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Sural sparing in Guillain–Barré syndrome subtypes: a reappraisal with historical and recent definitions

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HIGHLIGHTS

- Sural sparing is helpful to distinguish Guillain–Barré syndrome subtypes.
- Sural sparing as defined historically by an absent median/present sural response is specific of AIDP.
- Sural sparing as defined historically is useful irrespective of electrodiagnostic criteria utilized.

ABSTRACT

Objective: To ascertain the impact of definition and diagnostic criteria on sural sparing in Guillain–Barré syndrome (GBS).
Methods: We retrospectively reviewed records of 78 consecutive patients with GBS from Birmingham, UK (2001–2012) studied within 21 days post-onset. Different criteria were initially used for subtype classification. Sural sparing was subsequently ascertained using historical/recent definitions.
Results: With Hadden et al.'s criteria, "absent median present sural" and "absent median normal sural" patterns offered sensitivities of 21.7% and 15.2% respectively for AIDP, with specificities of 100% versus axonal GBS. Present sural with two abnormal upper limb responses had a sensitivity of 19.1% and 100% specificity. "Abnormal radial present sural" and "abnormal radial normal sural" patterns had sensitivities of 18.9% and 16.2% and specificity of 100%. With newly-proposed criteria (Rajabally et al., 2015), "absent median present sural" and "absent median normal sural" patterns offered sensitivities of 27.8% and 19.4% respectively, with specificity of 100%. Ulnar patterns were unhelpful with both criteria. Other patterns had suboptimal specificity.
Conclusion: Although of low sensitivity, sural sparing defined by absent median/present sural patterns, is specific of AIDP versus axonal GBS, irrespective of criteria.
Significance: Sural sparing is definition and criteria-dependent in GBS but is specific of AIDP with historical definitions, regardless of criteria.

1. Introduction

Although not formally included to date in any set of electrodiagnostic criteria, sensory nerve conduction studies are routinely performed for suspected Guillain–Barré syndrome (GBS). Few studies of sensory abnormality patterns have been conducted in inflammatory neuropathies. One of the reported features is that known as the "sural sparing" pattern which has been described as being suggestive of acute and chronic demyelinating neuropathies (Bromberg and Albers, 1993; Al-Shekhlee et al., 2005). Other studies demonstrated the utility of median/radial and sural/radial ratios in different neuropathy subtypes (Rutkove et al., 1997; Tamura et al., 2005) as well as comparative radial/sural amplitude patterns (Rajabally and Narasimhan, 2007).

Definitions of "sural sparing" have however been variable and multiple. Earlier studies have used the "abnormal median normal sural" pattern (Bromberg and Albers, 1993), or "normal or relatively preserved sural sensory nerve action potential (SNAP) compared with at least two abnormal SNAPs in the upper limb" (Al-Shekhlee et al., 2005). "Extreme" patterns comprising an absent median but preserved sural response were described over twenty years ago and found highly specific for acute inflammatory

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demyelinating polyneuropathy (AIDP) and chronic inflammatory demyelinating polyneuropathy (CIDP) (Bromberg and Albers, 1993). The usefulness of the "sural sparing" sensory abnormality pattern in diagnosing GBS has recently been further evaluated and found to be the most specific finding in distinguishing GBS from its mimics in a multicentre study (Derksen et al., 2014). The definition used in this study however was of a "spared" or present, normal sural response with an abnormal ulnar SNAP. Although initially described as a feature of demyelinating neuropathy, and therefore, of the AIDP form in GBS, sural sparing has also been reported in Miller Fisher syndrome (MFS) and found in some patients with acute motor axonal neuropathy (AMAN) (Umapathi et al., 2012, 2014; Sekiguchi et al., 2013; Capasso et al., 2011). A more recent analysis has suggested that sural sparing, which the authors defined as relative greater sensory potential amplitude reduction of median or ulnar versus sural nerves, was as frequently found in AIDP as in axonal forms of GBS and therefore not indicative of demyelinating pathology (Umapathi et al., 2015). Whether this finding is applicable to other possible definitions of sural sparing, to the use of different electrophysiological criteria for GBS and to electrophysiological studies performed in the early disease stages, when the findings can be truly diagnostically useful, is currently unknown. These many uncertainties about the significance of sural sparing in GBS prompted us to conduct this current analysis.

2. Methods

We retrospectively reviewed our institutional database of patients admitted with a diagnosis of GBS between 2001 and 2012 at the Queen Elizabeth Hospital, Birmingham, UK. The diagnosis was made in each case in accordance with established clinical criteria (Wakerley et al., 2014). Included patients had undergone electrophysiological testing of at least 3 motor and 2 sensory nerves (consisting of at least one upper limb and one sural nerve) within 21 days of symptom-onset. Electrophysiology was performed according to standard methods by a qualified senior physician trained and experienced in electromyography, using routine procedures and different neurophysiological equipment over the years of the study. Motor studies were performed as described elsewhere (Rajabally et al., 2015). Results were analyzed with our laboratory's normal values and the initial fulfillment of older (Hadden et al., 1998) and newly-proposed electrodiagnostic criteria (Rajabally et al., 2015), was ascertained in each case. These are summarized in Tables 1 and 2.

Median and ulnar sensory potentials were evaluated by orthodromic stimulation of the index and small fingers respectively using ring electrodes and recording at the wrist. Radial potentials were evoked by antidromic stimulation at lower forearm level, on the radius, the recording site being located at the anatomical snuff box. Sural potentials were recorded from antidromic stimulation at the lower lateral third of the mid-calf, the recording electrode being located below the lateral malleolus. Averaging of at least 8 responses was routinely performed to improve signal-to-noise ratio. Normal values were those used by our laboratory, as previously derived from non-neuropathic control populations (Rajabally et al., 2009; unpublished data).

A summary of all terms used and sensory abnormality patterns described in this analysis is provided for ease of reference in Table 3.

Terms used describing sural sparing will be defined as follows in this paper: "normal": within normal range for our laboratory, "abnormal": detectable but subnormal response; "present": any recordable response; "absent": unrecordable response.

We used all previous definitions utilized, in this analysis.

Sural sparing was first defined as a greater decrease of the median or ulnar SNAP compared to the decrease in the sural SNAP and was calculated by the ratio of the upper limb nerve relative SNAP amplitude decrease over that of the sural (Umapathi et al., 2015). Sensory studies were evaluated with this definition after initial GBS subtype classification using Hadden et al.'s criteria, as well as newly-proposed criteria.

Secondly, we defined sural sparing as a present sural SNAP in presence of 2 abnormal upper limb SNAPs (Al-Shekhlee et al., 2005).

Third, we considered sural sparing as a Sensory Ratio > 1. This ratio is defined as sural SNAP + radial SNAP/median SNAP + ulnar SNAP (Al-Shekhlee et al., 2007). Both sets of GBS criteria were similarly applied to the cohort.

Fourth, in relation to other published definitions (Bromberg and Albers, 1993; Rajabally and Narasimhan, 2007; Derksen et al., 2014) we applied a number of sensory abnormality patterns to our cohort, including: (1) abnormal median normal sural, (2) abnormal ulnar normal sural, (3) abnormal radial normal sural, (4) absent median normal sural, (5) absent ulnar normal sural, (6) absent radial normal sural, (7) absent median present sural, (8) absent ulnar present sural, (9) absent radial present sural, (10) abnormal median present sural, (11) abnormal ulnar present sural and (12) abnormal radial present sural.

Table 1
Hadden et al.'s electrodiagnostic criteria for Guillain–Barré syndrome (1998).

1. Normal
(All the following in all nerves tested)
DML $\leqslant$ 100% ULN
F wave present with latency $\leqslant$ 100% ULN
MCV $\geqslant$ 100% LLN
Distal CMAP $\geqslant$ 100% LLN
Proximal CMAP $\geqslant$ 100% LLN
Proximal CMAP/distal CMAP ratio > 0.5
2. Primary demyelinating
(At least one of the following in each of at least two nerves, or at least two of the following in one nerve if all others inexcitable and distal CMAP $\geqslant$ 10% LLN)
MCV < 90% LLN (85% if distal CMAP < 50% LLN)
DML > 110% ULN (120% if distal CMAP < 100% LLN)
Proximal CMAP/distal CMAP ratio <0.5 and distal CMAP $\geqslant$ 20% LLN
F-response latency > 120% ULN
3. Primary axonal
None of the above features of demyelination in any nerve (except one demyelinating feature allowed in one nerve if distal CMAP < 10% LLN), and distal CMAP < 80% LLN in at least two nerves
4. Inexcitable
Distal CMAP absent in all nerves (or present in only one nerve with distal CMAP < 10% LLN)
5. Equivocal
Does not exactly fit criteria for any other group