Our aim was to determine if a tourniquet placed on the forearm has any advantage in clinical practice over the usual position on the upper arm. We randomised 50 patients who were undergoing an open operation for carpal tunnel syndrome under local anaesthesia into two groups. One had a tourniquet on the upper arm and the other on the forearm. The blood pressure, pulse, and level of pain were recorded at intervals of five minutes during the operation. The surgeons were also asked to evaluate the quality of the anaesthesia, the bloodless field, and the site of the tourniquet.

The patients tolerated the tourniquet on the upper arm and forearm equally well. The surgeons had some difficulties when it was placed on the forearm. We therefore recommend placement of a tourniquet on the upper arm for operations on the hand and wrist which are carried out under local anaesthesia.

Patients and Methods

We studied 50 patients who were undergoing open operation for carpal tunnel syndrome. They all gave informed consent to participate in the study, for which ethical approval was obtained.

The patients were allocated into two groups using random numbers. One group had the tourniquet placed on the upper arm and the other on the forearm, 6 cm proximal to the distal wrist crease.

In 1997, we reported that in surgery on the foot a tourniquet placed at the ankle gives considerably less discomfort for the patient than one placed on the calf. We wished to determine if this was also true in the arm during hand surgery. Reports in the literature are conflicting. Youssif et al concluded that patients tolerate tourniquets on the upper arm and forearm equally well, whereas Hutchinson and McClinton found that a tourniquet on the forearm was tolerated longer and was considered to be less painful, both while it was inflated and immediately after release.

Table I. Details of the patients and intraoperative data (median and range) for the patients in the two groups undergoing surgery for carpal tunnel syndrome

<table>
<thead>
<tr>
<th>Tourniquet position</th>
<th>Upper arm</th>
<th>Forearm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Men</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Age in years (range)</td>
<td>54 (29 to 83)</td>
<td>46 (27 to 76)</td>
</tr>
<tr>
<td>Anaesthetic (ml) (range)</td>
<td>8 (3.5 to 18)</td>
<td>8 (4 to 12.5)</td>
</tr>
<tr>
<td>Tourniquet pressure (mmHg)</td>
<td>250 (200 to 295)</td>
<td>246 (204 to 294)</td>
</tr>
<tr>
<td>Tourniquet time (min) (range)</td>
<td>16 (9 to 30)</td>
<td>19 (6 to 37)*</td>
</tr>
</tbody>
</table>

* p = 0.053
Differences between the groups were evaluated by the Wilcoxon non-parametric two-sample test.

Results

The mean tourniquet pressures were similar in the two groups (Table I). Both positions were considered by the surgeons to give an excellent bloodless field and anaesthesia, but they preferred the site on the upper arm (Table II). The commonest complaints were that the fingers curled up after a time and that the tourniquet was in the way when placed on the forearm. There was no breakthrough bleeding in either group. The tourniquet time was slightly longer in the forearm group. There were no statistically significant differences between the groups with regard to pain felt during the operation (Fig. 1a). The forearm group showed a statistically significant increase (p = 0.01) in pain felt between five and 20 minutes of tourniquet time. This was not the case in the upper arm group.

Pain, blood pressure and pulse rate increased more in the upper arm group when the operation exceeded 20 minutes. Very few operations lasted this long, however, and the differences were not statistically significant (Fig. 1).

Discussion

Pain felt two minutes after release of the tourniquet gave a median VAS of 20 (0 to 92) in the upper arm and 23.5 (0 to 75) in the forearm group. The difference was not statistically significant. Our findings do not show that patients tolerate tourniquets on the distal forearm better than on the proximal upper arm. This is contrary to our experience in the lower limb, but supports the results of Yousif et al.
Hutchinson and McClinton\textsuperscript{3} studied volunteers and found that the mean tolerable tourniquet time was 31 minutes on the upper arm and 44 minutes on the forearm. Distal tourniquets were consistently considered to be less painful than those on the upper arm while inflated, and also two minutes after release.

We found some increase in pain, blood pressure and pulse rate in the upper arm group about 20 minutes after starting the operation, but as very few operations lasted this long, especially in the upper arm group, there were no significant differences between the groups. If the tourniquet times in our study had been longer our findings might have been more in agreement with those of Hutchinson and McClinton.\textsuperscript{3}

Ogufere, Giddins and Thom\textsuperscript{4} did not find any correlation between tourniquet time and pain felt by the patient. In their study the maximum time was 20 minutes. We had similar results in our forearm group, but in the upper arm group there was a significant increase in pain with a longer tourniquet time.

We found no significant difference between the two groups and conclude that patients tolerate tourniquets on the upper arm and forearm equally well in operations for carpal tunnel syndrome. The operation time was longer in the forearm group. It is possible that this was partly because the surgeon found the procedure more difficult with the tourniquet in this position.

On the basis of our findings we shall continue to place the tourniquet on the upper arm in operations carried out under local anaesthesia which do not require a tourniquet time of more than 15 to 20 minutes. We feel that the distal position should be avoided if the procedure is likely to be complicated, as the fingers may curl up and the tourniquet may be in the way when operating. This rules out a distal site in most procedures with local anaesthesia in the hand and wrist.

We conclude that there are very few indications for placing the tourniquet on the forearm in clinical practice. Most outpatient operations under local anaesthesia last less than 20 minutes and for these we recommend a tourniquet on the upper arm. If it is expected that the operation time will exceed 20 minutes, we recommend regional or general anaesthesia and a tourniquet on the upper arm.

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References
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