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Highlights:

- Delineation of functional seizures and epileptic seizures is supported by semiologic, experiential and phenomenological characteristics, including some visible on video recording and some which require direct patient questioning.
- Behavioural analysis in pre-ictal, ictal and post-ictal periods are critical to optimize the extraction of diagnostically useful data in individuals with functional seizures.
- Ictal testing with a focus on components that identify functional seizures can be supported by ictal testing batteries, and these are both feasible and effective when deployed in video telemetry.

Enhancing Diagnostic Yield in Functional Seizures: A Narrative Review, Design and Implementation of a Novel Ictal Testing Battery for Video Telemetry

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Abstract: (148/250)

Evaluation of behavioural impairment during functional seizures (FS) is critical for medical decision making, including accurate diagnosis, and future management recommendations. To date this type of behavioural evaluation in the setting of FS in an inpatient telemetry unit has not been closely reviewed. Here we perform a narrative review of the literature examining ictal testing and how best to improve diagnostic yield in the context of FS. We propose a novel ictal testing battery to obtain the most pertinent clinical information in people with functional seizures (PWFS). We then applied this novel ictal testing battery to patients as part of a service improvement project and compared it with the standard procedures in the video telemetry (VT) unit. This demonstrated significant improvement (Student's T-Statistic of 2.284 and a p-value of 0.014) in the amount of FS-specific information extracted as identified in the review, suggesting that such a battery is useful and can be utilised in the VT setting.

Keywords: Functional seizures, telemetry, electroencephalogram, ictal testing.

Introduction

Functional seizures (FS) present a significant diagnostic challenge, affecting 20-25% of patients admitted to epilepsy monitoring units for seizure-like events (1,2). Accurate diagnosis of FS relies on the simultaneous recording of video and electroencephalogram (EEG), with emphasis on differentiating these events from epileptic seizures (ES). Video telemetry (VT) is the gold standard; ictal testing batteries are employed to maximise diagnostic yield. These are usually targeted at the epilepsy population, with an emphasis on assessing aspects which aid epilepsy classification and localisation. We performed a narrative review to explore the literature and find the critical aspects of FS which may aid in delineation of these events.

Based on this review, we propose an ictal testing battery and perform a feasibility study to assess the utility of an ictal testing battery in enhancing the extraction of clinically relevant information during video telemetry (VT). This study aimed to compare the diagnostic yield from VT with the FS-informed novel battery, and the current standard operating procedure using one designed for epilepsy.

Aims

1. Review the current methods used to diagnose FS in VT settings, with particular focus on behavioural testing protocols.
2. Evaluate the feasibility of implementing an ictal testing battery in the inpatient VT setting for FS patients.
3. Compare the diagnostic yield during VT with and without the ictal battery, focusing on the feasibility of the implementation of the novel battery.

Considerations for assessment of FS in video telemetry

Background:

Approximately 20-25% of patients who present to a specialist monitoring unit for diagnostic evaluation of paroxysmal events or possible seizures are found not to have ES (1,2), but rather FS.
To secure a "documented diagnosis" of FS, a video recording with semiology consistent with FS and an EEG showing a lack of accompanying epileptiform activity, with preservation of normal cerebral rhythms before, during, and after the event, is required (1,2). Hence this is the gold-standard of diagnosis. Long term monitoring of the patient with VT is thus often required to capture ictal EEG.

Delineation from ES can prove diagnostically challenging, with misdiagnosis being relatively common (25%) and a significant rate of dual-diagnosis noted. It is estimated that 12% of people with ES have FS, and 22% of PWFS have epilepsy (1,2). Acute presentations of FS account for 10% of emergency seizure presentations and around 30% of cases in tertiary epilepsy centres (3). Diagnostic revision of apparent status epilepticus admitted to an intensive care unit (ITU) to FS occurs in 20% of cases (4,5). VT is fruitful for diagnostic purposes in over 50% of recordings (6). Accurate, early diagnosis thus provides the basis for an effective explanation of the condition to patient and family, which can be considered as a therapeutic intervention.

Previous reports suggest an average delay of seven years to the diagnosis of FS (7–9). Failure to recognise FS can cause morbidity or mortality from unnecessary treatment and indeed, there is evidence to suggest that ASMs can worsen FS severity (10,11). Early diagnosis reduces unnecessary and potentially harmful treatment, and permits more rapid appropriate management (7–9,12).

While some FS may be mistaken for ES, the converse may also occur. Differentiation based on clinical history alone can be challenging (13,14). Among these so-called 'chameleons 'is frontal

lobe epilepsy (FLE, particularly hyperkinetic seizures) (15–17), temporal lobe epilepsy (TLE, with ictal spitting, laryngeal spasm and ictal fear) and parietal lobe epilepsy (PLE) with ictal pain, ictal non-specific sensory disorder, or ictal alteration of perception (18,19).

Delineation of Epilepsy and FS

No single semiological feature is definite proof of FS, but rather constellations thereof can be useful, in conjunction with the electroencephalography (6,20–22). Some features convey reliable delineation of FS from FLE; for example, seizures occurring from EEG-confirmed sleep are much more likely to be FLE than FS (23). While the presence of symptoms may be a guide to diagnosis, the absence of the feature has less utility (20). Evidence suggests that collateral semiological history can sometimes be unreliable (24). The strongest delineating features during VT require staff-patient interaction and close observation (25).

FS and FLE were most reliably distinguished by the degree to which the seizure severity was modulated by the presence of staff (the observer effect (26)), whether the patient's eyes were open, closed or fluttering and whether the patient can recall information presented during the event. Post-ictal confusion or sleep, as well as abrupt onset of events suggest ES over FS (27). Lack of stereotypy is often considered a hallmark of FS in comparison to epilepsy, however a recent study has recognised a degree of stereotypy is also seen in FS presentations (19). Physical symptoms of autonomic arousal such as increases in heart or respiratory rate, sweating, subjective shortness of breath, choking feelings or chest discomfort, chills, hot flushes and unsteadiness and dizziness were reported in a high percentage of patients FS before, during or after the event (28–31). Recent work has related changes in the brain-heart axis to the onset of FS, and to preictal autonomic features (32–34).

The differential diagnosis of events on VT do not just include ES and FS. In panic attacks (a distinct category of event from FS), descriptions of depersonalisation, derealisation, and tremulousness can occur, though similar experiences may be occur in focal ES (28). If emotional symptoms are more isolated and brief, this is more characteristic of focal ES (28). Features that are useful in distinguishing panic attacks from epileptic seizures include a longer duration, associated cognitive symptoms, and the presence of specific environmental triggers in panic disorder. Paroxysmal symptoms in psychosis may sometimes raise the question of epilepsy but such symptoms (for example, hallucinations) can lack the stereotyped quality of epileptic phenomena and episodes are usually of long and variable duration (30). Other psychiatric disorders sometimes confused with epilepsy include depersonalisation disorder and attention deficit hyperactivity disorder (28,30,31,35). Catatonia may, paradoxically, both be mistaken for ES, or be a peri- or interictal feature of an epilepsy (36).

Overview of ictal testing in the epilepsy population:

The core purpose of ictal testing is to determine the dynamic neuro-cognitive expressions and deficits seen in association with an evolving event (semiology), and determine the presence and recovery from post-ictal deficits (37). Spread of the electrographic seizure to the region of the brain where it clinically manifests is often rapid and early features provide more information about the seizure onset zone (38,39). Hence, a comparison of the ictal semiological/behavioural/cognitive deficit and the interictal baseline can localise the symptomatogenic zone (39). Each component of semiology is associated with different positive predictive values in seizure onset zone localisation and lateralization (38,39). In contrast, based on our current understanding of the aetiology of FS, the semiology does not manifest as a response to aberrant synchronous cortical electrical activity (40). Work is ongoing to relate FS semiology to psychological aspects of their physiology (18).

A brief, user-friendly scheme for an appropriate ictal testing battery, to be used by non-experts with maximum utility in the inpatient VT setting has been proposed (41). Its focus is on identifying

the most useful semiological features early in their emergence (such as awareness and language), then moving through the testing paradigm to more individualised and bespoke items (such as visual field deficit). The neuro-biological rationale for this testing paradigm has been reviewed previously and guides to structured testing during seizures have since been developed (37,41). We have carefully considered these pre-existing testing options available to us in the inpatient VT setting and used them to create a modified testing battery for FS patients (Figure 2).

Assessing the level of awareness or responsiveness of the patient is critical, and is the first item tested in the ILAE testing scheme. PWFS generally have a significantly greater level of retained awareness or responsiveness (22). Postictally, patients may be amnestic of their awareness and so retrospective history will not be reliable (21,22,42). Aura experiences are also very valuable in helping to localise seizure onset when accurately recalled, however auras are also in fact relatively common in FS (70% reported in one study), and the most common symptoms are headache and dizziness (26,42,43). People with epilepsy may find their auras distressing, which may trigger a FS (21,26,42,43). Patients should be asked about these experiences during the seizure if possible, as after the event they may be amnestic. More nuanced clinical examination of motor, sensory, and visual patterns is required in functional presentations, as well as interactions such as the observer effect.

Assessment of FS in a VT setting

Baseline testing and clinical assessment:

The neurologist may suspect FS based on their initial assessment. Mental health history, trauma history, patient age and gender and a high burden of somatic symptoms (pain disorders for example) can be informative in the referral (44). Features that can help aid in the diagnosis include the duration of events, which is often much greater than two minutes in FS (4,20,23–25). Higher amplitude movements, and those that wax and wane, are suggestive of FS over ES (12,45), though frontal lobe seizures may also present with hypermotor semiology. Distinguishing motor features and other semiological differences are outlined in Table 1. Assessments should be prepared to look actively for features of both FS and ES as positive diagnostic features for both are useful, and non-exclusionary, as the two can co-occur.

The Anxiety, Abuse, and Somatisation Questionnaire (AASQ) is a clinically practical tool to distinguish epilepsy from FS. The AASQ's three domains index trauma (sometimes associated with FS (46–48)), somatisation (often a trait abnormality in FS (46)) , and anxiety (40). The AASQ can exclude FS with a high degree of confidence and can predict FS when considered alongside clinic-demographic variables (40). We recommend a modified version in our proposal to allow for the practicalities of an inpatient VT setting to be taken into account. (Figure 1).

During the event:

Initially, events should be attended with a battery that overlaps with the same domains for seizure testing as often it is unclear from the outset as to whether an event is epileptic or FS (49). Once a FS appears probable, the focus should be on assessing differentiating features such probing distractibility by asking them to tap their thigh with their hand. (50). The observer effect can be tested during the event. With more onlookers, particularly doctors attending the patient's bedside, the event may become more intense, strongly suggesting FS (51,52). Similarly, by asking relatives or other observers to leave the room, the converse can sometimes be observed. This effect can be enhanced with phrases such as, 'We know people can sometimes hear us during events, try focusing on what I am saying and the sounds around the room'. Attending staff need to observe if the patient clinically changes or responds to such a statement (26). Hiding an item in the room, in the presence of the patient during their event, and then postictally asking the patient where it is, allows for assessment of subconscious registration of memories during the event. Done sensitively, this may

help indicate a degree of preserved awareness during the event that the patient may not be able to access on postictal questioning.

After the event:

After the event, the level of drowsiness should be assessed, as PWFS rarely have protracted post-ictal drowsiness (51,53). Patient awareness or memory of the event should be questioned. Often, PWFS report some preservation of awareness during the events; they may endorse a partial memory of events (54). Physical assessment may reveal motor weakness, or other deficits such as aphasia or visual field defects, more indicative of a focal ES (54). Analysing patient's own drawings of their events may provide a useful additional perspective (55). At this stage, a patient can be asked to explain verbally or in writing any emotions or memories related to the event. This could provide deeper insight into the precipitants and nature of these events. The language used may provide support for the diagnosis of FS in some cases (56). Triggers and factors that may help terminate the FS should be explored.. The patient should be encouraged to describe what they felt physically, including autonomic and cardiorespiratory symptoms, such as palpitations or breathlessness.

Future possibilities:

Recent studies of automated testing have been published (57). This was a selection of video-recorded behavioural tasks triggered automatically to play by computerised seizure detection in the patient's room. This may reduce inter-rater variability in testing. PWFS were excluded from this study; however, this holds promise for future automated testing in both the epileptic and FS populations. In the future, with improvements in home video EEG monitoring, it will be important to consider if families will be able to administer a home testing battery.

Design and Application of the proposed ictal testing battery

Methods

This was a feasibility study aiming to assess the effectiveness of an ictal battery (as discussed in the review) in enhancing the extraction of clinically relevant data during video telemetry (VT) in patients with FS. This was performed as a service improvement project in the Sir Jules Thorn telemetry unit, National Hospital of Neurology and Neurosurgery. The study was conducted in two phases: a retrospective analysis of ictal assessments prior to the introduction of the ictal battery (control group) and a prospective analysis after its implementation (intervention group). In both cases, assessment was made by analysing the video record by a single rater, RK. Events were excluded if they had no video record available (i.e. if they occurred off camera). Each patient's first event where assessment occurred was chosen for analysis.

The ictal testing battery was developed based on the department's current epilepsy-targeted ictal testing battery (see Fig 2) and training was undertaken at the start of the intervention phase, in the form of sessions with the video telemetry team wherein the new battery was introduced and each component explained. All patients included in this study were referred to the VT unit for evaluation of their paroxysmal events. Inclusion criteria required a confirmed FS diagnosis based on video-EEG recordings (though the assessment with or without the battery may have occurred before this diagnosis was reached).

The primary outcome of this study was the fraction of required diagnostic data successfully extracted from each patient during telemetry with, or without the ictal battery implemented to determine feasibility of the present battery was to employ, over and above the usual practice in the VT unit. This was compared using an independent T-test (frequentist and Bayesian); one-tailed tests were chosen because the hypothesis was that the intervention would cause an increase in the percentage of components tested. Statistical analysis was performed using the statistical program, JASP (58).

Results

27 patients were analysed for **the retrospective** part, 18 patients were **tested with the new battery**. Eight patients had a dual diagnosis of epilepsy and FS (six pre-intervention, two post intervention). There were no significant differences between the two groups in age, gender or proportion with dual diagnosis epilepsy and FS. No participants were present in both pre- and post-intervention groups. No distress or detriment to the patient's routine care was effected by the introduction to the battery, as reviewed on the video record. Table 2 displays some of the characteristics of the assessed seizures, including their semiological details.

The most reliably assessed item on the battery was calling the patient's name, which was consistent before and after intervention. The hidden object was never captured on video, which may have reflected the inherent positioning of this action making it less likely to be caught on the camera aimed at the patient. The greatest change was seen in the introduction of the observer effect, with additional staff joining at different times and making their presence known to the patient 3% before the intervention, and 45% of the time after the intervention. These percentages are shown in more detail in figure 3.

The percentage of the components on the ictal battery which were assessed (component percentage, CP, the number of individual items on the battery which were tested, divided by the total number on the battery, of which there were 28, as a percentage) increased after application of the battery (figure 3). The data was normally distributed (Shapiro-Wilk W=0.98, p=0.63). Independent sample one-tailed T-test analysis showed a Student's T Statistic of 2.284 and a p-value of 0.014, with the alternate hypothesis that the post-intervention CP would be higher than the pre-intervention. Similar

results were found using Bayesian independent sample T-tests: Bayes Factor: 3.73, giving moderate evidence to support that there is a difference between the pre- and post-test CP.

To exclude confounding effects of seizure duration (as the longer the seizure, the more items are likely to be assessed), ANCOVA analysis was performed. Levene's test of equality of variance confirmed the data met assumptions for ANCOVA ($F=1.25$, degrees of freedom for the intervention and the seizure duration were 1 and 41 respectively, and the p value was 0.270). After including the seizure duration in the null model, the effect of pre/post intervention on CP remained significant ($F=5.56$, Tukey corrected $t=2.36$, $p=0.023$), see Figure 3. This supports the hypothesis that the increased CP is not an effect of different seizure durations between the two groups.

Discussion

The introduction of the ictal battery increased the fraction of diagnostic data extracted. Patients in the intervention group demonstrated a higher overall CP compared to those in the control group. Specifically, the ictal battery enabled more systematic and thorough testing of patient responses, awareness, and motor behaviours during the FS events. This suggests that the ictal battery is a feasible tool for use in clinical settings to enhance diagnostic yield.

The components that changed most after the battery's introduction were those specific to FS (for example, the observer effect). Conversely, others, such as the "hidden object" assessment and testing distractibility, still were rarely performed after introduction. Part of this effect might reflect the methodology for this study, where some actions may not be captured on the video record. The corollary to the finding that the FS-focused components changed the most, is the finding that the components which were pertinent to both ES and FS (for example calling the patient's name, which is relevant to assessing awareness in both situations) were consistent before and after intervention, supporting the non-deleterious nature of the battery. In other words, the battery did not reduce how well epilepsy-focused components were tested.

In the time-sensitive situation of ictal assessment, there is pressure to maintain safety while simultaneously maximising the utility of the recording. Incorporating a battery such as this into routine practice removes the need for trained assessors to weigh up what is a necessary question, but an excessive or overly complicated battery might be unapplicable. The results of this feasibility study demonstrate that the proposed ictal battery potentially represents a practical and effective tool for improving the extraction of clinically relevant information during VT monitoring of FS patients. The significant increase in the fraction of data extracted from patients using the ictal battery supports its potential utility in enhancing diagnostic accuracy. This improvement likely stems from the structured nature of the ictal battery, which ensures that critical behavioural and cognitive markers are systematically assessed during each FS event.

Limitations

Since FS-relevant items informed the battery's development, this experiment only tests its feasibility and utility—not its diagnostic accuracy.

The relatively small sample size limited our ability to detect more subtle trends in information gain, suggesting that further research with a larger cohort is needed to fully explore this aspect of the ictal battery's performance. Additionally, the uniformity of the sample, comprising exclusively FS events—may limit the generalizability of these findings to broader patient populations, particularly those with comorbid epileptic seizures and FS.

Future studies should focus on validating these findings in larger and more diverse patient populations, including those with probable epilepsy, as well as optimising the ictal battery for broader clinical use. This may involve refining the specific tasks within the battery to target key diagnostic markers more efficiently or integrating more advanced automated testing protocols.

Additionally, while inter-rater variability in this study is not a concern (as there was only one independent rater) future work will need to consider inter-rater variability. Moreover, exploring the impact of the ictal battery on clinical decision-making, treatment planning, and patient outcomes would provide valuable insights into its long-term clinical utility.

Conclusion

Overall, the review highlighted the need for a testing guideline tailored to FS patients. We suggest this as an addition to the pre-existing testing battery for ES. The overarching aim would be to improve accuracy and efficiency of diagnosis and thus aid in implementing appropriate management plans in a timely manner. The feasibility study demonstrates that the ictal battery is a feasible and effective tool for enhancing diagnostic data extraction during VT in PWFS. Although the sample size limits definitive conclusions regarding its impact on the rate of data extraction, the overall improvement in data yield supports further investigation into the broader application of ictal batteries in clinical practice. Future research with larger patient populations is warranted to fully assess and clarify the benefits of such a tool.

Declarations of interest:

MY has provided medicolegal opinions which have related to diagnoses of functional seizures or functional neurological disorders. Otherwise there are no conflicts of interest to report.

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Differentiating FS from ES events based on semiology			
Semiological feature	**Suggestive of:**	**Specificity for FS**	**Sensitivity for FS**
Fluctuating course	FS	96%(25,59), 96%(60)	69%(25,59), 42%(60)
Preserved awareness/Memory Recall	FS	96%(25), 93%(60) , 96%(59)	63%(25), 56%(60), 63%(59)
Eyes closed	FS	74-100%(25), 100%(60)	34-88%(25) , 33%(60)
Eyes fluttering	FS	100%(60)	50%(25)
Pelvic thrusting	FS	96-100% excluding frontal lobe focal seizures(25) , 96% across all seizure types(60)	1-31% excluding frontal lobe focal seizures(25) , 8% across all seizure types(60)
		No significant difference between FS vs frontal lobe focal seizures [77]	
Side-to-side head or body movements	FS	96-100% in convulsive events(25), 87% vs all seizure types(60)	25-63% in convulsive events(25) , 25% vs all seizure types(60)
Other people present affecting seizure	FS	100%(60)	55%(25),
Asynchronous movements	FS	96-100%(25), 78%(60)	47-48%(25), 17%(60)
Ictal crying	FS	100%(25), 91%(60)	13-14%(25), 8%(60)
		Specificity for ES	**Sensitivity for ES**
Postictal confusion	ES	94%(60), 84%(59)	55%(60), 67%(59)

Stertorous breathing	ES	100%(25), 100%(59)	61-91%(25), 61%(59)
Eyes opening or widening at onset	ES	100%(60)	84%(60)
Abrupt onset	ES	94%(60)	55%(60)
There was insufficient evidence to suggest diagnostic utility was found for gradual onset, non-stereotyped events, flailing or thrashing movements, opisthotonus, tongue biting, urinary incontinence (29).			

Table 1: Comparison of the specificity and sensitivity of various features regarding identifying functional seizures (FS) and epileptic seizures (ES).

Patient ID	Gender	Intervention group (pre/post)	Age	Diagnostic Group	Semiology	Seizure Duration (seconds)
1	M	Pre	63	FS	Subjective Sensory	389
2	F	Pre	46	FS	Generalised Motor	417
3	M	Pre	26	FS	Subjective Sensory	15
4	M	Pre	46	FS	Paucikinetic	189
5	F	Pre	28	FS	Generalised Motor	570
6	M	Pre	49	FS	Generalised Motor	137
7	F	Pre	33	FS	Paucikinetic	80
8	F	Pre	39	FS	Focal Motor	333
9	M	Pre	62	DD	Paucikinetic	1957
10	F	Pre	42	DD	Subjective Sensory	842
11	F	Pre	23	FS	Generalised Motor	311
12	M	Pre	50	FS	Generalised Motor	260
13	F	Pre	19	DD	Focal Motor	28
14	F	Pre	36	FS	Generalised Motor	63

15	F	Pre	24	FS	Paucikinetic	275
16	F	Pre	36	FS	Subjective Sensory	302
17	M	Pre	46	FS	Focal Motor	699
18	F	Pre	24	FS	Subjective Sensory	468
19	F	Pre	45	FS	Generalised Motor	1090
20	F	Pre	42	FS	Subjective Sensory	270
21	F	Pre	39	DD	Focal Motor	1298
22	M	Pre	80	FS	Focal motor	1856
23	F	Pre	46	FS	Paucikinetic	295
24	F	Pre	49	FS	Generalised Motor	81
25	M	Pre	50	FS	Subjective Sensory	125
26	F	Pre	63	FS	Subjective Sensory	139
27	F	Pre	41	FS	Paucikinetic	121
28	F	Post	30	FS	Generalised Motor	12
29	F	Post	22	FS	Subjective Sensory	2
30	F	Post	22	FS	Paucikinetic	780
31	F	Post	34	FS	Paucikinetic	180
32	M	Post	48	DD	Focal Motor	1230
33	F	Post	54	FS	Subjective Sensory	180
34	F	Post	40	DD	Paucikinetic	N/A
35	F	Post	48	FS	Subjective Sensory	600
36	F	Post	70	FS	Focal Motor	180
37	F	Post	40	FS	Focal Motor	1140
38	F	Post	34	FS	Generalised Motor	180
39	F	Post	23	FS	Generalised Motor	N/A
40	F	Post	21	FS	Paucikinetic	90

41	M	Post	58	FS	Generalised Motor	60
42	F	Post	54	FS	Generalised Motor	40
43	F	Post	28	FS	Generalised motor	280
44	F	Post	61	FS	Focal Motor	30
45	F	Post	40	FS	Subjective Sensory	420

Table 2: Characteristics of the included patients and the assessed seizures thereof. FS: Functional Seizures, DD: Dual Diagnosis Functional Seizures and Epilepsy, Pre: Preictal, Post: Postictal. The semiology of the events is categorised into generalised motor, focal motor, subjective sensory (i.e. those events characterised by subjective features reported by the patient) and paucikinetic (events marked by a lack of movement, such as freezing or slumping episodes) – adapted from Asadi-Pooya et al(61). Durations marked "N/A" had unclear offsets.

Pre-event Questionnaire		**Y/N**
Consent	Consent patient for activation procedures, including intermittent photic stimulation, hyperventilation and enquire as to non-invasive individual triggers.	
Somatic Features	Headaches	
	Palpitations	
	Light-headedness/Dizziness	
	Sweating	
	Anxiety	
	Fatigue	

Figure 1: The pre-event questionnaire, including components adapted from the Anxiety, Abuse and Somatisation Questionnaire (AASQ)

Event Testing	Check
Safety!	
Check camera and light, uncover patient	
Check and document if button pushed	
Say out loud if: pallor, flushing, sweating, small jerks, small eye movement	
Call the patient's name	
Hide an object in the room, making sure patient sees it or are alerted to its placement (without addressing patient directly)	

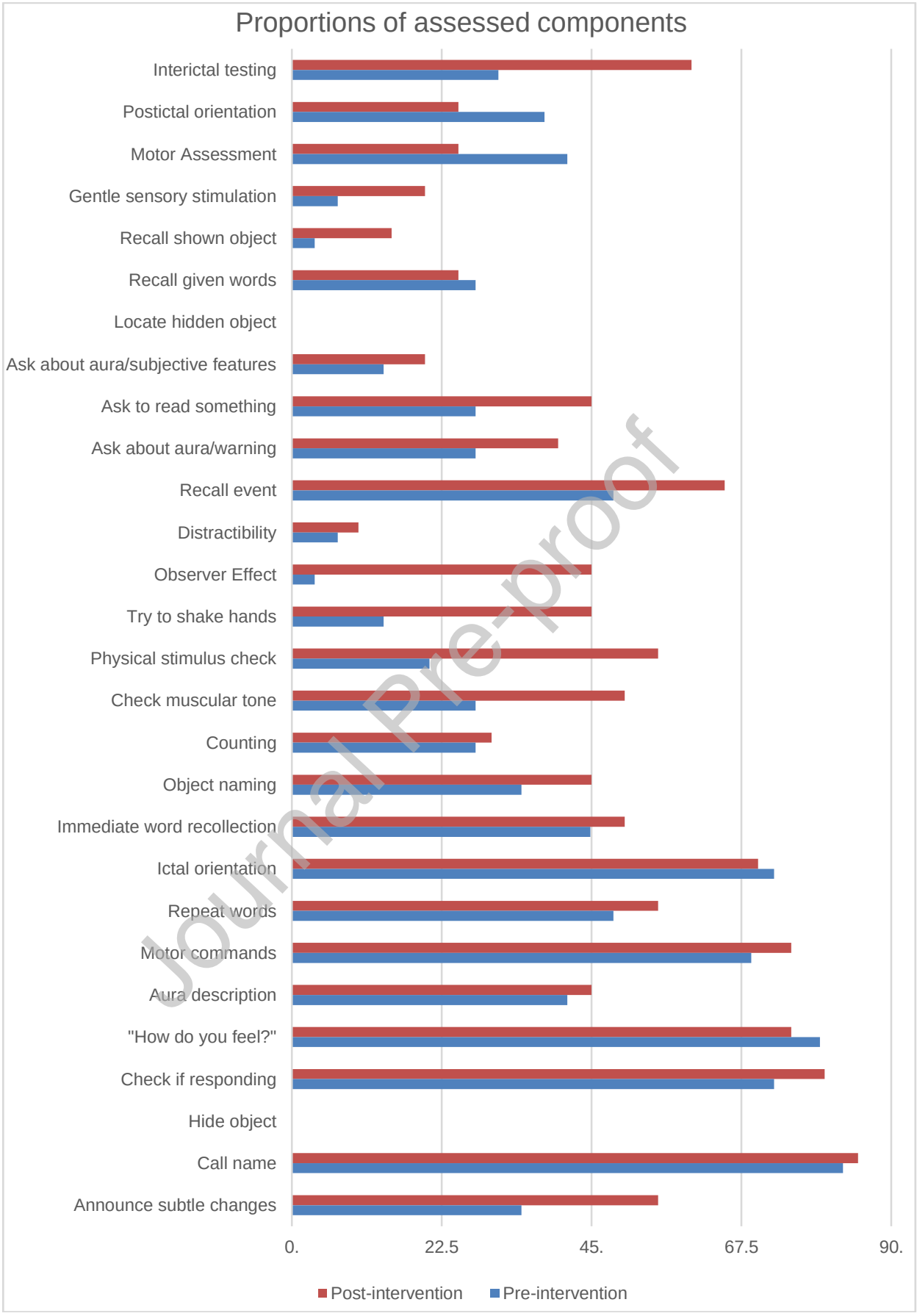
If responding		**If not responding**	
"How do you feel?"		Touch patient and check for a response (warn patient before touching them)	
"What are you experiencing?"			
"Lift up your arms" (initially say it, then show it if command not followed)			
"Please repeat: Horse, Table, Dog, Red"			
"What is your name? Where are you? What is the date"			
"What were the words I asked you to repeat?"		Try to shake patient's hand, feel for resistance	
Object naming: "What is this?" - if they cannot name the object, ask "what is this used for?" If no response, show the item and ask them to remember it.			
"Please count from 1 to 10"			
Check muscle tone			
Test oberver effect: observe if staff attending changes or enhances the attack			
Assess for distractibility (if responding, use distracting tasks – if not then startle)			

Post event testing:	
"Do you remember the event? What do you remember? What do you remember about the testing?"	
"Did you have a warning or an aura" - ask them to write about, draw or describe any subjective experiences	
"What were the words I asked you to repeat?"	
"What was the object I showed you?"	
Gentle sensory stimulation	

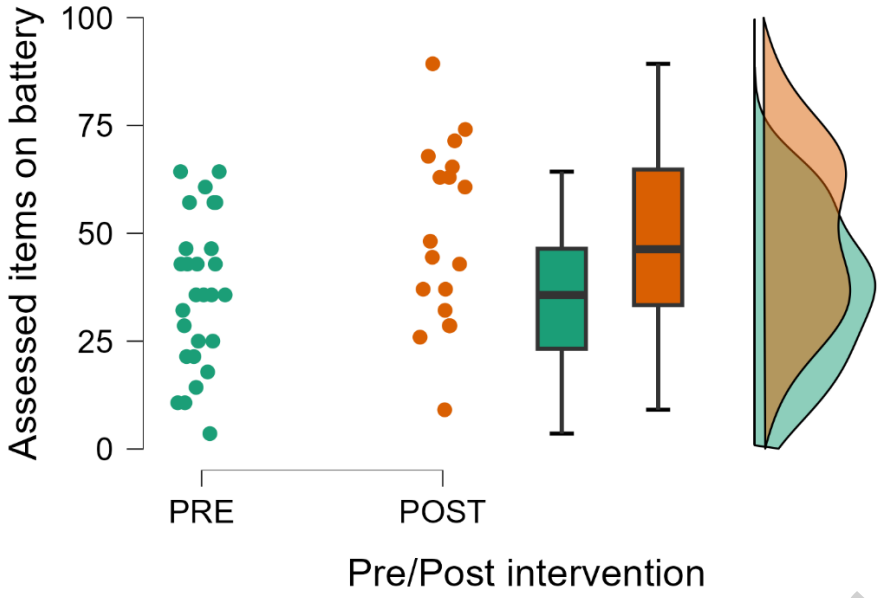
Motor assessment: "Can you lift both your arms; can you lift your legs, one at a time?"	
“What is your name? Where are you? What is the date?”	
“Did you have any other symptoms at the start of the event, or now?”	
“Can you tell me where the [object] is?” - if the patient is unable to locate then try forced choice paradigm. If fails, then observe later if patient locates it independently.	

Figure 2: The updated ictal testing battery, including both the established epilepsy-focused ictal testing components and the novel parts as suggested by our narrative review. This includes the postictal testing component.

A:



B:



C:
ANCOVA – Percentage of ictal battery items interrogated

Cases	Sum of Squares	df	Mean Square	F	p
Pre/Post intervention	1966.419	1	1966.419	5.556	0.023
Seizure Duration (Seconds)	266.723	1	266.723	0.754	0.391
Residuals	14157.465	40	353.937		

Note. Type III Sum of Squares

Post Hoc Comparisons - Pre/Post intervention

		Mean Difference	SE	t	p_{tukey}
PRE	POST	14.115	5.988	2.357	0.023

Figure 3: A: Proportions for each component of the ictal testing battery which were assessed before and after the introduction of the ictal testing battery ("Pre", and "Post" respectively), B: Comparison of the percentage of items on the ictal testing battery which were assessed before, and after the

introduction of the ictal testing battery (intervals are 95% . C: ANCOVA analysis of the effect of the intervention with the seizure duration (in seconds) included as a confounding factor.

Conflict of Interest

Regarding the submission: “Enhancing Diagnostic Yield in Functional Seizures: A Narrative Review, Design and Implementation of a Novel Ictal Testing Battery for Video Telemetry”, MY has provided medicolegal opinions which have related to diagnoses of functional seizures or functional neurological disorders. Otherwise there are no conflicts of interest to report.