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Original article

# An alternative treatment for contractures of the elderly institutionalized persons: Microinvasive percutaneous needle tenotomy of the finger flexors

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ABSTRACT

*Background:* Almost 10% of older adults in nursing homes have a fixed flexion deformity of the fingers (claw hand). Such contractures have important functional consequences, often leading to hygiene difficulties. Medical treatment (such as botulinum toxin injections, physiotherapy or positioning) is not always effective and surgery is often not possible in such fragile patients. Microinvasive tenotomy with a large needle could be a useful alternative because it can be carried out in an ambulatory setting under local anaesthesia.
*Methods:* A single center, retrospective study involving the 2012–2014 database from the day-hospital unit of a neuro-orthopaedic department in France. All patients who underwent percutaneous needle tenotomy of the finger or thumb flexors were included. Outcomes included Goal Attainment Scaling (GAS) and the distance in centimeters between the palm and the pulp of the most flexed digit (PPD).
*Results:* Eighteen patients underwent tenotomy (13 women; mean age: 76 ± 14 years); all patients lived in a nursing home. The limb to be treated was nonfunctional in all patients. The principal goal was determined by consensus with the patients and their health-care teams and was most often to facilitate hand hygiene. Eight patients had at least one secondary goal. In total, 10 patients underwent microinvasive tenotomy for 4 fingers, 5 patients 1 to 4 fingers and 3 patients only the thumb. At 3 months after treatment, goals were achieved for 11 patients, 5 patients progressed toward the goal without attaining it, and for 2 patients, scores were worse. The T-scores of the GAS and the PPD were significantly increased at 3 months ($P = 0.0326$ and $P = 0.0002$, respectively). No serious adverse events occurred.
*Conclusion:* Large-needle tenotomy seems safe and effective for treating claw hand in fragile older patients.



## 1. Introduction

Muscle contracture has been defined as an osteoarticular deformity caused by combined loss of range of joint motion and increased resistance during passive mobilization of the limb [1]. The cause of contracture remains uncertain but in older adults appears to be related to hypertonia (hyperactivity of pyramidal or extrapyramidal tract origin, spasticity, etc.). Hypertonia is known to cause soft-tissue changes and retractions. Contracture is common, with a prevalence of 61.2% in older adults in nursing homes in Philadelphia [2]. Contracture that limits activities of daily living is called acquired deforming hypertonia (ADH) [3]. In France, 22% of older adults in nursing homes have ADH of at least one muscle, 8.8% of which affects the wrist or finger flexors (claw hand) [3]. People with claw hand have reduced prehension capacity and may also have skin problems such as mycosis [1,3]. Certain chronic conditions such as stroke or degenerative cerebral lesions may also cause contracture in younger patients [4–6].

Treatment involves botulinum toxin injections (for muscle hypertonia) and/or physiotherapy and positioning (to prevent and treat muscle contracture); however, these methods are not always effective. The only truly effective treatment is surgery, such as tendon lengthening, tenotomy and joint surgery. Surgery often requires an in-patient stay and most often general anesthesia [7–13], which implies risks, particularly for fragile patients such as very old people.

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To reduce the risks and provide effective treatment, our physical and rehabilitation medicine (PRM) and neuro-orthopedic teams adapted a technique of percutaneous needle tenotomy under local anesthesia that had been developed for epicondylitis [14,15]. This microsurgical technique involves using the bevel of a large needle to section the affected tendons.

Goal Attainment Scaling (GAS) is a method for developing personalized evaluation scales to quantify progress towards predefined goals [16]. This approach is attracting growing interest in clinical practice because it allows for assessing the effectiveness of a treatment in terms of goals set by the patients themselves rather than generic scales that may not always include the problem that most bothers the patient. GAS is used in many fields, including medicine and especially psychiatry, geriatrics and PRM, fields in which setting precise goals is a fundamental part of treatment planning. Involving the patients and their families and caregivers in choosing treatment goals may allow for better integrating these goals into activities of daily living by transforming goals related to the International Classification of Functioning activity domain into participation goals in the patient's usual context [17].

The aim of this pilot study was to evaluate the effectiveness of our percutaneous finger-flexor needle tenotomy technique by using GAS with older adults in nursing homes.

## 2. Methods

An anonymous retrospective study was carried out. We included patients who underwent lengthening of the finger flexor by needle tenotomy in our multidisciplinary neuro-orthopaedic department between 2012 and 2014. Patients were referred to the department if they are older or had disabling muscle contractures related to a neurological condition. All patients had severe claw hand ($<$ 4 cm between the pulp of the fingers and the palm of the hand) and had a non-functional upper limb. All had contraindications for treatments usually used for contracture or muscle hypertonia (such as botulinum toxin injections) and were considered by their general practitioners to be too fragile to undergo general anaesthesia or too confused or agitated for an intervention under local-regional anaesthesia. Demographic characteristics of patients (age, diagnosis, side of treatment) were recorded.

Institutional research board approval is not required for retrospective studies in France.

### 2.1. Microinvasive percutaneous needle tenotomy

The fingers requiring treatment were determined by a surgeon and a PRM physician (Fig. 1A,B). Tendons of the flexor digitorum superficialis, flexor digitorum profundus and flexor pollicis longus were located by palpating the subcutaneous cords of the muscles during passive stretching of the finger or thumb. Since the muscles were shortened, palpation of most of the muscles to be treated was straightforward. The site to be treated was prepared with povidone-iodine. Next, the skin and subcutaneous tissues were injected with a total dose of 10 mL of 1% lidocaine with use of a hypodermic needle (2 to 3 mL per finger). The point of injection was the palmar side of the proximal phalanx. Anesthetic solution was also injected directly into the tendon. Once adequate anesthesia was achieved, another needle (gauge 16.5, 1.6 $\times$ 40 mm, classically used for paracentesis) was used to repeatedly fenestrate the tendon of the muscles. The needle was inserted perpendicular to the tendon at the palmar side of the proximal phalanx, not more than 0.5 cm deep. As a general rule, one puncture was needed for each tendon. Initial passes through the tendon were typically met with resistance, producing palpable and audible crepitation. As the needle was passed repeatedly, the tissues softened, and crepitation was reduced. An extension force was manually applied on the finger or the thumb throughout the whole procedure to keep the tendon tense. The total duration of the intervention was about 15 to 30 min. At the end of the procedure, sometimes a "pop" was heard (reflecting the complete rupture of the tendon). The intervention was considered complete once the subcutaneous cord disappeared and range of motion of the finger increased.

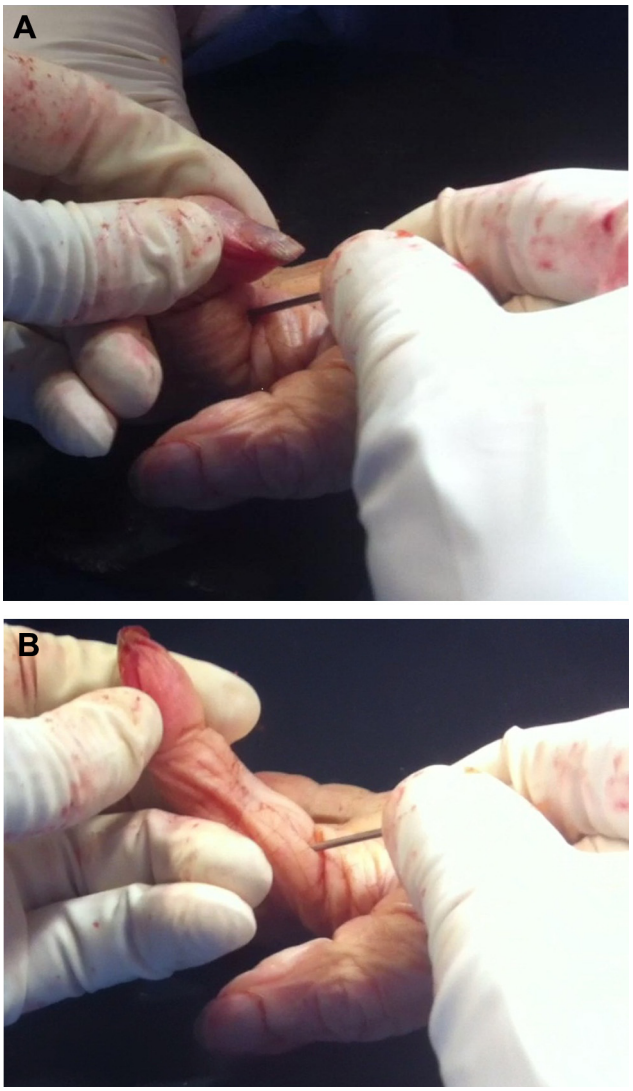


**Fig. 1.** Microinvasive percutaneous needle tenotomy. A. Before surgery. B. After surgery.

All patients resided in nursing homes and received only a small amount of physiotherapy ($<$ 1 hr per week), so patients had no specific rehabilitation after the tenotomy. Advice was simply given to continue to stretch the treated muscles. If the palmar skin was particularly painful after the procedure (e.g., severe mycosis), then a non-removable, short, arm cast was set, which was changed at 2 days and 3 weeks post-intervention.

### 2.2. Assessments

The aim was to improve passive function. One primary goal was determined by consensus with the patients and their healthcare teams and, when possible, their families. To aid in determining the