Usefulness of Thermography in the Upper Extremity Entrapment Neuropathy

by

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Introduction

Thermography is one of the supplemental diagnostic methods in the field of orthopaedic diseases. Thermography itself is relatively simple test and harmless to the patient. Clinical usefulness of thermography in the upper extremity entrapment neuropathies, such as cubital tunnel syndrome and carpal tunnel syndrome, were studied in this article.

Materials and Methods

Between the year of 1986 and 1995, 26 cases with unilateral operated upper extremity entrapment neuropathy were investigated at the Department of Orthopaedic Surgery, Saga Medical School. There were 13 women and 13 men. Their ages were ranging from 37 to 80 years old (mean 57.7). The diagnosis was 16 cubital tunnel syndrome (14 right affected, 2 left) and 10 carpal tunnel syndrome (7 right affected, 3 left). Postoperative period was ranging from 1 to 115 months (mean 29.4).

Thermotracer 6T66 (Nihondenki Sanei) which we used had measurable range of 4.0°C with sensitivity of 0.5°C. Relative thermal difference (ΔT) was calculated as a ratio of temperature at volar site of little finger in cubital tunnel syndrome, and middle finger in carpal tunnel syndrome to that of non-affected site, respectively. Relationships between these values and preoperative motor nerve conduction velocity (MCV), preoperative staging and postoperative prognosis were studied.

Results

Each case of ΔT was summarized in Table 1. Only 4 cases showed decrease of skin temperature to non-affected site.

In cubital tunnel syndrome, ΔT was ranging from -1.0 to +1.0°C (mean±SD, +0.6°C±1.0). There was no statistical significance between preoperative MCV and ΔT (p>0.05). According to
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Table 1 Relative thermal difference (ΔT)

<table>
<thead>
<tr>
<th>a. Cubital tunnel syndrome</th>
<th>b. Carpal tunnel syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔT (°C)</td>
<td>case</td>
</tr>
<tr>
<td>-1.0</td>
<td>1</td>
</tr>
<tr>
<td>-0.5</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>+0.5</td>
<td>3</td>
</tr>
<tr>
<td>+1.0</td>
<td>2</td>
</tr>
<tr>
<td>mean±SD=+0.6°C±1.0</td>
<td></td>
</tr>
</tbody>
</table>

Akahori's preoperative classification\(^1\), stage III was 4 cases, stage IV was 10 cases and stage V was 2 cases. There was also no statistical significance between these classification and ΔT (p>0.05).

Postoperative evaluation using Akahori's postoperative prognosis\(^1\) was regarded as "excellent" by 4 cases, "good" by 4 cases and "fair" by 8 cases. Mean ΔT in 8 cases with excellent and good cases was +0.06°C compared to +0.19°C in 8 cases with fair cases. The worse postoperative evaluation showed the higher ΔT.

In carpal tunnel syndrome, preoperative staging using Hamada's classification\(^3\) was 2 cases of Grade T, 5 cases of U and 3 cases of V. Mean ΔT was 0.25°C in stage T, 0.5°C in stage U and 1.0°C in stage V, respectively. Advanced stage has tendency of the higher ΔT. However, there was no statistical significance between them (p>0.05). There was also no statistical significance between preoperative MCV and ΔT (p>0.05).

Postoperative evaluation according to Hamada\(^3\) showed 5 cases of "excellent" and 5 cases of "good", and there was no "fair" cases. So, no comparative study was done between "excellent" "good" groups and "fair" groups in this series.

Discussion

Ide et al\(^4\) reported that patients with severe peripheral nerve palsy of the upper extremity had thermal changes in suffered palmar region, because autonomic vasomotor fiber was also disturbed. We assumed that same phenomenon would be recognized in entrapment neuropathy. However, there was no statistical significance between ΔT and pre- and postoperative evaluation. According to Ide et al\(^4\), patients with neurotmesis had bigger thermal changes compared to that with axonotmesis and neurapraxia.

In our study, all patients were entrapment neuropathy. So minimum thermal changes was recognized compared to neurotmesis in trauma (mean±SD, +0.31°C±0.76). Because the sensitivity of thermography was 0.5°C. Moreover, Feldman\(^2\) stated that physiological thermal laterality in palmar region was within 0.23°C. This might be one of the reason of no statistical significance.

Simultaneous sweating test using iodine showed no obvious abnormality. These results suggested that obvious autonomous vasomotor fiber was not disturbed in almost all cases with entrapment neuropathy. Oppositely, 11 cases (5 cases of cubital tunnel syndrome and 6 cases of
carpal tunnel syndrome) out of 26 cases showed higher skin temperature. Ide et al⁴ mentioned that patients who had higher skin temperature in median nerve palsy (axonotmesis and neurapraxia) complained causalgia or over response of sensory. But there was no case with causalgia like complaint in our cases.

**Conclusions**

1) Clinical usefulness of thermography in the upper extremity entrapment neuropathy was studied.

2) In 26 cases, skin temperature in affected site was up in 11 cases and down in 4 cases, remaining 11 cases showed no thermal changes. Mean ΔT was 0.31°C ± 0.76.

3) There was no statistical significance between ΔT and pre- and postoperative evaluation.

4) Minimum thermal change was seen in the upper extremity entrapment neuropathy because their preoperative grading was not so severe in all cases.

**References**

1) Akahori, O.: Cubital tunnel syndrome; Grade of palsy and prognosis, and selection of operation. Seikei Saigaigeka (Orthopaedic Surgery and Traumatology), 29: 1745-1751, 1986 (Japanese).


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上肢 Entrapment Neuropathy における
サーモグラフィーの有用性について

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サーモグラフィーは簡便で非侵襲的な検査法であり、
整形外科領域でもよく用いられている。今回、我々は
上肢の entrapment neuropathy におけるサーモグラフィーの有用性を検討した。対象とした肘部管症候群
16 例、手根管症候群 10 例について、それぞれサーモグラフィーを用いて得られた皮膚温の変化と、術前
の MCV、病期及び術後の評価との関係について調べ
た。26 例中、健側に対して皮膚温の低下を認めたの
は 4 例のみであり、温度変化自体も小さく、いずれの
関係においても統計学的な相関はみられなかった。神経自体の障害が比較的軽度で緩徐にくることの多い上肢
の entrapment neuropathy においては、サーモグラフィーの有用性は低いと思われた。