

Role of Grey Scale Ultrasound Including Elastography in Grading the Severity of Carpal Tunnel Syndrome - A Comparative Cross-sectional Study

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Abstract : BACKGROUND: Carpal tunnel syndrome (CTS) is a common entrapment neuropathy with an estimated prevalence of 0.6 - 5.8% in the general adult population. It is caused by compression of the Median Nerve (MN) at the wrist as it passes through a narrow osteofibrous canal. Presently, the diagnosis is established by the clinical symptoms and physical examination and Nerve conduction study (NCS) is used to assess its severity. However, it is considered to be painful, time consuming and expensive, with a false-negative rate between 16 - 34%. Ultrasonography (USG) is now increasingly used as a diagnostic tool in CTS due to its non-invasive nature, increased accessibility and relatively low cost. Elastography is a newer modality in USG which helps to assess stiffness of tissues. However, there is limited available literature about its applications in peripheral nerves. OBJECTIVES: Our objectives were to measure the Cross-Sectional Area (CSA) and elasticity of MN at the carpal tunnel using Grey scale Ultrasonography (USG), Strain Elastography (SE) and Shear Wave Elastography (SWE). We also made an attempt to independently evaluate the role of Gray scale USG, SE and SWE in grading the severity of CTS, keeping NCS as the gold standard. MATERIALS AND METHODS: After approval from the Institutional Ethics Review Board, we conducted a comparative cross sectional study for a period of 18 months. The participants were divided into two groups. Group A consisted of 54 patients with clinically diagnosed CTS who underwent NCS, and Group B consisted of 50 controls without any clinical symptoms of CTS. All Ultrasound examinations were performed on SAMSUNG RS 80 EVO Ultrasound machine with 2 - 9 Mega Hertz linear probe. In both groups, CSA of the MN was measured on Grey scale USG, and its elasticity was measured at the carpal tunnel (in terms of Strain ratio and Shear Modulus). The variables were compared between both groups by using 'Independent t test', and subgroup analyses were performed using one-way analysis of variance. Receiver operating characteristic curves were used to evaluate the diagnostic performance of each variable. RESULTS: The mean CSA of the MN was 13.60 + 3.201 mm² and 9.17 + 1.665 mm² in Group A and Group B, respectively (p < 0.001). The mean SWE was 30.65 + 12.996 kPa and 17.33 + 2.919 kPa in Group A and Group B, respectively (p < 0.001), and the mean Strain ratio was 7.545 + 2.017 and 5.802 + 1.153 in Group A and Group B respectively (p < 0.001). CONCLUSION: The combined use of Gray scale USG, SE and SWE is extremely useful in grading the severity of CTS and can be used as a painless and cost-effective alternative to NCS. Early diagnosis and grading of CTS and effective treatment is essential to avoid permanent nerve damage and functional disability.

Keywords : carpal tunnel, ultrasound, elastography, nerve conduction study

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