A study of Carpal Tunnel Syndrome Patients

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Abstract. Purpose: To determine the incidence of anatomic variations of the hook of hamate and to evaluate its association with the development of carpal tunnel syndrome (CTS) in Korean patients. Materials and Methods: Carpal tunnel views of 916 hands (458 patients) that received out-patient treatment for tingling hands, from March 2008 to November 2009. The sex distribution was 69 men and 389 women and the average age was 52.7 years old. The frequency of appearance of variations of the hamate and the ratio of each variation were identified. In addition, patients with variant hooks of hamate with CTS were compared to patients with variant hooks of hamate who had no evidence of CTS. The counting variant age and the correlation of the variant of the hooks of hamate and the occurrence of CTS were analyzed.

Key Words: Hook of hamate, variations, carpal tunnel syndrome.

1 Introduction

A trigonal prism-shaped carpal bone, the hamate has a hook stretching a long ways forward where nonarticual surface is set. The transverse carpal ligament or flexor retinaculum borders the end of the hook forming the carpal tunnel toward the radialis and ulnar nerve compression toward ulnar acting as a support keeping the surrounding neurovascular tissues in the right place. The hook has two centers which remain ossicless if not agglutinated with each other. Hypoplasia and aplasia are considered congenital malformations developing on one or both sides.

The hook of hamate is a structure usually located in a fixed place and thus used for spot selection at the time of endoscopic carpal tunnel release and used as a boundary mark, to avoid any neurovascular damage. It also is useful at the time of open carpal tunnel release in finding the right line to cut.

The average height of the hook is 9.8 mm, and the average width of the fundus is 7.5 mm with anatomical variations reported as very rare. However, we have encountered such variations through radioactive examinations we did for patients with carpal tunnel syndrome. In addition, seeing that cases of deformations of the hook occur more often for patients with carpal tunnel syndrome, we wondered if such variations may influence the complications of carpal tunnel syndrome. Coming to
realized that there have been no reports on the matter specific to Korea while there were reports by writers overseas\cite{8,12}, we decided to analyze possible connections between the frequency of anatomical variations in the hamate hook and the development of carpal tunnel syndrome in Koreans.

2 The subjects & methods of the study

The subjects were chosen among 458 patients (69 males, 389 females) with an average age of 52.7 (20-87) who visited outpatient clinics from March 2008 to November 2009 complaining of numbness in their hands. We took radiographs on carpal tunnels on both hands of each subject.

We took the radiographs following the method of James et al\cite{12} focusing on the fundus of the fourth metacarpal towards the palm with forearm in pronation and wrist joint extended to at least a 70 degree angle with the other hand, and shot X-rays at 30-degree angles on the finger axis for every subject uniformly.

Carpal tunnel syndrome was diagnosed through physical exam including sensation, motor function, pain provocation tests (Tinel’s sign, Phalen’s test), and EMG, nerve conduction re-diagnosing to confirm when the results showed any abnormality in the thenar muscles through EMG and any delay in nerve conduction velocity. Ultrasonography was also conducted to verify the exercise condition of the flexor hallucis longus muscle in the carpal tunnel along with whether or not tumors existed.

The autoradiograph was taken one more time to confirm if aplastic variations were shown considering in such cases that the autoradiograph taking angle and direction might not have accorded with classification standards.

Any subjects who ever had hand trauma, or tenderness in the hamate hook detected by physical exam, were excluded from the study together with those whose fundus or the full length of the hook were not shown in the autoradiograph of the carpal tunnel. Variations were classified into three types by measuring the ratio of the width of fundus and the height (height/fundus: the height-to-width ratio) according to the evaluation of James et al\cite{12}, such as hypoplastic hook if the ratio was less than 1.3, aplastic hook if less than 0.6, and as dichotomy hamate hook if the edge of the radiation images formed a compact bone shape and divided into two bones showing no involutional changes between the two bones.

We inquired into the frequency of occurrence of hamate variations and such variation ratio targeting the whole subjects. Patients who showed such variations were divided into two groups: those diagnosed with carpal tunnel syndrome and those not diagnosed to identify any connection with carpal tunnel syndromes, including age variables for the analysis on any correlation of age dependent hamate hook variations and carpal tunnel development with chi-square test & Fisher’s exact test. The analysis showed $P < 0.05$ as statistical significance.

3 Results

Six hundred eighty of nine hundred sixteen hands were diagnosed with carpal tunnel syndrome. Forty-eight hands showed hamate hook abnormalities (5.2%), and
the length ratio of height and fundus appeared as an average of 0.97 with a standard deviation of 0.32. The distribution of right and left hands was 25 right and 23 left showing no significant difference (P=0.8823). Gender-dependent variations also revealed no statistical differences, for the ratio was 4 females and 44 males among a total of 458 subjects (P=0.805). Forty-two cases were diagnosed with carpal tunnel symptoms among forty-eight cases with hamate hook variations making up 6.1% of the total six hundred eighty cases diagnosed with carpal tunnel syndrome. Nine cases were diagnosed with hamate hook variations, twenty-seven cases with hypoplasia variations and six cases with aplasia. Six cases with variations of the horn of hamate were not diagnosed with carpal tunnel syndrome making up 2.5% of the two hundred thirty-six cases without CTS. Two of these cases were dichotomy hamate hook variations, three cases with hypoplasia and one case with aplasia (Table 1). The occurrence frequency was significantly higher in the group diagnosed with carpal tunnel symptoms as the result of the two groups being analyzed with Chi-square test and Fisher’s exact test (P=0.0282).

<table>
<thead>
<tr>
<th></th>
<th>CTS (680 hands)</th>
<th>No CTS (236 hands)</th>
<th>Total Variant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bipartite</td>
<td>9</td>
<td>2</td>
<td>11 (1.2%)</td>
</tr>
<tr>
<td>Hypoplastic</td>
<td>27</td>
<td>3</td>
<td>30 (3.3%)</td>
</tr>
<tr>
<td>Aplastic</td>
<td>6</td>
<td>1</td>
<td>7 (0.8%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>42 (6.1%)</strong></td>
<td><strong>6 (2.5%)</strong></td>
<td><strong>48 (5.3%)</strong></td>
</tr>
</tbody>
</table>

**Acknowledgements**

This work was supported by Grant from Inje University, 2011.

4 References