AUSTRAL JOURNAL OF IMAGING
REVISTA CHILENA DE RADIOLOGÍA

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ORIGINAL ARTICLE

Ultrasound-guided percutaneous needle release of the A1 pulley and its cost in patients with stenosing tenosynovitis

Liberación percutánea con aguja de la polea A1 guiada por ultrasonido y su costo en pacientes con tenosinovitis estenosante

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Abstract

Introduction: *The initial treatment of stenosing tenosynovitis is usually conservative. When there is no good response, it must be resolved by surgically releasing the A1 pulley, traditionally with open release (OR). However, there is the alternative of ultrasound-guided percutaneous A1 pulley release (UPAR), which has shown similar results.* **Objective:** *To evaluate the effectiveness and costs of UPAR compared to OR at our center.* **Method:** *A retrospective study was carried out in patients undergoing UPAR. Information on pain scale, mechanical symptoms (Quinnell grades), and disability (QuickDASH) was obtained before and after the procedure. The costs of UPAR and OR alternatives were evaluated.* **Results:** *A statistically significant improvement in pain, mechanical symptoms and disability was observed after the procedure. No complications were reported. UPAR was found to be 63% less expensive than the most economical OR alternative.* **Conclusion:** *UPAR is a safe and effective alternative to treat "trigger finger or thumb", with low costs and a shorter recovery period compared to OR. UPAR should be considered as the initial treatment when other options have not been successful.*

Keywords: *Stenosing tenosynovitis. Trigger Finger. Ultrasound. Glucocorticoids.*

Resumen

Introducción: *El tratamiento inicial de la tenosinovitis estenosante suele ser conservador. Cuando no hay buena respuesta debe resolverse liberando quirúrgicamente la polea A1, tradicionalmente con liberación abierta (LA), sin embargo, existe la alternativa de la liberación percutánea de la polea A1 guiada por ultrasonido (LPAUS), que ha mostrado similares resultados.* **Objetivo:** *Evaluar la eficacia y costos de LPAUS en comparación con la LA en nuestro centro.* **Método:** *Se llevó a cabo un estudio retrospectivo en pacientes sometidos a LPAUS. Se obtuvo información sobre escala del dolor, síntomas mecánicos (grados de Quinnell) y discapacidad (QuickDASH) antes y después del procedimiento. Se evaluaron los costos de este y las alternativas de LA.* **Resultados:** *Se observó una mejora estadísticamente significativa en dolor, síntomas mecánicos y discapacidad después del procedimiento. No se informaron complicaciones. La LPAUS resultó ser un 63% menos costosa que la alternativa de LA más económica.* **Conclusión:** *La LPAUS es una alternativa segura y efectiva para tratar el «dedo o pulgar en gatillo», con bajos costos y un periodo de recuperación más corto en comparación con la LA. La LPAUS se debe considerar como tratamiento inicial cuando otras opciones no han tenido éxito.*

Palabras clave: *Tenosinovitis estenosante. Dedo en gatillo. Ultrasonido. Glucocorticoides.*

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Date of reception: 14-12-2023
Date of acceptance: 07-02-2024
DOI: 10.24875/AJI.23000082

Available online: 02-09-2024
Austral J. Imaging. (Engl. ed.). 2024;30(4):171-176
www.resochradi.com

Introduction

Stenosing tenosynovitis is a relatively common pathology of the flexor tendons of the hand that limits their free movement inside the synovial sheaths, encompassing symptoms from mild discomfort to fixed locking of the fingers, affecting 2-3% of people throughout life, a figure that reaches 10% in diabetic patients[1,2]. As the pathology progresses, it generates thickening of the flexor pulleys, mainly A1, which produces a restriction in the normal sliding of the tendons, unleashing the so-called "trigger finger or thumb." The usual initial treatment begins conservatively with kinesiotherapy, splints and anti-inflammatories, including in a second stage injection with corticosteroids into the synovial sheath[3], the latter with a response rate that does not exceed 70-80%[4] and a recurrence of up to 50%[4,5]. Those patients who do not respond to conservative management are candidates for surgical management[6].

Within surgical management, open release (OR), which corresponds to the incision with direct visualization of the A1 pulley, has a success rate of approximately 90-98% and a complication rate of 0-5%[3,4]. There are meta-analyses and systematic reviews that have shown that ultrasound-guided percutaneous release of the A1 pulley (UPAR) does not present significant differences in terms of treatment failure or complications when compared to open surgery, with success rates close to 97%[5].

The objective of the present work was to evaluate the response of UPAR associated with corticosteroid infiltration of the synovial sheath in patients with trigger finger in our imaging department and compare its costs vs. OR surgical alternatives.

Method

A retrospective observational study was conducted that included patients diagnosed with trigger finger and thumb who underwent UPAR between August 2018 and June 2023. All procedures were performed with the same ultrasound equipment and with the same transducer (Philips IU-22, L15-7io "hockey stick" transducer), by the same radiologist with more than five years of experience in ultrasound-guided procedures at the beginning of the study period, obtaining informed consent in all cases. The procedures were performed using cutaneous antisepsis with 2% chlorhexidine gluconate, sterile sleeve for transducer, sterile gel, 2% lidocaine as local anesthetic and 25 G needle for the administration of anesthesia and corticosteroid, with a distal to proximal approach, with longitudinal direct visualization technique of the needle, parallel to the transducer. The release of the A1 pulley was performed according to the technique described by Rajeswaran et al.[7] with two modifications; the 1.5" 19 G needle used to release the A1 pulley was bent approximately 10 mm distal to the junction with the base to avoid weakening it (Fig. 1), in addition to infiltration of the synovial sheath of the flexor tendons with compound corticosteroid (3 mg micronized betamethasone acetate + 4 mg betamethasone sodium phosphate in 1 ml), maximum 1 ml according to the capacity of each sheath, prior to release. The post-procedural indications were to keep the hand elevated using a sling for 3 days, local ice for 20 minutes every 6 hours for 2 days, remove the dressing and sling on the third day, and postpone using a strong grip for two weeks (Fig. 2).

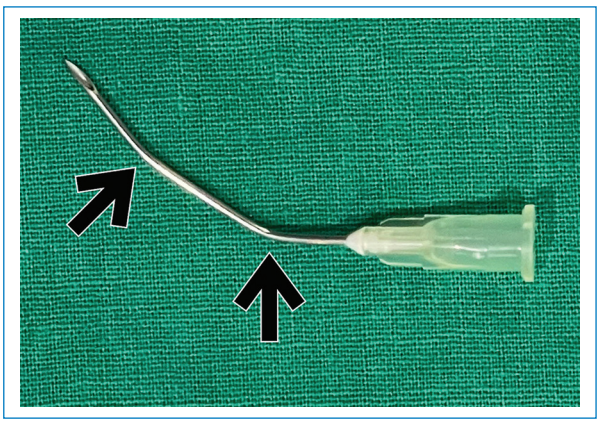

Figure 1. Image of the 19 G needle in which two bends (black arrows) of between 15° and 20° are made, the first approximately 10 mm from the union with the base, to avoid weakening said union.

The patients were surveyed by telephone obtaining information about their status before and after the procedure in three variables: numerical pain scale (from 0 to 10), Quinnell grades to evaluate mechanical symptoms (0, normal movement; 1, uneven movement flexion-extension; 2, actively correctable locking; 3, passively correctable locking, and 4, fixed flexion locking) and level of disability based on the QuickDASH questionnaire[8,9]. The inclusion flow chart in the study is detailed in fig. 3.

Statistical analysis was performed with the IBM SPSS Statistics v29.0.1.0 program using the Wilcoxon signed-rank test and the Mann-Whitney U test given the non-normal distribution of the variables obtained.

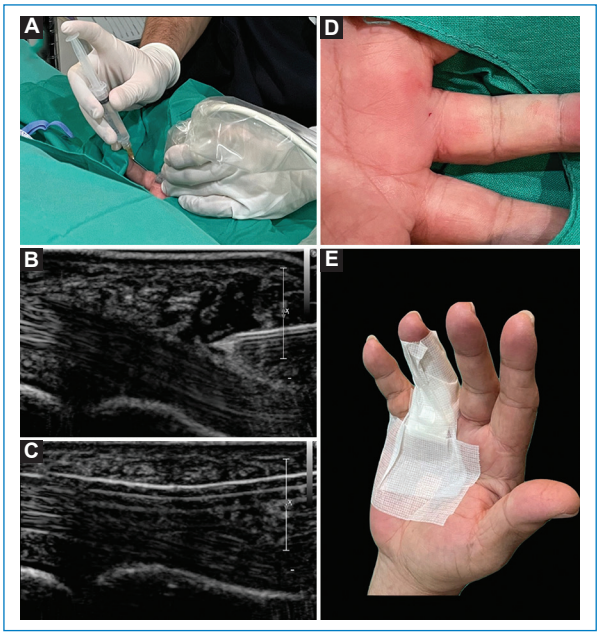

Figure 2. Representative images of the procedure. **A**: image prior to the initial injection of local anesthetic (2% lidocaine), positioning of the patient's hand, syringe with 25G needle and the transducer. **B**: longitudinal US image during injection of the anesthetic into the subcutaneous tissue. **C**: longitudinal US image during the release of the A1 pulley with a 19 G needle. **D**: image of the puncture site at the end of the procedure. **E**: image of the patient's hand after the procedure. US: ultrasound.

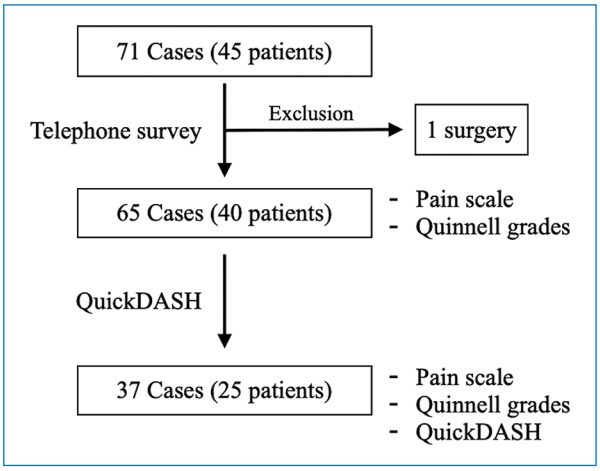

Figure 3. Flowchart of inclusion in the study. During the study period, 71 procedures were performed. Of the respondents, one was excluded for undergoing surgery on the same finger, resulting in a total of 65 surveyed procedures from which pain scale and Quinnell grades data were obtained. Of these, only 37 responded to the QuickDASH questionnaire.

Additionally, a preliminary study was made of the costs of UPAR vs. the OR alternatives available at our center for private patients (without health insurance) and for patients belonging to the National Health Fund (FONASA).

Results

In the period studied, a total of 71 procedures were performed, corresponding to 45 patients. 62% were women and 38% were men, with average ages of 61 and 62 years respectively (33 to 92 years and 41 to 79 years respectively). The distribution of the involved fingers is shown in table 1.

In the 65 cases surveyed in which pain scale and Quinnell grades were obtained, and in the 37 in which the QuickDASH questionnaire was applied, the comparison of pre- and post-procedure results demonstrated a statistically significant improvement with a large effect size (Table 2). Another variable that showed a statistically significant difference was the pain scale prior to the procedure, where women (Mdn: 8; Range: 8) presented higher values than men (Mdn: 5; Range: 10), Z: –3.143, p = 0.02, r: 0.389. Table 3 summarizes the ranges of pain reduction, table 4 the levels of reduction in mechanical symptoms, and table 5 the reduction in the QuickDASH questionnaire score. Regarding mechanical symptoms, all patients presented grade 2 or higher in the Quinnell classification prior to the procedure. No complications were reported.

Table 1. Distribution of laterality and operated fingers

	Right	Left	No. Total (%)
Thumb	9	10	19 (26.8)
Index	3	1	4 (5.6)
Middle	13	11	24 (33.8)
Ring finger	9	8	17 (23.9)
Little finger	4	3	7 (9.9)
Total	38	33	

The results of the cost comparison are summarized in table 6. UPAR was found to be 63% less expensive than the most economical OR method at our center.

Discussion

In recent years, the publication of works on UPAR has increased, which demonstrates the interest in this

Table 2. Comparison of results before and after the procedure

	Preprocedure Median (range)	Postprocedure Median (range)	Z	p	r*
Pain	7 (10)	0 (8)	–6.866	< 0.001	0.852
Quinnell	3 (2)	0 (3)	–7.019	< 0.001	0.871
QuickDASH	43.18 (70.45)	2.27 (56.82)	–5.234	< 0.001	0.860

*Magnitude of effect = Z/√N (0.1-0.3 = small effect, 0.3-0.5 = moderate effect, > 0.5 = large effect).

Table 3. Postprocedural pain reduction compared to initial pain level

	N°. total (%)
100% Pain reduction	38 (60.3)
≥ 75% Pain reduction	48 (76.2)
≥ 50% Pain reduction	62 (98.4)
< 50% Pain reduction	1 (1.6)

Table 4. Reduction of post-procedure lock on the Quinnell scale compared to initial symptoms. 95.4% of patients had a reduction of at least 1 grade

	N°. total (%)
Full resolution	54 (83.1)
Reduction by 2 grades	5 (7.7)
Reduction by 1 grade	3 (4.6)
No reduction	3 (4.6)

Table 5. Reduction in post-procedure QuickDASH score compared to initial score

	N°. total (%)
100% Reduction	16 (43.2)
≥ 75% Reduction	24 (64.8)
≥ 50% Reduction	29 (78.4)
< 50% Reduction	8 (21.6)

procedure, which presents excellent results, comparable to those of OR[10]. A recent systematic review showed a pooled success rate of 97% for UPAR compared to the overall success rate for OR of between 60 and 97%[10]. Additionally, some studies have shown superiority of UPAR associated with injection with corticosteroids vs. UPAR alone in terms of pain, healing rate and impression of improvement reported by the patient, in the short term[11,12]. Our work showed a reduction in pain by more than 50% of the initial scale in 98.4% of patients and a reduction in mechanical symptoms by one grade or more in 95.4% of patients, comparable with other similar studies[13,14] and with the OR[15].

Several comparative studies have shown a similar or lower rate of complications, a shorter postoperative period and a better healing process of the surgical wound, with better aesthetic results in patients undergoing UPAR compared to OR[3,4,15,16].

There is heterogeneity in the technique of performing UPAR, using approaches from distal to proximal, from proximal to distal, with different gauge needles or special devices[10]. In our imaging department we use one of the most economical techniques, with commonly used syringes and needles, which allows us to reduce costs. In relation to the cost of the procedure, there is a substantial difference between the private cost of UPAR that reaches 328,042 Chilean pesos vs. the cost of OR performed privately, which costs from 897,400 pesos, reducing the cost by approximately 63% when using UPAR. These results are similar to those reported in the study carried out by Lapègue et al., in which they compared the costs in France, showing a total cost of 146.30 euros when performing OR vs. 45.07 euros when performing UPAR, which corresponds to a 69% lower cost[13]. Beyond the cost of the procedure, treatment with OR requires longer rest, associated with monitoring and healing, with a comparatively longer recovery period[3,13,17,18], with a marked difference perceived by patients in the short term, and without significant differences in the long term[19], there are several publications that show that percutaneous management is the most cost-effective management in most cases, mainly in diabetics[20,21].

Table 6. Comparison of costs between UPAR and open surgical alternatives for private patients and FONASA (Fondo Nacional de Salud – National Health Fund) in Chilean pesos ($) and American dollars (USD).

	UPAR	Open surgery with anesthesiologist and assistant	Open surgery with WALANT and without assistant
Private (without health insurance)	$328,042 (353 USD)	$1,130,190 (1,215 USD)	$897,400 (965 USD)
FONASA (State health insurance)	$215,362 (232 USD)	Copay PAD $285,790 (307 USD)*	Copay PAD $220,570 (237 USD)*

* With an asterisk the benefits are not available at our center.
UPAR: ultrasound-guided percutaneous A1 pulley release; WALANT: wide-awake local anesthesia no tourniquet; PAD: payment associated with diagnosis.

The main limitations of our study are that, being a retrospective study, it was not possible to exactly show the recovery time, nor what the evolution of the immediate postoperative period was like, likewise in some cases the grade of response was such that the patients did not remember which finger was subjected to the procedure, and there was also a recall bias. All procedures were performed by a single operator, which made it impossible to assess reproducibility.

Conclusions

Patients with trigger finger or thumb undergoing UPAR presented a significant improvement in pain, locking and disability, this procedure being a safe alternative with a low rate of complications, much lower cost and a shorter recovery period than surgery with OR, therefore UPAR should be considered the initial treatment of choice when there is no response to conservative management or injections with corticosteroids, particularly in patients with Quinnell classification grade 2 or higher.

Funding

The authors declare that they have not received funding for this study.

Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of people and animals. The authors declare that no experiments have been carried out on humans or animals for this research.

Data confidentiality. The authors declare that they have followed their workplace's protocols regarding the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Use of artificial intelligence to generate texts. The authors declare that they have not used any type of generative artificial intelligence in the writing of this manuscript or for the creation of figures, graphs, tables or their corresponding captions or legends.

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