Postoperative drainage is recommended in ulnar nerve transposition

E Gene Deune MD¹, Susan E Mackinnon MD²

¹*Division of Plastic Surgery, Wayne State University School of Medicine, Detroit, Michigan and*

²*Division of Plastic and Reconstructive Surgery, Washington University School of Medicine, St Louis, Missouri*

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Surgery to transpose the ulnar nerve is a common treatment for cubital tunnel syndrome. Postoperative hematoma is a rare, but well recognized complication of this surgery, whereas postoperative bruising is a common sequela. A retrospective review of 138 cases of anterior submuscular transposition performed between December 1991 and December 1995 was conducted to evaluate the merits of postoperative drainage. Various parameters (patient, surgical, and anesthetic) were compared to determine their effect on drainage. Males had a higher postoperative drainage volume than females ($P < 0.0001$). Other patient, surgical and anesthetic factors did not correlate significantly with the drainage volume. The mean drainage during the first postoperative day was 41.2 ± 2.5 mL (range 3 mL to 190 mL). This volume is significant and warrants drainage with an indwelling catheter when anterior submuscular transposition of the ulnar nerve is performed.

Key Words: *Anterior submuscular transposition, Cubital tunnel syndrome, Drainage, Hematoma, Ulnar nerve transposition*

Drainage post-opératoire recommandé dans la transposition du nerf cubital

RÉSUMÉ : La chirurgie pour transposition du nerf cubital est un traitement courant pour le syndrome du nerf cubital. L'hématome post-opératoire est une complication rare, mais bien reconnue de cette chirurgie, alors que l'ecchymose post-opératoire est une séquelle courante. On a procédé à une revue rétrospective de 138 cas de transposition sous-musculaire antérieure entre décembre 1991 et décembre 1995, afin d'évaluer les mérites du drainage post-opératoire. Divers paramètres (liés aux patients, à la chirurgie ou à l'anesthésie) ont été comparés pour déterminer leur effet sur le drainage. Le drainage a été plus abondant chez les hommes que chez les femmes ($P < 0.0001$). D'autres facteurs, liés au patient, à la chirurgie ou à l'anesthésie n'ont pas été en corrélation significative avec le volume drainé. Le drainage moyen durant le premier jour post-opératoire a été de $41,2 \pm 2,5$ mL (entre 3 et 190 mL). Ce volume est significatif et justifie l'installation d'un drain à demeure lorsque l'on effectue une transposition du nerf cubital.

Cubital tunnel syndrome, or ulnar nerve compression at the elbow, is the most common entrapment of the ulnar nerve and the second most common compressive nerve lesion of the upper extremity after carpal tunnel syndrome (1). Conservative treatment in early and mild cases consists of anti-inflammatory medications, elbow splinting, and modifications of sleep and work habits and elbow positions. When conservative therapy fails, surgical decompression is indicated.

While postoperative hematoma requiring surgical drainage is rare, bruising, induration and swelling are common.

These sequelae increase postoperative pain and inhibit elbow mobilization. To decrease these effects of postoperative bleeding around the ulnar nerve and to decrease scarring, it has been our practice to drain the wounds with a silastic catheter that is removed on postoperative day one. This study was undertaken to evaluate the amount of drainage observed and to determine if the amount correlated with any particular patient, anesthetic or surgical parameters.

MATERIALS AND METHODS

The form, Request For Review of Research Proposal Involving Retrospective Data Review of Medical Records, was submitted and approved by the Human Studies Committee at Barnes Hospital at the Washington University School of Medicine before commencing this study.

Correspondence and reprints: Dr E Gene Deune, Johns Hopkins Division of Plastic Surgery, McElderry #8152A, 601 N Caroline Street, Baltimore, Maryland 21287. Telephone 410-955-6897, fax 410-614-1296

TABLE 1
Concurrent procedures performed with anterior submuscular transposition of the ulnar nerve

Procedure	N
None	57
Carpal tunnel release	24
Carpal tunnel, Guyon's canal release	16
Transposition neuroma	9
Carpal tunnel release; transposition neuroma	3
Guyon's canal release	3
Carpal tunnel, Guyon's canal, median nerve release, forearm	2
First dorsal compartment release	2
Median nerve release, forearm	2
Carpal tunnel, trigger finger release	1
Carpal tunnel, Guyon's canal, trigger finger release	1
Carpal tunnel, Guyon's canal release; muscle and lymph node biopsy	1
Median nerve release, forearm; transposition mean arterial blood pressure neuroma	1
Ulnar nerve repair at elbow	1
Ulnar nerve graft in hand	1
Tendon transfer	1
Chin lipoma excision	1
Total	127

A total of 138 anterior submuscular transposition of the ulnar nerve operations were performed by a single surgeon from December 1991 to December 1995; one chart was not available for review, three did not have drains placed, two drains were dislodged in the early postoperative period and five had no postoperative drainage recordings. This left 127 procedures in 116 patients for complete analysis (67 left hand, 60 right hand). One hundred and nine procedures were primary ulnar nerve transpositions, and 18 procedures were secondary ulnar nerve decompressions. The most common procedure performed concurrently was an ipsilateral carpal tunnel decompression, followed by simultaneous ipsilateral carpal tunnel and Guyon's canal decompression (Table 1). The mean age of patients was 45.3 ± 14.3 years at the time of surgery, with a range of 21 to 81 years. Mean weight for all the patients was 82.9 ± 1.8 kg. Males had a mean weight of 91.0 ± 2.1 kg; females had a mean weight of 71.6 ± 2.5 kg.

Anesthesia was administered by axillary block (n=93), general anesthesia (n=19), Bier block (n=14) or supraclavicular block (n=1). In selected cases (n=67) bretylium tosylate, a sympathetic antagonist, was infused intravenously in the ipsilateral arm of patients with significant preoperative discomfort who were considered to be predisposed to postoperative pain syndromes (2). Bretylium (1.5 mg/kg per body weight) was infused after the arm was exsanguinated and the tourniquet inflated, either concurrently with the Bier block,

TABLE 2
Comparison of drainage in subgroups of anterior submuscular transposition of the ulnar nerve

Group	N	Drainage (mL)	P
Sex			<0.001
male	74	49.7 ± 3.5	
female	53	29.2 ± 2.9	
Anesthesia			>0.05
Axillary block	93	40.2 ± 2.7	
Bier block	14	31.9 ± 5.7	
General	19	53.6 ± 9.0	
Supraclavicular	1	23	
Bretylium			>0.05
with	67	38.0 ± 3.1	
without	60	44.7 ± 4.1	
Reoperations			>0.05
primary	109	40.6 ± 2.8	
secondary	18	43.7 ± 5.3	
Total	127	41.2 ± 2.5	

or separately in saline (20 mL to 50 mL) when axillary block or general anesthesia was used.

The surgical technique for anterior submuscular transposition of the ulnar nerve with modifications has been well described (3-6). All operations were performed under sterile tourniquet. Patients were given perioperative antibiotics for skin flora organisms. A drainage catheter was placed subcutaneously exiting the proximal wound and secured with a steristrip at the conclusion of surgery. A bulky dressing and a splint were then applied. The drain was removed on postoperative day one, keeping the operative dressing intact.

Different types of drains were used: Jackson-Pratt (Baxter Health Care, Illinois) (7 mm or 10 mm); and Blake (Johnson and Johnson, New Jersey) drains (10 French catheter, 15 French catheter, 19 French catheter). Drainage was recorded every 8 h until the drains were pulled. The unpaired *t* test ($P < 0.05$) was used for statistical analysis. Values are mean plus or minus standard error, unless otherwise stated.

RESULTS

The mean drainage before the removal of the drain was 41.2 ± 2.5 mL. Males had a higher drainage volume than females: 49.7 ± 3.5 mL versus 29.2 ± 2.9 mL ($P < 0.0001$). Those patients who had either axillary or Bier block had less drainage than those who received general anesthesia, although this was not statistically significant: axillary block 40.2 ± 2.7 mL; Bier block 31.9 ± 5.7 mL; general anesthesia: 53.6 ± 9.0 mL ($P > 0.05$). Patients who received bretylium had lower drainage than those who did not, bretylium 38.0 ± 3.1 mL and no bretylium 44.7 ± 4.1 mL ($P > 0.05$). There was also no difference in the drainage between primary or secondary ulnar

nerve decompression, primary 40.8 ± 2.8 mL and secondary 43.7 ± 5.3 mL ($P > 0.05$) (Table 2).

Five different types of drains were used. Although the drainage from patients who had the 15 French catheter Blake drains compared with those who had the 19 French catheter Blake drains was significant, it is doubtful that this has any real meaning because the sample sizes were small in both groups and there was no correlation established between drainage volume and drain size (Table 3).

Although there is always the risk of infection with an indwelling drainage catheter, no wound infections were observed in this study. In our study, the drain was pulled on postoperative day one without having to remove the operative dressing.

There were two technical complications: two drains broke during attempted removal leaving behind 8 cm to 10 cm in the wounds. Both wounds were reopened under local anesthetic, and the drains remnants were removed. The drains had been sewn into the wound by subcuticular sutures. No untoward sequelae resulted from this procedure.

DISCUSSION

Several surgical techniques are currently used to treat cubital tunnel syndrome. In a comprehensive review of 50 published reports on more than 2000 patients, Dellon (7) reported that in mild compression of the ulnar nerve, near excellent results can be achieved in 100% of the patients by any of five surgical techniques: in situ decompression of the ulnar nerve,

medial epicondylectomy, anterior subcutaneous transposition, anterior intramuscular transposition and anterior submuscular transposition. However, for moderate and severe degrees of compression, anterior submuscular transposition with internal neurolysis yielded the best results with the fewest recurrences. For severe compression, anterior intramuscular transposition yielded the fewest 'excellent' results and most recurrences (7). In Barnes Hospital at the University of Washington School of Medicine, anterior submuscular ulnar transposition is performed when conservative therapy fails. Drainage with an indwelling silastic catheter is routinely used with this operation.

This study shows that the drainage varies widely from 3 mL to 190 mL with a mean of 41.2 ± 2.5 mL. Several factors were analyzed with respect to drainage volume. Males had more drainage than females due to their larger forearm muscle mass and therefore a larger cut surface. Bretylium is known to produce a sympathetic blockade, preventing the release of norepinephrine. While its infusion, producing a sympathetic blockade and deterring vasoconstriction, would be expected to increase the drainage rather than decrease it, we did not note this finding. Patients who had axillary block or Bier block drains had less drainage than those who had general anesthesia. Finally, the patients who underwent secondary ulnar nerve decompression at the elbow did not have increased drainage. These patients had previously undergone either in situ decompression or subcutaneous transpositions and not anterior submuscular transpositions.

TABLE 3
Comparison of drainage by type of drain placed

Drain type	N	Drainage (mL)*
15 French Blake	6	28.0 ± 9.0
19 French Blake	3	63.7 ± 8.6
7 mm Jackson Pratt	49	47.3 ± 4.4
10 mm Jackson Pratt	4	37.0 ± 7.2

*The only statistically significant difference shown was between the drainage from the 15 French blake and the 19 French blake drains (Johnson and Johnson, New Jersey) ($P = 0.04$)

Although every attempt is made to achieve good intraoperative hemostasis, postoperative bleeding can cause hematoma formation. We hypothesize that postoperative bleeding will cause increased scarring around the nerve and be associated with increased swelling and decreased mobility that subsequently results in increased elbow stiffness and decreased nerve excursion.

Hemoglobin is neurotoxic when injected into cerebral cortex in vivo and when administered into neuronal and glial neocortical cell cultures derived from fetal mice (8,9). Blood, which contains hemoglobin as its major component, has also shown to cause flap necrosis when injected under rat dorsal flap (10). This is secondary to free radicals generated from hemolyzed red cells, and its effect can be modulated by the administration of deferoxamine, a free radical scavenger (11).

The authors recommend placement of an indwelling drain for the first postoperative day to decrease the incidence of hematoma and its potential sequelae.

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