Haemostasis in Open Carpal Tunnel Release: Tourniquet *vs* Local Anaesthetic and Adrenaline

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Abstract: Open carpal tunnel release is one of the commonest performed procedures in hand surgery. We performed a prospective randomised control trial to compare the efficacy and patient satisfaction of the traditional arm tourniquet versus infiltration of adrenaline and local anaesthetic solution to achieve haemostasis during the procedure. Using a combination of objective and subjective measures we concluded that infiltration of local anaesthetic and adrenaline not only provided adequate haemostasis but also provided a significantly more tolerable experience for the patient during the procedure.

Keywords: Carpal tunnel, surgery, haemostasis, tourniquet, adrenaline.

INTRODUCTION

Carpal Tunnel Syndrome (CTS) caused by compression of the median nerve within the hand is one of the most common peripheral entrapment neuropathies. Its incidence has been estimated to be between 0.1% and 10% [1]. Carpal Tunnel Release is one of the most commonly performed procedures in hand surgery. Open Carpal Tunnel Release (OCTR) is still considered the gold standard [2, 3] in the treatment of CTS however over the years there have been several modifications to this technique [4, 5]. More recently, significant debate has been generated regarding the benefits of Endoscopic Carpal Tunnel Release (ECTR) in the treatment of CTS [3, 6, 7]. OCTR is most commonly performed as a day case procedure using local anaesthesia and a tourniquet [8]. The procedure may also be conducted using various forms of regional anaesthesia [9] or a general anaesthetic. The purpose of our study was to assess the effectiveness and patient acceptability of the use of adrenaline as a means of achieving haemostasis in OCTR when compared to the traditional arm tourniquet.

MATERIALS AND METHODS

Fifty consecutive cases of Carpal Tunnel Decompression were randomised into 2 groups using an envelope technique which was opened in the anaesthetic room. All procedures were carried out under local anaesthetic using a 50% mixture of Lignocaine 1% and Marcaine 0.5% by a single surgeon using a standard minipalm incision. Patients excluded from the study were those undergoing other concomitant procedures requiring a GA and those requesting a GA. Patients on Warfarin with an INR of up to 3.0 were included in the study. Patients taking Clopidogrel were also included however they were advised to cease this one week prior to surgery. In group A, haemostasis was achieved by use of an arm tourniquet inflated to a pressure 100mmHg above systolic blood pressure. The tourniquet was inflated after draping, and was released prior to skin closure. In group B, addition of adrenaline (1:200,000) to the local anaesthetic solution was used. In both groups, bipolar diathermy was used when necessary to achieve additional haemostasis, and skin closure was performed with a continuous 5/0 Ethilon suture.

Discomfort perceived by the patient was recorded during surgical site infiltration with local anaesthetic, as was discomfort related to the inflated arm tourniquet during the procedure. Subjective discomfort was assessed by means of a 10 point pain visual analogue scale (V.A.S) and records of pulse and systolic blood pressures throughout the procedure provided the objective data for assessment of patient distress. The time to complete the procedure and the occurrence of any adverse events were also recorded. Adverse events during surgery in the form of an unsatisfactory bloodless field and the need to inflate a tourniquet in the Adrenaline group were also recorded. The Michigan Hand Outcomes Questionnaire (MHQ) [10] was used to determine overall hand function, activities of daily living, work performance, pain, aesthetics, and satisfaction with hand function at six weeks post procedure.

RESULTS

During local anaesthetic infiltration, no significant difference was observed in patient discomfort between the two groups, based on objective and subjective measurements. There was however a significant difference ($p < 0.05$) in the discomfort felt during the procedure, with those in group A (tourniquet) experiencing considerably more pain and discomfort than those in group B (no tourniquet) (Table **1**).

There was no significant difference ($p > 0.05$) with regards to the ease of the surgeon to perform the procedure as evidenced by the duration of the procedure and the occurrence of technical difficulties (Table **2**).

There were no perceived outcome differences at six weeks as evidenced by the Michigan Hand Outcomes Questionnaire ($p > 0.05$) (Table **3**).

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Table 1. Patient Discomfort

Patient Discomfort	Group A (Tourniquet)	Group B (Adrenaline)
During Local Anaesthetic Infiltration		
Pain V.A.S	3.2	3.4
Heart Rate	86.4	88.2
Systolic Blood Pressure	168.1	165.6
During Surgical Procedure		
Pain V.A.S	3.4	0.2
Heart Rate	88.7	75.6
Systolic Blood Pressure	169.2	157.4

Table 2. Ease of Procedure

Ease OF Procedure	Group A (Tourniquet)	Group B (Adrenaline)
Surgical Time (min)	6.9	7.1
Tourniquet Time (min)	5.1	0
Surgeon Reported Technical Difficulties	0	0

Table 3. Outcome at 6 Weeks Post Procedure

Outcome (Michigan Hand Outcomes Questionnaire)	Group A (Tourniquet)	Group B (Adrenaline)
Overall Hand Function	2.3	2.1
Patient Satisfaction	2.1	1.9

DISCUSSION

Haemostasis in hand surgery has traditionally been achieved by means of an arm tourniquet. The potential for digital ischaemia [11] to develop through inadvertent administration of adrenaline containing solutions into the extremities is well known and most probably plays a role in many surgeons reluctance to use such solutions in the hand [12]. It has previously been noted that the use of local anaesthetic containing adrenaline solutions are a simple, safe and effective method of achieving haemostasis during OCTR [13, 14]. There appears to be an increasing popularity amongst surgeons with regards to this technique as it also affords several other advantages when compared to the traditional tourniquet method of haemostasis. The most notable benefit as demonstrated by our study and a previous similar study by Braithwaite *et al*. [13] was a significant reduction in the level of intra-operative patient discomfort. Tourniquet use is not without risk and its potential complications have been well documented in the literature [15-18]. These range from local soft tissue and neurovascular injuries to systemic events such as deep vein thrombosis and pulmonary embolism. Whilst previous papers have reported good tolerance to the use of the arm tourniquet [19] our study suggests that no tourniquet at all provides a more comfortable experience for the patient during OCTR. Addition of adrenaline to the local anaesthetic solution also provides prolonged post operative analgesia [14] with an associated reduction in the requirement for post operative analgesics. Application of an arm tourniquet to the conscious patient also limits the time available for which to perform the procedure. A previous study by Maury *et al*. measured the mean tourniquet tolerance time as 18 minutes (range 10-26) [20] in the conscious patient. While most straightforward OCTRs can be performed well within this time limit occasionally complications may arise or an additional procedure may need to be performed. By performing the initial procedure with adrenaline one can always apply a tourniquet and have it inflated later should further exploration or additional procedures be needed and in doing so "save" on tourniquet time. Use of adrenaline for haemostasis is also suitable for those cases where use of a tourniquet may be contraindicated eg; sickle cell disease and peripheral vascular disease [21].

In our study, there was no significant difference observed in patient discomfort during local anaesthetic infiltration, as the same surgeon and technique was used in all cases. Techniques involving the use of buffered anaesthetic agents and fine gauge needles have been described as being effective in reducing the pain associated with local anaesthetic infiltration [22, 23].

No significant difference was noted in the time taken to perform the procedure, the occurrence of technical difficulties during the procedure, or the outcome of the procedure at six weeks. This suggests that the use of adrenaline combined with local anaesthetic is just as effective in providing a clear and blood free operative field during OCTR when compared to the traditional arm tourniquet.

CONCLUSION

The use of adrenaline is a simple, safe and effective technique for achieving haemostasis in OCTR. It has several advantages which include reduced intra-operative discomfort, prolonged post operative analgesia and avoidance of tourniquet associated complications.

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