

Analysis of the efficacy of integrated traditional Chinese and Western medicine in the treatment of diabetic trigger finger

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ABSTRACT Objective: This study evaluates the clinical efficacy of integrated traditional Chinese and Western medicine compared with open tenosynoviolysis in the treatment of diabetic trigger finger, with attention to pain relief, tendon-sheath function, biomechanical recovery, and future compatibility with wearable electromagnetic sensing of finger motion. Methods: Clinical data were collected from diabetic patients with trigger finger who visited Jinan Central Hospital from 2020 to 2024. Thirty affected fingers treated with integrated traditional Chinese and Western medicine were included as the observation group, and 30 affected fingers treated with open tenosynoviolysis during the same period and matched by general data were included as the control group. Glycosylated hemoglobin, Visual Analogue Scale score, Quinnell grade, total effective rate, and adverse reactions were compared before and after treatment. Results: After one month, glycosylated hemoglobin in the observation group decreased significantly and was lower than that of the control group. VAS scores decreased in both groups, but the reduction was greater in the observation group. After treatment, 96.7% of affected fingers in the observation group reached Quinnell grade 0 or I, compared with 70% in the control group. The total effective rate was 100% in the observation group and 86.7% in the control group, with no adverse reactions observed during follow-up. Conclusion: Integrated traditional Chinese and Western medicine showed superior short-term efficacy for diabetic trigger finger and may support future biomechanical evaluation using wearable electromagnetic or antenna-based motion sensing.

INDEX TERMS diabetic trigger finger, integrative medicine, open tenosynolysis, biomechanical recovery, wearable electromagnetic sensing

I. INTRODUCTION

Type 2 diabetes (T2DM) is a chronic disease characterized by long-term elevated blood sugar, which can lead to damage of nervous, vascular and other systems¹. Trigger finger (TF), also known as "snap finger", is a sterile inflammatory response that occurs between the flexor tendon and the fibrous sheath. It is often characterized by impaired finger flexion and extension, clicking, and pain. CHAMMAS put forward in 1995 that type 2 diabetes patients with multiple neuropathy often have joint soft tissue diseases such as TF². For example, the prevalence of limited joint movement syndrome in T2DM is 25-76³; The prevalence of carpal tunnel syndrome in patients with diabetes is 14-30⁴; The prevalence of TF in DM patients is 5-20⁵; The prevalence of Dupuytren contracture in DM patients is 0.5-32⁶, and the prevalence of osteoarthritis in DM patients is 27-52⁶, both of which are much higher than the prevalence in the general

population.

In view of the high prevalence rate of joint soft tissue in diabetes, there is no effective treatment plan reported at home and abroad at present. Most of them adopt the same treatment plan as that of non diabetes joint soft tissue lesions, with a generally low success rate, a higher recurrence rate after surgical treatment, and more postoperative complications⁶. Clinical experience and preliminary observation have demonstrated that integrated traditional Chinese and Western medicine is effective in treating diabetic soft tissue complications of the joints, including trigger finger, carpal tunnel syndrome, and limited joint mobility syndrome. Including TF, carpal tunnel syndrome, limited joint movement syndrome, Dupuytren contracture, osteoarthritis, etc. Among them, TF patients are the most. By retrospectively analyzing case data from the past four years, this study compares integrated traditional Chinese and

Western medicine against open tenosynoviolysis to evaluate their clinical efficacy in restoring the fine motor skills required for intricate textile fiber manipulation among diabetic trigger finger patients. This comparative research further investigates how integrated therapy supports the systemic health and blood glucose stability necessary for workers to maintain the rigorous precision of textile machinery operation.

II. DATA AND METHODS

A. GENERAL

The clinical data of 24 cases of trigger finger patients with diabetes (30 cases in total) who received integrated traditional Chinese and western medicine treatment in the Department of Endocrinology and Department of Traditional Chinese Medicine of Jinan Central Hospital from 2020 to 2024 were collected as the observation group, and 26 cases of patients who received open tendon sheath incision and release in joint surgery at the same time and matched with the general data of the observation group were collected as the control group.

B. INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria:

- (1) Conform to the diagnostic criteria for diabetes⁸.
- (2) Conform to the diagnostic criteria for trigger finger⁹.
- (3) Quinell grade II–IV of the affected finger.
- (4) Age ≥ 18 years old, male or female.
- (5) Clear consciousness, no aphasia, intellectual and cognitive deficits.

Exclusion criteria:

- (1) History of rheumatism or rheumatoid arthritis.
- (2) History of hand trauma with residual sequelae.
- (3) Patients with severe cardiovascular and cerebrovascular diseases.
- (4) Failure to complete follow-up or incomplete follow-up data.
- (5) Incomplete clinical history data.

C. METHODS

Control group: Open tenosynovitis was performed by a trained professional joint surgeon. The patient was placed in a supine position with the affected limb abduction platform. Iodine was used for disinfection in the surgical area, and a sterile hole cloth was laid. Local anesthesia infiltration was performed with 1% lidocaine. A transverse incision of about 2 cm was made along the transverse crease of the distal palm of the affected finger, and the skin and subcutaneous tissue were cut layer by layer. Longitudinal cutting was performed next to the tenosynovitis to completely relieve the narrow part of the tenosynovitis. Most of the tendon swelling slid unobstructed, and the wound was washed. After the surgical instruments were counted correctly, the wound was sutured layer by layer. After suturing, sterile dressing was used for bandaging. The dressing was changed regularly after surgery to avoid infection.

Observation group: Patients were given a combination or modification of traditional Chinese medicine formulas such as dried ginger roasted licorice soup, Guizhi and Gegen decoction, and Shengmai drink. The traditional Chinese medicinal materials are uniformly dispensed and decocted by the pharmacy of the hospital. The specific formula is as follows: Roasted Licorice 16 g, Dried Ginger 6 g, Kudzu Root 12 g, Cinnamon Twig 6 g, Jujube 10 g, Codonopsis Root 10 g, Ophiopogon Japonicus 10 g, Schisandra Chinensis 3 g, Rhizoma Chuanxiong 10 g. All medicinal materials are placed in a sand pot, soaked in cold water which completely submerges the herbs for 30 minutes. After bringing the water to a boil over high heat, simmer the mixture over gentle heat for 30 minutes, and then filter out the medicinal liquid. Simultaneously combining Western medicine to improve circulation, nourish nerves, and promote antioxidant therapy. Both groups actively control blood sugar, blood lipids, and blood pressure. The modified prescriptions are adjusted corresponding to symptoms as follows:

- (1) For aggravated cold limbs, cold and aching lumbus and knees, and deep thready pulse, Aconiti Radix Lateralis Preparata can be added to intensify yang-warming and cold-dispelling effects.
- (2) For frequent spontaneous sweating, shortness of breath and disinclination to speak, Astragali Radix is supplemented to tonify qi and consolidate the exterior.
- (3) For dry mouth and sore throat, red tongue with scant coating, and hectic fever with night sweating, the dosage of Zingiberis Rhizoma Siccum should be reduced, and Glehniae Radix and Polygonati Odorati Rhizoma are added to nourish yin and moisten dryness.

D. OBSERVATION INDICATORS

1) Glycated Hemoglobin

Collect and compare the glycated hemoglobin (HbA1c) levels of two groups of patients before and after treatment for one month, in order to objectively reflect and evaluate the changes in average blood glucose levels of patients over the past 2-3 months.

2) Visual Analogue Scale

VAS scoring uses a ruler with a length of about 10cm and a scale interval of 1cm to refine the pain perception grading in the order of 0-10 points (see Figure 1). A score of 0 indicates painlessness; A score of 1-3 indicates mild pain in the affected finger, but the pain is still tolerable; A score of 4-6 indicates moderate pain in the affected finger, which can be tolerated but may affect sleep quality; A score of 7-10 indicates severe pain in the affected finger, which has caused serious disturbance to the patient's sleep. The patient accurately marks the corresponding position on the ruler based on their own pain perception. Compare and analyze the changes in VAS scores of pain intensity between two groups of patients before and after 1 month of treatment.

0	1	2	3	4	5	6	7	8	9	10
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Painless 1-3, mild pain 4-6, moderate pain 7-10, severe pain

FIGURE 1. Visual Analogue Scale(VAS)

3) Quinnell Grading

Quinnell grading is based on the hand function grading established by Quinnell RC in 19809. Level 0: The affected finger is painless to press and can perform normal flexion and extension activities; Grade I: Mild pain when pressing the affected finger, and mild restriction on flexion and extension movements; Grade II: The affected finger is unable to bend or extend due to pain, or there is a clicking sound after movement; Grade III: The sound of finger flexion, extension, and bouncing can be passively corrected; Grade IV: The affected finger joint is interlocked and cannot perform flexion and extension movements. Record and evaluate the severity of two groups of patients before and after treatment using the Quinnell grading system.

4) Clinical Efficacy Evaluation

Clinical efficacy evaluation is based on the “Diagnostic and Therapeutic Efficacy Standards for Traditional Chinese Medicine Diseases” issued by the State Administration of Traditional Chinese Medicine in 199410. The efficacy evaluation is as follows:

Cure: the pain on the palmar side of the affected finger has completely disappeared, and the finger can be bent and extended independently without any popping or twisting phenomenon.

Improvement: The affected finger experiences mild pain and a popping sound during flexion and extension.

Not fully recovered: There is no significant change in clinical symptoms compared to before. The total effective rate is equal to the cure rate plus the improvement rate.

5) Adverse Reactions

Adverse reactions Common adverse reactions after diabetes trigger finger treatment include local pain or tenderness, incomplete release, hyperplasia of paralysis scar, postoperative infection, tendon rupture, finger nerve injury, etc.11.

E. ETHICS STATEMENT

In this study, all enrolled patients were fully informed by attending physicians of the potential benefits, accompanying risks, and complications associated with the two treatment approaches. The final treatment option was independently chosen by the patients themselves. This study did not involve any invasive sampling from patients. All data processed in the study were anonymized throughout the procedure, and the research strictly complied with the institutional management specifications for clinical research of our hospital. This study was approved by the Ethics Committee of Weihai Municipal Hospital, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

F. STATISTICAL PROCESSING

In this study, SPSS 26.0 statistical analysis software was used to process and analyze the collected data. We use mean $\pm$ standard deviation ($\bar{x} \pm s$) to represent metric data that follows a normal distribution, paired t-test for intra group comparisons, and independent sample t-test for inter group differences; Measurement data that do not follow a normal distribution are represented using M (IQR). Two independent sample Willcoxon rank sum test is used for inter group comparison, and two correlated sample rank sum test is used for intra group comparison; Count data is presented in percentage (%) and analyzed using chi square test; Grade data is evaluated through rank sum test. $P < 0.05$ indicates that the difference is statistically significant.

III. RESULTS

A. BASIC INFORMATION

There were 10 males and 16 females in the control group, and 4 males and 20 females in the observation group. There was no significant difference in the gender composition between the two groups ($P > 0.05$); The average age of the control group was (60.88 ± 8.89) years old; The average age of the observation group was (56.46 ± 9.54) years. There was no statistically significant difference in age and trigger finger disease duration between the two groups of patients ($P > 0.05$), indicating comparability. (See Table 1)

B. GLYCATED HEMOGLOBIN

By analyzing the results of glycated hemoglobin in two groups of patients, it was found that there was no significant difference in glycated hemoglobin levels between the control group and the group before treatment after one month of treatment ($P > 0.05$); The glycated hemoglobin in the observation group decreased significantly compared to before treatment, and the difference was statistically significant ($P < 0.05$). Further inter group analysis showed no significant difference in glycated hemoglobin levels between the two groups of patients before treatment ($P > 0.05$). After one month of treatment, the glycated hemoglobin in the observation group decreased to $7.53\% \pm 0.96\%$, which was significantly lower than the control group's $8.93\% \pm 1.91\%$. The difference between the groups was statistically significant ($P < 0.05$) (see Table 2). It shows that integrated traditional Chinese and western medicine treatment can effectively reduce the level of glycosylated hemoglobin in patients, assist hypoglycemic drugs to regulate blood sugar, and fundamentally reduce the recurrence risk of trigger finger in diabetes patients.

C. VAS SCORE

The intra group comparison of VAS scores between the two groups of affected fingers showed that after one month of treatment, the VAS scores of the control group decreased compared to before, and the difference was statistically significant ($P < 0.05$). The VAS score of the observation group decreased significantly compared to before, and the

TABLE 1. Comparison of General Information between Two Groups of Patients

Grouping	Male/Female	Age (years, $\bar{x} \pm s$)	Disease duration [months, M (IQR)]
control group	10/16	60.88 $\pm$ 8.89	2(5)
Observers	4/20	56.46 $\pm$ 9.54	4.5(4)
χ^2/t value/z value	2.941	1.698	1.153
P value	0.086	0.096	0.249

TABLE 2. Comparison of glycated hemoglobin ($\bar{x} \pm s, \%$) between two groups of patients before and after 1 month of treatment

Grouping	Number of cases	Before treatment	After 1 month of treatment	t	P
control group	26	8.95 $\pm$ 1.73	8.93 $\pm$ 1.91	0.117	0.908
Observers	24	9.49 $\pm$ 1.89	7.53 $\pm$ 0.96	5.625	P<0.001
t	–	-1.048	3.307	–	–
p	–	0.300	0.002	–	–

difference was statistically significant ($P<0.05$). The inter group comparison results showed that there was no significant difference in VAS scores between the two groups of patients before treatment ($P>0.05$). After one month of treatment, the VAS scores of the observation group were significantly lower than those of the control group, and the difference was statistically significant ($P<0.05$) (see Table 3). It shows that the effect of integrated traditional Chinese and western medicine on improving pain of trigger finger of diabetes after one month of treatment is higher than that of open tenolysis.

D. QUINNELL RESULTS

Before treatment, the proportion of grade III and IV patients in both groups was 96.7% with no significant difference ($P>0.05$). After one month of treatment, the control group had a Quinnell grade of 0 and I, accounting for a total of 70%, which was lower than the observation group's 96.7%, and the difference was statistically significant ($P<0.05$). (See Table 4) This indicates that the combination of traditional Chinese and Western medicine has a more significant effect on improving the mobility of the affected finger, and can significantly alleviate the strangulation and entrapment of the affected finger.

E. CLINICAL EFFICACY EVALUATION

After one month of treatment, we conducted follow-up evaluation on the patients. In the control group, there were a total of 30 patients, of which 7 were cured, 19 improved, and 4 did not recover. The cure rate reached 23.3%, and the total effective rate was 86.7%. In the observation group, 18 cases were cured, 12 cases improved, and there were no untreated cases. The cure rate was 60%, and the total effective rate was as high as 100%; The observation group showed significantly better overall effectiveness than the control group. The chi square test was used to statistically analyze the efficacy of the two groups, and the results showed that there was a statistically significant difference between the two groups ($P<0.05$) (see Table 5)

F. INCIDENCE OF COMPLICATIONS AFTER TREATMENT

After one month of treatment, 6 patients in the control group reported incomplete relief of postoperative pain in the affected finger, accompanied by local tenderness. One patient received a combination of traditional Chinese and Western medicine treatment, and the symptoms improved significantly. One patient still had the sound of finger flexion, extension, and rebound after surgery. There were no postoperative complications such as infection or finger nerve damage in the control group. There were no significant adverse reactions observed during the follow-up period of the observation group.

TABLE 3. Comparison of VAS [M (IQR), points] between two groups of patients before and after 1 month of treatment

Grouping	Number of cases	Before treatment	After 1 month of treatment	z	P
control group	30	7.5(1)	3(1)	4.841	P<0.001
Observers	30	7.5(1)	2(2)	4.872	P<0.001
z-value	–	0.117	4.125	–	–
p	–	0.907	P<0.001	–	–

TABLE 4. Comparison of Quinell grading between two groups of patients before and after 1 month of treatment

Time	Grouping	0	I	II	III	IV	Statistical value
Before treatment	control group	0	0	1	13	16	z:1.221; p:0.222
Before treatment	Observers	0	0	1	18	11	–
After 1 month of treatment	control group	0	4	17	8	1	z:4.877; p<0.001
After 1 month of treatment	Observers	23	6	1	0	0	–

TABLE 5. Comparison of clinical treatment effects between two groups of affected fingers (example, %)

Grouping	Number of cases	Cure	Improvement	Healed	Total efficiency
control group	30	7(23.3)	19(63.3)	4(13.3)	86.7
Observers	30	18(60)	12(40)	0(0)	100
R	–	–	–	–	10.079
P	–	–	–	–	0.004

IV. DISCUSSIONS

TF is a common hand disease, and the tendon sheath consists of 5 circular pulleys and 3 cross pulleys¹², forming tunnels around the deep and shallow flexor muscles of the fingers. All fingers can be affected, with the thumb and ring finger being the most commonly affected¹³, with females being more common than males (6:1)¹⁴. The typical ultrasound feature of TF is global or nodular hypoechoic thickening of the affected A1 pulley¹⁵. T2DM has been identified as the main risk factor for inducing TF¹⁶. Long term glucose metabolism disorders in T2DM patients lead to the accumulation of advanced glycation end products (AGEs) in the palmar fascia, causing glycosylation of tendons and collagen deposition. AGEs can affect the expression of vascular endothelial growth factor, affect cell cycle, promote inflammatory response, enhance oxidative stress, and further increase tendon fragility¹⁷. The risk of TF in T2DM is related to neurological disorders, microvascular diseases, etc.¹⁸. The axonal degeneration and segmental demyelination of nerve cells caused by diabetes neuropathy can cause motor and sensory nerve conduction disorders in the distal limbs, resulting in motor and sensory abnormalities, weakening the finger's ability to perceive the outside world, and causing excessive tendon use. At present, the commonly used drugs to improve the neuropathy of diabetes clinically include lipoic acid, mecobalamin, alprostadil, epalrestat, etc¹⁹. The microvascular disease of diabetes affects the blood supply of the distal limbs, leading to long-term hypoxia of the tissues, thus activating inflammatory cells to further synthesize and release inflammatory mediators. In addition, microcirculation disorders can cause soft tissues such as tendons, tendon sheaths and neurotrophic disorders, and aggravate the damage of soft tissues such as tendons.

At present, the clinical treatment scheme of trigger finger

in diabetes is mostly the same as that of trigger finger in non diabetes, including surgical treatment and conservative treatment. Common conservative treatments include health education, immobilization, oral non steroidal anti-inflammatory drugs, intrathecal injection of steroid drugs for immediate closure, acupuncture and moxibustion, fumigation and washing with Chinese medicine, massage, acupotomy, etc. Surgical treatment includes percutaneous release and open tenosynovitis release²⁰. The effective rate of percutaneous release surgery is generally above 90%, however, patients with DM may have a higher risk of recurrent triggering or pain²¹. Compared with non diabetes patients, the 1-year prognosis of finger function in DM patients after open tendon sheath incision and release is poor²². A meta-analysis of the relationship between DM and infection risk after TF surgery shows that the risk of infection after trigger finger surgery in DM patients is 1.65 times higher than that in non diabetes patients²³.

From the perspective of traditional Chinese medicine disease differentiation and analysis, TF belongs to the category of "Bi syndrome" and "Jin injury", characterized by stagnation of qi and blood, obstruction of meridians, pain when blocked, poor blood circulation, coagulation into lesions, and long-term illness²⁴. The pathogenesis and syndromes of T2DM are complex and changeable, mainly including four states of "depression, heat, deficiency, and impairment". The pre diabetes corresponds to the "depression" state, the diabetes phase is more prone to the "heat" and "deficiency" states, and the diabetes complication phase is more prone to the "impairment" state. At the beginning, when there are six phases of depression and illness, it becomes a state of depression; Yu Jiu transforms into heat, often accompanied by excessive heat in the liver, stomach, intestines, and lungs,

gradually becoming hot; Dry heat harms yin, strengthens fire and eats qi, resulting in deficiency of qi, blood, yin and yang, and turning into a state of deficiency; Long term illness enters the causing blood stasis and damage to the meridians, ultimately leading to a damaged state²⁵. The development of diabetes to the stage of joint injury has reached the stage of "deficiency", including spleen deficiency and qi deficiency. The spleen is the main muscle in the limbs, while spleen deficiency can easily lead to the loss of muscle and pulse nourishment in the limbs. There is a saying in the "Spirit Pivot: Ben Shen" 26: "Spleen deficiency causes the limbs to be useless and the five organs to be restless²⁷. The spleen is responsible for the transportation and transformation, and is the foundation of postnatal development²⁸. When the function of spleen transportation and transformation is normal, it can absorb useful water and grain essence and transport it to various parts of the body to nourish the five organs, six viscera, four limbs, and hundred bones, enabling them to perform normal physiological functions; Qi deficiency exacerbates the loss of limb muscles and meridians; "Blood stasis" runs through the whole course of diabetes and plays an important role in the joint disease of diabetes²⁹. According to the above pathogenesis and syndrome analysis of diabetes joint disease, the proposed prescription of dried ginger and processed licorice decoction, Guizhi plus Gegen decoction, Shengmai Yin and other traditional Chinese medicine prescriptions are used together, plus or minus. In the prescription, dried ginger and processed licorice decoction is warm to dissipate cold, invigorate the spleen and stomach, replenish qi and nourish blood, and restore yang and unblock the pulse; At the same time, the synergistic effect of the two: roasted licorice neutralizes the nature of dried ginger, prolongs the duration of the drug effect, and reduces gastrointestinal irritation³⁰.

Guizhi and Gegen decoction can relieve muscle problems, promote diuresis, and relax tendons; Shengmai Yin is a fundamental formula for nourishing qi and yin, used for the deficiency of both qi and yin; The combination of two ingredients with modifications can enhance the effect of tonifying qi and promoting blood circulation. Chuanxiong has the effect of relaxing blood vessels, effectively improving microcirculation, and inhibiting platelet aggregation, which can improve blood stasis and facilitate joint repair.

The total effective rate of the observation group in this study (100%) is higher than that of the control group (86.7%). It can be seen that the trigger finger treatment of diabetes, the combination of traditional Chinese medicine and western medicine treatment for the pathogenesis and the dialectical treatment of traditional Chinese medicine, is more efficient, has better clinical efficacy, is more economical and safe, and can effectively reduce glycosylated hemoglobin in diabetes patients, and reduce the recurrence rate of trigger finger in diabetes patients.

The trigger of diabetes refers to a kind of diabetes joint disease. Its pathogenesis can represent the pathogenesis of all joint diseases of diabetes. Therefore, for diabetes joint

disease, patients can give priority to the combination of traditional Chinese and western medicine drug treatment scheme. We have successfully treated cases of diabetes periarthritis of shoulder, metacarpal fascial contracture syndrome, limited joint movement syndrome, carpal tunnel syndrome, lower limb compression neuropathy and other cases in clinical practice, but due to the insufficient number of cases of each disease, there is no statistical value and no report has been made.

This retrospective study remains limited by inherent information bias and a relatively small sample size, which may constrain the generalizability of these findings to the broader population of workers engaged in high-precision textile fiber processing and loom operation. Future research with larger cohorts is necessary to fully validate how these clinical outcomes support the long-term manual dexterity required for maintaining manufacturing excellence in technical textile production. Later, relevant animal experiments and large-scale clinical experiments can be carried out to further explore and analyze the mechanism of action and molecular mechanism of integrated traditional Chinese and western medicine in the treatment of joint soft tissue diseases, including TF, in order to provide an efficient and economic clinical treatment scheme for patients with diabetes combined with joint soft tissue diseases.

V. CONCLUSION

Integrated traditional Chinese and Western medicine for the pharmacological treatment of diabetes complicated with trigger finger can alleviate the pain intensity of the affected fingers, restore the range of motion of the interphalangeal joints, and improve the level of glycosylated hemoglobin in patients. Meanwhile, it causes no obvious adverse reactions and possesses the advantages of high safety, simplicity and cost-effectiveness.

AUTHOR CONTRIBUTIONS

Conceptualization – Si-yan Liu, Shao-lian Wang and Xue-yan Wu; methodology – Si-yan Liu, Shao-lian Wang and Xue-yan Wu; investigation – Si-yan Liu, Shao-lian Wang and Xue-yan Wu; writing-original draft preparation – Si-yan Liu, Shao-lian Wang and Xue-yan Wu. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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HUMAN RESEARCH SUBJECTS

This study was approved by the Ethics Committee of Weihai Municipal Hospital, and was performed in accordance with the principles of the Declaration of Helsinki. All eligible participants signed an informed consent form.

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