

Neurological examination: what do psychiatrists need to know?

ARTICLE

Andrew J. Larner , Killian A. Welch & Alan J. Carson

SUMMARY

Psychiatrists may be daunted by the prospect of undertaking a neurological examination. In this article we briefly review the neurological signs that may be seen in the context of some common neurological disorders of cognition and movement which may present with neurobehavioural symptoms and therefore may be seen initially by psychiatrists. This approach emphasises that neurological examination is not simply an operationalised procedure but an interpretative process. We propose a minimum neurological examination suitable for use by psychiatrists. Many of the signs included are relatively simple to observe or elicit, require no special equipment, and the examination techniques involved are easy to master.

LEARNING OBJECTIVES

After reading this article you will be able to:

- conduct a brief, focused neurological examination in patients presenting with psychiatric symptoms but in whom there is clinical suspicion of an underlying neurological disorder
- apply the neurological examination findings to the differential diagnosis of common cognitive and movement disorders
- feel more confident when discussing the neurological examination findings if consultation with a neurologist is required.

KEYWORDS

Cognition; diagnosis; examination; neurology; psychiatry.

encounter patients with so-called neurological symptoms in the context of so-called psychiatric disorders. It therefore behoves neurologists to be aware of those situations in which psychiatric symptoms may reflect medical conditions (Lyketsos 2008; Welch 2018). Likewise, psychiatrists should know something of neurological syndromes that can be mistaken for psychiatric conditions (Butler 2005) and how to conduct some form of neurological examination to help identify such disorders. Although neurologists are approachable and willing to give advice (by telephone, email or video call) if psychiatrists are concerned about the possibility of an underlying neurological disorder, they may want to know some basic examination findings in order to formulate a diagnosis or plans for investigation.

The neurological examination may be a daunting prospect for the uninitiated. A standard textbook on the subject runs to nearly 800 pages over 53 chapters (Campbell 2012), and hundreds of neurological signs are described, each with their semiologic value (Larner 2016). This profusion may be one factor contributing to the induction of ‘neurophobia’ (Jozefowicz 1994) among both students and trainees. However, this apparent superfluity may be broken down into a more manageable number of domains (Box 1). It should also be borne in mind that few neurological signs have been subjected to rigorous examination in the form of diagnostic test accuracy studies, and that neurological examination may have both qualitative and Bayesian elements, born of previous clinical experience and significantly informed by the preceding neurological history taking.

What skills in neurological examination does the practising psychiatrist actually need? Some guidance has already been published (Sanders 1998; Garden 2014). There are also some previous attempts to define a suitable neurological examination for use by psychiatrists (Box 2). Of these, the Neurological Evaluation Scale (NES; Buchanan 1989) seems to have attracted most attention, at least in terms of publications. The NES was designed to standardise the assessment of neurological impairment in schizophrenia. It is a battery consisting of 26 items, generating a total score,

Andrew J. Larner is a consultant neurologist at the Walton Centre for Neurology and Neurosurgery, Liverpool, UK. **Killian A. Welch** is a consultant neuropsychiatrist in the Robert Fergusson Unit, Royal Edinburgh Hospital, UK. **Alan J. Carson** is Professor of Neuropsychiatry in the Department of Clinical Neurosciences, Western General Hospital, Edinburgh, UK. **Correspondence** A.J. Larner. E-mail: a.larner@thewaltoncentre.nhs.uk

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The essential unity of neurology and psychiatry as disciplines that address disordered function of the nervous system has been obscured by the historical development of professional boundaries between them. It is to be hoped that in the fullness of time a unified and integrated discipline (neuropsychiatry? psychoneurology? brain medicine?) will develop (Zeman 2014).

In clinical practice this overlap is daily manifest to clinicians. Those trained as neurologists will encounter patients with so-called psychiatric symptoms in the context of so-called neurological disorders, and those trained as psychiatrists will

BOX 1 Domains of the canonical neurological examination

Elemental

- Cranial nerves: I–XII
- Motor system:
 - appearance
 - tone
 - power
 - coordination
 - reflexes (tendon, myotatic, phasic; cutaneous)
 - gait
- Sensory system:
 - light touch
 - pain
 - temperature
 - proprioception
 - (vibration)

Higher, or cognitive, function

- Consciousness/attention
- Language
- Perception
- Memory
- Executive function

functional areas of interest and individual items. Preliminary validity data demonstrated the ability of the battery to discriminate patients with schizophrenia from non-psychiatric controls. This is quite a detailed and potentially lengthy approach; a shortened version has also been described (Ojagbemi 2017). At the other end of the spectrum, the ultra-minimalist ‘doorway physical exam’ (Box 3) may be used (Madan 2002), although some may find it stigmatising and potentially disrespectful.

In neurological practice, examination is not simply an operationalised procedure, but an interpretative process. The patient history, supplemented where necessary by collateral history from a knowledgeable

informant, forms the context for a targeted neurological examination to test diagnostic hypotheses formulated from the history. If one accepts the essential unity of neurology and psychiatry, the same process is surely true for practice in psychiatry. If there is no diagnostic hypothesis emergent from the history, then (and only then) might an itemised neurological screening examination be undertaken, with the proviso that a diagnosis is unlikely to be clinched from examination findings alone.

As psychiatrists have offered helpful advice on psychiatric disorders presenting to medical, most often neurological, settings (Welch 2018), reciprocal advice addressing the desirable elements of neurological examination for psychiatric presentations of neurological disorders might also be of value. The aim of this article is to offer some pragmatic suggestions concerning neurological examination that may be applicable in day-to-day psychiatric practice. Rather than an iterative ‘sign by sign’ or ‘item by item’ approach, the focus is on ‘neurological disorders’ in which ‘psychiatric symptoms’ are prominent, hence which may present to psychiatrists in the first instance. Disorders of cognition and movement in particular are considered, to illustrate pertinent neurological examination techniques, although many other neurological disorders may sometimes manifest psychiatric symptoms (e.g. multiple sclerosis), although seldom as the initial presenting complaint. Many of the examination techniques are relatively simple to perform, require no special equipment and are easy to master. Traditional learning by examining patients may be supplemented by recourse to online resources, for example videos demonstrating neurological signs (Morris 2015).

Cognitive disorders

The value of simply observed categorical signs should not be underestimated in the context of cognitive disorders. Patients with cognitive complaints are routinely requested to bring a knowledgeable informant to appointments to provide collateral history, and failure to do so (the ‘attended alone’ sign) has a high positive predictive value for the absence of cognitive impairment, whereas the ‘attended with’ sign has a high sensitivity for cognitive impairment (Larner 2020). Head turning towards an informant during the early phases of history taking is a frequently observed sign in patients attending with cognitive symptoms, more so in Alzheimer’s disease than in other dementias and with an intermediate frequency in mild cognitive impairment, and has a high positive predictive value for the presence of a cognitive disorder (Ghadiri-Sani 2019). These signs have been incorporated

BOX 2 Existing neurological examination schedules for use by psychiatrists

- Physical and Neurological Examination for Soft Signs (PANESS) – 1976–1978
- Neurological Evaluation Scale (NES) – 1989–2016
- Convit’s Quantified Neurological Scale – 1994
- Cambridge Neurological Inventory (CNI) – 1995

BOX 3 The 'doorway physical exam'

Madan suggested this examination for use in the emergency department, where it could even be performed while observing the patient from a doorway.

- Is the patient awake?
- Pupillary reactions (Madan suggested these could be checked by flicking the lights on and off).
- Observe for facial droop.
- Observe for proper articulation (Madan suggested of profanity).
- Observe gait (Madan suggested this be done while the patient tries to leave the room: 'Is she or he moving all four limbs?')
- Strength assessment (Madan suggested this could be based on the number of security guards required)

(Adapted from Madan 2002)

into an interactional profile to assist the differential diagnosis of neurodegenerative and functional memory disorders (Reuber 2018), as may particular features of communication (Bailey 2018).

Alzheimer's disease

Currently most patients with Alzheimer's disease are seen in old age psychiatry clinics. Episodic memory deficit is usually the earliest and most prominent symptom, with behavioural and psychological symptoms of dementia (BPSD) more common in the later stages. Routine neurological examination is usually unremarkable: myoclonus and Parkinsonism may be seen (Box 4 gives a glossary of neurological terms used in this article), usually late in the disease course. In early-onset Alzheimer's disease, arbitrarily defined as onset at ≤ 65 years of age, such as those cases arising from mutations in the presenilin-1 gene, various neurological signs may be found, including myoclonus, Parkinsonism and, rarely, spastic paraparesis and cerebellar ataxia (Larner 2013a). Variant forms of Alzheimer's disease may also have prominent neurological symptoms, such as the visual complaints in posterior cortical atrophy and language deficits in logopenic progressive aphasia (Dubois 2014), and more usually present directly to ophthalmologists and neurologists respectively.

Simple tests of limb praxis, the translation of an idea into action, may be of use in diagnosis of Alzheimer's disease. These include pantomiming learned actions, such as brushing the hair or striking and blowing out a match, or copying meaningless hand gestures or postures. Limb apraxia is relatively common at presentation in all the Alzheimer's disease variants (Ahmed 2016).

BOX 4 Glossary of neurological signs

Akinesia: difficulty initiating voluntary movements.

Apraxia: impaired praxis, i.e. the performance of learned skilled movements, in the absence of muscle weakness or ataxia.

Cerebellar ataxia: lack of coordination as a consequence of disease of the cerebellum or its connections, which may manifest as intention tremor, dysmetria (past-pointing), dysdiadochokinesia, dysarthria, unsteady gait and abnormal eye movements.

Chorea: jerky, restless, literally dance-like movements that give rise to a fidgety appearance.

Fasciculation: rapid, flickering, twitching, involuntary movements observed within a muscle belly.

Imitation behaviour: a component of the environmental dependency syndrome in which the patient reproduces, unbidden, the examiner's gestures (echopraxia) or utterances (echolalia).

Logopenia: a language disorder characterised by word-finding pauses and impaired repetition of phrases and sentences but with relatively preserved phrase length and syntactically complete spontaneous speech.

Myoclonus: involuntary, arrhythmic, 'shock-like' muscle jerking.

Paraparesis: weakness of the lower limbs. May be further classified as spastic (upper motor neuron pathology) or flaccid (lower motor neuron pathology).

Parkinsonism: a clinical syndrome characterised by the presence of some or all of the following features: akinesia, rigidity, bradykinesia, rest tremor, impaired postural reflexes.

Rigidity: increased resistance to passive joint movement, which is constant throughout the range of joint displacement, sometimes referred to as 'lead-pipe' rigidity.

Spasticity: increased resistance to passive joint movement due to abnormally high muscle tone, which varies with the amplitude and speed of displacement of a joint (*cf.* rigidity).

Tremor: an involuntary movement, roughly rhythmic and sinusoidal (*cf.* chorea, myoclonus).

Utilisation behaviour: a component of environmental dependency syndrome in which there is unbidden use of external stimuli, sight of an object implying that it should be used.

(Adapted from Larner 2016)

Frontotemporal dementia

Patients with the behavioural variant of frontotemporal dementia (bvFTD) are often, and understandably, referred for psychiatric assessment in the first instance. Neuropsychiatric manifestations include apathy, disinhibition, loss of insight, transgression of social norms, emotional blunting, and repetitive and stereotyped behaviours. Psychiatrists generally recognise that these symptoms do not fit any

disorder recognised in the psychiatric classification. Of the linguistic variants of frontotemporal dementia – non-fluent (agrammatic variant of primary progressive aphasia) and fluent (semantic variant of primary progressive aphasia) – behavioural symptoms may be more prominent in the latter, because of the failure of comprehension. Non-fluent cases may sometimes be erroneously labelled as Alzheimer’s disease or vascular dementia (Randall 2020).

Neurological examination is usually unremarkable. Mild akinesia and Parkinsonian gait or posture may occur. Limb apraxia is less common than in Alzheimer’s disease, with the possible exception of non-fluent progressive aphasia (Ahmed 2016), and the cumulative probability of myoclonus is lower than in Alzheimer’s disease or dementia with Lewy bodies (Beagle 2017). Motor sequencing deficits may be found with frontal pathology, as shown with the Luria three-step test: a repeated series of hand movements (fist, edge, palm) is shown to the patient, who is then asked to reproduce them. Environmental dependency behaviours such as imitation behaviour and utilisation behaviour may occur or be provoked in people with bvFTD (Ghosh 2013). Imitation behaviour is the unbidden reproduction by the patient of gestures (echopraxia) or utterances (echolalia) made by the examiner in the patient’s presence. Utilisation behaviour, in which seeing an object implies that it should be used, may be tested by handing the patient a cup or a pair of glasses without comment or instruction, and seeing whether the items are appropriately used.

Psychotic symptoms (delusions, hallucinations) are generally rare in frontotemporal dementia, with the possible exception of that with concurrent motor neuron disease (FTD+MND). In one series of patients with FTD+MND, over two-thirds were under the care of a psychiatrist at the time of neurological diagnosis, some with provisional diagnoses of hypomania or depression, and all were receiving either antidepressant or antipsychotic medications (Sathasivam 2008). FTD+MND sometimes manifests an early psychotic phase characterised by hallucinations and delusions, which may be dramatic and bizarre (Larner 2013b; Ziso 2014) but is often transient. FTD+MND is often genetic, a consequence of hexanucleotide repeat expansions in *C9orf72*, which may also present as obsessive–compulsive disorder or bipolar disorder. Examination of the motor system may be useful here, sometimes disclosing focal wasting and weakness, with muscle fasciculation, particularly in the shoulder girdle musculature; indeed, such signs may alert clinicians to the need for revision of pre-existing psychiatric diagnoses (Ziso 2014). A combination of upper and lower motor neuron signs, particularly

in the same muscle (e.g. biceps spasticity and brisk reflex in a fasciculating and weak muscle), is highly suspicious for concurrent MND.

Vascular dementia

Vascular dementia or cognitive impairment has multiple types (Skrobot 2017). That consequent on large vessel infarction may be attended with obvious focal neurological signs, such as spastic hemiparesis with hemiparetic gait, aphasia or visual field defect, dependent on the affected arterial territory. Hemisensory dysfunction may also be a feature. More likely to be encountered in psychiatric practice is vascular cognitive impairment due to small vessel ischaemic disease, in which behavioural features such as emotional lability may be prominent, along with a subcortical pattern of cognitive deficits typified by slow information processing, apathy and difficulty sustaining attention. A gait disorder characterised by short steps and a broad base but with relative preservation of upright stance (compare with Parkinson’s disease, where stooped posture is common), and sometimes termed *marche à petit pas*, may be seen in subcortical ischaemic vascular cognitive dementia or impairment. Limb rigidity of Parkinsonian type, often more evident in the lower limbs, may also occur (Staekenborg 2008).

It should of course be remembered that concurrence of vascular and Alzheimer type pathology, mixed dementia, is relatively common in older people, and that vascular changes on brain imaging do not automatically equate to vascular dementia or vascular cognitive impairment (although they increase the risk of later dementia and mandate the treatment of vascular risk factors). The presence of such neuroimaging appearances in people with functional cognitive symptoms may also be a particular issue, leading to incorrect initial diagnoses or undermining patient confidence in the diagnosis of functional disorder. The key, as ever, is to base the diagnosis on the patient’s symptoms, not neuroimaging in isolation.

Dementia with Lewy bodies

Visual hallucinations are one of the core diagnostic criteria of dementia with Lewy bodies (DLB) (McKeith 2017), often taking the form of complex images of people or animals. Insight that these are not real is often preserved (hence they are sometimes referred to as ‘pseudo-hallucinations’) and there is often a lack of associated distress, two features that may help to distinguish these visual hallucinations from those occurring in psychiatric disorders. A sensation of a presence, someone standing beside the patient (*anwesenheit*), is another

symptom that may prompt psychiatric referral, although visual hallucinations are atypical for psychiatric disorders and auditory hallucinations are not a recognised feature of DLB. Diagnostic clues may include the pattern of cognitive decline, which is fluctuating and with attention and visuospatial function affected more than memory and orientation. Parkinsonian motor features may be subtle or absent in the early stages of disease. There is reported to be a higher cumulative probability of developing myoclonus in DLB than in Alzheimer's disease (Beagle 2017). Enquiries for a prior history of rapid eye movement (REM) sleep behaviour disorder ('dream enactment') or of anosmia may also be of value in reaching a diagnosis of DLB.

Prion diseases

Psychiatric features are relatively frequent in sporadic Creutzfeldt–Jakob disease (sCJD), the most common of the human prion diseases, but these are not adequately encompassed within current diagnostic criteria (Ali 2013). Sporadic CJD can sometimes have a long 'psychiatric' prodrome with features suggestive of depression, and one of the rare molecular subtypes of sCJD (VV1) can present with prominent psychiatric features in young people. Visual hallucinations may sometimes occur in sCJD, usually elemental forms (colours, shapes) in contrast to the formed visual hallucinations of DLB (Du Plessis 2008). Psychiatric features are also common in the early stages of variant CJD, including dysphoria, social withdrawal and anxiety. Limb myoclonus may be an early clue to the diagnosis of sCJD, but other neurological signs may also occur, including cerebellar ataxia, pyramidal (spasticity, hyperreflexia) and extrapyramidal (akinesia, rigidity) signs (Nakatani 2016).

Functional neurological disorder – cognitive subtype

Cognitive symptoms of functional origin are commonly encountered in clinics dedicated to cognitive disorders, prompting the development of diagnostic criteria akin to other functional neurological disorders (Ball 2020). The 'attended alone' sign may be suggestive of this diagnosis (Bharambe 2018), likewise the provision of a written list of symptoms, *la maladie du petit papier* (Randall 2018), both signs indicative of the inconsistencies between self-reported symptoms and everyday function which typify functional disorders (Ball 2020). A detailed description of episodes of forgetting is also indicative of internal inconsistency, and contrasts with the inability of individuals with amnesia to give any such account (Bailey 2018). Limb praxis may be

preserved in patients diagnosed with subjective cognitive impairment (Ahmed 2016).

Movement disorders

The patient's facies (general appearance), station and gait may immediately raise suspicion of a movement disorder, as exemplified by James Parkinson's identification of three of his original six cases merely in passing on the street. Involuntary movement disorders such as myoclonus, tremor or chorea may also be immediately apparent.

Parkinson's disease and other Parkinsonian syndromes

Although patients with the typical motor features of Parkinson's disease (akinesia, rigidity, rest tremor, stooped posture) are unlikely to present initially to psychiatrists, the emergence of visual hallucinations, either spontaneous or with dopaminergic therapies, suggestive of the development of cortical Lewy body disease, may prompt psychiatry referral, as might progression of Parkinson's disease to cognitive impairment and dementia.

The applause sign, clapping more than three times in imitation of the examiner's demonstration of three claps, was first described in progressive supranuclear palsy (PSP) and later in other disorders, such as Alzheimer's disease and frontotemporal dementia, although less frequently than in PSP and DLB (Isella 2013). The applause sign is a motor perseveration, probably indicative of frontal lobe dysfunction.

Huntington's disease

The behavioural features of Huntington's disease, including irritability, apathy, depression and schizophrenia-like features, along with subcortical-type cognitive decline, may prompt initial psychiatric referral. Observation of chorea may suggest the diagnosis, although these movements can be subtle.

Minimum neurological examination

The consideration of these neurological disorders which may present initially to psychiatrists informs the considerations for a provisional 'minimum neurological examination' suitable for application in psychiatric practice (Box 5). This is not presented as prescriptive (or proscriptive), but simply as a heuristic of potential utility for the psychiatrist faced with a patient with a possible neurological disorder.

The schema emphasises the importance of observation. Many of these signs may be evident within seconds of meeting the patient (e.g. facies, posture, gait, 'attended alone' or 'attended with' signs, involuntary movements) and do not require sophisticated equipment for their detection (e.g. head turning sign,

MCQ answers

1 b 2 b 3 d 4 c 5 d

BOX 5 Suggested minimum neurological examination**Observation**

- Attends with informant? Attends alone?
- Head turning sign towards informant during history taking?
- Facies, posture
- Abnormal involuntary movements: tremor, myoclonus, chorea?
- Gait: Parkinsonian? *Marche à petit pas*? Hemiparetic?
- Muscle wasting, fasciculation (shoulder girdle, tongue)

Listening

- Aphasia (fluent, non-fluent?) versus dysarthria (nasal, spastic?)

Formal examination

- Applause sign
- Environmental dependency: imitation and utilisation behaviour
- Praxis: simple learned hand movements, both meaningful (e.g. brushing the hair) and meaningless
- Limb tone: spasticity, rigidity
- Limb power: focal weakness
- Reflexes: 'tendon jerks'; plantar responses (Babinski's sign)

aphasia, environmental dependency, praxis, applause sign), or even access to an examination couch. They focus on the assessment of cognitive and motor function; the former may require administration of dedicated cognitive screening instruments and the latter elements of the formal neurological examination (e.g. muscle tone, power and tendon reflexes). Of the reflexes, Babinski's sign may be difficult to elicit and interpret: interobserver agreement is low, as is its sensitivity for upper motor neuron dysfunction. Notable omissions from this examination schedule include so-called frontal release signs or primitive reflexes (such as the palmomental reflex), eye movements and the sensory examination, as these are deemed of little clinical value in these circumstances.

In the era of COVID-19, when face-to-face patient assessments may become the exception rather than the norm, it is reassuring that most of this proposed examination may be performed by video link (if sound and picture quality suffice). The only precluded elements are limb tone, power and reflexes.

Conclusions

Some form of neurological examination is a necessary part of the assessment of patients presenting

with psychiatric symptoms. On the basis of the neurological disorders that may present with psychiatric symptoms, we suggest a brief neurological examination focusing on simple observations and motor testing that may prove of service to psychiatrists.

Author contributions

A.J.L. had the idea for the article and wrote the first draft; K.W.A. and A.J.C. read and revised the manuscript for intellectual content.

Declaration of interest

None.

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MCQs

Select the single best option for each question stem

1 In a patient with memory complaints, referred by the general practitioner for suspected dementia, which of the following signs would argue against the diagnosis of Alzheimer's disease?

- a apraxia
- b the 'attended alone' sign
- c the head turning sign
- d myoclonus
- e Parkinsonism.

2 Which of the following features would be atypical in patient suspected to have a diagnosis of dementia with Lewy bodies?

- a anosmia
- b auditory hallucinations
- c fluctuating attention
- d REM sleep behaviour disorder
- e visual hallucinations.

3 Which of the following signs would cause you to question a suspected diagnosis of frontotemporal dementia?

- a aphasia
- b environmental dependency
- c fasciculation
- d hemiparetic gait
- e myoclonus.

4 Which of the following signs might raise a suspicion of functional cognitive disorder?

- a apraxia
- b the 'attended with' sign
- c *la maladie du petit papier*
- d limb tremor
- e spasticity.

5 Which of the following features of the neurological examination cannot be adequately assessed simply by observing the patient (e.g. by video link)?

- a the applause sign
- b gait
- c the head turning sign
- d limb tone
- e praxis.