

# Peripheral nerves cross-sectional area for the diagnosis of diabetic polyneuropathy: A meta-analysis of ultrasonographic measures

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## Background

As complimentary technique, nerves Ultrasonography (US) is a novel method that can assist the physician in localization and differential diagnosis of neuropathy in challenging cases. Although nerve ultrasound is commonly utilized for entrapment mononeuropathies and demyelinating neuropathies, data on the usefulness of US for diabetic polyneuropathies are limited<sup>1</sup>.

It has been hypothesized that in individuals with diabetes mellitus the peripheral nerve is swollen due to sorbitol over-accumulation<sup>2</sup>. Additionally growing evidence supported electrodiagnostic study of diabetes induced neuropathy as a method having some challenges.

## Objectives

To examine the performance of sonographic cross-sectional area (CSA) measurements in the diagnosis of diabetic polyneuropathy (DPN).



## Methods

### Data Sources

Electronic databases, comprising PubMed and EMBASE and Google scholar, were searched for the appropriate studies before Jan 1, 2020.

### Study Selection

Eleven trials comparing different peripheral nerve CSA measurements between participants with and without DPN were included.

### Data Extraction

Study design, participants' demographic characteristics, diagnostic reference of DPN, and evaluated peripheral nerves and methods of CSA measurement.

Table 1: Characteristics of studies

| Study | Author, country            | Number of patients | Nerves                                     | Sensitivity/specificity | ROC | CSA (cross-section area) | Regression | correlation |
|-------|----------------------------|--------------------|--|-------------------------|-----|--------------------------|------------|-------------|
| 1     | Agirman et al, Turkey      | 63                 | Median-Ulnar                               | +                       | +   | +                        | -          | -           |
| 2     | Riazi et al, Canada        | 55                 | Tibial                                     | +                       | +   | +                        | +          | -           |
| 3     | Arumugam et al, Malaysia   | 100                | Ulnar. Median. Radial tibial.sural.proneal | -                       | -   | +                        | -          | +           |
| 4     | Breiner et al, Canada      | 100                | all  | +                       | -   | +                        | -          | -           |
| 5     | Webb et al, USA            | 25                 | Peroneal. Sural                            | -                       | -   | +                        | -          | +(with age) |
| 6     | Singh et al, India         | 75                 | Tibial                                     | -                       | -   | +                        | -          | -           |
| 7     | Liu et al, China           | 100                | Sural                                      | +                       | +   | +                        | -          | -           |
| 8     | Kang et al, Korea          | 20                 | All  | +                       | +   | +                        | -          | -           |
| 9     | Lee et al, China           | 24                 | Tibial                                     | -                       | -   | +                        | -          | -           |
| 10    | Pitaroccoli et al, Germany | 44                 | All  | -                       | -   | +                        | -          | +(with EDx) |
| 11    | Borire et al, UK           | 37                 | Median-Ulnar-Tibial-Peroneal               | -                       | -   | +                        | -          | -           |

## Results

Among different peripheral nerves, Tibial nerve diagnostic odds ratios pooled from 5 studies (713 participants) were 4.46 (95% CI, 0.35–8.57) and the largest one with  $P < 0.0001$ ,  $I^2: 64\%$ . Median nerve CSA at wrist and mid-arm took second and third place with ORs= 2.82 (1.50-4.15), 2.02(0.26-3.77) respectively. The sensitivities and specificities pooled from 2 studies for Sural nerve were .78 (95% CI, .68–.89), and .68 (95% CI, .53–.74). Included studies for other nerves were limited to one study. The largest sensitivity was for Sural nerve and the largest specificity was for Tibial nerve.

## Conclusion

The peripheral nerves CSA measured by ultrasound imaging is useful for the diagnosis of DPN and is most significantly different between patients and participants without DPN at the Tibial nerve. Because the Tibial nerve CSA in healthy participants, at various locations, rarely exceeds  $24\text{mm}^2$ , this value can be considered as a cutoff point for diagnosing DPN.

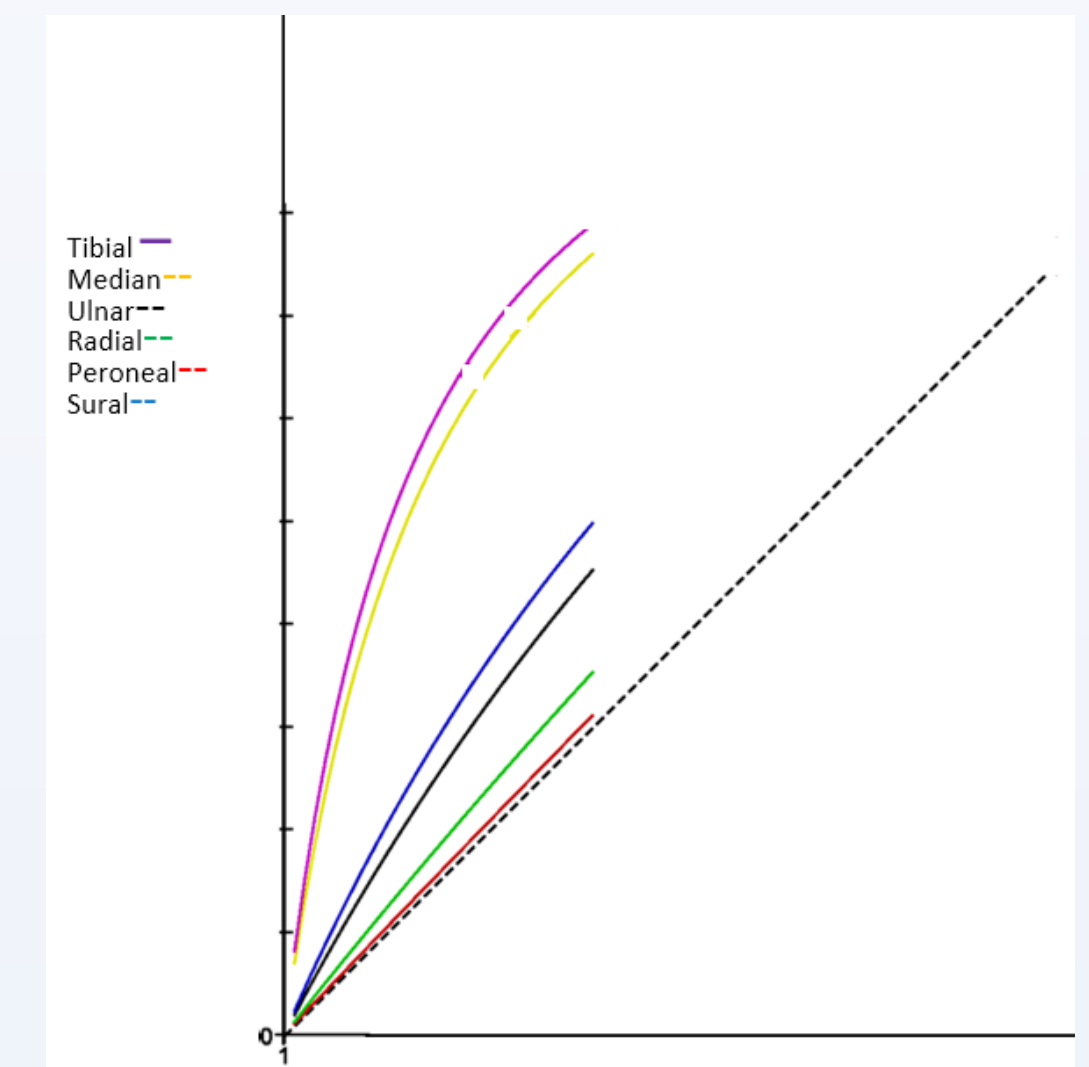


Figure 1: SROC for different nerves

## References

- 1 Telleman JA, Grimm A, Goedee S, Visser LH, Zaidman CM. Nerve ultrasound in polyneuropathies. Muscle & nerve. 2018 May;57(5):716-28.
- 2 Singh KP, Gupta K, Kataria N, Arora V, Nagpal N. High-resolution ultrasonography of the sural nerve in diabetic peripheral neuropathy. Journal of Ultrasonography. 2020 Jul;20(81):e83.