SHORT REPORT

Selection criteria for reconstructive surgery to correct mobile hand deformities in leprosy

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Introduction

Claw hand and z-thumb due to proximal or distal ulnar nerve paralysis, and loss of thumb opposition due to distal median nerve paralysis are the most common deformities affecting the hand in leprosy, and are among the main causes for stigma and de-habilitation.1,2 Ulnar or ulnar-median paralysis is more frequent than triple nerve paralysis (ulnar, median and radial). These deformities affect hand function, hinder the patients’ daily routine activities3–5 and restrict their social participation.4–6 Reconstructive surgery (usually with tendon transfer) aims at re-establishing the balance of forces in the hand and improving the appearance and function, thereby improving both physical abilities and social participation. Various types of tendon transfers have been described5–7 and have been shown to restore the balance of forces and the functional ability of the paralysed hand.6,7

There is wide variation in the presenting deformities due to anatomical, anthropometric, and occupational factors. These factors include the presence of secondary impairments, the strength of the long flexors and/or the donor tendon, hypermobile joints of digits, the presence or absence of palmaris longus muscles, short or long fingers, heavy or light work, and dominant or non-dominant hand. These factors should play a major role in selecting the particular type of tendon transfer which then impacts the outcome in terms of form, function and complications due to surgery. Guidelines exist for the selection of patients but they are usually restricted to the duration of deformity, age and previous medical treatment, with scant attention to other factors.8–10 For this reason, there is need for a comprehensive guideline to match the variation in the presenting deformity to the appropriate tendon transfer techniques. This would help maximise the beneficial outcome for the patient. Therefore, in this short report we present guidelines to recommend rational selection criteria for reconstructive surgery to correct claw hand and thumb deformities in leprosy.
Methods

The Leprosy Mission Community Hospital at Naini, Allahabad district in Uttar Pradesh, India treats a large number of active untreated leprosy patients as well as those with serious complications. It has an excellent electronic medical records system with a unique registration number for each patient, facilitating the recording of every detail at baseline and during follow-up. Over 250 tendon transfer surgeries for hand deformities are carried out at this institution every year. These guidelines have been developed by the surgeon and therapist/technician based on their clinical experience. More than 2500 tendon transfer surgeries have been done at this hospital, based on these guidelines over the past decade.

RATIONALE FOR SURGERY

The impairment status, mobility of proximal inter-phalangeal (PIP) joints, length of the fingers, the client’s occupation and hand dominance were taken into consideration before selecting the appropriate procedure for a presenting deformity. The voluntary muscle assessment and sensory testing of the hand was recorded pre-operatively to determine the impairment status. The client’s occupation was classified as heavy or light work. Farmers, shop-keepers, labourers, weavers and drivers were considered as heavy workers, while students, supervisors, tailors or those doing clerical jobs were considered as light workers. Hypermobility of the PIP joint was assessed by passively extending the joint. When the middle phalanx goes beyond the vertical axis of the proximal phalanx, it is considered as a hypermobile PIP joint. The length of the fingers were noted as short or long. Hand dominance was noted as left or right. The pre-operative assessments also include the presence of secondary impairments, unassisted, assisted and contracture angle of the PIP joint along with functional status of the hand. The presence of an assisted angle without a contracture angle indicates attenuation of the function of the dorsal digital expansion. These factors were discussed during the pre-operative clinic by the surgeon and therapist with the patient before selecting the particular type of tendon transfer surgery to be done.

Figure 1 shows various tendon transfer techniques with notes on suitability.

Table 1 shows various tendon transfer techniques against clinical variables with options indicated as preferred choice, can be done, avoid and not relevant.

STATIC PROCEDURE

Pulley advancement with or without capsulorrarophy is a release of A1 and advancement of the proximal edge of the flexor A2 pulley. This allows bowstringing of the flexor tendon and creates semi-active flexion of MCP joints. This procedure is suitable for those with minimal claw i.e. small-unassisted angles and no assisted angles.

DYNAMIC PROCEDURES

Flexor Pulley insertion surgeries

In middle finger lasso surgery, flexor digitorum superficialis (FDS) of the middle finger tendon is divided into four slips and looped through A1 and A2a (proximal half) pulleys and sutured to itself to create active flexion of MCP joints and facilitating IP joint extension.
Ring finger lasso and half FDS lasso are identical to middle finger lasso surgery except in respect of the motor tendon used. In the former procedure, FDS of the ring finger is used as the donor tendon, while in the latter the ulnar half of the middle finger FDS is used.

In Palmaris Longus (PL) and Extensor Carpi Radialis Longus (ECRL) lasso surgeries, the PL and ECRL tendons are used as the donor tendons, respectively. A tensor fascia lata (TFL) tendon graft is used to increase the length to reach the flexor pulleys for lasso. For those who have hypermobile joints and/or long fingers, PL or ECRL lasso are preferred over FDS lasso.

In hands with reversed distal transverse metacarpal arch, a 5th slip can be created and inserted into the ulnar side of the abductor digitii minimi tendon to increase the arch.

**Lateral band insertion surgeries**

In lateral band insertion surgeries the transferred tendon is inserted into the lateral bands (ulnar side of middle, ring and little finger and radial side of index finger) of the extensor expansion of each digit. In EF4T and EMT, ECRL and ECRB is used as the donor tendon, respectively with TFL as a tendon graft to restore the active flexion of the MCP joints and extension of the interphalangeal joints of the digits. PL4T and SU4T5 are identical with the EF4T except in respect of the motor tendon used: palmaris longus and the middle finger FDS are used as donor tendons, respectively.
Table 1. Various tendon transfer techniques against clinical variables with options

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**KEY**
- Preferred choice
- Can be done
- Avoid
- Not relevant
THUMB OPPONENSPLASTY

Thumb opponensplasty using FDS of ring finger\(^9\) and extensor indicis proprius\(^{16}\) have been standard procedures. Mobile thumb and good active extension of the interphalangeal (IP) joint is essential for the EIP procedure. For those who have a relatively stiff thumb and are involved in heavy work, FDS is preferred over EIP opponensplasty. EIP is also used when FDS removal is not advisable.

Z-THUMB CORRECTION

In patients with severe IP flexion deformity which interferes with pulp-to-pulp pinch, flexor to extensor transposition of half flexor pollicis longus is indicated. This stabilises the IP joint in extension and causes semi active flexion at the MCP joint and allows pulp-to-pulp pinch.\(^9\)

Conclusions

Hand deformities due to nerve damage are the most common disability in leprosy. There are various types of tendon transfer surgeries available to correct deformities of hand. Due to the variation in presentation, the specific tendon transfer procedure must be selected to suit each individual hand to optimise the outcome.

References