Coexistence of a Bifid Median Nerve and Persistent Median Artery in a Pediatric Trauma Case

Bir Pediatrik Travma Hastasında Bifid Median Sinir ve Persistan Median Arter Birlikteliği

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INTRODUCTION

Knowledge regarding variations of median nerve branching is particularly important in surgical decompression and trauma cases. A bifid median nerve with a persistent median artery is a rare anatomical variation. The importance of a persistent median artery lies in the fact that a large caliber artery may lead to an early compression of the median nerve in the carpal tunnel. Furthermore, the bifid median nerve may be the cause of the carpal tunnel syndrome because of its relatively higher cross-sectional area compared with a non-bifid median nerve. It is possible to avoid the advertent injury to the median nerve during surgery by recognizing the anatomy and its variations.

CASE PRESENTATION

A 12-year-old male presented with a 5 cm long laceration of his left wrist. After explaining the purpose of the study, written informed consent was obtained from the parents of the patient. The patient complained of the loss of sensation in his index and middle fingers. During surgical exploration, a bifid median nerve and persistent median artery were found. A bifid median nerve had two unequal branches. The radial division was larger than the ulnar division of the median nerve, and a large persistent median artery was identified between them (Figure 1). Median artery and the ulnar branch of the median nerve were completely lacerated, while the radial branch of the median nerve was partially lacerated. Ulnar and radial arteries were observed intact in the performed exploration. It was observed that the median artery joined the superficial palmar arch. Epineural repair of the branches of the median nerve were performed, and the carpal tunnel was prophylactically released.

DISCUSSION

The classic pattern describes the division of the median nerve into five branches at the distal end of the flexor retinaculum. However, a high division of the median nerve proximal to the carpal tunnel, also known as a bifid median nerve, is an anatomical variation.1 Lanz
classified the variations of the course of the median nerve into four groups. Group I comprises thenar branch variations, Group II includes accessory branches at the distal carpal tunnel, Group III encompasses high median nerve divisions, and Group IV includes accessory branches proximal to the carpal tunnel. Group III may be further divided into three subgroups according to the absence of a median artery (Group III a), presence of a median artery (Group III b), or an accessory lumbral muscle (Group III c) between the two branches of the proximally divided median nerve.2

The median artery is a transitory vessel that represents the arterial axis of the forearm during the early embryonic life. It normally regresses after the second embryonic month.3 The median artery may persist in adult life in two different patterns, palmar and ante brachial, based on their vascular territory. The ante brachial pattern, because of its high incidence in adult forearms, may be considered as a normal feature rather than as a variation. In contrast, the palmar pattern appears with a lower incidence in adult forearms.4

The prevalence of bifid median nerves and persistent median arteries in the general population is poorly delineated. The reported prevalence of a bifid median nerve ranges from 5% to 15.4%, and persistent median arteries have a prevalence that range from 0.6% to 23% in wrists of carpal tunnel patients, adult cadavers, or healthy individuals.3-14 The most common association with a bifid median nerve is a persistent median artery. Absolute percentages of persistent median arteries or bifid median nerves may vary with the techniques used to detect them.

Median nerve variations are well described because of their diagnostic and surgical importance. The occurrence of a bifid median nerve has been widely reported in the literature, and it is observed most commonly during surgical interventions or anatomical dissection and rarely during preoperative sonographic or magnetic resonance imaging (MRI). In a series of 913 carpal tunnel patients who were operated and dissected, Tountas et al.15 discovered the coexistence of the bifid median nerve and persistent median artery in eight cases. In another study involving 294 hands, a single case of a bifid median nerve without a median artery was reported.12 In a recent study, 17 cases of the coexistence of a bifid median nerve and persistent median artery have been reported in 1026 wrists of manual workers.1 Stanić et al.16 reported that 48 hands revealed standard anatomy while examining 100 hands, and there was only one case with the coexistence of a bifid median nerve and median artery. In a series of 110 patients who underwent open carpal tunnel release, Beris et al.17 reported two such cases (Table I).

In the literature, there are several studies that use imaging techniques. The coexistence of a bifid median nerve and persistent median artery in the carpal tunnel of four patients was identified in a study where 194 wrists were evaluated using MRI.13 Gassner et al.14 reported 10 cases of a bifid median nerve and persistent median artery in 100 wrists.14 In another study reporting the coexistence of a bifid median nerve and persistent median artery that was examined using USG, the carpal tunnel syndrome patients and control group were compared and it was reported that the existence of a bifid median nerve is not a risk factor for the carpal tunnel syndrome.18 In most studies, patients referred to a physician for the evaluation of suspected carpal tunnel syndrome. Only three cases of the coexistence of a bifid median nerve and persistent median artery have been previously reported among trauma patients.19,20

![Figure 1. Perioperative view of the case](image)

<table>
<thead>
<tr>
<th>Reference/Year</th>
<th>Population studied</th>
<th>Technique</th>
<th>Coexistence of BMN and PMA/Wrists</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tountas et al.15</td>
<td>CTS patients</td>
<td>Intraoperative</td>
<td>8/913</td>
<td>0.87%</td>
</tr>
<tr>
<td>Stancic et al.16</td>
<td>CTS patients</td>
<td>Intraoperative</td>
<td>1/100</td>
<td>1%</td>
</tr>
<tr>
<td>Ahn et al.12</td>
<td>CTS patients</td>
<td>Intraoperative</td>
<td>0/294</td>
<td>0%</td>
</tr>
<tr>
<td>Gassner et al.14</td>
<td>Healthy controls</td>
<td>Ultrasound</td>
<td>10/100</td>
<td>10%</td>
</tr>
<tr>
<td>Beris et al.17</td>
<td>CTS patients</td>
<td>Intraoperative</td>
<td>2/110</td>
<td>1.8%</td>
</tr>
<tr>
<td>Pierre-Jerome et al.19</td>
<td>Patients</td>
<td>MR</td>
<td>4/194</td>
<td>2%</td>
</tr>
<tr>
<td>Walker et al.1</td>
<td>Manual workers</td>
<td>Ultrasound</td>
<td>17/1026</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

BMN: bifid median nerve; PMA: persistent median artery
However, a bifid median nerve may cause the carpal tunnel syndrome because of its relatively higher cross-sectional area compared with a non-bifid median nerve. In addition, a persistent median artery of a large caliber may further lead to an early compression of the median nerve in the carpal tunnel.21 Therefore, in hand trauma cases and carpal tunnel release patients, these anatomical variations should be considered.

CONCLUSION

In the presence of persistent median artery, surgeons must be aware regarding the possibility of additional median nerve anomalies. Careful exploration is necessary to not overlook the variations of the median nerve and artery. Moreover, the prophylactic release of the carpal tunnel should be considered because of the increased predisposition to nerve compressions.

Informed Consent: Written informed consent was obtained from patients’ parents who participated in this case.

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