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Chapter 24

Functional sensory symptoms

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Abstract

Functional (psychogenic) sensory symptoms are those in which the patient genuinely experiences alteration or absence of normal sensation in the absence of neurologic disease. The hallmark of functional sensory symptoms is the presence of internal inconsistency revealing a pattern of symptoms governed by abnormally focused attention.

In this chapter we review the history of this area, different clinical presentations, diagnosis (including sensitivity of diagnostic tests), treatment, experimental studies, and prognosis.

Altered sensation has been a feature of "hysteria" since descriptions of witchcraft in the middle ages. In the 19th century hysteric sensory stigmata were considered a hallmark of the condition. Despite this long history, relatively little attention has been paid to the topic of functional sensory disturbance, compared to functional limb weakness or functional movement disorders, with which it commonly coexists.

There are recognizable clinical patterns, such as hemisensory disturbance and sensory disturbance finishing at the groin or shoulder, but in keeping with the literature on reliability of sensory signs in neurology in general, the evidence suggests that physical signs designed to make a positive diagnosis of functional sensory disorder may not be that reliable.

There are sensory symptoms which are unusual but not functional (such as synesthesia and allochiria) but also functional sensory symptoms (such as complete loss of all pain) which are most unusual and probably worthy of independent study.

INTRODUCTION

We begin with a review of the history of this area, moving on to a description of different types of sensory disturbance. We then summarize what is known about the reliability of sensory signs in this area, drawing heavily on the studies of Selma Aybek and colleagues (Daum et al., 2014a, b). Finally we discuss what is known about the pathophysiology of sensory symptoms and their treatment.

HISTORIC BACKGROUND

Freud stated in 1888 that, "In the middle ages, the discovery of anaesthetic and non-bleeding areas (stigmata diaboli) was regarded as evidence of witchcraft" (Freud, 1966). Although this is generally accepted, our search for primary material relevant to this was not fruitful. The "witches mark" was certainly often looked for; this was usually an accessory nipple or some skin lesion such as a wart or corn, which would have been more anasthetic and less likely to bleed. There were various trials by ordeal, such as picking a stone from boiling water to see if the wounds healed well (innocent) or festered (guilty). In England and Scotland, "common prickers" gave testimony on those suspected of witchcraft,

> *caused John Kincaid of Tranent [near Edinburgh], the common pricker, to exercise his craft upon her. He found two marks of the devil's making; for she could not feel the pin when it was put into either of the said marks, nor did the marks bleed when*

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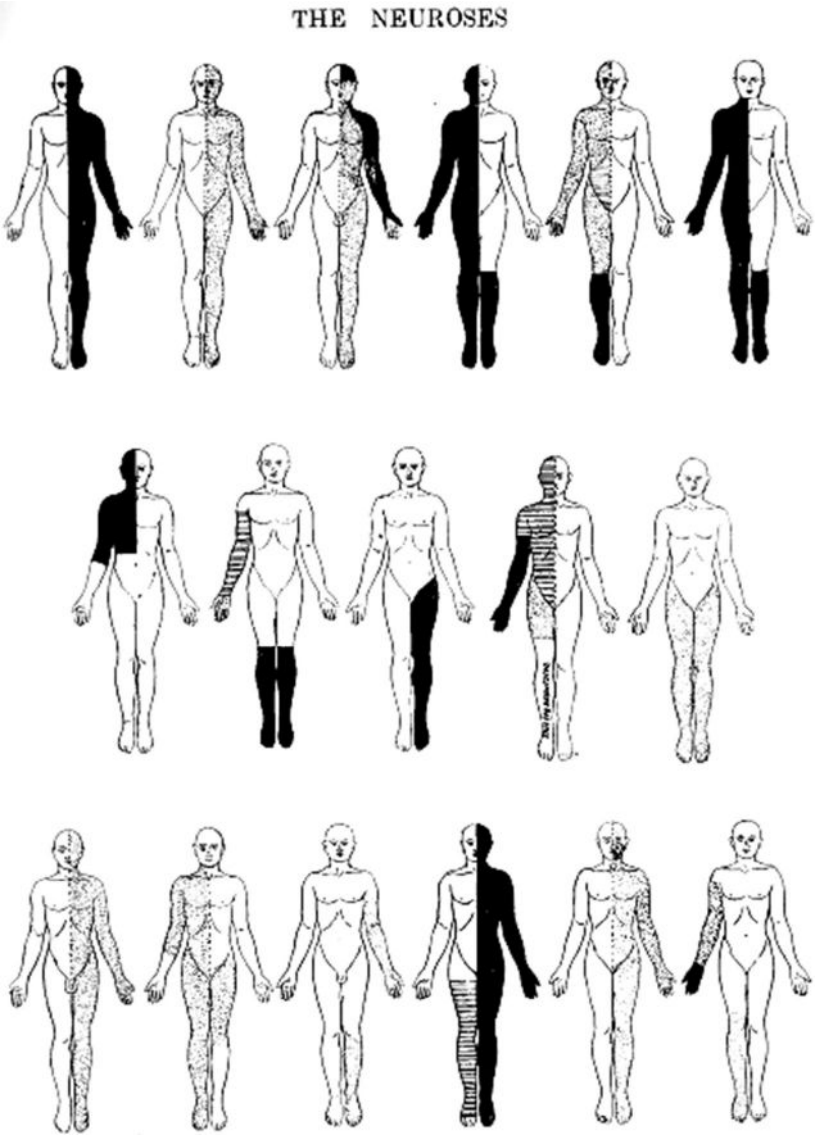

Fig. 24.1. Various types of "hysterical anesthesia." Total loss of sensation (black); shaded (more severe impairment); dotted areas (slight sensory loss). (Reproduced from Purves-Stewart, 1913.)

> *the pin was taken out again. When she was asked where she thought the pins were put in her, she pointed to a part of her body distant to the real place. They were pins of three inches in length (Pitcairn, quoted in Summers, 1926).*

From the 18th century onwards, descriptions of altered sensation in hysteria appear quite regularly in texts on the topic. Whytt, for example, writing about hysteria in 1767, wrote chapters on "an uncommon sense of cold or heat in different parts of the body, sometimes suddenly succeeding each other" and "pains in different parts of the body, suddenly moving from one place to another."

By the late 19th century there was quite intense interest in the various types of sensory disturbances seen in hysteria, and many textbooks of the time carry charts demonstrating patterns including hemisensory disturbance. Figure 24.1, from an early-20th-century textbook of neurology, indicates various patterns thought to be "hysterical" (Purves-Stewart, 1913).

The observation was made that such sensory disturbance could arise from the patients' own ideas (autosuggestion) or through suggestion by the physician, either informally or through hypnosis (heterosuggestion). There was a temporary vogue for using metals to cure hemisensory disturbance (metallotherapy) until it was discovered that wood and amyl nitrite did the same (Gowers, 1892). Often, it was observed that altered sensation arose accidentally through the way a physician spoke to the patient during the examination – "And do

you feel numb here?" Generally speaking, the longer a patient is examined, the more abnormal areas would be found. Babinski was so impressed by this phenomenon that he asserted that all cases of hemisensory disturbance were a result of suggestion by physicians. He even wanted to change the name of hysteria to pithiatism (from the Greek "persuasion" and "curable") (Babinski and Froment, 1918). Others agreed, including Janet, although later he changed his mind on the basis of finding extensive anesthesia in patients apparently unaware of extensive sensory loss found on examination. He noted how it sometimes returned during chloroform anesthesia, when the patient was drunk, after a nonepileptic attack, or during sleep:

> *We have to take the patients by surprise at night, using all sorts of precautions not to wake them. We pinch them on the anaesthetic side. They groan, turn over, complain in their dream, or wake suddenly, exactly as a normal person would (Janet, 1907).*

Similar evidence that functional motor disorders improve during sleep has been published (Lauerma, 1993; Worley, 2002).

It was also realized that there was a close connection between sensory disturbance and weakness. Fox, for example, writing in 1913, commented that, "In the mind of the laity, paralysis must be accompanied necessarily by numbness; paralysis implying that the affected member must be numb and dead" (Fox, 1913). Hurst in 1920 asked medical students to simulate paralysis and found that many of them had areas of altered sensation that they had not been instructed to have and which conformed to patterns of altered and reduced sensation seen in hysteria. He proposed several situations in which hysteric anesthesia could occur, including: (1) suggestion by a physician; (2) anesthesia following an episode of stupor during which there is "profound inattention"; and (3) anesthesia beginning with a disease of the nervous system such as ulnar nerve irritation, but amplified by a functional disorder.

It was noted by several authors that cutaneous reflexes appeared to be altered in patients with hysteric sensory disturbance and this in turn suggested that there must be some form of psychophysiologic disturbance at work. For example, plantar responses have been found to be diminished in patients with hysteria by Allen (1935), and this is our experience also.

Dense anesthesia, including insensibility to pain, as occurs in some patients with functional sensory disturbance, is particularly thought provoking with respect to the physiology of the symptom. Some patients are able to experience a loss of sensation which goes beyond that which most people can imagine being able to sustain

Fig. 24.2. Nineteenth-century illustration of "hysterical" anesthesia used to demonstrate complete absence of sensation (Regnard, 1887). The implausibility both of the lack of bleeding and the smiling nature of the subject in this drawing represent a theatric and objectified view of "hysteria," common at the time.

through effort or pretense. We have been impressed, for example, with the ability of some of our patients to tolerate very-high-amplitude peripheral nerve stimulation on the affected side. Nineteenth-century illustrations of patients with safety pins or long sharp objects through areas of anesthesia are in keeping with this clinical phenomenon, although claims that the patient didn't bleed or would be truly as cheerful, as depicted in Figure 24.2, are less plausible and speak more to theatric objectification of patients with hysteria at that time.

Conversely, pain is a frequently occurring symptom in patients with functional symptoms. Sollier (1897) produced a cartography of the main pain points on the body of women with functional symptoms. The zones were located above, on, and under the breast, between the ribs or just under the lower ribs, at the iliac crest, and at the site of the ovaries. According to Charcot, the ovaries were an important cause of pain and were often enlarged in patients with functional symptoms (Goetz, 1999). Jelgersma could not confirm this enlargement of the ovaries, which he explained by his difficulties with palpation in women with much pain of the ovaries. The observation of enlarged ovaries led to ovariectomy as a treatment for women with functional symptoms, but Charcot disapproved of this treatment (Goetz, 1999). In addition to the zones described by Sollier, Jelgersma (1926) mentioned the nasal cavity and the tympanic cavity.

Much of our knowledge of functional neurologic symptoms and their assessment emerged in the late 19th and early 20th century and has been passed on at the bedside to later generations of neurologists, which was for many of us the only way in which we were taught about this area. Textbooks of neurology had declining amounts of information on "hysteria" over the 20th century, with chapters on functional neurologic symptoms becoming increasingly rare and textbooks of psychiatry emphasizing (incorrectly) diagnosis by exclusion and psychologic mechanisms, not symptoms (Stone et al., 2008). In the absence of any recent systematic studies for this review, we have used British, French, German, and Dutch sources (Jelgersma, 1926) and combined this with our own experience in order to describe the phenomenology.

EPIDEMIOLOGY

"Sensory symptoms" appear as a category in many older studies of "hysteria" or "conversion symptoms," but usually with little other characterization. Typically, around one-third of patients are recorded as having these, usually in combination with other symptoms. The St. Louis group, in their original description of somatization disorder in 500 patients, recorded them in 25% (Guze et al., 1971). Other larger studies have recorded them in 43% ($n = 43$) (Kapfhammer et al., 1992) and as low as 8% ($n = 79$) (Wilson-Barnett and Trimble, 1985).

There are few published studies focusing on functional sensory symptoms. Toth (2003) described a case series of 34 patients with hemisensory syndrome: 74% were women, with a mean age of 35. Even this apparent series of sensory disturbance is a little deceptive. Twenty-five percent of the patients had unilateral heaviness of the limb as well as sensory disturbance. One-third had a sudden onset. In two-thirds it was gradual. Ipsilateral blurring of vision (asthenopia) was present in 28% and ipsilateral hearing loss in 16%. Toth reported persisting symptoms in only 20% of the 30 patients he followed up at 16 months. In a follow-up study of 60 patients with functional motor and sensory symptoms seen 12 years earlier, there was evidence of crossover between symptoms of weakness and numbness. Fifty-eight percent of those initially just complaining of altered sensation complained of weakness at follow-up (Stone et al., 2003).

A number of studies suggested that functional hemisensory symptoms were particularly likely to occur on the left. This fitted with various superficially attractive hypotheses drawing parallels with anosagnosia or *la belle indifférence*. A systematic review of laterality of functional motor and sensory symptoms in 121 studies with 1139 participants found that differences were only seen in studies ($n = 395$) where laterality was an explicit aim of the study (66% on the left). In other studies ($n = 553$) there was no difference with only 53% on the left (Stone et al., 2002) (Fig. 24.3). In fact, *la belle indifférence* itself is a sign without clear diagnostic value and in our experience often indicates a distressed patient "putting on a brave face" (Stone et al., 2006).

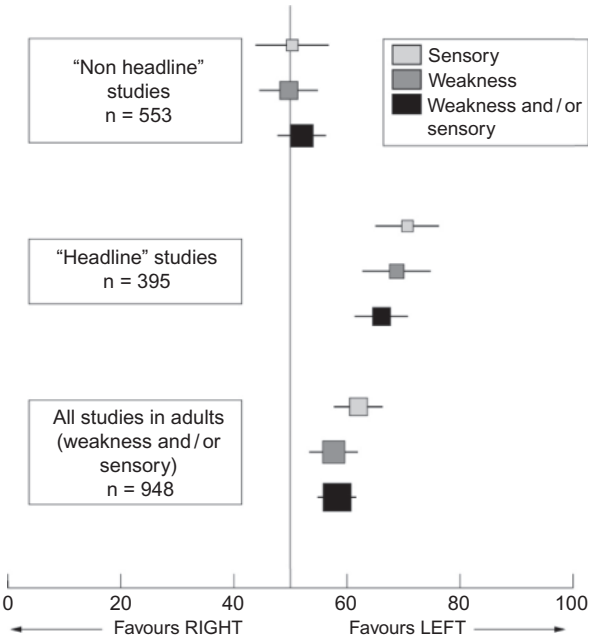

Fig. 24.3. Functional sensory symptoms appear to be more common on the left, but this seems to be a result of publication bias. There is no difference in studies where this was not the explicit aim of the study. n = numbers of patients; 121 studies in total. (Reproduced from Stone et al., 2002, with permission from BMJ Publishing Group.)

Studies in complex regional pain syndrome (CRPS) populations have demonstrated that a hemisensory syndrome or "whole-limb" sensory disturbance is quite common when looked for (Rommel et al., 1999). Sometimes the literature refers to them as "nondermatomal sensory abnormalities" (Mailis-Gagnon and Nicholson, 2010). In recent publications this type of sensory problem has been termed "neglect-like" (Lewis et al., 2007; Bultitude and Rafal, 2010), although others have pointed out that the symptom is different to neglect in that the patient pays attention to the affected limb and is hyperaware of the problem rather than unaware (Punt et al., 2013). In one study of 145 CRPS patients, sensory disturbance occurred in 88% of patients, with 36% reporting a glove-and-stocking distribution, hypoesthesia in 53%, and hyperesthesia in 17% (Birklein et al., 2000). Veldman et al. (1993) found hyperesthesia in 76% of 829 CRPS patients, as well as reduced proprioception and sometimes anesthesia dolorosa (pain in areas of numbness). Other studies of sensory disturbance in CRPS have shown significant response to placebo

(Verdugo and Ochoa, 1998). In their study Verdugo and Ochoa found that all 27 patients with CRPS with no nerve lesion had placebo responsiveness of their sensory disturbance. Tensions in this area have not been helped by equating functional disorders with malingering, which has led to entrenched positions. Arguably the field of functional sensory disorders has much to learn from the work already done on CRPS, and vice versa.

HYPOESTHESIA/SENSORY LOSS

Nature of symptoms

Patients are often not aware of their hypoesthesia. It is not unusual for them to notice this sensory impairment for the first time during the neurologic examination. However, some patients with hypoesthesia definitely do notice the symptom before presenting to medical services and come to clinic complaining that they have burnt themselves or that their limb "doesn't feel right."

The quality of the sensory impairment is variable. Most common is disturbance of pain sensation and in decreasing frequency it is the sensation of touch and temperature which is impaired. The intensity of the symptoms is also variable. There may be only a slight difference in touch or pinprick sensation between the left and the right side, but complete insensitivity to pain has also been observed. Patients may even lose the sensation of having an arm or leg, at which point the problem appears more like a loss of the "idea" of a limb rather than a cutaneous sensory problem. Lasègue (1864) described a situation when patients with functional sensory loss can only move an arm or leg when they look at it. They may find it difficult to say what the position of their arm is with eyes closed. Patients with fixed ankle dystonia have been observed to have similar difficulties knowing, with their eyes closed, whether their ankles were twisted or straight, typically either feeling that the foot "isn't there" or is in a normal straight position even when it patently isn't (Stone et al., 2012a). As with hypoesthesia, sometimes this observation is apparently new when we detect it and may be the result of suggestion, but other patients have told us that they had noticed it themselves but were reluctant to discuss it.

Distribution of symptoms

In some cases patients complain of generalized sensory loss over the whole body. This type of widespread sensory impairment is usually of short duration, but may recur during stressful events. Probably the most common sensory disturbance is hemisensory in nature. This may vary from a small area, often the face, to one side of the whole body. Patients commonly complain of feeling "cut in half" or "split down the middle." This is often more pronounced on the front of the trunk than the back. As found by Toth and described frequently in older texts (e.g., Gowers, 1892), there may be reduced vision (asthenopia) and, less commonly, reduced hearing on the same side. Numbness has a tendency to affect the arm and leg before the trunk. Sometimes sensory disturbance may mysteriously "flip" from one side to the other. A sensory level on the trunk should be a red flag for spinal demyelination or another type of spinal lesion.

Circumferential sensory deficit which ends at the top of the leg, with numbness extending down from the crease of the groin and posteriorly from the crease below the buttock, was described by Janet and Freud. Similar patterns may be seen in the arm, with sensory loss ending abruptly at the shoulder. Such distributions are often said to be "nonanatomic," although they are in keeping with the "idea of a limb." More limited forms of unilateral sock or glove circumferential sensory loss are also well described (Magee, 1962). In our personal experience, unless the patient spends a lot of time sitting on a hard bicycle seat (which can cause perineal nerve compression), has prostate pathology or, rarely, multiple sclerosis, complaints of a numb penis are usually functional.

Another distribution of sensory symptoms is irregular areas. Sensory impairment may be restricted to joints, for instance, shoulders or hips, or there is impairment of the whole foot or hand. In patients with irregular areas of sensory impairment, the boundaries between normal and abnormal are often difficult to establish. In these patients, the sensory disturbances have a distribution comparable with neither that in patients with peripheral neuropathies nor with that in patients with radicular segmental sensory loss. If there is a truncal deficit it may have only an anterior but not a posterior level. The sensory loss may extend over the boundaries between skin and mucosa, for instance, the conjunctiva, vagina, lips, and even the whole oral cavity.

Physical signs of functional sensory loss

In general terms, none of the signs described to diagnose functional sensory disturbance are that reliable, and have performed less well in controlled studies than signs for functional limb weakness or functional movement disorder. This is not surprising, since sensory signs generally have poor reliability and validity in the neurologic examination (Lindley et al., 1993). They rely on an interaction between doctor and patient and reporting of subjective phenomena. They are therefore prone to many forms of bias in their assessment, including problems with suggestion highlighted earlier. In addition, when sensory signs have been reported in previous studies there are several methodologic problems: (1) the diagnosis may have been made partly using the sign being reported, thus overinflating its utility (diagnostic suspicion bias); (2)

nearly all studies of these signs are unblinded (except for one study of interrater reliability (Daum et al., 2014a); (3) there are few studies, mostly with small numbers; and (4) sensory signs are especially liable to verbal misunderstanding. For example, in Janet's "say 'yes' when you feel it and 'no' when you don't" test, patients may think "no" means "feel it less." We describe the signs below and present data on sensitivity and specificity in Table 24.1, but these should be interpreted with great caution for these methodologic reasons.

1. Midline splitting of sensory deficit is suggestive of functional sensory symptoms. Midline splitting is defined by sensory loss with a clear edge on the midline. This midline splitting is considered typical for functional symptoms since in anatomic central lesions the trunk is either spared or sensory loss occurs a couple of centimeters from the midline because of crossover of cutaneous sensory nerves. The sensitivity of midline splitting appeared to be low, but this sign appears specific, particularly if thalamic lesions have been excluded (Rolak, 1988; Chabrol et al., 1995; Stone et al., 2010; Daum et al., 2014a).
2. Splitting of vibration sense has for a long time been a sign of functional sensory loss, since a tuning fork on the left or right side of the sternum or on the forehead is expected to be similar because of the bone conduction. However, although this sign is highly sensitive in patients with functional symptoms, the specificity is surprisingly too low (Rolak, 1988).
3. Nonanatomic sensory loss. Nonanatomic sensory loss has been described as a moderately sensitive and highly specific sign for functional sensory loss, although the quality of the study this is based on is particularly poor (Baker and Silver, 1987).
4. Inconsistency and nonreproducibility of sensory signs in repeated testing have been proposed as important characteristics of functional sensory symptoms (Baker and Silver, 1987; Chabrol et al., 1995), but these signs are difficult to define and therefore the diagnostic value is hard to evaluate. Some specific variants of this testing include:
   (a) Inconsistency between joint position sense and other signs may be informative. If the Romberg test and tandem walk are perfectly carried out in the absence of joint position sense, this supports the diagnosis of a functional disorder (Hayes et al., 1999).
   (b) An absent upper-limb position sense but normal finger-to-nose test with eyes closed is consistent with this diagnosis (Magee, 1962).

   Caution is especially warranted in the interpretation of inconsistencies of a subjectively reported phenomenon. Inconsistencies in sensory testing, for instance, may also be seen in patients with parietal lesions (Critchley, 1964) and complete instability to stand and walk without abnormalities of the legs in bed has also been seen in patients with thalamic lesions (Baik and Lang, 2007).
5. Below-chance performance. Sensory testing can be performed in such a way that the patient ought to score at least 50% by chance, for example by asking the patient to say whether the toe is going up or down during proprioception. Scores of 70% or 80% incorrect raise the suspicion of a functional

Table 24.1

Sensitivity and specificity of functional sensory signs. Data should be interpreted with caution due to methodologic issues, described in text

				Number		
Test	Sensitivity	Specificity	Positive predictive value	Case	Control	Studies
Midline splitting	20%	93%	40%	20	80	Rolak (1988)
	19%	98%	95%	107	46	Stone et al. (2010)
	26%	86%	40%	15	42	Chabrol et al. (1995)
	53%	100%	100%	17	14	Daum et al. (2014a)
Splitting of vibration	95%	14%	22%	20	80	Rolak (1988)
	38%	89%	89%	107	46	Stone et al. (2010)
	50%	88%	82%	18	16	Daum et al. (2014a)
Nonanatomic distribution	85%	95%	94%	20	20	Daum et al. (2014a)
	85%	100%	100%	20	23	Baker and Silver (1987)
Below-chance performance	15%	100%	100%	20	20	Daum et al. (2014a)
	10%	100%	100%	20	23	Baker and Silver (1987)

Adapted from Daum et al. (2014b), with permission from BMJ Publishing Group, adding data from Daum et al. (2014a).

sensory deficit and possibly even malingering but cannot confirm it. This is sometimes called "systematic failure" (Daum et al., 2014a). The principle of systematic failure has also been explored in a neurophysiologic setting using tactile threshold (Tegner, 1988) and a psychologic technique (Miller, 1986).

6. "Say 'yes' when you feel it and 'no' when you don't." Pierre Janet first described this sign (Janet, 1907). It is prone to error when the patient interprets "no" as "feeling it less." Patients may also figure out that the question is a trick and this could reduce trust between doctor and patient.
7. The Bowlus–Currier test. The patient is asked to place the palms of the hands together, thumbs down and wrists crossed. The fingers are interlocked and the patient is asked to rotate the hands and to bring them in front of the chest. Sensory testing starts with the fifth finger and goes on up to the thumb, the only uncrossed finger. The test is positive if the thumb of the normal side is reported to be hypoesthetic (Fig. 24.4) (Bowlus and Currier, 1963). This has been described as a test for malingering, although it is really no more so than any of the other tests described. Since functional disorders are dependent on idea, it would not be that surprising if the patient had the "idea" that a different part of the hand was numb during this test.
8. Sensory deficit sensitive to suggestion. The difficulty here is that symptoms in neurologic disease are also prone to suggestion. Chabrol et al. (1995), for example, found that 60% of patients with neurologic disease had this (vs. 60% of patients with functional disorders).

These studies highlight that, although these tests for functional sensory disturbance may have a reasonably sound basis, in practice there are many vagaries of sensory testing which tend to make them less valuable.

An examination of interrater reliability of these signs was carried out by Corinna Daum, Selma Aybek, and colleagues (Daum et al., 2014a). The study used videos of examination of 20 patients with functional disorders and 20 patients with organic disease in which a series of "functional" signs were performed and the viewers of the video were blinded to the diagnosis. In this study midline splitting and splitting of vibration sense both performed well with a good kappa and high specificity (greater than 90%) and reasonable sensitivity (40–50%), suggesting they can be used to support a diagnosis of functional disorders.

HYPERESTHESIA/PARESTHESIA AND PAIN

Patients with hyperesthesia and paresthesia typically complain about these symptoms more than those with hypoesthesia. Hyperesthesia is a common phenomenon in patients with functional neurologic symptoms. Hyperesthesia may be generalized and may occur as hemihyperesthesia. Literature on hyperventilation shows that hemisensory tingling can be induced experimentally in some people during hyperventilation (Brodtkorb et al., 1990; O'Sullivan et al., 1992). This is clinically relevant when considering physiologic triggers for hemisensory syndrome and functional limb weakness, which may

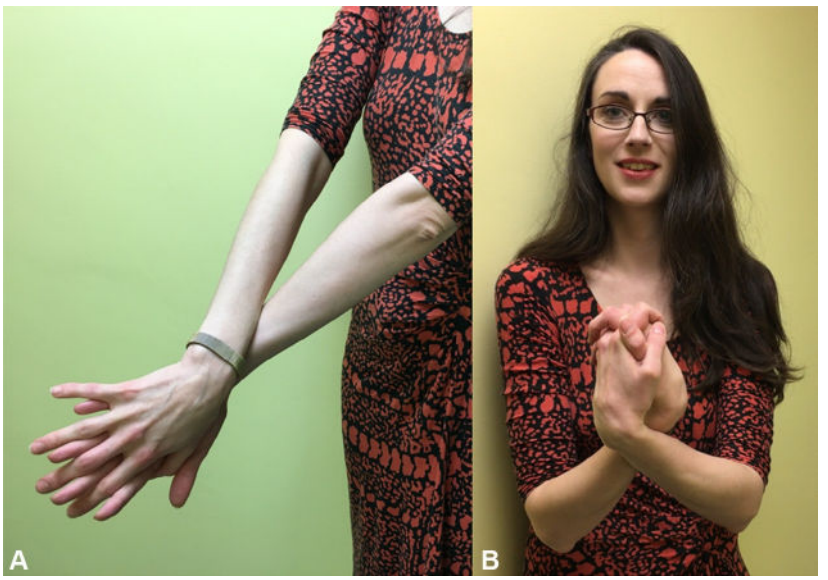

Fig. 24.4. Bowlus–Currier test for functional sensory loss in the hand.

include panic attacks, migraine, and dissociation (Stone et al., 2012b).

In the past, much attention has been given to hyperesthesia in the form of geometric segments or irregular areas. The geometric segments are often located around joints and are accompanied by contractures of muscles around the joint, whereas hypoesthesia comes with paresis of these muscles. These hyperesthesias around joints were often seen after physical trauma. In patients with functional symptoms the area of hyperesthesia is like a hood over the knee, hip, elbow, or shoulder. Slight touch of the skin is experienced as extremely painful (allodynia). This functional hyperesthesia has the tendency to expand and there are parallels again here with CRPS.

In the past problems with the knee after small traumas seem to have presented with high frequency to neurologists, especially in continental Europe, although now this is rarely the case (MV, personal observation). It was impossible to stretch the knee and movements of the knee were hardly possible. Pain was present from one finger under to one finger above the knee joint. Coxalgia or hip pain was another symptom to which much attention was given. These patients had a short period of limping, after which they became bedridden. The prognosis of the arthralgias was variable. According to Charcot, hyperesthesia was the last symptom that disappeared when more symptoms were present and if all symptoms had resolved the chance of recurrence was low. A case like this is presented in his lectures (Charcot, 1889).

If painful hyperesthesia is the only symptom, the diagnosis of small-fiber neuropathy should be considered (Themistocleous et al., 2014). In this type of neuropathy the sensory, often painful, symptoms begin in the feet and progress proximally, eventually involving the hands. Less typical onset of symptoms has been described in patients with demonstrated gain-of-function mutations of the genes *SCN 9A* or *SCN 10A*, mutations found in some patients with this type of neuropathy. Difficulties may arise when small-fiber neuropathy is diagnosed on the basis of skin biopsy. In this situation it can be unclear whether loss of nerve fibers occurs as a primary phenomenon or secondary to limb disuse in chronic pain. Paresthesia appears very commonly with many types of chronic pain syndrome, including those where there is a clear organic cause such as herpes zoster, but also those where there is no clear pathology, such as fibromyalgia. Hyperesthesia may be mixed with hyperalgesia and allodynia.

Sensory disturbance in CRPS has already been discussed. It now forms one of the accepted symptoms, and signs in the Budapest criteria (Harden et al., 2009). This means that a clinical diagnosis of CRPS can now be made on the basis of three symptoms and two signs. Two of these symptoms and two of the signs may be motor and sensory – both of which have been demonstrated repeatedly to share the same qualities as functional motor and sensory symptoms and signs (Verdugo and Ochoa, 1998, 2000; Birklein et al., 2000; Schrag et al., 2004).

UNUSUAL (BUT NONFUNCTIONAL) SENSORY SYMPTOMS

Some clinicians are tempted to make a diagnosis of functional disorder just because symptoms are weird or unusual. A good rule of thumb is that the more odd the symptoms are, the less likely they are to be functional.

Synesthesia

Synesthesia is when the experience of one sensory modality causes also an experience of another. For example, viewing letters or numbers causes the experience of colors (grapheme–color synesthesia) or listening to music causes the experience of seeing colors (Baron-Cohen et al., 1996; Blakemore et al., 2005). Synesthesia is relatively rare, but grapheme–color synesthesia occurs in 0.5–1% of the population (Ramachandran and Hubbard, 2001; Mulvenna et al., 2004) and is not a feature of a functional disorder.

Cenesthesias

Cenesthesias are abnormal bodily sensations which are perceived as totally different from sensations previously experienced and are therefore difficult for patients to communicate. This easily leads to the wrong conclusion that the symptoms are vague and therefore functional. Cenesthetic sensations may consist of very circumscript pain and of sensations of pulling, pressure, or movements in the brain (Podoll et al., 1999). These symptoms have been reported by patients with migraine, epilepsy, Parkinson's disease (Jimenez-Jimenez et al., 1997), and multiple sclerosis (Wurthmann et al., 1990).

Allesthesia or allochiria

Allesthesia or allochiria is the phenomenon that a touch on the contralesional side of the body is reported as occurring on the ipsilateral side (Obersteiner, 1881). Similar transferable sensations from left (affected) to right (normal) have been seen in audition and olfaction (Halligan et al., 1992). If allesthesia is present, a right parietal lesion should be looked for. We have already mentioned a couple of times that parietal lesions have to be considered, but a parietal lesion does not exclude the development of functional sensory symptoms superimposed on the lesion (Ramasubbu, 2002).

PATHOPHYSIOLOGY

Discussion of studies exploring the pathophysiology in functional sensory disorders using neurophysiology (Chapter 6) and functional imaging (Chapter 7) can be found elsewhere in this volume (Levy and Behrman, 1970; Moldofsky and England, 1975; Lorenz et al., 1998; Vuilleumier et al., 2001; Hoechstetter et al., 2002; Ghaffar et al., 2006; Egloff et al., 2009).

Evidence is converging towards a model in which symptoms arise from a physiologic or psychologic trigger (for example, hyperventilation, migraine, transient nerve compression) and are then perpetuated by abnormally focused attention in which a "top-down" expectation of the symptom overrides and modifies "bottom-up" sensory input (Edwards et al., 2012). Such ideas have a lot in common with those put forward by Janet, Charcot, and others at the end of the 19th and the beginning of the 20th century.

TREATMENT SPECIFIC FOR SENSORY SYMPTOMS

Treatment is discussed in detail elsewhere in this volume. Our personal experience is that reduced sensation often does not need specific treatment and it commonly co-occurs with weakness. Older textbooks frequently refer to successful treatment with faradization. In the modern era we have found a transcutaneous electric nerve stimulation machine, often turned up high, or in some cases peripheral nerve stimulation has provided a form of biofeedback, not only to see muscle contraction but also to experience new sensation in an anesthetic limb.

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