

Neurometer[®] CPT

Sensory Nerve Conduction Threshold (sNCT[®])
Electrodiagnostic Evaluation

Overview and References

Appendix H. Evaluation of sNCT Measures

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The computerized evaluation of sNCT studies compares the CPT measures generated in the studies to standardized, clinically established ranges of healthy measures established for dozens of different body test sites. The standardized measures were collected from clinical studies conducted at Johns Hopkins Medical Institution, University of Maryland School of Pharmacology, Creighton University School of Medicine, New York Medical College, New York University Medical Center, and the University of New Mexico School of Medicine. Appendix E, section 8 lists related publications.

sNCT/CPT values and their ratios are both considered when determining the degree of sensory nerve impairment. The analysis can include determinations of hyperesthetic, hypoesthetic and anesthetic neuropathological conditions. The grading system used to characterize sNCT/CPT measures is shown in the table below. It allows a linear characterization of a sensory dysfunction from the earliest stage all the way through to the anesthetic stage (total loss of sensory function)

sNCT/CPT Grading Parameters Table

Grade Range	Clinical Characterization	Statistical Parameters
10.00 - 12.00	Anesthetic at one or more frequencies	No response to maximum stimulus
9.00 - 9.90	Severely hypoesthetic at one or more frequencies	Above healthy range & More than 4 S.D. above mean
8.00 - 8.82	Moderately hypoesthetic at one or more frequencies	Above healthy range & 3+ to 4 S.D. above mean
7.00 - 7.74	Mildly hypoesthetic at one or more frequencies	Above healthy range & 2+ to 3 S.D. above mean
6.00 - 6.62	Moderately hyperesthetic at one or more frequencies	Below healthy range & More than 2.5 S.D. below mean
5.00 - 5.52	Mildly hypoesthetic at one or more frequencies	Below healthy range & 1 to 2.5 S.D. below mean
4.00 - 4.82	Mild sensory dysfunction	Within-site ratio beyond healthy range by more than 30%
3.00 - 3.70	Very Mild sensory dysfunction	Within-site ratio beyond healthy range up to 30%
2.00 - 2.78	Extremely Mild sensory dysfunction	Between-sites ratio beyond healthy range by more than 30%
1.00 - 1.66	Slight sensory dysfunction	Between-sites ratio beyond healthy range up to 30%

Grade Range	Clinical Characterization	Statistical Parameters
10.00 - 12.00	Anesthetic at one or more frequencies	No response to maximum stimulus
0	No Abnormalities Detected	All measures within healthy parameters

Sample Clinical Reports

The software that evaluates the sNCT/CPT measures can also produce a two-part Clinical Report documenting the evaluation. The first part is a clinical summary and narrative page which summarizes the findings from test sites in a tabular form and creates a narrative detailing the findings. The second part is a raw intermediate calculations sheet that details the intermediate statistical calculations upon which the clinical summary is based. This part of the report is generated for documentation purposes only and does not necessarily represent a final determination of the condition of the nerve(s) being studied. It does, however, provide a level of detail that may be useful in assisting the health care provider in reaching certain diagnoses. As with any neurodiagnostic test, a clinician's interpretation including a clinical correlation is essential and necessary for diagnostic purposes. Three sample reports follow:

Report #1: Lumbar (L5) Radiculopathy.

The patient in this report had sNCT/CPT studies conducted at 3 sites bilaterally for the evaluation of lumbar/sacral radiculopathy:

- #1 Dorsal medial big toe, superficial peroneal nerve, Lumbar 4 dermatome.
- #2 Dorsal distal third toe, superficial peroneal nerve, Lumbar 5 dermatome.
- #3 Dorsal lateral little toe, sural nerve, Sacral 1 dermatome.

The finding of an isolated sensory impairment of the sensory function at site #2 on the right side is consistent with an L5 radiculopathy. A lesion of the fifth lumbar nerve root (L5 radiculopathy) would show an impairment confined to the Lumbar 5 dermatome. This isolated abnormality finding helps rule out the possibility that the patient's sensory impairment is the result of a lesion of the superficial peroneal nerve or from a polyneuropathy.

Report #2: Diabetic Distal Axonal Polyneuropathy, with loss of protective function at the big toe test site.

The patient in this report had sNCT/CPT studies conducted at the big toe wrap around site bilaterally. Polyneuropathy is evaluated at this location because it includes both the deep and superficial peroneal nerves and the Lumbar 4th and 5th dermatomes. A loss of sensory function is only detected at

this site if multiple nerve/dermatomes are impaired. Distal axonal polyneuropathy a predominant type of diabetic polyneuropathy begins first at the tips of the longest nerve fibers located in the big toe. The sNCT/CPT findings from this study are consistent with a loss of protective sensation transmitted by the smaller diameter nerve fibers. This loss of small fiber function patient would also place this patient at increased risk of cardiac death. This neuropathy would not be detectable by NCV and ER electrodiagnostic tests because they do not evaluate smaller diameter nerve fiber function.

Report #3: Carpal Tunnel Syndrome (CTS).

The patient in this report had sNCT/CPT studies conducted at 3 sites bilaterally for the evaluation of CTS:

- #1 Tip of index finger (digital branch of the median nerve)
- #2 Tip of little finger (digital branch of the ulnar nerve)
- #3 Mid proximal palm (palmar branch of the median nerve)

The finding of an isolated sensory impairment of the median nerve function at the left index finger test site is consistent with the diagnosis of CTS. The finding of normal sensory function of the palmar branch of the left median nerve helps rule out the possibility that the patients median nerve sensory impairment in the hand is the result of a lesion proximal to the carpal tunnel. The finding of normal sensory function of the ulnar nerve at the little finger tests sites and at the right index finger test site helps to rule out the possibility that the patient's sensory impairment in the left index finger was consistent with a polyneuropathy.

Clinical Summary Report #1

Lumbar (L5) Radiculopathy

SENSORY NERVE CONDUCTION THRESHOLD (CPT) TEST: DATA ANALYSIS SUMMARY SHEET

PATIENT NAME: Public, John, Q

ID: 111 111 111 DOB: 01-01-1929 SEX: M

NOTE: radiating pain and numbness L5 dermatome R

DATE: 01-04-2001 TYPE: SIDE: B VER: nvdb 2.41 (Y2K)

CPT Measures and Analysis Summary

		2K Hz	250 Hz	5 Hz	GRADE
S.PERONEAL-toe1	:L	499	161	068	0.00
	:R	398	108	077	0.00
S.PERONEAL-toe3	:L	408	142	092	0.00
	:R	666	229	044	8.37
SURAL-toe5	:L	469	150	084	0.00
	:R	411	099	123	0.00

CPT Summary Report Observations

CPT Measures were taken from 6 sites. Bilateral measurements were obtained from the superficial peroneal n. on toe 1 (dorsal medial aspect); L4. The grade of the left side measures was 0.00 which indicates no abnormal measures. The grade on the right side was 0.00 indicating no abnormal measures.

Bilateral measurements were obtained from the superficial peroneal n. on toe 3 (dorsal distal aspect); L5. The grade of the left side measures was 0.00 which indicates no abnormal measures. The grade on the right side was 8.37 indicating a moderate hypoesthetic condition.

Bilateral measurements were obtained from the sural n. on toe 5 (dorsal lateral aspect); S1. The grade of the left side measures was 0.00 which indicates no abnormal measures. The grade on the right side was 0.00 indicating no abnormal measures.

Intermediate Calculations Report #1 Lumbar (L5) Radiculopathy

SENSORY NERVE CONDUCTION THRESHOLD (CPT) TEST: INTERMEDIATE CALCULATIONS

PATIENT NAME: Public, John, Q
 ID: 111 111 111 DOB: 01-01-1929 SEX: M
 NOTE: radiating pain and numbness L5 dermatome R
 DATE: 01-04-2001 TYPE: SIDE: B VER: nvdb 2.41 (Y2K)

Current Perception Threshold (CPT) Measures & Range Analysis

	2K Hz	scr	250 Hz	scr	5 Hz	scr	GRADE
L-S.PERONEAL-toe1	499	(0)	161	(0)	068	(0)	0.00
L-S.PERONEAL-toe3	408	(0)	142	(0)	092	(0)	0.00
L-SURAL-toe5	469	(0)	150	(0)	084	(0)	0.00

Within Site CPT Ratios & Analysis

	2K:5	scr	2K:250	scr	250:5	scr	GRADE
L-S.PERONEAL-toe1	7.34	(0)	3.10	(0)	2.37	(0)	0.00
L-S.PERONEAL-toe3	4.43	(0)	2.87	(0)	1.54	(0)	0.00
L-SURAL-toe5	5.58	(0)	3.13	(0)	1.79	(0)	0.00

Between Sites CPT Ratios & Analysis

	2K:2K	scr	250:250	scr	5:5	scr	GRADE
L-S.PER-t3:L-S.PER-t1	0.82	(0)	0.88	(0)	1.35	(0)	0.00
L-SUR-t5:L-S.PER-t1	0.94	(0)	0.93	(0)	1.24	(0)	0.00
L-SUR-t5:L-S.PER-t3	1.15	(0)	1.06	(0)	0.91	(0)	0.00

Current Perception Threshold (CPT) Measures & Range Analysis

	2K Hz	scr	250 Hz	scr	5 Hz	scr	GRADE
R-S.PERONEAL-toe1	398	(0)	108	(0)	077	(0)	0.00
R-S.PERONEAL-toe3	666	(+2)	229	(+1)	044	(0)	8.37
R-SURAL-toe5	411	(0)	099	(0)	123	(0)	0.00

Within Site CPT Ratios & Analysis

	2K:5	scr	2K:250	scr	250:5	scr	GRADE
R-S.PERONEAL-toe1	5.17	(0)	3.69	(0)	1.40	(0)	0.00
R-S.PERONEAL-toe3	15.14	(0)	2.91	(0)	5.20	(0)	0.00
R-SURAL-toe5	3.34	(0)	4.15	(0)	0.80	(0)	0.00

Between Sites CPT Ratios & Analysis

	2K:2K	scr	250:250	scr	5:5	scr	GRADE
R-S.PER-t3:R-S.PER-t1	1.67	(0)	2.12	(0)	0.57	(0)	0.00
R-SUR-t5:R-S.PER-t1	1.03	(0)	0.92	(0)	1.60	(0)	0.00
R-SUR-t5:R-S.PER-t3	0.62	(0)	0.43	(0)	2.80	(2)	2.00

Bilateral/Between Sites CPT Ratios & Analysis

	2K Hz	scr	250 Hz	scr	5 Hz	scr	GRADE
S.PERONEAL-toe1 - L:R	1.25	(0)	1.49	(0)	0.88	(0)	0.00
S.PERONEAL-toe3 - L:R	0.61	(0)	0.62	(0)	2.09	(1)	1.00
SURAL-toe5 - L:R	1.14	(0)	1.52	(0)	0.68	(0)	0.00

Clinical Summary Report #2 Diabetic Distal Axonal Polyneuropathy

SENSORY NERVE CONDUCTION THRESHOLD (CPT) TEST: DATA ANALYSIS SUMMARY SHEET

PATIENT NAME: Smith, Joe, R

ID: 000-00-0000 DOB: 02-19-58 SEX: M

NOTE: R/O neuropathy

DATE: 01-10-98 TYPE:

SIDE: B VER: nvdb 2.30

CPT Measures and Analysis Summary

	2K Hz	250 Hz	5 Hz	GRADE
S.PERONEAL-toe1 :L	318	650	999	10.45
:R	298	705	999	10.45

CPT Summary Report Observations

CPT Measures were taken from 2 sites. Bilateral measurements were obtained from the superficial peroneal n. on toe 1 (dorsal medial aspect); L4. The grade of the left side measures was 10.45 which indicates a profound sensory loss anesthetic at one frequency. The grade on the right side was 10.45 indicating a profound sensory loss anesthetic at one frequency.

Intermediate Calculations Report #2 Diabetic Distal Axonal Polyneuropathy

SENSORY NERVE CONDUCTION THRESHOLD (CPT) TEST: INTERMEDIATE CALCULATIONS

PATIENT NAME: Smith, Joe, R

ID: 000-00-0000 DOB: 02-19-58 SEX: M

NOTE: R/O neuropathy

DATE: 01-10-98 TYPE:

SIDE: B VER: nvdb 2.42 (Y2K)

Current Perception Threshold (CPT) Measures & Range Analysis

	2K Hz	scr	250 Hz	scr	5 Hz	scr	GRADE
L-S.PERONEAL-toe1	318	(0)	650	(+3)	999	(+4)	10.45
R-S.PERONEAL-toe1	298	(0)	705	(+3)	999	(+4)	10.45

Within Site CPT Ratios & Analysis

	2K:5	scr	2K:250	scr	250:5	scr	GRADE
L-S.PERONEAL-toe1	0.32	(2)	0.49	(2)	0.65	(0)	4.41
R-S.PERONEAL-toe1	0.30	(2)	0.42	(2)	0.71	(0)	4.41

Between Sites CPT Ratios & Analysis

	2K:2K	scr	250:250	scr	5:5	scr	GRADE
L-S.PER-t1:R-S.PER-t1	1.07	(0)	0.92	(0)	1.00	(0)	0.00

Clinical Summary Report #3 Carpal Tunnel Syndrome (CTS)

SENSORY NERVE CONDUCTION THRESHOLD (CPT) TEST: DATA ANALYSIS SUMMARY SHEET

PATIENT NAME: Sample, Patient, E
ID: 500-10-1000 DOB: 10-06-58 SEX: F
NOTE: Lft wrist pain numbness, tingling in fingers
DATE: 08-18-98 TYPE: SIDE: B VER: nvdb 2.3

CPT Measures and Analysis Summary

	2K Hz	250 Hz	5 Hz	GRADE
MEDIAN-index :L	585	325	038	9.45
:R	265	078	061	0.00
ULNAR-little :L	238	088	042	0.00
:R	243	088	035	0.00
MEDIAN-plmr/thnr :L	225	076	037	0.00
:R	302	081	063	0.00

CPT Summary Report Observations

CPT Measures were taken from 6 sites. Bilateral measurements were obtained from the median n. on the index finger; C7. The grade of the left side measures was 9.45 which indicates a very severe hypoesthetic condition. The grade on the right side was 0.00 indicating no abnormal measures.

Bilateral measurements were obtained from the ulnar n. on the little finger; C8. The grade of the left side measures was 0.00 which indicates no abnormal measures. The grade on the right side was 0.00 indicating no abnormal measures.

Bilateral measurements were obtained from the median nerve - palmar branch (thenar); C6, C7. The grade of the left side measures was 0.00 which indicates no abnormal measures. The grade on the right side was 0.00 indicating no abnormal measures.

Intermediate Calculations Report #3 Carpal Tunnel Syndrome (CTS)

SENSORY NERVE CONDUCTION THRESHOLD (CPT) TEST: INTERMEDIATE CALCULATIONS

PATIENT NAME: Sample, Patient, E

ID: 500-10-1000 DOB: 10-06-58 SEX: F

NOTE: Lft wrist pain numbness, tingling in fingers

DATE: 08-18-98 TYPE: SIDE: B VER: nvdb 2.3

Current Perception Threshold (CPT) Measures & Range Analysis

	2K Hz	scr	250 Hz	scr	5 Hz	scr	GRADE
L-MEDIAN-index	585	(+3)	325	(+3)	038	(0)	9.45
L-ULNAR-little	238	(0)	088	(0)	042	(0)	0.00
L-MEDIAN-plmr/thnr	225	(0)	076	(0)	037	(0)	0.00

Within Site CPT Ratios & Analysis

	2K:5	scr	2K:250	scr	250:5	scr	GRADE
L-MEDIAN-index	15.39	(1)	1.80	(0)	8.55	(2)	4.35
L-ULNAR-little	5.67	(0)	2.70	(0)	2.10	(0)	0.00
L-MEDIAN-plmr/thnr	6.08	(0)	2.96	(0)	2.05	(0)	0.00

Between Sites CPT Ratios & Analysis

	2K:2K	scr	250:250	scr	5:5	scr	GRADE
L-ULN-lttl:L-MED-indx	0.41	(2)	0.27	(2)	1.11	(0)	2.39
L-MED-plm/thn:L-MED-indx	0.38	(2)	0.23	(2)	0.97	(0)	2.39
L-MED-plm/thn:L-ULN-lttl	0.95	(0)	0.86	(0)	0.88	(0)	0.00

Current Perception Threshold (CPT) Measures & Range Analysis

	2K Hz	scr	250 Hz	scr	5 Hz	scr	GRADE
R-MEDIAN-index	265	(0)	078	(0)	061	(0)	0.00
R-ULNAR-little	243	(0)	088	(0)	035	(0)	0.00
R-MEDIAN-plmr/thnr	302	(0)	081	(0)	063	(0)	0.00

Within Site CPT Ratios & Analysis

	2K:5	scr	2K:250	scr	250:5	scr	GRADE
R-MEDIAN-index	4.34	(0)	3.40	(0)	1.28	(0)	0.00
R-ULNAR-little	6.94	(0)	2.76	(0)	2.51	(0)	0.00
R-MEDIAN-plmr/thnr	4.79	(0)	3.73	(0)	1.29	(0)	0.00

Between Sites CPT Ratios & Analysis

	2K:2K	scr	250:250	scr	5:5	scr	GRADE
R-ULN-lttl:R-MED-indx	0.92	(0)	1.13	(0)	0.57	(0)	0.00
R-MED-plm/thn:R-MED-indx	1.14	(0)	1.04	(0)	1.03	(0)	0.00
R-MED-plm/thn:R-ULN-lttl	1.24	(0)	0.92	(0)	1.80	(0)	0.00

Bilateral/Between Sites CPT Ratios & Analysis

	2K Hz	scr	250 Hz	scr	5 Hz	scr	GRADE
MEDIAN-index - L:R	2.21	(2)	4.17	(2)	0.62	(0)	2.39
ULNAR-little - L:R	0.98	(0)	1.00	(0)	1.20	(0)	0.00
MEDIAN-plmr/thnr - L:R	0.75	(0)	0.94	(0)	0.59	(0)	0.00