DOES POSTOPERATIVE HAND ELEVATION REDUCE SWELLING? A RANDOMIZED STUDY

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The purpose of this study was to assess the effect of limb elevation on hand swelling after surgery. We prospectively randomized 113 patients undergoing fasciectomy or a trapeziectomy into one of two groups. The first group had the hand elevated postoperatively and the hands of the second group were not elevated. Hand swelling was assessed using a volumetric method. Although the swelling was less in the elevated group this did not reach statistical significance. Subgroup analysis revealed no further significant differences. There were no complications in patients who did not have limb elevation. This study does not support the routine use of elevation for 24 hours after fasciectomy for Dupuytren’s disease and trapeziectomy to reduce hand swelling.

Keywords: Dupuytrens, elevation, trapeziectomy

INTRODUCTION

Elevation after hand surgery is standard practice to prevent hand swelling and its associated potential complications: stiffness, infection and pain. However, there is little published evidence to support the role of elevation and its effect on swelling after elective hand surgery.

It has been suggested that postoperative elevation may be problematical. Some authors have shown a decrease in the transcutaneous oxygen tension when a limb is elevated. Bandaging or elevation alone resulted in a statistically significant decrease in cutaneous blood flow (Mars, 1988; Matsen et al., 1977), suggesting that hand elevation with postoperative compressive bandaging is potentially hazardous (Mars, 1988).

A randomized controlled trial on 43 patients undergoing carpal tunnel decompression compared postoperative high arm elevation at home versus a sling (Fagan et al., 2004). Hand swelling was assessed using a volumetric method and there was no difference between the two groups at 5 days with respect to hand swelling. The effect of paracetamol, naproxen and placebo on hand swelling in patients undergoing carpal tunnel decompression and primary surgery for Dupuytren’s contracture and their effect has been studied by Husby et al. (2001). They found the change in swelling after carpal tunnel decompression was so small that no comparisons could be made. Naproxen showed a reduction in hand swelling in the Dupuytren’s group but did not reach statistical significance measured using a volumetric technique. Vacuum splinting has been proven to reduce hand swelling after surgery used in conjunction with limb elevation (Ward, 1977).

This study investigated whether postoperative hand elevation reduces hand swelling.

We routinely admit patients undergoing trapeziectomy or fasciectomy for Dupuytren’s disease overnight for limb elevation postoperatively and so these cases were perfectly suited for this study. There has been a recent trend to perform these procedures as day cases. The senior author (J.F.) was concerned that without strict overnight elevation there was the potential for postoperative complications secondary to hand swelling.

METHODS

One hundred and thirteen patients undergoing trapeziectomy or primary fasciectomy for Dupuytren’s disease were randomized into one of two groups. In Group 1 (63 patients) the limb was elevated in a Bradford sling suspended from a drip stand and in Group 2 (50 patients) the patients had no elevation or sling and were allowed to place the hand however they wanted by the side, either on the bedclothes or a pillow. Random number tables were used to generate group selection and left in sealed envelopes. Patients were placed into groups by the ward sister who opened the envelopes once the patient had returned to the ward after operation. The surgeon who carried out the procedure was blinded to the group.

Hand swelling was measured using a water displacement technique. This technique applied the Archimedes principle to record hand volume. The hand was placed into a graduated chamber filled with sterile water. Inside the chamber was a stop bridge which the patient placed between the index and middle fingers, to prevent...
over-insertion of the hand and wrist into the water (Fig 1). The volume of water displaced was then calculated from the mass of water displaced assuming the mass of 1 L of water was 1 kg.

Our technique was validated for intra-observer error on 22 volunteer hands before the study was done. The volunteers had their hand volumes measured on three occasions, by two observers. Measurements were taken in the morning and then at the same time 24 hours later. Inter-observer error was tested for on 12 volunteer hands, by four observers. The intra-observer error was calculated at 1.2% and the inter-observer error 1% of the total average hand volume. The day-to-day variation was estimated as 0.5%.

All measurements were made by the ward nurses. A loose sterile glove was worn by the patient for both readings after all dressings and splints had been removed. The water temperature was controlled for all experiments (24°C). Measurements were taken in the morning 30 minutes before surgery and then 24 hours later.

The patients' age, sex, hand dominance, operation, complications and pre- and postoperative hand volumes were recorded.

Of the 113 patients who were randomized into the study, 77 patients underwent fasciectomy for Dupuytren's disease of whom 41 were randomized to hand elevation and 36 to no elevation. Thirty-six patients had a trapeziectomy of whom 22 were randomized to hand elevation and 14 to no elevation.

Ethical approval for the study was granted by our local Research and Ethics Committee.

**Statistical analysis**

Two-sample t-tests were used to compare the differences between those randomized to elevation and no elevation.

**RESULTS**

Twelve patients were unable to complete the study, due to an inability to place the operated hand in a glove secondary to pain, nine in the Dupuytren's group and three in the trapeziectomy group (six patients belonged to Group 1 and six to Group 2). Thus 101 patients were assessed for changes in hand volume.

Patient demographics were similar in each group (Table 1). No patients suffered a complication relating to lack of postoperative elevation of the limb.

Changes in hand volumes related to elevation are shown in Table 2. Although there was a smaller increase in volume of the elevated hands, when limb elevation versus no elevation was analysed there was no significant difference between the two groups. Subgroup analysis for patients having either fasciectomy or trapeziectomy found no significant difference for hand swelling with respect to hand elevation (Table 3).

A retrospective power analysis was performed to ensure adequate patient enrolment. We had enrolled enough patients (48 required in each group) with a power value of 80% and a P-value of 0.05, to predict a difference in swelling of 20 ml between the two groups.

**Table 1—Patient demographics**

<table>
<thead>
<tr>
<th>Operation</th>
<th>n</th>
<th>Age (mean)</th>
<th>Sex</th>
<th>Hand dominance</th>
<th>Operated Group</th>
<th>Group 1</th>
<th>Group 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasciectomy</td>
<td>77</td>
<td>65</td>
<td>60:17</td>
<td>71:6</td>
<td>42:35</td>
<td>41</td>
<td>36</td>
</tr>
<tr>
<td>Trapeziectomy</td>
<td>36</td>
<td>61</td>
<td>7:29</td>
<td>35:1</td>
<td>18:18</td>
<td>22</td>
<td>14</td>
</tr>
</tbody>
</table>

**Table 2—Hand volume comparison between elevated and non-elevated groups, values are mean (SD) ml**

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Preop. volume</th>
<th>Postop. volume</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevated</td>
<td>63</td>
<td>33 (51)</td>
<td>336 (46)</td>
<td>7.6 (33.3)</td>
</tr>
<tr>
<td>Non-elevated</td>
<td>50</td>
<td>318 (64)</td>
<td>329 (56)</td>
<td>13.2 (38.9)</td>
</tr>
</tbody>
</table>

*Number of patients who had postoperative reading.
Table 3—Hand volume comparison between operation type, values are mean (SD) ml

<table>
<thead>
<tr>
<th>Operation</th>
<th>Elevated</th>
<th>n</th>
<th>Preop. volume</th>
<th>Postop. volume</th>
<th>Difference *</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasciectomy</td>
<td>No</td>
<td>36</td>
<td>339 (62)</td>
<td>348 (53)</td>
<td>11.7 (43.0)</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>41</td>
<td>347 (46)</td>
<td>346 (41)</td>
<td>3.8 (24.6)</td>
<td></td>
</tr>
<tr>
<td>Trapeziectomy</td>
<td>No</td>
<td>14</td>
<td>266 (34)</td>
<td>285 (36)</td>
<td>16.7 (27.8)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>22</td>
<td>304 (48)</td>
<td>319 (51)</td>
<td>14.8 (45.1)</td>
<td>0.89</td>
</tr>
</tbody>
</table>

*Number of patients who had postoperative readings.

DISCUSSION

In this study limb elevation for 24 hours made no significant difference in postoperative hand swelling after elective hand surgery. The mean change in volume after surgery for Dupuytren’s disease was lower than in the patients undergoing trapeziectomy. This may be in part due to any haematoma/serous fluid draining through the skin incisions.

Small and insignificant volume changes have been noted after carpal tunnel decompression (Fagan et al., 2004; Husby et al., 2001). This may relate to the minor surgical insult. The current study identified a large range of changes in hand volume after surgery, in both groups, independent of the surgical procedure. However, both groups (elevated versus non-elevated) had similar standard deviations of the mean (Table 2).

Using volumetric methods to determine the change in hand volume is an accurate technique. However, the question remains: what change in volume is significant to cause postoperative complications such as wound dehiscence? Retrospective power analysis to predict a difference in swelling of 20 ml between the two groups identified that we had enrolled enough patients (48 required in each group). Furthermore to predict a difference of 50 ml, ten patients would be required in each treatment arm and to observe a difference in swelling of only 5 ml between treatment arms would require 400 patients in each group. The volume change was greater in the non-elevated group indicating a trend towards swelling without elevation. It may be that no significant differences could be shown between the two groups as there was such a large spread of volumetric changes recorded in both groups in the study. Furthermore, swelling was only checked on the first day after surgery and we may have missed delayed swelling in either group.

The presence of hand swelling will reduce the ability of the patients to mobilize their wrists, metacarpophalangeal and interphalangeal joints after operation leading to stiffness and delayed return to function. Hand swelling may also contribute to postoperative pain. These factors were not addressed by this study but are important considerations in the postoperative period.

Although we found no statistically significant evidence that elevation reduces swelling, it is still the practice of the senior author to elevate limbs postoperatively, as there were no complications from its use. However, the need to keep patients overnight for strict elevation has been questioned by the results of this study.

Acknowledgements

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References


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