Motor-Evoked Potential Analysis of Peroneal Nerve Status during Closed Wedge High Tibial Osteotomy

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INTRODUCTION: During closed wedge high tibial osteotomy (CWHTO), a retractor is placed on the posterior wall of the tibia to pull the tibialis anterior muscle. This procedure may be associated with common peroneal nerve (CPN) injury. This study aimed to clarify the effects of a posterior retractor on CPN status during CWHTO based on transcranial motor-evoked potential (MEP) analysis.

METHODS: A single surgeon performed primary CWHTO on 21 consecutive knees of 18 patients between June 2020 and December 2022. Patients with no history of nerve palsy, neuromuscular disease, or knee surgery were included. Consequently, one patient with epilepsy was excluded. A prospective analysis of CPN function using MEP was performed in the remaining 20 knees of 17 patients who underwent primary CWHTO. The 17 patients included 12 males and five females. At the time of surgery, the patients had a mean age of 63.6 years (range, 48–76 years), mean height of 162.5 cm (range, 141.0–174.4 cm), mean weight of 72.4 kg (range, 58.0–86.3 kg), and mean body mass index of 27.5 kg/m2 (range, 22.9–33.4 kg/m2). The CPN and median nerve integrity were both tested by recording MEP at four timepoints: after a train-of-four monitor showed 100% recovery preoperatively as a control (first period); just after retractor placement on the fibula for fibular osteotomy in the middle portion (second period); just after a large retractor was placed behind the targeted osteotomy line in direct contact with the osseous wall of the tibia (third period); and after the procedure (fourth period) (Fig.1). In the third period, the large retractor was gently pulled to obtain an adequate view of the lateral wall of the tibia for tibial osteotomy. The amplitude in the first period was defined as 100%. The correlation between the operative time and CPN status was also examined. Postoperative CPN damage was evaluated on the basis of the presence of paralysis and a manual muscle test (MMT) for ankle dorsiflexion strength. A linear mixed-effects model was used to investigate the effect of intraoperative procedures on the amplitudes of the CPN and median nerve for comparison with the first-period response. Statistical significance was set at $p < 0.05$.

RESULTS: There was no significant difference in the mean amplitude of the CPN between the first and second periods (100% vs. 89.5 ± 18.4%; $p = 0.30$); however, the amplitude was significantly reduced from the second period to 56.8 ± 27.1% in the third period ($p < 0.01$), and then significantly improved to 76.7 ± 27.2% in the fourth period ($p < 0.05$). In 18 knees (90.0%), the amplitude of the CPN in the third period was reduced, while only two knees showed no reduction. The mean amplitude of the median nerve was 100% in the first period, 99.9 ± 0.4% in the second period, 98.8 ± 2.6 in the third period, and 98.8 ± 3.8% in the fourth period with no significant differences ($p = 1.00$, $p = 0.25$, $p = 1.00$, respectively). The mean operative time was 96 min (range, 67–114 min), and no significant correlation was observed between operative time and improvement in CPN status between the third and fourth periods ($p = 0.80$, $r = 0.06$). All 17 patients had a postoperative MMT grade of 5 for ankle dorsiflexion without CPN paralysis.

DISCUSSION AND CONCLUSION: A significant reduction in CPN amplitude was observed in 18 of 20 knees (90.0%) despite the careful placement of the retractor on the posterior tibia to retract the tibialis anterior muscle. Although the reduction appeared to be reversible, the placement of a posterior retractor should be performed with careful attention to the CPN.