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An Assessment of Symptomatic Relief after Carpal Tunnel Release in Patients on Haemodialysis

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Key Words
Carpal tunnel syndrome · Haemodialysis · Amyloidosis · β_2-Microglobulin · Hyperdynamic circulation

Abstract
Patients receiving haemodialysis for chronic kidney disease are at risk of developing β_2-microglobulin-related carpal tunnel syndrome (CTS). There is a lack of evidence regarding outcome of this complication following surgical treatment. The current study specifically addressed the relief of symptoms after carpal tunnel release in this particular group of patients. ***Materials and Method:*** 26 carpal tunnel release operations were performed in 19 patients (12 males, 7 females) between 1992 and 1996. The mean age of the patients was 59 years (range 41–78) with a mean duration of haemodialysis of 12.6 years. Patients were dialysed the day before surgery with low-dose heparin. All procedures were performed using 1% Xylocaine with adrenaline 1:200,000 without tourniquet as day cases. Relief of weakness of the hand, tingling, pain at rest, pain on use, nocturnal paraesthesiae and scar pain were assessed. ***Results:*** All outcome measures showed marked improvement and 84% (16/19) of patients were satisfied with the outcome. One patient showed worsening of pain at rest and pain on use of hand. ***Conclusion:*** Release of carpal tunnel in patients on haemodialysis helps alleviation of symptoms due to median nerve compression and improves the function of hand and quality of life in the majority of patients. There can still be a small minority of patients who may not show any improvement and a few may rarely get worse.

Introduction

The aetiology, pathophysiology and diagnosis of haemodialysis-related rheumatic disorders have been extensively studied since the first description of association of carpal tunnel syndrome (CTS) in 1975 [1]. Identification of the amyloid protein β_2-microglobulin in perineural, paratenon and in synovial tissues of the joints has established the systemic involvement of haemodialysis-associated amyloidosis [2–5]. Patients on long-term haemodialysis showing symptoms of median nerve neuropathy are routinely assessed to diagnose carpal tunnel syndrome or its progression. Routine clinical tests and electromyographic studies make up the initial screening of these patients. Radiographic imaging, computed tomography, magnetic resonance imaging [6] and ultrasonic

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evaluation can further assist in the evaluation and progression of the disease and may help to identify pathological fractures often seen in this group of patients [7, 8]. Release of carpal tunnel is frequently performed for the relief of symptoms, but there is a paucity of studies describing objective efficacy of the procedure in this group of patients [9–13]. The current retrospective study involves postoperative assessment of five main symptoms associated with amyloid-associated CTS in patients on haemodialysis.

Patients and Methods

Between 1992 and 1996, 21 patients were referred to the Plastic, Reconstructive and Burns Unit by the Nephrology Dialysis Unit, Northern General Hospital, Sheffield, UK. Mean age of the patients was 59 years (range 41–78) with mean haemodialysis duration of 12.6 years. Their main symptoms were tingling, nocturnal paraesthesiae, weakness of the hand, pain at rest and pain on use. Tinel's and Phalen's tests were the main clinical criteria for the diagnosis of CTS. EMG studies were also performed to confirm CTS in 19 (73%) out of 26 hands, 17 of these showed positive and 2 (bilateral CTS) negative results. Criteria for the diagnosis of CTS on EMG were prolonged median distal latency (DL) with normal motor conduction velocity, prolonged median sensory DL with normal proximal sensory conduction velocity and prolonged sensory DL with normal ulnar sensory DL. Ultrasound and X-ray imaging of the hand was done in 2 (8%) and 4 (15%) selected cases, respectively, showing erosive changes. 19 patients (12 males and 7 females, ratio of 1.7:1) with a mean age of 51 years (range 41–78) proceeded to surgery. Of the 19 patients that were operated on, 8 had bilateral CTS (6 males and 2 females). One patient declined surgery, one improved on changing to continuous ambulatory peritoneal dialysis.

Technique

All patients had dialysis 1 day before surgery on low-dose heparin and were transferred and admitted as a day case in the Plastic and Reconstructive Unit. Carpal tunnel release was performed under local anaesthetic using Xylocaine with adrenaline 1:200,000 concentration. A single dose of antibiotics was given perioperatively, and the arm was kept in an elevated position with a support underneath. Tourniquet was not used to avoid injury to the fistula, and after releasing carpal tunnel skin closure was performed using 4-0 prolene and light dressings. Patients were discharged back to their renal unit and were looked after by the nurses on the ward. Follow-up assessments were arranged as necessary.

Results

With a mean postoperative follow-up of 18.6 months (range 5–65), repeat EMG tests showed improved conduction across the previous constriction point, consistent with clinical improvement. One patient with negative bilateral EMG had a bilateral release of carpal tunnel on two occasions without any improvement and was eventually referred to a neurosurgeon. Further investigation, including neck MRI and CT scan, showed compression of the cervical roots of nerves, and the patient had a cervical decompression with complete relief of symptoms.

Patients were contacted and interviewed on the phone postoperatively. A subjective assessment was performed, and weakness, tingling, pain at rest, pain on use, sleep disturbance and presence of scar pain were assessed. Five of the patients died before the interview, 1 was lost to follow-up and 1 refused to take part in the telephonic interview. Patients were asked whether they felt better, same or worse. Full postoperative data were available on 19 hands in 12 patients. Sleep disturbance was improved in 17 hands (89%), unchanged in 2 (11%), and no worsening was reported. Tingling was improved in 15 hands (79%), same in 4 hands (21%) and no worsening was seen. Pain on use was improved in 15 hands (79%), same in 3 hands (16%) and worse in 1 hand (5%). Pain at rest was improved in 9 hands (53%), same in 7 hands (42%) and worse in 1 hand (5%). Weakness of hand was improved in 9 hands (56%), same in 7 hands (44%) and no worsening was seen. Over 84% (16/19) of all patients were happy with the outcome, and scar pain was present in 21% (4/19) of patients with an average follow-up of 18.6 months. No statistical tests were performed on the postoperative assessment data due to the small size of the sample.

Relationship between the Fistulae and CTS in 17 Patients

Bilateral fistulae were present in 9 patients, of these 5 had bilateral CTS (10 hands), 4 had unilateral CTS and had a fistula on the contralateral side without CTS. Unilateral fistulae were present in 8 patients, 4 (8 hands) of these had bilateral CTS, 3 had ipsilateral and 1 had contralateral CTS. 4 patients had a contralateral side CTS with out having a fistula on the same limb.

Discussion

Arthropathies and neuropathies are recognised in patients on haemodialysis and CTS in patients on haemodialysis was first described in 1975 [1]. The causes of symptoms were attributed to the hyperdynamic circulation [1], non-myeloma-associated deposition of amyloid, β_2-microglobulin [2, 3] and its almost selective association to skeletal system [5], although similar deposits in

rectal arteries suggest its multiorgan involvement [3]. The symptoms may also develop due to the lack of use of the hand [1] and can be due to associated uraemia in this group of patients [3]. These arthropathies, termed as dialysis-associated arthropathies (DAA), were due to involvement of almost all components of a joint. The changes are seen in almost any joint [5] and were seen as bone cysts, proliferation of synovial lining of the joints, joint capsules and tendons and nerves around it.

CTS is the most common form of neuropathy and hence most extensively studied. Symptoms of median nerve compression are many and can be divided into sensory and motor components. The most commonly performed clinical tests are Tinel's and Phalen's tests. In a Tinel's sign, tapping with the flexed finger or with a tendon hammer over the course of the nerve at the retinaculum produces paraesthesiae into the median nerve distribution. Phalen's test increases the compression on the median nerve by placing the wrist in acute flexion in patients with CTS. The syndrome is usually confirmed using EMG studies. Bone cysts and carpus-related arthropathies have been imaged using X-rays, ultrasound and MRI [6].

In current series, patients were primarily referred by Nephrology Department to the senior hand surgeon of the Plastic, Reconstructive and Burns Unit of Northern General Hospital, Sheffield. The plan of surgery was outlined on the basis of the clinical, EMG studies and radiological imaging. All patients had haemodialysis a day before surgery on low-dose heparin to reduce intra-operative bleeding, and the procedure is performed under local anaesthetic using 1% xylocaine with adrenaline 1:200,000. Exsanguination of hand by raising the limb is essential as these procedures are ideally performed without tourniquet in order to avoid damage to the fistula. Hands are rested and supported on a hand table and elevation of exsanguinated hand can be maintained during surgery by placing a towel roll under the wrist. Once effective, adrenaline helps to reduce the intra-operative bleeding. However, in one large series, a pneumatic tourniquet was routinely used without any reported incidence of damage to the fistula, and surgery without tourniquet was only performed in patients who had a prosthetic shunt in situ [14].

There are known documented contributory factors involved in the pathogenesis of DAA, while others [1–5, 15] did not find a significant relationship between various aetiologies and prevalence of DAA [16]. Using synthetic dialysis membranes, high-flux dialysis, hemodiafiltration and ultra-clean fluids has been proposed in the standardisation of management of patients. Daily dialysis was considered more effective as a preventive measure and early release of carpal tunnel was proposed [17]. In this particular group, early and regular screening using EMG studies is proposed for early detection of the median nerve compression leading to its early treatment [18]. However, an established CTS can be treated with a splint to the wrist or by early decompression of the tunnel. Late decompression in patients with a long history of sensory or motor symptoms is of limited benefit or improvement may be non-existent; similarly, local anaesthetic injection [11] or corticosteroids bring only temporary relief [11–13]. Repeat carpal tunnel release in recurrent CTS is difficult to perform and often less beneficial [12, 13], and to improve results in such revision surgeries, removal of flexor digitorum superficialis tendons III and IV has been performed [19]. However, it has been documented in a series that 2.4% of all CTS operations were revision procedures and were either due to incomplete release of carpal tunnel or misinterpreted EMG studies [20]. In this series, the highest recurrence rate was observed in patients on haemodialysis. A sound clinical, EMG and radiological assessment is important, and the procedure should be performed by a dedicated hand surgeon, with a standard protocol as outlined above, to avoid such revisions.

With the increasing availability of hemodialysis, life expectancy in this group of patients has risen. Hand surgeons are seeing more patients with hemodialysis-associated arthropathies including CTS, and surgical release is performed more often today. The aim of a surgical procedure is functional restoration and improvement of quality of life. There is a paucity of objective analyses of the relief of symptoms due to CTS in this group of patients following surgical treatment. Grip strength was assessed when conventional release of flexor retinaculam was compared with enlargement plasty combined with synovectomy [13].

In this study, the postoperative interview was kept simple, and questions were asked whether the hand function was better, same or worse. Postoperative EMG studies were consistent with the outcome and showed improved nerve conduction across the carpal tunnel. In one study, 93% of cases showed disappearance of acroparaesthesia, 79% showed sensory recovery versus 27% motor recovery, and 20% observed decreased digital mobility due to extension of tenosynovitis [14]. In the current series, 84% of the patients were happy with the outcome of the surgery along with their postoperative wound management by Renal Department. The most effective outcome after the release of carpal tunnel was improvement

in sleep pattern (89%), tingling and pain was improved in 79% of the patients, while weakness of the hand and pain at rest were improved in only 56 and 53% of the cases, respectively.

Our study provides more data on the improvement of different modalities of hand function following surgery and should help surgeons provide information to prospective patients regarding outcomes.

Conclusion

Haemodialysis-associated CTS is a complication of long-term haemodialysis, and surgical decompression is performed more frequently than ever. The majority of patients (84%) reported improvement in symptoms, with the remaining patients reporting no improvement. A small minority of patients developed worsening of symptoms. The author recommends that patients be informed of this small chance, which will help them decide whether to go ahead with operative treatment. It will help and improve the process of obtaining informed consent for surgical treatment of CTS associated with haemodialysis.

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