Botulinum toxin A injections in lateral epicondylitis – a prospective 3-month follow-up of 30 patients

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Abstract

Objectives
To investigate short-term effects of EMG-guided botulinum toxin A injections in chronic lateral epicondylitis.

Methods
Prospective 3-month follow-up study of 30 patients (mean age 46 years, 21 women). Single EMG-guided injection of botulinum toxin A into the motor endpoint zone and the origin of common extensor muscle. Outcomes: pain visual analog scale, grip strength, and Disability of the Arm, Hand and Shoulder scale (DASH).

Results
The mean pain score decreased during rest (5.1 to 3.1, \( p=0.04 \)), night (5.3 to 3.5, \( p=0.03 \)), and exertion (7.9 to 4.9, \( p=0.02 \)). The grip strength did not improve at any time point. Finger extension paresis occurred in 13 patients (42%) without correlation with pain reduction (\( p=0.37 \)). The DASH showed improvement in only a few activities.

Conclusions
There was a significant pain reduction after botulinum toxin A injections in a short-term follow-up. Thus, botulinum toxin A injections could be considered when treating chronic tennis elbow.

Keywords: lateral epicondylitis; botulinum toxin A; follow-up; short-term effect

INTRODUCTION

As one of choices of treatment of lateral epicondylitis, Botulinum toxin A injections have been introduced almost 20 years ago (1). The reports on their effect have been controversial. The studies supporting the use of botulinum toxin A in lateral epicondylitis have mostly been conducted on small study samples (1-6). Two previous trials have reported conflicting findings of little or no improvement in terms of pain severity (7, 8). Hayton et al. (7) have injected botulinum toxin A without EMG guidance observing no effect in pain severity, grip strength or Disability of the Arm, Hand and Shoulder scale (DASH) points after 3 months; two thirds of the patients had palsy of fingers’ extensors. Lin et al. (8) have injected botulinum toxin A, also unguided by EMG, comparing outcome with one of corticoid injections after 3 months and reporting better results in corticosteroid group; all patients in botulinum group had palsy of fingers’ extensors. No study on the topic has employed precise EMG guidance so far.

The objective was to investigate if EMG-guided procedure may result in, at least, short-term positive effects on pain severity, grip strength, or DASH score.

METHODS

This study was performed in a university outpatient hand surgery clinic amongst adult patients in 2013 – 2015. Forty-seven patients were referred to a clinic by primary healthcare or private physicians. They were assessed by a hand surgeon and 41 presented symptoms fitting to chronic lateral epicondylitis. Six of these 41 patients were excluded due to improved condition. Four patients cancelled the injection appointment without further explanation. The intervention was a part of routine clinical treatment and, therefore, the formal approval of ethical committee was not was requested. The use of gathered clinical data for the research purpose was registered at the university research center and approved by a medical administration.

The botulinum A (Botox®) injections were guided by EMG to two distinct points: the motor endplate zone of extensor carpi radialis brevis muscle and the origin of common extensor muscle. The Botox® solutions were prepared on site by adding 0.9% normal saline solution to a toxin. The concentration of final solution was 100 U/ml. The solution was loaded in 1.0 ml disposable syringes fitted with BOTOX® Injection Needles which are sterile, disposable, monopolar needle electrodes with attached lead wire. The syringes holding the solution were kept at room temperature until use.

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Conflicts of interest: none to declare

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temperature and they were used within one hour since preparation. The 50 units of Botox® were injected. Injections were performed by six different physicians experienced in EMG. The injections were administered to dorsal forearm 4–5 cm distally to lateral epicondyle through cutaneous layers and extensor carpi radialis longus muscle (ECRL) and extensor carpi radialis brevis muscle (ECRB). The injections were distributed in two locations – 25 units to the motor endplate zone and another 25 units near the origin of common extensor muscle. After the injection, the patients remained under surveillance for one hour. The patients were offered a sick leave if needed and they were recommended to avoid strenuous activities. Additionally, the counterforce bracing of forearm was often applied.

The following independent variables were assessed at baseline: occupation, leisure activities, presence of repetitive or forceful movements (e.g. nursing, retail selling, logistics, handcrafts, assembly line work, mechanics, farm work, terminal work, chef, musical instrument, tennis, golf, and weightlifting).

No surgical interventions were allowed during the follow-up. Clinical assessment was conducted by a hand surgeon before the procedure and six and 12 weeks after the injection. Pain level at rest, at night and in exertion was defined on a 100-mm visual analogue scale (VAS) with 0 indicating ‘no pain’ and 100 ‘worst imaginable pain’. Functional status was measured using a DASH questionnaire. The DASH has 30 questions about everyday activities, four about occupational, and four questions about leisure-time activities that is 38 questions in total. Questions are scored from one (‘no difficulty’) to five (‘unable to complete the task’). The grip strength of both hands was measured using a Jamar® dynamometer, first with an elbow in a 90° flexion and then arm fully extended. The clinical examination included manual assessment of extensor digitorum muscle (EDC) and wrist extension strengths and whether the extension was causing any radiating pain. The tenderness of the lateral epicondyle was also assessed.

Weakness in EDC extension and digit extension was assessed after the injection. Finger extension weakness was assessed by inspection of finger drop with all fingers in a straight plane. The observed finger drop was documented with the accuracy of half finger width, one finger width, or more than one finger width.

All statistical analysis was calculated by statistical expert. Significance was set at 0.05. Statistical analyses were performed with IBM SPSS Statistics 22.

RESULTS

The final study sample comprised 30 patients aged between 33 and 58 (mean 46) years. The majority were women, n=21 (70%). Twelve (40%) patients had bilateral lateral epicondylitis symptoms, but only one patient was treated for both elbows, making in total 31 treated elbows. Of the treated elbows, 21 (68%) were right-sided and 20 (65%) were on the dominant side. The mean duration of symptoms before the procedure was 22 months (range 5 to 240 months). Twenty-three patients (74%) did repetitive movements at work and 8 (26%) did repetitive movements during leisure-time activities.

At the end of 3-month follow-up, pain level decreased in rest (5.1 to 3.1, p = 0.044), at night (5.3 to 3.5, p = 0.032), and exertion (7.9 to 4.9, p = 0.016) (Table 1). In turn, while also grip strength showed slight improvement over 3 months, no statistically significant changes were observed at any time point: extended elbow 19.1 kg to 24.6 kg, p = 0.908; flexed elbow 25.2 kg to 28.6 kg, p = 0.398. Only a few DASH items, such as carrying a shopping bag (p=0.027) and carrying a heavy object (p=0.004), showed statistically significant improvement.

Five of 31 patients (16%) underwent surgery after 3 months follow-up time. Their pain level was similar with the rest of the sample at baseline (p=0.387), but they were more painful after 3-month follow-up – 6.9 vs. 1.9 (p=0.001) points at rest and 7.3 vs. 4.2 (p=0.013) points in exertion.

Middle finger extension paresis occurred in 13 patients (42%) at 6 weeks follow-up without difference between patients who did or did not undergo surgery later (p=0.368). There was no difference in appearance of paresis between patients received their injections from different physicians. There was no difference in pain level at any time point between patients with and without finger paresis.

DISCUSSION

The pain level of 30 patients with chronic tennis elbow decreased after EMG-guided Botox® injections at 3-month follow-up. Injections did not significantly affect the patients’ grip strength or arm function.

The results were more promising than the results of several previous trials. There might be several reasons for that. Previous studies on botulinum A injections in chronic tennis elbow have usually defined an injection site using visual landmarks uncontrolled by EMG. Only a few studies have employed EMG for the task (1, 4). The EMG guidance might increase the precision of procedure and minimize performer-related effect heterogeneity (when there are several physicians involved in a trial)

This study did not show any association between a successful (defined by pain severity) injection and fingers’ extensors’ paresis – the effect desired by previous studies by Morre et al. (1) and Keizer et al. (3). It is possible that the analgesic effect of botulinum A is produced through other mechanisms than motoric paresis as has previously been suggested (5, 8).

Oskarsson et al. (4) found a grip strength improvement at 12 months. No other previous study has observed improvement of grip strength in short term follow-up after botulinum A injections. It could only be speculated whether this finding was a result of treatment or simply natural process of recovering.

This was uncontrolled study with only short-term follow-up. The main strength of the study was a uniform diagnosis made by an experienced hand surgeon, an EMG guidance, and a comprehensive set of outcome measures including pain severity, grip strength and arm function.
Further research on the topic is needed involving bigger samples, controlled design, and longer follow-ups.

CONCLUSIONS

Pain caused by chronic tennis elbow decreased after EMG-guided Botox® injections at 3-month follow-up. The absence of correlation between analgesic effect and extensors’ paresis supported the hypothesis of direct analgesic effect of botulinum A.

REFERENCES


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