour and a half
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, one and a half hours
Disposition	ICU admission, patient discharged the following day

23. Recurrent psychogenic paresis after dural puncture in a parturient (Nguyen)	
Age at onset of episode	29
Gender	Female
Ethnicity	Not reported
Description of seizure event	Bilateral lower extremity weakness and sensory deficit
Duration of seizure	14 hours started to notice some improvement, return to baseline at postoperative day 5
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not performed
Hand-raise drop test? Attempt to avoid hitting self?	Not performed
Neurological exam	Bilateral weakness of both hip flexion and extension. Her sensory examination was inconsistent and revealed decreased pinprick sensation on some tests and normal sensation on others. She did not appear concerned about her motor deficits
Treatment given for episode and response	Observation, supportive treatment
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes (had same symptoms after a lumbar tap was performed at 27 weeks gestation to diagnose meningitis)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Chiari Type 1 malformation
Type of anesthetic (general, MAC, regional)	Initially neuraxial anesthesia with spinal which was not sufficient (only obtained T10 sensory level), so was converted to general anesthesia
Duration of MAC or general anesthesia	2 hours
Type of surgery (general, orthopedic, gynecological, etc.)	Obstetric (C-section)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	13.5 mg of hyperbaric bupivacaine intrathecally, 10 mcg intrathecal fentanyl, 0.2 mg intrathecal morphine; general anesthesia medications (propofol, succinylcholine, nitrous oxide, sevoflurane, IV fentanyl, IV oxytocin, IV ondansetron)
Serological studies	Not reported
Radiologic imaging results	MRI spine negative
Electroencephalogram results	Not performed
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes (diagnosed as psychogenic paresis due to inconsistent upper and lower motor neuron signs)
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Asymptomatic Chiari Type 1 malformation, asthma, G4P1 parturient
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, two hours after spinal placement, patient was able to move legs back and forth on the bed
Disposition	Admission for observation for 5 days post-operatively

24. Recurrent psychogenic coma following tracheal stenosis repair (Meyers)	
Age at onset of episode	39
Gender	Female
Ethnicity	Not reported
Description of seizure event	Sudden unresponsiveness
Duration of seizure	12 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Yes (patient resisted having eyes opened)
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Unresponsive to external stimuli, CN2-12 normal
Treatment given for episode and response	Flumazenil and naloxone with no response
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes (3 weeks earlier had unresponsiveness for 36 hours postoperatively after another tracheal stenosis repair)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Depression, anxiety, history of sexual abuse by her father (who at times smothered her with a pillow; she states that she relives this experience whenever she has airway distress)
Pre-operative prescription meds for mental illness?	Paroxetine 20 mg per day which was held three weeks ago
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (repair of tracheostomy)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Fentanyl IV, propofol IV
Serological studies	Electrolyte levels, complete blood count, thyroid function tests, and ABG within normal limits
Radiologic imaging results	CXR no abnormalities, CT head showed mild volume loss with few nonspecific hypodensities but was otherwise unremarkable for hemorrhage or ischemic infarct
Electroencephalogram results	EEG was normal (nonspecific diffuse intermixed slowing that could be seen with benzodiazepine use but was not consistent with coma, unconsciousness, or significant neuropathologic disorder)
Referral for psychiatric evaluation following episode?	Yes (restarted her home paroxetine)
Referral for neurological evaluation?	No
List of other pertinent medications	Levothyroxine, lorazepam, clonidine, omeprazole
List of allergies	Not reported
PMH	Depression, anxiety, tracheal stenosis, OSA, morbid obesity, HTN, hypothyroidism, right-sided hearing deficit; has a surgical history of gastric stapling, emergency tracheostomy
Other	On recovery, she related that she had no memory of the spell
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, two hours following surgery
Disposition	Hospital admission for observation for 1 day and discharged the following day

25. An unusual case of hysterical postoperative coma (Maddock)	
Age at onset of episode	36
Gender	Male
Ethnicity	Not reported
Description of seizure event	Unresponsiveness (not responsive to painful stimuli including pressure behind jaw, over sternum, and over nailbeds; but occluding airway with Waters circuit and outlets occluded led to purposeful movement of patient grabbing the mask after 60 seconds)
Duration of seizure	6 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	No focal deficits
Treatment given for episode and response	Observation and time
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, depression, and prior episodes of self-harm
Pre-operative prescription meds for mental illness?	Citalopram
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (nasal septum surgery)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Fentanyl, thiopentone, atracurium, nitrous oxide, isoflurane, ketorolac, glycopyrrolate
Serological studies	Blood count, urea, electrolytes, glucose, liver enzymes, and arterial blood gas unremarkable
Radiologic imaging results	Not reported
Electroencephalogram results	Not reported
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Depression
Other	Patient was not responding to painful stimuli; dramatic step of occluding patient's airway was taken by applying a Waters circuit firmly to the patient's face with the outlets obstructed; this then led to a purposeful grab for the face mask after which he resumed his previous state; he denied any recollection of postoperative events
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Admitted to hospital for observation, discharged home the next morning

26. Hysteria: a cause of failure to recover after anaesthesia (Adams)	
Age at onset of episode	22
Gender	Female
Ethnicity	Not reported
Description of seizure event	Unresponsive, did not respond to verbal commands nor to application of painful stimuli to the limbs or chest
Duration of seizure	Four hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Reflexes were intact, no focal deficits
Treatment given for episode and response	Naloxone and doxapram (no response)
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes, had an episode three years previously when she passed during during a visit to the hospital dentist and was admitted to the ward after which she was hypotonic, unresponsive to verbal command and to painful stimuli and remained in this condition for 11 days
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Dental phobia previously undergoing desensitization treatment
Pre-operative prescription meds for mental illness?	No
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	None
Type of anesthetic (general, MAC, regional)	General anesthesia (has severe dental phobia)
Duration of MAC or general anesthesia	75 minutes
Type of surgery (general, orthopedic, gynecological, etc.)	Dental surgery
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Alfentanil, methohexital, vecuronium, nitrous oxide, isoflurane
Serological studies	Not obtained
Radiologic imaging results	Not obtained
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	Yes
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Dental phobia
Other	Worked as a nurse before, after four hours of unresponsiveness a tetanic stimulus of 50 Hz was applied for 5 seconds to the ulnar nerve at the wrist and the response was dramatic (she opened her eyes, sat up on bed, fully oriented in space and time, and announced she was sorry and was now ready to go home)
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Discharged home same day

27. Factitious disorder as a cause of failure to awaken after general anesthesia (Albrecht) – Case 1	
Age at onset of episode	36
Gender	Female
Ethnicity	Not reported
Description of seizure event	Unresponsive to verbal commands or noxious stimuli
Duration of seizure	Not reported
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Normal, no focal deficits
Treatment given for episode and response	Observation
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Yes (has previously exhibited prolonged postoperative paresis after straightforward removal of ganglion cyst under general anesthesia; four years ago was diagnosed with conversion disorder)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, histrionic personality disorder, conversion disorder
Pre-operative prescription meds for mental illness?	No
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	No
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (intranasal ethmoidectomy with middle antrostomies)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	IV morphine, IV thiopental, IV succinylcholine
Serological studies	Not reported
Radiologic imaging results	Not reported
Electroencephalogram results	Not reported
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes (realized that the patient looking surreptitiously at her surroundings when no one stood at her bedside)
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	ASA 2, recurrent sinusitis, juvenile onset diabetes mellitus for 21 years with resultant retinopathy and peripheral neuropathy
Other	Injection of ice water into the left ear (consistent with the vestibuloocular reflex test) caused the patient to sit bolt upright on her cart and exclaim “What did you have to do that for?” and she demonstrated marked rightward fast-phase nystagmus and experienced nausea
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Admitted for a 72 hour hospital observation and discharged home thereafter

28. Factitious disorder as a cause of failure to awaken after general anesthesia (Albrecht) – Case 2	
Age at onset of episode	32
Gender	Female
Ethnicity	Not reported
Description of seizure event	Suddenly became flaccid while talking on phone and fell backward onto her bed, unresponsive to verbal commands
Duration of seizure	Not reported
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Normal
Treatment given for episode and response	Sham/placebo intravenous injection of 1 mL of LR while declaring that medication was a "potent experimental anesthesia reversing agent"; 30 seconds after, she responded by moving slightly and speaking unintelligibly; then a second mL of LR was injected with further elaboration of the strength and resulted in immediate, complete awakening
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Histrionic personality disorder
Pre-operative prescription meds for mental illness?	No
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	No
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (zygote intrafallopian tube transfer procedure)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	IV fentanyl, IV midazolam, IV propofol, IV succinylcholine, isoflurane
Serological studies	Not obtained
Radiologic imaging results	Not obtained
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Infertility, Hashimoto's thyroiditis, recurrent streptococcal phatyngitis Surgical history included left nephrectomy as a donor and partial pancreatectomy for donation
Other	Patient reported no memory of the syncope-like episode
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, fully alert, cognizant, and conversant on transfer to the outpatient recovery unit, but 90 minutes later experienced spell
Disposition	Admitted for observation and discharged home the next day

29. Conversion phenomenon following general anesthesia (Orr) – Case 1	
Age at onset of episode	17
Gender	Female
Ethnicity	Not reported
Description of seizure event	Unresponsiveness, would not respond to verbal communication or pain (trapezius muscle pinch)
Duration of seizure	3 hours and thirty minutes
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	No focal deficits
Treatment given for episode and response	Observation, administration of 800 mL of 5% dextrose led patient to complain of bladder pain after an hour and she aroused thereafter to urinate
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, manic depression (patient was currently depressed during the surgery and was transferred from the psychiatric ward)
Pre-operative prescription meds for mental illness?	Haloperidol 5 mg three times daily for mania; currently receiving electroconvulsive therapy
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (removal of teeth numbers 17 and 32)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Methohexital, atropine
Serological studies	Complete blood count, blood glucose, and electrolyte concentrations were within normal limits
Radiologic imaging results	Not performed
Electroencephalogram results	Not performed
Referral for psychiatric evaluation following episode?	Yes, diagnosed the patient with hysterical conversion reaction resulting in unconsciousness
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Depression
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	Transfer back to psychiatric ward for observation

30. Conversion phenomenon following general anesthesia (Orr) – Case 2	
Age at onset of episode	23
Gender	Female
Ethnicity	Not reported
Description of seizure event	Unresponsiveness after walking with assistance prior in the PACU
Duration of seizure	24 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Lid reflex and corneal aversion tests were normal; on opening the patient's eyelids, the eyes were directed toward the ground no matter what the head position
Treatment given for episode and response	Ammonia capsule was broken and placed beneath the nares, and the patient opened eyes and began to cry but did not speak, naloxone 0.4 mg IV without effect; the next day, the patient remained unresponsiveness and had a brief episode of apnea and intubation was attempted but then the patient immediately recovered normal ventilatory efforts and actively resisted insertion of ETT and verbalized several profanities
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	History of alcohol abuse previously admitted to an alcoholic rehabilitation program one year ago
Pre-operative prescription meds for mental illness?	No
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (removal of tooth number 17)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Atropine, pentazocine lactate, diazepam 10 mg IV, methohexital 30 mg IV
Serological studies	Negative for blood alcohol and other toxic substances, normal electrolytes and glucose level, arterial blood gas was normal
Radiologic imaging results	Normal head CT
Electroencephalogram results	Normal EEG
Referral for psychiatric evaluation following episode?	Yes
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	History of alcohol abuse
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	Yes (patient walked with assistance in the recovery area)
Disposition	Patient was transferred to a local hospital for hospital admission and observation and then was discharged on POD#15 to a psychiatric ward for observation

31. An acute psychiatric episode following transvaginal oocyte retrieval – case report (Hwang)	
Age at onset of episode	34
Gender	Female
Ethnicity	Not reported
Description of seizure event	Sudden development of limb spasm (lower limb rigidity and spontaneous flexion of upper limbs), patient was stuporous and agitated in response to external stimuli; after 6-9 hours, the patient was able to open eyes but stared blankly and did not respond to external stimuli; the next day, she responded to her name but did not verbalize; she cried upon arrival of her husband
Duration of seizure	1 day (24 hours); started talking 3 days after procedure
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	No focal deficits
Treatment given for episode and response	Antihypertensive and sedative were administered (not specified)
Hemodynamic abnormalities during episode	Yes, tachycardia of over 160 beats/min and blood pressure up to 190/125
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (transvaginal ultrasound-guided oocyte retrieval)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	IV Fentanyl, IV propofol
Serological studies	Serum electrolytes, glucose, and arterial blood gas were normal
Radiologic imaging results	CT head was normal
Electroencephalogram results	EEG was normal
Referral for psychiatric evaluation following episode?	Yes (patient showed expressions of suffering when mentioned was made of the oocyte retrieval); she had three courses of supportive psychotherapy
Referral for neurological evaluation?	Yes
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	None
Other	Patient could not remember what happened in the 2 hours before anesthesia, and could not recall of her ICU admission
Regain of consciousness between anesthesia and first spell/episode and duration	No
Disposition	ICU admission, discharged 8 days after oocyte retrieval

32. Hysterical paraplegia simulating acute transverse myelitis after general anesthesia (Hobaika)	
Age at onset of episode	36
Gender	Female
Ethnicity	Not reported
Description of seizure event	Lower limb paralysis in addition to lumbar pain
Duration of seizure	9 days
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Non-uniform paresthesia distribution; anal tone and bladder control were preserved; patellar and plantar reflexes were normal
Treatment given for episode and response	Observation, placebo (corticotherapy) with mild improvement slowly over the hospital days
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Gynecological (video laparoscopic bilateral tubal ligation)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	IV midazolam, IV fentanyl, IV atracurium, IV propofol, isoflurane, nitrous oxide
Serological studies	Serum alcohol level normal
Radiologic imaging results	CT head and CT cervical/thoracic/lumbar spine were normal
Electroencephalogram results	Not performed
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes (reported to ambulatory neurology and the proposed diagnosis was hysterical paraplegia)
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	ASA II, prior episode of paraplegia due to transverse myelitis 7 years ago; surgical history included bariatric surgery and video laparoscopic cholecystectomy
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	No (as soon as she regained consciousness, she reported lower limb paralysis)
Disposition	Hospital admission for 8 days, discharged on day 9 when the patient walked with some difficulty

33. Postoperative conversion disorder (Afolabi)	
Age at onset of episode	28
Gender	Female
Ethnicity	Native American
Description of seizure event	Difficulty speaking, followed by right-hand numbness and weakness, and then inability to move her right leg (moved her right thumb but not other fingers, and unable to move the toes on her right foot)
Duration of seizure	1 day (24 hours)
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not applicable
Hand-raise drop test? Attempt to avoid hitting self?	Not applicable
Neurological exam	Decreased pin sensation from below the lateral side of the right elbow down to the thumb area and decreased pin sensation of the right thigh all the way down to the ankle region laterally. Decreased sensation in the 3 major divisions of the distribution of the right cranial nerve V. Motor strength was normal in the face, 5/5 on the right arm, and 3/5 on the right lower extremity. Decreased vibratory sensation in the right foot area. Proprioception was completely intact. No drift in the right upper extremity. Her grip strength appeared to vary over time. There was no hyperreflexia or hypertonia.
Treatment given for episode and response	Observation
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Yes (depression), also stressed from failing an examination prior to surgery
Pre-operative prescription meds for mental illness?	Yes although she had decided to stop taking her prescribed antidepressant medications more than a year previously
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Vascular (right-upper arm arteriovenous fistula revision)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Sevoflurane
Serological studies	Not reported
Radiologic imaging results	Negative head CT and head/cervical spine MRI
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes (diagnosed the patient as having conversion disorder)
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	ASA III, depression, obesity, HTN secondary to end-stage renal disease
Other	Follow-up two weeks later: patient reported residual numbness and tingling of right finger and toes; follow-up 1 month later: baseline function without any sensory deficit
Regain of consciousness between anesthesia and first spell/episode and duration	Yes (she was able to move herself from the OR table to her gurney without assistance or visible physical weakness); one hour duration between normal neurological exam and event
Disposition	Observation in hospital, discharged next day

34. Conversion paralysis after cervical spine arthroplasty - A case report and literature review (Boudissa)	
Age at onset of episode	45
Gender	Female
Ethnicity	Not reported
Description of seizure event	Left hemiplegia sparing the face; complete motor loss initially then incomplete with a marked decrease in muscle strength; sensation was normal and urethral and anal sphincters were spared; pain and temperature sensation on the right side was normal
Duration of seizure	>7 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not applicable
Hand-raise drop test? Attempt to avoid hitting self?	Not applicable
Neurological exam	As described above (it was that patient had differing neurological exams from different providers): first complete hemiplegia sparing the face, then hemiparesis, then tetraparesis, and finally hemiparesis again, and then neurologist found a high sensory level which was not apparent before; deep tendon reflexes were normal and symmetrical
Treatment given for episode and response	Observation
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Orthopedic (cervical spine arthroplasty)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	MRI brain and spinal cord were normal but unable to rule out spinal cord compression and thus a second surgical procedure was performed 7 hours after the first
Electroencephalogram results	Not performed
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Left cervico-brachial neuralgia due to left-sided C6-7 disc herniation without disruption of the posterior longitudinal ligament
Other	Electromyography and motor evoked potentials were normal
Regain of consciousness between anesthesia and first spell/episode and duration	No (had left hemiplegia after awakening from anesthesia)
Disposition	Due to inability to rule out spinal cord compression, a second surgical procedure was performed 7 hours after the first which did not reveal any abnormality; when she awakened her motor function was completely normal; she was admitted to hospital and discharged on day 7 and did not have any residual deficit at that time

35. Postoperative conversion disorder in a pediatric patient (Judge)	
Age at onset of episode	16
Gender	Female
Ethnicity	Not reported
Description of seizure event	Marked left-sided weakness involving face, upper, and lower extremities after first initially exhibiting normal motor function after awakening
Duration of seizure	3 days
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not applicable
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Pupils were equal and reactive. Sensation was intact to light touch. Over the ensuing two days, the patient demonstrated slow improvement in strength, spontaneous movements of the left-sided extremities, and the examiners noted Hoover's sign. This sign relies on the principle of synergistic contraction. Involuntary extension of the 'pseudo-paralyzed' leg occurs when flexing the contralateral, nonparalyzed leg against resistance. If downward pressure is felt from the contralateral heel while raising the nonparalyzed extremity, the weakness is likely nonorganic or, in this case, psychiatric in nature. If no pressure is felt, the patient is likely suffering from organic limb weakness.
Treatment given for episode and response	Observation, psychotherapy
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	1 hour
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (laryngoscopy and injection of gelfoam for left true vocal cord paralysis)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents)	Midazolam 1.5 mg IV, IV propofol, IV lidocaine, IV fentanyl, IV cisatracurium
Serological studies	Electrolytes, lactate, and CK enzyme were normal
Radiologic imaging results	CT head, MRI head, and MRA brain were all within normal limits
Electroencephalogram results	Not obtained
Referral for psychiatric evaluation following episode?	Yes (found significant evidence of baseline anxiety and emotional distress; over several months of psychiatric therapy, the patient was also found to have significant familial stressors involving recently divorced parents and tension with her new stepmother, as well as a difficult relationship with her boyfriend)
Referral for neurological evaluation?	Yes
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Recent upper respiratory tract infection, left true vocal cord paralysis
Other	EMG was normal
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, she demonstrated adequate strength and purposeful movement initially
Disposition	Admitted to hospital for observation, discharged home on postoperative day 8; during recovery, she required progressive use of wheelchair, a walker, crutches, and then braces; at 3 months patient reported that she was planning to resume normal activities; thereafter, she was lost to follow-up

36. A case of conversion disorder showing transient hemiplegia after general anesthesia (Nakagawa)	
Age at onset of episode	22
Gender	Male
Ethnicity	Chinese
Description of seizure event	Inability to move his left extremities and showed no response to painful stimuli after emerging from general anesthesia
Duration of seizure	24 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not performed
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Paralysis of the left side extremities and the disappearance of perception in these regions.
Treatment given for episode and response	Initiated treatment for brain infarction, however 12 hours after start of treatment, patient suddenly moved his left extremities
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	No
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	No
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	ENT (removal of the oral plate in the maxilla)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Not reported
Serological studies	Not reported
Radiologic imaging results	CT and MRI head negative
Electroencephalogram results	Not performed
Referral for psychiatric evaluation following episode?	Yes (diagnosed hemiplegia due to conversion disorder)
Referral for neurological evaluation?	Yes
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	ASA I
Other	Not reported
Regain of consciousness between anesthesia and first spell/episode and duration	No; after patient regained consciousness, he was unable to move his left arm and leg upon emergence
Disposition	Not reported

37. Hysteria: a cause for opisthotonus (Stoddart)	
Age at onset of episode	49
Gender	Female
Ethnicity	Not reported
Description of seizure event	Generalized convulsions followed by a 10 minute hypertonic stage during which she developed profound opisthotonus
Duration of seizure	Greater than 24 hours
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Not reported
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	Normal, no focal deficits
Treatment given for episode and response	7.5 mg IV midazolam which relieved the seizure and she opened her eyes and responded to simple comments, but then subsequently suffered over 30 similar episodes lasting between 5-70 minutes; IV procyclidine 10 mg twice, but did not produce any discernible effect
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No (SpO2 remained at 97-98%)
History of prior PNES	Yes (two prior episodes of opisthotonus lasting a few hours following general anesthesia)
History of epilepsy	No
History of mental illness (e.g. depression, anxiety, PTSD)	Yes, depression
Pre-operative prescription meds for mental illness?	Amitriptyline 150 mg at night
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	General
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	GI (elective repeat esophageal dilation)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Premedication with PO temazepam 20 mg, anesthesia induction with 120 mg IV propofol followed by IV atracurium 25 mg, isoflurane, nitrous oxide
Serological studies	CPK increased to 980 IU
Radiologic imaging results	Not reported
Electroencephalogram results	Not reported
Referral for psychiatric evaluation following episode?	Yes
Referral for neurological evaluation?	No
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Pharyngeal web, persistent chronic back pain
Other	Occupation is nursery nurse
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, 10 minutes between regaining consciousness and onset of seizure
Disposition	Admission to the ICU

38. Opisthotonus and hysteria (Crabb)	
Age at onset of episode	40
Gender	Female
Ethnicity	Not reported
Description of seizure event	Coarse bilateral tremor after arrival to the PACU affecting her arms, and soon extending to her legs; after 15 minutes, she developed extensor spasms of her shoulders and neck, and soon afterwards, episodic opisthotonus lasting a few seconds at a time, occurring every 3-4 minutes; muscular spasms continued over the subsequent 48 hours but only while patient was awake
Duration of seizure	Two days
Presence of tongue biting	No
Presence of incontinence	No
Retained pupillary response?	Yes
Forced eye closure with resistance to opening?	Not reported
Hand-raise drop test? Attempt to avoid hitting self?	Not reported
Neurological exam	During the opisthotonus, she remained fully conscious
Treatment given for episode and response	IV diazepam 20 mg which reduced abnormal muscular activity to a faint tremor; she was prescribed clonazepam 1 mg TID by the neurologist
Hemodynamic abnormalities during episode	No
Respiratory abnormalities during episode	No
History of prior PNES	Not reported
History of epilepsy	Not reported
History of mental illness (e.g. depression, anxiety, PTSD)	Not reported
Pre-operative prescription meds for mental illness?	Not applicable
Pre-operative prescription meds for epilepsy?	Not applicable
Risk factors for epilepsy	Not reported
Type of anesthetic (general, MAC, regional)	Regional anesthetic
Duration of MAC or general anesthesia	Not reported
Type of surgery (general, orthopedic, gynecological, etc.)	Pain procedure (lumbar epidural steroid injection at the L3-L4 interspace)
Intra-operative meds related to adjustment in mental status (e.g. ketamine, benzodiazepines, anticholinergics, dopaminergic agents, etc.)	Received 20 mL of lignocaine 1.5% with methylprednisolone via epidural route
Serological studies	Full blood count, electrolytes, glucose, and calcium were all normal
Radiologic imaging results	Not performed
Electroencephalogram results	Not performed
Referral for psychiatric evaluation following episode?	No
Referral for neurological evaluation?	Yes (concluded that the spasms were functional in nature)
List of other pertinent medications	Not reported
List of allergies	Not reported
PMH	Five-year history of low lumbar back pain and left-sided sciatica, breast carcinoma
Other	Occupation is medical secretary
Regain of consciousness between anesthesia and first spell/episode and duration	Yes, she was normal during transport to PACU and for a short time (although interval of normal neurological status was not specified)
Disposition	Transferred to neurological general care unit and over the next 5 days made a complete recovery without further treatment

PubMed search strategy:

P: anesthesia, anesthetic, surgery, postoperative complications
I: seizure, epilepsy, pseudoseizure, PNES, somatoform disorder

Employed in PubMed on 9/10/19 (yielded 694 total studies)

("anesthesia"[mesh] OR "anesthetic"[tiab] OR "surgery"[tiab] OR "postoperative complications"[tiab]) AND ("seizure"[mesh] OR "pseudoseizure"[tiab] OR "PNES"[tiab] OR "psychogenic"[tiab] OR "spell"[tiab] OR "convulsion"[tiab] OR "somatoform"[tiab])

PMID:

1. Psychogenic non-epileptic seizures after general anesthesia (Gregory Rose)
2. Psychogenic coma following upper endoscopy: a case report and review of the literature (Downs J)
3. Postoperative pseudoepileptic seizures in a known epileptic: complications in recovery (Ng)
4. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – case 1
5. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – case 2
6. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – case 3
7. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – case 4
8. Postoperative pseudostatus - everything that shakes is not epilepsy (Reuber) – case 5
9. Anaesthesia and pseudoseizures (Allen G, Farling P) – case 1
10. Anaesthesia and pseudoseizures (Allen G, Farling P) – case 2
11. Pseudoseizures and surgery (Collard)
12. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – case 1
13. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – case 2
14. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – case 3
15. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – case 4
16. Nonepileptic seizures following general anesthetics: a report of five cases (Lichter) – case 5
17. New-onset psychogenic seizures after surgery for epilepsy (Ney)
18. Psychogenic non-epileptic seizures in the post-anesthesia recovery unit (Ramos)
19. Psychogenic seizures after general anaesthesia (Parry)
20. Conversion paralysis after surgery for lumbar disc herniation (Hsieh)
21. Psychogenic coma after use of general anesthesia for ethmoidectomy (Weber)
22. Psychogenic coma after dental surgery under general anesthesia (Yong)
23. Recurrent psychogenic paresis after dural puncture in a parturient (Nguyen)
24. Recurrent psychogenic coma following tracheal stenosis repair (Meyers)
25. An unusual case of hysterical postoperative coma (Maddock)
26. Hysteria: a cause of failure to recover after anaesthesia (Adams)
27. Factitious disorder as a cause of failure to awaken after general anesthesia (Albrecht) – case 1
28. Factitious disorder as a cause of failure to awaken after general anesthesia (Albrecht) – case 2
29. Conversion phenomenon following general anesthesia (Orr) – case 1
30. Conversion phenomenon following general anesthesia (Orr) – case 2
31. An acute psychiatric episode following transvaginal oocyte retrieval – case report (Hwang)
32. Hysterical paraplegia simulating acute transverse myelitis after general anesthesia (Hobaika)
33. Postoperative conversion disorder (Afolabi)
34. Conversion paralysis after cervical spine arthroplasty - A case report and literature review (Boudissa)
35. Postoperative conversion disorder in a pediatric patient (Judge)
36. A case of conversion disorder showing transient hemiplegia after general anesthesia (Nakagawa)
37. Hysteria: a cause for opisthotonus (Stoddart)
38. Opisthotonus and hysteria (Crabb)