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Neurobehavioral assessment in forensic practice

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Abstract

There is a growing awareness among mental health practitioners that many mental disorders previously believed to be primarily behavioral in nature, reflecting character and environment, are actually grounded in brain mal-development or brain disorder. This growing awareness, influenced by the advent of new diagnostic procedures and measures, is also found among forensic practitioners. In this paper, we describe some of the elements involved in conducting a neurobehavioral assessment of cognitive functioning, particularly in capital cases, organizing this material in terms of the professional disciplines – social work, mitigation investigation, psychological, and medical – with which these methods are mainly identified. The paper concludes with a brief discussion of how to integrate the multiple areas of expertise to create an accurate understanding of the neurobehavioral functioning and capacity of the subject. This is the basis from which civil and criminal forensic opinions must emanate.

Keywords

Assessment; Neurocognition; Neurodevelopmental; Multigenerational social history; Best practices

1. Introduction

A paper on neurobehavioral forensic assessment is appropriate in a special issue honoring Dr. Tom Gutheil because he has been the voice of clinical expertise before forensic assumption in forensic psychiatry for many years. Until fairly recently, brain impairment was seen as something relatively peripheral to psychiatry (as seen in only a few relevant categories in DSM-4-TR) and it was hardly emphasized at all in forensic assessment or testimony. That is beginning to change, however, as a wealth of evidence now demonstrates that many psychiatric disorders previously viewed primarily as character flaws or deviant environments actually reflect, to a significant degree, brain mal-development or disease (Asarnow et al., 1994; Bilder et al., 2000; Bozikas, Kosmidis, Kiosseoglou, & Karavatos, 2006; Danielyan, & Nasrallah, 2009). Reflecting this change, Carl C. Bell, MD, Professor of Psychiatry and Public Health and Director of the Institute for Juvenile Research at the University of Illinois at Chicago, has written about coming to grips with the fact that a large percentage of patients seen by him and his clinicians previously thought to have purely behavioral psychiatric disorders, actually have underlying brain-based cognitive diseases, such as Fetal Alcohol Spectrum Disorder (FASD) and mild mental retardation (Bell, 2012).

Dr. Bell's experience in clinical practice has meaning for forensic practitioners. What used to be simple questions of mal-adjusted behavior in forensic practice, now requires a cross-disciplinary assessment of underlying neurodevelopmental impairments. The observable outcomes, the ways in which the individual's cognitive deficits shape behavior and function, are fundamental to criminal or civil forensic evaluations. Increasing incarceration rates and civil litigation has concomitantly required additional attention to the role of neurocognition (Steadman, Osher, Robbins, Case, & Samuels, 2009; Zonana, 2010). As more people with neurobehavioral impairments are identified in forensic evaluations, those evaluations are being influenced by advances in social history methodology, technology and testing, and the more integrated understanding of neural networks and processes, which was arrived at through better study designs and animal models. One reason for this increased attention to neurocognition in criminal settings is the growing acceptance that brain-based impairments in functioning can play a very important role in establishing whether a criminal defendant has defects in awareness or self-control (e.g., whether or not they rise to the level of a formal disease diagnosis) that could be relevant in determining moral culpability or punishment (e.g., *Atkins v. Virginia*, 2002; *Roper v. Simmons*, 2005; *Williams v. Taylor*, 2000). Such information can also be very useful in civil proceedings, such as in seeking to void one-sided contracts entered into by people who lacked relevant competence or in establishing the nature and extent of brain impairment that an individual seeking monetary damages in a liability lawsuit has suffered, or whether a person's decreased job performance may be neurologically-based.

Quite simply, best practice in neuropsychiatry today require integrating the assessment of neurodevelopmental disorders into every day practice. As we will discuss, clinical and forensic practice must now carefully work across the historical lines between neurodevelopmental disorders and psychiatric disorders because the underlying science of brain behavior and function has developed to the point where integration of approaches is required. The limited number of neurobehavioral syndromes and lack of recognition of neurobehavioral symptoms in the Diagnostic and Statistical Manual-IV and IV-TR speak to the continued belief in the mind/body dichotomy at least through the early 1990s.

The historical dichotomy between neurodevelopmental disorders and neuropsychiatric disorders, at least in terms of cognitive functioning, has lost its importance in light of the scientific advances that provide a more unified and coherent picture of the individual in the real world. This means that the transdiagnostic assessment of cognitive deficits, which manifest similarly in both neurodevelopmental disorders and psychiatric disorders, has become best practice in clinical and forensic assessment (Andrew, 1981; Hall & Sbordone, 1993; McMurtrie, 2012; Raja, Blumenthal, & Doraiswamy, 2004).

In line with the growing use of a multi-disciplinary team approach to forensic services, many types of professionals play an important role in establishing the existence and nature of neurobehavioral deficits, whether or not the methods used are explicitly "cognitive." Among the professionals who play a role in neurobehavioral assessment, broadly defined, are social workers/mitigation specialists, psychologists (including neuropsychologists and developmental psychologists), and physicians (including psychiatrists, neurologists and neuroradiologists). The range of methods used in neurobehavioral assessment will, therefore be described briefly, organized in relation to the discipline with which these methods are associated. Following this, we conclude with a brief discussion of the ways in which these assessment methods can be integrated to address questions that may arise in forensic settings.

2. Activities performed by social workers and mitigation specialists

A problem with much expert testimony is that it is so focused on test score numbers and their psychometric properties, or diagnostic criteria and categorization, that the individual being evaluated sometimes gets forgotten. This often results in “expert battles” about cut-offs or comorbidity, diminishing the credibility of all the participants in the courtroom, but more significantly, failing to bring into focus the significant ways in which the symptoms of a person's mental illness shaped his/her life experiences, altered his/her options, choices, and decisions, and brought that person into the courtroom as a subject of testimony. Yet, particularly in family law, elder law, and criminal law, how symptoms shape life paths may be the central issue. A multigenerational and comprehensive social history, which is typically the province of a mitigation specialist, social worker, or psychologist in criminal cases, is critical in creating a longitudinal and holistic understanding of the individual and illustrating how his or her test scores translate into behaviors in the real world over time that may be relevant to the criminal or civil case. These social histories provide developmental and trajectory evidence, clinical substantiation and evidentiary corroboration, and are the foundation for recognizing how cognitive deficits manifest in daily family and community life behaviors and impairments (Haney, 2008; Holdman & Seeds, 2008; Wayland, 2008). On the other hand, an inadequate social history will prevent a full understanding of the link between brain impairments and everyday functioning. As example, some people with frontal lobe impairment are more likely to exhibit asocial or antisocial behavior (Anderson, Damasio, Tranel, & Damasio, 2000; Raine, Lencz, Bihrlé, LaCasse, & Colletti, 2000; Volavka, Martell, & Convit, 1992); but the failure to assess and interpret how the impairment affects every day functioning and behavior, and how it may be managed with supports, undermines the relationship between the impairments and their potential relationship to the legal proceedings. The judicial system's treatment of the individual whose neurobehavioral deficits have not only been misidentified, but also not placed in appropriate familial and social context, is likely to be based on a view that the person has a character or personality disorder (Hall & Sbordone, 1993; MacDonald et al., 2005; Murphy et al., 2001). Comprehensive social histories provide developmental, prodromal and pre-syndromal markers and support for the presence and importance of cognitive disorders, while testing or diagnosis does not provide a link to behavior. Cognitive deficits often present as a series of defective links in an action, particularly in new, novel or stressful circumstances (Godefroy, 2003), rather than discrete symptoms, like hallucinations or delusions. Often these defective links of action, secondary to cognitive deficits, are found in families and other social contexts, even when the diagnostic criteria for a disorder are not completely met in the family members (Chamberlain et al., 2007; Constantino et al., 2006; Hom et al., 2008; Keshavan, Sujata, Mehra, Montrose, & Sweeney, 2003; Szoke et al., 2006; Trandafir, Meary, Schurhoff, Leboyer, & Szoke, 2006).

Similarly, the comprehensive social history provides evidence essential to culturally competent assessments. Cultural factors are directly relevant to both clinical and forensic determinations. Potentially cultural factors, such as religiosity (MacDonald & Holland, 2002), emotionality, dissociative experiences, and language usage, may also have neurological and neurodevelopmental substrates (Adnams et al., 2007; Dimoska, McDonald, Pell, Tate, & James, 2010; Kennedy et al., 2006; Winsler, Diaz, Atencio, McCarthy, & Chabay, 2000). Culture is essential to include in the differential diagnoses of behavior's brain-based factors. Although one can accurately diagnose a brain tumor or multiple sclerosis or hypothyroidism as the likely cause of a cognitive disturbance in about 20–60 minutes, diagnosis is rarely the end-point in forensic cases. The meaning of the diagnosis and the details of how the symptoms that make up the diagnosis, most often crosses the bridge from neurobehavioral symptom to the mens rea issue. Multigenerational histories often provide the context in which neurobehavioral disorders developed and point to how

these disorders manifested in the family and community setting, affecting the subject's life-course long before the symptoms coalesced into the diagnosis.

A comprehensive social history allows documentation of the developmental underpinnings of cognitive deficits. For example, it is especially important to separate out the effects of culture and “cultural overshadowing,” particularly for those with mild mental retardation (Reschly, 2009; Woods, Greenspan, & Agharkar, 2011), in which biological factors are overlooked or discounted in poor, marginalized, and minority individuals. A social history can show that an individual stood out in his own culture and ecology as different and deficient, perhaps resulting from being at high risk for an event such as being born anoxic in a home delivery by a poorly-trained mid-wife in rural Mexico. Such perinatal history enhances confidence that the impairments observed later in life are the result of neurodevelopmental insults (Miller et al., 2007; Shonkoff, & Phillips, 2000).

Childhood physical and sexual abuse, child maltreatment and neglect, and exposure to violence must be thoroughly documented as well. Exposure to trauma, which can result in long-term symptoms including dissociation, has been found to have neurological substrates (Anda et al., 2006; Lambert, Sierra, Phillips, & David, 2002) and changes the developmental course, altering brain function and structure (Anda et al., 2006; Schwarz & Perry, 1994). Exposure to trauma during the developmental periods has been shown to cause long-term changes in endocrine, cardiac, and pulmonary function (Rasmusson, Schnurr, Zukowska, Scioli, & Forman, 2010; Spitzer et al., 2009). The impact of trauma on cognitive functioning has only recently become part of mainstream neurobiological understanding. Documentation of chronic trauma is a key component of the comprehensive, multigenerational social history, and must be one component of a competent neuropsychiatric examination (*Porter v. McCollum*, 2009; *Rompilla v. Beard*, 2005; *Wiggins v. Smith*, 2003).

3. Methods used by psychologists and neuropsychologists

Typically, psychologists who testify in legal proceedings are licensed clinical psychologists. However, other disciplines, such as developmental psychology, can play a role if they have relevant specialized expertise, such as on intellectual disabilities, or content knowledge, such as the role of gullibility, not typically possessed by most clinical psychologists. With respect to identifying neurobehavioral deficits, however, the psychological discipline that is potentially most useful is, neuropsychology. This discipline features the administration and interpretation of standardized tests and batteries intended to identify areas of brain impairment. In this section, we review briefly some of the methods used by psychologists generally, and neuropsychologists in particular, in neurobehavioral assessments.

3.1. Neuropsychological tests and batteries

Neuropsychology is the study of brain–behavior relationships. Many standardized test instruments are designed to identify and measure specific types of cognitive deficits and brain dysfunction. Neuropsychological assessment provides a functional description of the cognitive, behavioral, psychological, and emotional consequences of disrupted brain function. A comprehensive neuropsychological assessment provides information about various aspects of cognitive functioning, including intelligence, academic ability, attention and concentration, verbal and visual memory, language functioning, visual–spatial functioning, motor abilities, sensory–perceptual processing, abstract reasoning and executive functioning (e.g. planning, self-monitoring, inhibition of impulses, understanding social contexts, and mental flexibility). Neuropsychology is a sub-specialty of psychology that requires unique training and clinical experience, and has its own professional organizations, journals, credentialing and ethical guidelines.

After developing a comprehensive social history, it is important to retain properly trained neuropsychologists who are familiar with testing appropriate to the neurodevelopmental conditions suspected, specific to the case at hand. There are two types of approaches to neuropsychological testing: standardized batteries and flexible batteries. Flexible batteries are stand-alone tests that are not commercially bundled into a package. They vary according to the person administering the examination and, therefore, each examination will vary as to reliability and validity depending on the specific tests given. Standard batteries, such as the Halstead–Reitan Neuropsychological Battery, have been normed and validated to be administered as a set of tests, with flexible follow-up testing to pursue and further elucidate strengths and weaknesses identified on the battery. In addition to using a standardized battery, tests which specifically follow up indications of impairment based on results from the social history investigation should be administered. The requirement for a complete battery may be different than the clinical practice of many neuropsychologists. Often neuropsychologists are asked to answer a specific question, typically one which may have a known intervention, for instance, tutoring for a learning disability, which they attempt to answer. In a forensic neuropsychiatric assessment, treatment is not the goal. Rather, the determination of cognitive deficits that may be relevant to the forensic question is the focus, as well as a holistic view of the strengths and weaknesses of the individual across all domains that affect social and behavioral functioning should be identified before launching into forensic determinations (R.A. Barkley, 2012). This requires a complete neuropsychological battery administration.

Executive abilities require special attention because they represent a complex set of behaviors and functions that involve processes which can be said to define the human experience. These include the initiation of behaviors and intentionality; abstraction of patterns and concepts and giving meaning to stimuli in relation to prior experiences; appropriately prioritizing external stimuli (separating signal from noise); appropriately assessing the emotional valence in stimuli; holding concepts in working memory and information retrieval; vigilance to tasks; complex problem recognition and resolution, including resolving conceptual conflicts and cognitive dissonance; response inhibition, including changing or switching sets; and strategy development, evaluation, monitoring and implementation (Freedman & Brown, 2011). Neuropsychological tests specific to testing executive functions, such as the Delis–Kaplan Executive Function System, should be considered in almost all forensic situations because of the critical role executive functioning plays in neurodevelopmental disorders.

Executive functions, although often referred to with the shorthand term of “frontal” abilities because of the unique role of the frontal lobe, are more accurately understood to be neural networks that reach into every aspect of human life and functioning (Lichter & Cummings, 2001). In addition to the abilities noted previously, executive functions also include the ability to form and maintain social relationships, perceiving social cues and the emotional content of social interactions, and social judgment and insight (Barkley, 2012; Cummings & Mega, 2003; Miller & Cummings, 2007). Screening tests are useful in clinical settings when time is very limited and testing is necessary prior to the review of a comprehensive social history. In forensic practice, screening tests should never be relied upon because they sacrifice accuracy and reliability to achieve speed, providing a vague estimate of how someone might function in one area, but failing to fully assess functioning. None of the screening tests are reliable as an assessment of brain functioning; they are designed and intended for a different purpose and have no place in a competent and complete neuropsychiatric assessment.

The interpretation of the battery requires more than a summing of scores and comparing them to national norms. Interpretation requires an understanding of the patterns across tests

even when the individual is found to have many strengths. Neuropsychological assessment should include multiple tests of specific domains of functioning, which allows for more subtle assessment of specific deficits and strengths (Freedman & Brown, 2011). Consistency between test performance in specific ability areas increases confidence in the observed results (Groth-Marnat, 2000; Lezak, 2004). For instance, deficits on Trails B – which requires cognitive switching, response inhibition, and strategic planning, but not on Trails A – which assesses processing speed and serves as a prime for Trails B – can be compared to performance on the Wisconsin Card Sorting Test, which measures some similar domains, but in a different way. Consistency on these measures is not proof that Type I error, e.g., finding significant results by chance because numerous tests are administered, is not operating. Instead, the consistency of results enhances the confidence in the convergent and divergent validity, reliability and specificity of the findings. In the forensic setting, consistency interpretation remains the best mechanism for assessing malingering and effort.

3.2. Academic tests

Individualized tests of academic ability can be administered by any psychologist, as well as by educational specialists. Academic tests are designed to assess specific skills and knowledge in various areas of academic ability. To assess for the presence of learning deficits or disabilities, an individual's performance on academic tests has traditionally been considered in conjunction with information about his or her current intellectual functioning. According to this method of analysis, one's academic functioning should be commensurate with one's intellectual abilities. Thus, a significant discrepancy between intellectual functioning and academic achievement – with academic achievement lower than expected given measured IQ – can signal the presence of learning problems. The most widely utilized tests for assessing academic level are the WRAT (Wide Range Achievement Test) and the Woodcock–Johnson test instruments. Tests of academic level do not provide much information specifically about brain function, but they are important for interpreting neuropsychological testing that has education-level norms and adjustments. The WRAT and Woodcock–Johnson instruments also provide information on actual educational level in specific academic areas, such as arithmetic, spelling and reading.

3.3. Intellectual assessment

An individual and comprehensive test of intelligence, such as the WAIS-4 (Wechsler Adult Intelligence Scale, 4th edition), is typically one of the measures administered by a neuropsychologist, but it can also be administered as a stand-alone test by virtually any qualified psychologist, regardless of specialized expertise in neuropsychology (or, for that matter, in any particular psychological subspecialty). Intelligence tests produce a full-scale IQ score, indicating one's relative intelligence in relation to the general population. These tests set the 50th percentile of the population at a score of 100 and standard deviation units (indices of statistical variability) at 15; thus someone who scores one standard deviation below the mean (at the 17th percentile rank) would have a score of 85, while some who scores minus two standard deviations (at the 2nd percentile rank) would have a score of 70. Full-scale IQ scores are mainly useful in diagnosing mental retardation (now termed Intellectual Disability), as a score below 70–75 is typically used to make that diagnosis in *Atkins v. Virginia* (death penalty exemption) or other criminal proceedings where a diagnosis of mental retardation may be relevant.

Tests of intellectual abilities are designed to tap a variety of intellectual functions, and they usually consist of a range of individual subtests. Individual subtest scores are typically combined to yield an overall estimate of current intellectual functioning, called the intelligence quotient (IQ). Assessment of an individual's current level of cognitive functioning is one of the primary psychodiagnostic functions of intelligence testing. Patterns

of scores and performance on individual subtests may be of interpretive significance as well. There are many tests of intelligence, but only a few are suitable for making high-stakes diagnostic purposes, such as determining eligibility for death penalty exemption. In particular, group-administered tests or brief screening tests are not appropriate for such a purpose, both because they are not sufficiently comprehensive and also because we can never be certain they were administered properly. In interpreting IQ test scores, there are times when results should be discounted or adjusted, to correct for possible confounds or sources of error, among which are the “Flynn effect” (the gradual toughening of norms to account for changes in population intelligence), “Practice effect” (the results of learning from one test administration to another), test unreliability (standard error of measurement) and the possibility of problems in norm construction, such as with the Spanish language norms for the Mexican version of the WAIS-3 (Suen & Greenspan, 2009).

3.4. Adaptive behavior

Adaptive behavior is a term that refers to the quality of one's functioning in the world, as opposed to in a test situation. It originated in the field of mental retardation (MR, now Intellectual Disability, or ID) in order to be a check against the possibility of false positives resulting from excessive reliance on IQ tests in diagnosing the disorder. Because adaptive behavior is the second prong in clinical and legal definitions of ID, it has come to be assessed routinely in forensic evaluations, particularly in so-called “Atkins” death penalty exemption proceedings. Adaptive behavior assessment is also useful in diagnosing other neurodevelopmental disorders, particularly FASD, where it is one of the so-called “brain functions” tapped in diagnosing that disorder.

Adaptive behavior assessment is typically conducted using a rating instrument, such as the Vineland Adaptive Behavior Scale (VABS-2), Adaptive Behavior Assessment System (ABAS-2) or Scales of Independent Behavior (SIB-R). Because people with ID are almost always reluctant to admit fully to limitations, diagnostic administrators of these instruments, which contain 200 or so items, should rely on third party raters, such as family members or teachers, and *not* on the subject himself. This can pose a challenge to a psychologist or neuropsychologist not used to getting out of the testing room, although some clinicians employ an assistant, such as a nurse or social worker experienced with these measures, to do the interviewing for them. A criticism sometimes directed against adaptive behavior assessment is that existing measures lack adequate content validity, particularly in the realm of social functioning (Greenspan, Switzky, & Granfield, 1996). There is increasing awareness that the main vulnerability (criminally, vocationally and otherwise) of people with neurodevelopmental disorders lies in their poor judgment in negotiating the pressures, dangers and ambiguities of the interpersonal world. Measures of adaptive behavior do a poor job of tapping into judgment deficits, as for example in the almost universal gullibility of people with brain-based neurobehavioral impairments. Hopefully, measures of adaptive behavior with better content validity, especially in the social domain, are in the process of being developed.

3.5. Personality tests

Personality tests are typically self-report measures, which provide a snap-shot of the person's current self-reflection and emotional state. They aim to describe the personality traits a person exhibits through use of standardized questions. As such, they provide no reliable data on the longitudinal course of functioning or help to uncover the causes of functioning and behavior, but do provide information on the person's adaptation to his or her immediate context. The most commonly used are the Minnesota Multiphasic Personality Inventory II (MMPI-II), the Personality Assessment Inventory (PAI) and the Millon Clinical Multiaxial Inventory III (MCMI-III). Results often appear on a chart and in some cases a

computer-generated narrative provides interpretation based on psychological characteristics associated with the scores. Computerized narratives typically are derived from summaries of a vast array of research studies. They provide a composite description based on many people who have answered questions in a similar way rather than an individualized assessment. Computerized narratives are all too frequently adopted by evaluators as is, which is contrary to the best practices for psychologists using this type of information. These computerized narratives have been criticized as lacking validity, being devoid of social history context, inaccurate and misleading, and often false (Butcher, Perry, & Atlis, 2000; Butcher, Perry, & Hahn, 2004; Groth-Marnat & Horvath, 2006). The scales of these instruments, however, reflect personality traits not symptoms relevant to neurodevelopmental disorders; thus, the protocols carefully advise that an elevated scale is insufficient to diagnose a person; for example, an elevated “schizophrenia” scale does not mean the person is schizophrenic and an elevated “psychopathic deviant” scale does not mean the person is psychopathic. These tests do not help to explain a client's life or experiences in an effective way, and there is a high risk that statements endorsed in the test will be taken out of context to portray the individual negatively, and that long-standing symptoms can be misjudged to reflect personality traits rather than neurodevelopmental disorders.

Therefore, when a client's records contain personality or psychological testing from prior evaluations, it is important to investigate fully the circumstances of the administration of the testing, the qualifications of the evaluator to administer the tests, and reevaluate conclusions drawn in light of the evidence obtained in the comprehensive social history.

4. Methods used by psychiatrists and other medical personnel

While neuropsychological information has a vital role to play in identifying a possible brain disease or defect, actual diagnosis most often is the purview of a physician, typically someone with advanced training in psychiatry or a related medical discipline. Furthermore, physical methods can play an important role in first identifying possible conditions for which neuropsychological methods may be indicated. Psychiatrists are especially well-equipped to diagnose mental illnesses, such as schizophrenia or autism, which may have, at root, a neurodevelopmental basis. Following is a brief overview of the methods which are used by psychiatrists, or other medical practitioners, in forensic cases.

4.1. The neuropsychiatric mental status examination

The neuropsychiatric mental status examination should be an ongoing, evolving examination of a person's emotional, perceptual, thinking, and cognitive states. Many mental status examination formats have been developed, and these serve as brief screening tools (e.g. the Folstein Mini-Mental Status Examination). However, the neuropsychiatric mental status examination's real purpose is to use “bedside” visits to develop rapport, to obtain gross data on a broad range of everyday abilities, and to assess changes over time in treatment (e.g., from admission to discharge, or for repeat visits). The mental status examination is not a stand-alone examination, and should never be considered a sufficient basis for forming forensic opinions. Moreover, because it is a type of assessment that provides new information when repeated on multiple visits, it can be informed and adapted as the comprehensive social history develops, providing a more complete picture of the multigenerational medical, psychiatric, legal, and employment history from which to interpret the current condition of the person being assessed.

The neuropsychiatric mental status examination starts with posing general questions of the client, such as: “How old are you?,” “Do you wear hearing aids?,” “How far did you go in school?,” followed by inquiring about his or her level of consciousness and arousal: “How do you spend your days?,” “Do you have trouble staying focused on tasks you wish to

accomplish?," "How long do you sleep each night?," "When do you wake up in the morning?," etc. Asking questions about sleep is important, because disorders of sleep and arousal are closely related to psychiatric disorders, as well as cognitive symptoms (Garcia-Rill, 1997; Reese, Garcia-Rill, & Skinner, 1995).

The examiner should also pay attention to motor skills: posture, gait, and movement of limbs, trunk, and face (spontaneous, resting, and after instruction) must all be examined. Many cognitive deficits and psychiatric disorders have corresponding motor deficits (Chamberlain, Fineberg, Blackwell, Robbins, & Sahakian, 2006; Chamberlain et al., 2007; Maj, Pirozzi, Magliano, & Bartoli, 2003; Maruff et al., 1994)

The subject's response (such as visual/ facial cues) to the examiner during the clinical interaction can provide clues to how the person perceives and reacts to his or her social context, including internal emotional states, as reflected by which aspects of the social history seem to hold strong emotional valence. Language – both receptive and expressive – must be explored, including where appropriate the person's native or primary language. The exploration of language continues with evaluating comprehension of words, sentences, and simple and complex commands and concepts. Speech output, including spontaneity, rate, fluency, volume, coherence, prosody, and vocabulary should also be reviewed. Disruption of thought processes, thought content, perceptual disorders, and thought form are all cognitive deficits, often observed in psychiatric disorders, such as schizophrenia.

Affect, mood, engagement, level of social withdrawal, depression, suicidal ideation, cognitive coherence and mood dissonance should all be considered as information is gained during the assessment process. A culturally sensitive social history can provide an understanding of the individual's insight and understanding of current circumstances, personal roles and responsibilities, and social relationships. This is important information in a neurobehavioral assessment, as impaired insight is a feature of psychiatric disorders, such as mania (Caruso, Benedek, Auble, & Bernet, 2003; Geller, 2006; Mullick, Miller, & Jacobsen, 2001) and often is brain-based.

The neuropsychiatric mental status examination is, therefore, a flexible and repeated mechanism that is not in itself always sufficient to reach a diagnostic conclusion, but must be combined with the neuropsychiatrist's prior exploration of social history, neuropsychological testing, and, perhaps, neuroimaging, in order to gain an understanding of the person's immediate functional condition at the time of the evaluation. Cognitive deficits and mental diseases may wax and wane. These undulations should be captured, if possible, by documenting and assessing changes during the course of successive visits.

4.2. Physical examination

Many forensic psychiatrists have come to understand that it is no longer adequate to rely upon a physical examination conducted by someone else. The physical exam, like the mental status exam, is a core feature of the neuropsychiatric assessment because it assists in the development of hypotheses and provides some types of corroboration which cannot be obtained in any other manner. For instance, evidence of scarring, burns, malformations resulting from poorly treated broken bones, or head disfigurement from closed head insults, are indications which might suggest previous exposure to child abuse or trauma. The physical exam is critical to developing data that may suggest abuse or trauma and may corroborate, in some instances, a specific trauma.

The physical examination should also investigate medical and developmental markers of illness and genetic pre-dispositions to disease. Craniofacial abnormalities, midline asymmetry, non-descended testes in males, prominent supraorbital ridges with puffy upper

eyelids and lower epicanthal folds, and cleft palate, to name only a few common malformations, are all associated with cognitive dysfunction (Dahlof, Hard, & Larsson, 1978; Mac Donald et al., 2011; Mattson, Riley, Gramling, Delis, & Jones, 1998; Milders, Ietswaart, Crawford, & Currie, 2008; Nopoulos, Berg, VanDemark, Richman, & Canady, 2001; Scott, Price, George, Brillman, & Rothfus, 1993; Wiseman, Sanchez, et al., 1999). In brief, there is no substitute for the hands-on physical examination, and it is recognized to be a core component of the competent neuropsychiatric assessment.

4.3. Neurological examination and imaging

The physical examination should include neurological tests, including tests of olfaction, known to be impaired in a significant number of persons with traumatic brain injury, Parkinson's disease, psychosis and frontal lobe deficits (Langdon, McGuire, Stevenson, & Catts, 2011; Schiffman, 1997). Examinations of sensory and motor functions may provide insight into neurological function, and allow comparisons of brain function bilaterally. Motor incoordination, abnormal mouth and facial reflexes, Babinski reflexes, and other neurological signs can provide bedside evidence of brain dysfunction that will not necessarily be picked up in laboratory values or neuropsychological testing. These neurological abnormalities and soft signs, i.e., non-specific indicators of cognitive dysfunction, may be potential warnings of neurological impairments which must be taken into consideration when attempting to identify mental diseases and defects. Keep in mind that soft signs are not necessarily indicative of cognitive impairment without corroborating data and findings.

The standard neurological physical examination is so well established in the literature that little needs to be said about it. Properly performed, the physical examination tests each of the cranial nerves and reflexes. Neurological exams will generally include the following: a mental status assessment; cranial nerve assessment, a test for each of the twelve cranial nerves; motor system testing, including muscle strength and tone, coordination and gait; reflex testing; and sensation testing (Devinsky & D'Esposito, 2004). Frontal lobe dysfunction can and should be assessed by neurological examination as well as neuropsychological testing. Both types of tests are important and can provide corroborating evidence of brain impairment. Assessment of reflexes, gait, posture, muscle tone and olfactory disturbances provides reliable evidence of frontal lobe damage (Devinsky & D'Esposito, 2004; Heilman & Valenstein, 1979).

4.4. Measures of brain function and structure

In establishing the possible existence of a brain disorder, techniques for determining patency of brain structure and function are highly recommended, and are generally relatively affordable. A basic method is the electroencephalogram (EEG), which measures electrical activity in the brain. Although it has serious limitations, it still can be extremely useful as a screening tool, for example for seizure disorders, which often are found in people with brain abnormalities. However, the EEG fails to discriminate a substantial number of people with seizure disorders. Standard EEGs use leads (which monitor electrical activity) on the outside of the head, but this placement is not particularly effective for assessing certain parts of the brain, particularly in the middle (mesial) areas where aberrant electrical activity can impair certain types of memory. Psychiatric symptoms, such as hallucinations, can occur secondary to seizure activity. The EEG is not utilized to determine memory problems or psychiatric disorders. Rather, EEGs can be useful in determining seizure activity which may manifest as hallucinations, emotional lability, and other neuropsychiatric symptoms. Nasopharyngeal leads – leads placed deep inside the nasal passages in order to attempt better temporal lobe connection – are more effective but uncomfortable and rarely used today. The computerized EEG measures brain function in the same way, but uses computerized analysis to compare

the data to known standards. It provides information on more subtle forms of dysfunction. Quantitative EEG (QEEG) is a limited methodology that is not recommended.

Another measure of brain function is positron emission tomography (PET) scans, which measure glucose uptake and blood flow by marking glucose with a radioactive agent and tracking how the marked glucose is used in the brain. PET scans show areas of normal and abnormal energy utilization. Criticism of the PET methodology focuses on its high sensitivity and poor specificity. This tendency is ideal for neuropsychiatric assessment, again providing appropriate differential diagnoses in co-morbid conditions (Heinrichs, 2005; Joseph, 1999; Shin et al., 2009). Nevertheless, PET scans are still clinically indicated for some diagnoses (e.g., interictal epileptic foci and hypermetabolic tumors), and are less useful if used without social history, neuropsychological and structural neuroimaging support.

Magnetic Resonance Imaging (MRI) and Functional MRI (fMRI) use the same basic technology to produce images of the brain. MRI provides excellent structural images by subjecting the brain to a magnetic force (which aligns atomic nuclei) and then sending radio wave pulses through the brain that are absorbed by some nuclei and change the energy state of nuclei. MRI is very good for detecting lesions or scar tissue or malformation. In general, MRI is superior to CT with a few exceptions, e.g., calcification, subarachnoid lesions, skull fractures. fMRI assesses the oxygenation status of hemoglobin in the brain. This test is primarily used today to study cognitive tasks (Ernst, Chang, Jovicich, Ames, & Arnold, 2002; Lee et al., 2006). fMRI provides an excellent and precise image of the brain in action. Resolution of the image using fMRI is by far the most subtle and detailed of any imaging technique. This technique also allows for repeated images over a period of time so that assessment can be made of the brain at rest and during performance of tasks. Interpretation of the images remains debated by experts. Magnetic Resonance Spectroscopy (MRS) works on a similar technology to MRI but provides a better image of neurometabolism and neurochemical functioning. MRS is very good for examining NAA (N-acetyl aspartate), CH (Choline) and Lactate in the brain. Diffusion Tensor Imaging (DTI) is an imaging technique using water diffusion (Mac Donald et al., 2011). DTI provides an image of white matter tracts in the brain, such as the corpus callosum, showing the communication connection between the right and left hemisphere (Jea et al., 2008; Riecker et al., 2007).

4.5. Laboratory screening procedures

Laboratory examination allows us to pair our physical findings with possible immunological, genetic, hematological and metabolic values. Laboratory testing can take us far beyond toxicology panels and urinalysis. Yet, since many of the clients seen in forensic settings may have had poor health care historically, the requirement for comprehensive laboratory testing is paramount. Comprehensive laboratory testing is particularly necessary in those with neurobehavioral disorders, as such disorders may point to other abnormalities (Monteleone, Martiadis, & Maj, 2009)

Complete hematological testing is, of course, essential. Urinalysis is also a necessity. Tests of impaired glucose functioning, such as fasting blood glucose and Hemoglobin A1C, the current ability to get long standing blood glucose analysis, can allow the diagnoses of Type I or Type II diabetes to be accurately determined. Diabetes, a disease known to impair cognition both acutely in delirium and long term, through the destruction of small blood vessels in the brain, can lead to altered mental states. Glucose abnormalities are also, unfortunately, the side effects of some atypical antipsychotic medications (Guo et al., 2006).

Liver metabolism can alter drug metabolism, causing increases or decreases in the rate at which drugs are broken down. These potential alterations in drug metabolism, along with

other rate-altering factors, including ethnic origin, drug–drug interactions, and blood protein status, are called pharmacokinetics. The individual pharmacokinetics of a client may have significant impact on the ways in which either medications or other drugs can effect mental state (Perlis, 2007) and the individual response to medication can have important forensic implications (*Melton v. Ayers*, 2007). Laboratory testing, including Cytochrome P450 or Cyp2d6 activity can be easily and inexpensively drawn in most labs today (Bradford, 2002).

Most causes of mental retardation are not genetic. However, blood testing for Fragile X Syndrome and several other chromosomally-transmitted disorders is available and should be undertaken to support clinical findings (Rotimi & Jorde, 2010). In older adults, B12 levels should be evaluated as part of a cognitive screen (Coelho et al., 2008). As mentioned previously, thyroid dysfunction is common in mood disorders, and may independently create symptoms of mental disease (Geffken, Ward, Staab, Carmichael, & Evans, 1998; Krassas, Rivkees, & Kiess, 2007).

5. Forensic uses of the neurobehavioral assessment

As we have sought to make clear, a comprehensive and competent neurobehavioral assessment requires interactions among experts, who each bring specific skills and techniques necessary for a clinical understanding that can then serve as the platform on which to form legal opinions. This should be a multi-directional process, where data points obtained by one expert inform the others, suggesting further inquiries by each. These feedback loops of data gathering, assessment and inference provide the basis for each expert to develop opinions within his or her own specialty about neurobehavioral functioning and capacity.

In the high stakes forensic arena, we cannot forget that our forensic decisions must be buttressed by good clinical skills, not just knowledge of the newest landmark case. For example, many of the most recent treatises on legal competency, unfortunately, make no mention of the necessity for a competent, thorough clinical evaluation, which must precede legal competency determinations.

Our main point is that a comprehensive perspective must be applied to the forensic inquiry at hand. For instance, the degree of dementia has to be understood before its relationship to contractual agreements entered into can be accurately understood. The ability to effectively weigh and deliberate must be understood before the value of a Miranda warning can be determined. Consequently, the neurodevelopmental assessment is an ongoing, iterative, and collaborative process of understanding neurocognition.

Recently, in response to the pervasive denial of disability claims of Post-traumatic Stress Disorder based primarily on personality testing interpreted to indicate faking, the United States Army demanded that the evaluation of PTSD in soldiers returning from combat zones must rely on comprehensive assessment, not personality test cut-offs (Coley, 2012). The Army's guidelines state that relying on tests scores or limited interactions with only the individual soldier is not sufficient for conducting a competent assessment. This is no less true for civilian forensic neurobehavioral assessments. Similarly, the forensic neuropsychiatric specialists' responsibility is to determine if there are deficits, how they have shaped the life-course of the individual, and only then, to determine the relationship to the forensic question. Reducing the assessment to test scores or heavy reliance on the clinical interview fails to obtain adequate information about neurocognition upon which to attempt to answer the forensic question.

Moreover, the lesson taught by Dr. Bell must inform our practice: many of the behavioral and “psychological” conditions which forensic clinicians readily use to label based on a

short interview, are misapplied, misleading, and based on inadequate integration of the available evidence. Best practices require a more thorough approach as we have discussed, because practitioners who agree to undertake a forensic assessment have a duty to first understand the complex neurobehavioral processes involved in the functioning and behavior, and to then apply it to the forensic question. Those cognitive processes are often multigenerational (Schulze, Hedeker, Zandi, Rietschel, & McMahon, 2006), as well as neurodevelopmental, manifesting in childhood and adolescence, or acquired from an environmental exposure. The causes may or may not matter, but the way in which neurobehavioral functioning shapes the experience, options, and capacities of the individual does matter, and certainly matters more than the labeling process of diagnostic short-hand.

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