INFORMATION BRIEF (RAPID REVIEW)

RADIOFREQUENCY ABLATION FOR PAIN MANAGEMENT:

SHOULDER (TENDONITIS, ADHESIVE CAPSULITIS), ELBOW EPICONDYLITIS AND CARPAL TUNNEL SYNDROME

Malaysian Health Technology Assessment Section (MaHTAS)
Medical Development Division
Ministry of Health Malaysia
001/2023

IPT Mark
Mini-HTA
INAHTA

DISCLAIMER

This technology review (mini-HTA) is prepared to assist health care decision-makers and health care professionals in making well-informed decisions related to the use of health technology in health care system, which draws on restricted review from analysis of best pertinent literature available at the time of development. This technology review has been subjected to an external review process. While effort has been made to do so, this document may not fully reflect all scientific research available. Other relevant scientific findings may have been reported since the completion of this technology review. MaHTAS is not responsible for any errors, injury, loss or damage arising or relating to the use (or misuse) of any information, statement or content of this document or any of the source materials.

Please contact htamalaysia@moh.gov.my if further information is required.

Malaysian Health Technology Assessment Section (MaHTAS)
Medical Development Division
Ministry of Health Malaysia
Level 4, Block E1, Precinct 1
Government Office Complex
62590, Putrajaya
Tel: 603 8883 1229

Available online via the official Ministry of Health Malaysia website: http://www.moh.gov.my

eISSN:

SUGGESTED CITATION: Fatin NM and Izzuna MMG. Radiofrequency Ablation for Pain Management: Shoulder (Tendonitis, Adhesive Capsulitis), Elbow Epicondylitis and Carpal Tunnel Syndrome. Information Brief. Ministry of Health Malaysia: Malaysian Health Technology Assessment Section (MaHTAS); 2023. 11 p. Report No.: 018/2022. eISSN: ……

DISCLOSURE: The author of this report has no competing interest in this subject and the preparation of this report is entirely funded by the Ministry of Health Malaysia.

TITLE: RADIOFREQUENCY ABLATION FOR PAIN MANAGEMENT: SHOULDER (TENDONITIS, ADHESIVE CAPSULITIS), ELBOW EPICONDYLITIS AND CARPAL TUNNEL SYNDROME

PURPOSE

To provide brief information on the effectiveness, safety and cost-effectiveness of radiofrequency ablation for pain management: shoulder (tendonitis, adhesive capsulitis), elbow epicondylitis and carpal tunnel syndrome based on request from the Director of Medical Practice Division, Ministry of Health Malaysia.

BACKGROUND

Any part of a joint can cause discomfort, pain, or inflammation, including cartilage, bone, ligaments, tendons, or muscles. However, most people associate joint pain with arthritis or arthralgia, which is inflammation or pain within the joint itself. Joint pain can be mild, causing soreness only after certain activities, or severe, causing even limited movement, especially bearing weight, to be excruciatingly painful.[1]

This review will describe more on the following joint pains:

i. **Shoulder tendonitis** is a common cause of pain and stiffness in the shoulder. It represents swelling (inflammation) of a specific area within the shoulder joint. A group of muscles known as the rotator cuff, as well as the biceps tendon, keep the shoulder joint stable. These tendons and muscles help to keep the upper arm bone (humerus) in the shoulder socket (glenoid). Rotator cuff tendinitis and bicipital tendinitis are conditions in which the rotator cuff tendons or the biceps tendons become inflamed and irritated.[2]

ii. **Adhesive capsulitis**, also known as frozen shoulder, is more common among Malaysians aged 40 to 70. Frozen shoulders typically present with a sudden onset of shoulder and arm pain with no history of injury or trauma. Patients usually complain of shoulder pain that extends into the arm. Most people will also complain of neck and upper back pain. Local shoulder pain can occur over the front and inner portion of the shoulder and radiate into the biceps, or it can occur over the outer portion of the shoulder and radiate into the lateral deltoid region. Shoulder active and passive range of motion are significantly reduced, with at least 50% loss of external rotation.[3]

iii. **Elbow epicondylitis** is a painful condition caused by overuse and development of tendon degeneration. It is one of the most common elbow problems in adults, occurring both laterally and medially. “Tennis elbow” or lateral epicondylitis is diagnosed seven to 10 times more often than the medial form, “golfer’s elbow”.[4] Although these injuries are often associated with racquet sports, activities such as bowling and weightlifting and the professions of carpentry, plumbing and meat-cutting have been described as causes.[5,6]

iv. **Carpal tunnel syndrome** is the commonest median nerve entrapment neuropathy of the hand, up to 90% of all nerve compression syndromes. In Malaysia, local literature has reported its prevalence at a range of 20% to 60%.[7,8] It is a peripheral nerve disease that may resolve on its own or with conservative measures such as wrist splinting, physiotherapy, medications, and lifestyle changes. However, worsening and

progressive symptoms can be alleviated by a simple surgery (transverse carpal ligament release), which can be performed openly or endoscopically.[9]

Radiofrequency ablation

Although there are numerous treatments available, such as oral analgesics, intra-articular steroid injections and physical therapy, there is disagreement in the literature regarding the best treatment at various stages of the diseases.[10, level I] Previous research suggested that pulsed radiofrequency lesioning could relieve chronic pain by delivering an electrical field and heat bursts (42°C, as opposed to conventional radiofrequency applications that deliver a constant temperature of 60°C to 80°C) to neural tissue without causing neural injury.[11]

The procedure is similar to a needle biopsy in that a needle-like probe is inserted into the body **(see Figure 1)**. The probe emits radiofrequency waves into the surrounding tissue, causing nearby cells to die. As these cells die, the immune system removes them, causing an internal reaction and, in general, causing the nodule to shrink. The health care provider uses ultrasound or another imaging technique to place the probe's tip in the correct location. Radiofrequency ablation can be performed in an office or as an outpatient procedure and does not require general anaesthesia. The patient may be given relaxation medication as well as a numbing agent for the area of the skin where the probe is inserted. Most people who have radiofrequency ablation can go home the same day and resume their normal activities within 24 hours.[12]

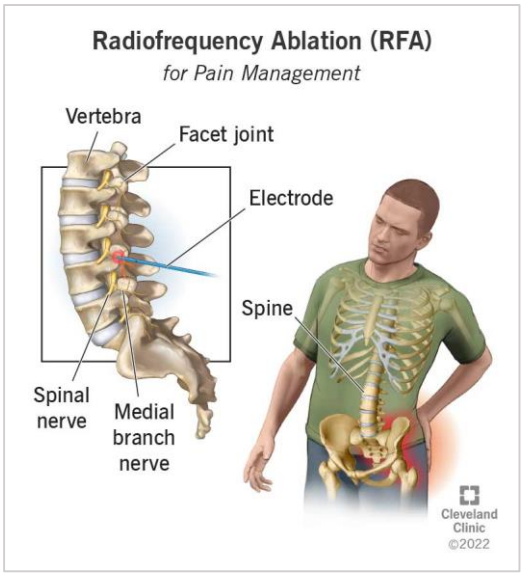

Figure 1: Radiofrequency ablation targets specific parts of a nerve so that it stops sending pain signals to the brain.[13]

EVIDENCE SUMMARY

A total of 182 titles were retrieved from the scientific databases such as Medline, EBM Reviews, EMBASE, PubMed and 729 from the general search engines [Google Scholar and US Food and Drug Administration (USFDA)]. Additional articles were identified from reviewing the references of retrieved articles. Last search was conducted on 4 January 2023. Seven articles were found to be relevant and included in this review which comprised of one randomised controlled trial, four case series and two case studies.

EFFECTIVENESS/ EFFICACY

There were seven studies reported on the efficacy of radiofrequency ablation for pain management: adhesive capsulitis, elbow epicondylitis and carpal tunnel syndrome **(see Table 1)**. There was no study retrieved on shoulder tendonitis.

Table 1: Effectiveness of radiofrequency ablation for pain management.

Type of Joint Pain	Study/ Year/ Study design	Objective	Outcome
Adhesive capsulitis	Wu YT et al./ 2014/ RCT[10], level I	To compare the effect of physical therapy alone (control group) with physical therapy and pulsed radiofrequency lesioning of the suprascapular nerve using ultrasound-guided techniques (intervention group).	**Onset time of pain relief (day)** The intervention group had a notably shorter time to onset a significant pain relief than the control group (6.1 ± 3.4 vs 28.1 ± 9.2 days; $p < 0.001$)*. **Pain assessment [by using visual analog scale (VAS)]** • The VAS score immediately after pulsed radiofrequency lesioning decreased from 6.5 ± 1.3 to 4.2 ± 2.2 ($p < 0.001$)* in the intervention group. • Moreover, the intervention group had a significant reduction in their VAS scores at week one follow-up (40% vs 4.7%) compared with the control group ($p < 0.001$)*. Comparison of the two groups indicated significant improvement in the intervention group throughout the study with respect to the VAS and shoulder pain and disability index (SPADI) scores, and for the most gain in patient-reported outcome measures (PROM) (passive flexion: weeks eight and 12; passive extension in week 12, medial rotation in weeks four, eight, and 12; all $p < 0.05$)*. *standard deviation
Elbow epicondylitis	Viswanathan S et al./ 2022/ Retrospective case series[14]	To evaluate the therapeutic efficacy and report long-term results and recurrences in patients treated with radiofrequency microtenotomy.	**At one year** • The mean QuickDASH scores decreased from 61.7 (range: 38.6 to 84.1) to 18.9 (range: zero to 61.4) (T-test showed $p < 0.0001$). • The mean pain component of the QuickDASH scores decreased from 4.8 to 2.0 (out of 5.0) (T-test showed $p < 0.0001$). **At eight years** • QuickDASH scores decreased further to 8.5 (range: zero to 75) (T-test showed $p < 0.0001$). • The pain component of the QuickDASH scores decreased further to 1.5 (out of 5.0) (T-test showed $p < 0.0001$).

			• More than 83% of the patients had excellent to good functional improvement (QuickDASH scores improved by 75% or more).
	Tasto JP et al./ 2005/ Prospective case series[15]	To evaluate the safety and effectiveness of microetonomy using a radiofrequency probe to treat chronic tendinosis of the common extensor tendon origins of the elbow (lateral epicondyle).	**Pain assessment (by using VAS)** • At all post-operative follow-up time points after seven to 10 days, median scores were two or less. • The proportion of patients who reported minimal to no pain (VAS ≤ 1) at each post-operative visit increased steadily through the first six months. • Pain was reduced significantly (five to six points on a scale of 10) seven to 10 days after the procedure ($p \leq 0.01$). • Post-operative scores for pain were statistically stable ($p \leq 0.01$) over the follow-up period (24 months and beyond). **Functional assessment (by using DASH)** • Grip strength in treated limbs at baseline was less than that in untreated limbs. • At the four- to six-week examination, grip strength in the treated limb was improved significantly ($p \leq 0.01$). • The four- to six-week post-operative DASH score was significantly improved over baseline ($p \leq 0.01$); later post-operative scores were statistically stable or improved further ($p \leq 0.01$) through one year. **Magnetic Resonance Imaging (MRI) findings** • At six months, of the 11 patients who had positive findings of tendinosis on the baseline MRI scan, 10 had complete or near complete resolution of the signal or equivalent scans to baseline and one patient had increased post-operative signal changes, although the patient had improved clinically from baseline. • At 12-months, nine of the 11 patients who had signal change consistent with tendinosis at baseline returned for a follow-up MRI scan. All nine patients showed improvement.
	Lin CL et al./ 2011/ Prospective case series[16]	To present a newly developed minimally invasive procedure, ultrasonographically-	**Pain assessment (by using VAS)** Significant pain reductions were observed at the one-, three-, and six-month follow-ups ($p < 0.01$).

		guided percutaneous radiofrequency thermal lesioning, and its clinical efficacy in treating recalcitrant lateral epicondylitis.	**Functional assessment [by using QuickDASH and modified Mayo Clinic performance index (MMCPI)]** • The three- to six-month post-operative grip strength as measured by the Jamar dynamometer increased significantly compared with pre-radiofrequency thermal lesion ($p < 0.01$), although the one-month grip strength did not change significantly. • The QuickDASH scores were significantly improved at the one-, three-, and six-month follow-ups (from 54.3 ± 14.4 preoperatively to 21.0 ± 24.8 at the six-month follow-up) ($p < 0.01$). • The MMCPI score improved from 50.6 ± 16.6 preoperatively to 90.2 ± 6.3 at the six-month follow-up (from poor to excellent; $p < 0.01$). **Significant events** • The average wait until return to unrestricted work was 6.9 ± 6.2 weeks. • Of the 35 elbows undergoing radiofrequency thermal lesion, five had pain recurrence before the end of the six-month follow-up and required a repeat radiofrequency thermal lesion procedure. • Four elbows of four different patients had pain relief with satisfactory results six months after the second radiofrequency thermal lesion.
	Tasto JP et al./ 2016/ Prospective case series[17]	To evaluate the safety and midterm effectiveness of microtenotomy using a radiofrequency probe to treat chronic tendinosis of the elbow.	**Pain assessment (by using VAS)** <u>Lateral epicondylitis group</u> • 91% (63/69) of the patients reported a successful outcome. • The post-operative VAS improved to 1.3 from 6.9, which demonstrated an 81% improvement. • Of the six patients that did not improve, two underwent repeat conventional surgery. <u>Medial epicondylitis group</u> • 91% (10/11) reported improvement in symptoms. • The post-operative VAS improved to 1.3 from 6.1, a 79% improvement. • One patient did not improve and did not go repeat conventional surgery.
Carpal tunnel syndrome	Yadav N et al./ 2010/ Case study[18]	Not available	A 63-year-old male with carcinoma prostate had been diagnosed with carpal tunnel syndrome. After the pulsed radiofrequency was done on the median and ulnar nerve, the patient started showing relief in the symptoms within two to four

			hours. On the next day, the patient reported 40% relief, and 90% relief in pain within two days. The dose of morphine was stopped and patient was discharged with no pain medications.
	Haider N et al./ 2007/ Case study[19]	To evaluate the use of ultrasound-guided pulsed radiofrequency in the treatment of recurrent carpal tunnel syndrome resistant to medical therapy.	Following all three applications of pulsed radiofrequency to the median nerve, a 70% reduction in pain was reported on the verbal rating scale. Follow-up assessment via telephone revealed continuing pain relief at 12 weeks with a gradual return to baseline pain after the 12-week period.

i. *VAS: The VAS measures pain intensity and consists of a 10 cm line, with two end points representing zero (no pain) and 10 (pain as bad as it could possibly be).*
ii. *SPADI: Overall total scores range from zero to 130 with a percentage score of zero indicating less shoulder disability and 100 indicating more shoulder dysfunction.*
iii. *PROM: Higher scores represent a more favourable health state.*
iv. *DASH: Disabilities of the Arm, Shoulder and Hand Score. The possible score ranges from zero to 100 points. Zero points represent a complete, unrestricted function of the upper extremities, while 100 points represent the greatest possible functional impairment.*
v. *MMCPI: Lower scores represent a less favourable of health state.*

SAFETY

Out of seven, four studies reported on the safety of radiofrequency ablation for adhesive capsulitis, elbow epicondylitis and carpal tunnel syndrome.

Three studies reported that there was no complications or adverse events during and after the procedures.[10, level I, 15,16] However, a superficial wound infection was developed and it was settled with debridement under local anaesthesia and oral antibiotics.[14] Besides that, two studies reported on tenderness or light swelling, slight stiffness, slight occasional pain or mild discomfort, slight bruising and mild tingling at the puncture site. These symptoms disappeared later without any treatment.[10, level I, 15]

According to the Medical Device Authority Malaysia, there were 21 radiofrequency ablation devices manufactured by various manufacturer registered.[20] The devices had also received 510(k) from the United States Food and Drug Administration.[21]

COST-EFFECTIVENESS

There was no evidence retrieved on cost-effectiveness of radiofrequency ablation for shoulder tendonitis, adhesive capsulitis, elbow epicondylitis and carpal tunnel syndrome.

Nevertheless, the cost of radiofrequency ablation greatly depended on the chosen professional and the geographical location. In several countries, the patients had to pay cash or arrange a payment plan with the provider or a third-party source. That being said, the patients would be expected to pay anywhere between $2,200 (RM 9,682.20) and $5,100 (RM22,445.10) for the procedure, with the results lasting one to two years.[22]

CONCLUSION

There was limited evidence on radiofrequency ablation for adhesive capsulitis, elbow epicondylitis and carpal tunnel syndrome. Nevertheless, the evidence showed that the radiofrequency ablation may relief the pain as there were improvements on the VAS score, SPADI, PROM and MMCPI. Besides that, the grip strength had improved significantly through the follow-up.

As per safety on this procedure, even though there was no report on complication and adverse event, a superficial wound infection, tenderness or light swelling, slight stiffness, slight occasional pain or mild discomfort, slight bruising and mild tingling were reported at the puncture site. In addition, the radiofrequency ablation devices had been registered with the Medical Device Authority Malaysia and approved by the United States Food and Drug Administration.

There was no study retrieved on cost-effectiveness of the radiofrequency ablation for shoulder tendonitis, adhesive capsulitis, elbow epicondylitis and carpal tunnel syndrome. The patients would be expected to pay cash or make a payment arrangement plan with the hospital provider/ a third-party source.

REFERENCE

1. Symptoms: Joint Pain. Mayo Clinic. 2021. Available at https://www.mayoclinic.org/symptoms/joint-pain/basics/definition/sym-20050668. Accessed on 04.01.2023.
2. Shoulder Tendinitis. Cleveland Clinic. Available at https://my.clevelandclinic.org/health/diseases/13203-shoulder-tendinitis. Accessed on 04.01.2023.
3. Zafer Y. Adhesive Capsulitis & Shoulder Pain Treatment without Surgery or Injections. Chiropractice in Malaysia. 2017. Available at https://www.chiropractic-in-malaysia.com/blog/adhesive-capsulitis-shoulder. Accessed on 04.01.2023.
4. Leach RE, Miller JK. Lateral and Medial Epicondylitis of the Elbow. Clin Sports Med. 1987; 6(2): 259-272.
5. Vangsness CT Jr, Jobe FW. Surgical Technique of Medial Epicondylitis: Results in 35 Elbows. J Bone Joint Surg Br. 1991; 73(3): 409-411.
6. Galloway M, DeMaio M, Mangine R. Rehabilitative Techniques in the Treatment of Medial and Lateral Epicondylitis. Orthopedics. 1992; 15(9): 1089-1096.
7. Munira MA, Normastura AR, Azizah Y et al. Prevalence of Probable Carpal Tunnel Syndrome and Its Associated Factors Among Dentist in Kelantan. Int J Coll Res Int Med Public Health. 2014; 6(8): 247-59.
8. Tamrin SB, Zakaria NS. The Prevalence of Carpal Tunnel Syndrome Among Counter Workers in Telecommunication Company. Malays J Hum Factors Ergon. 2016; 1(1): 68-76.
9. Hwee GC, Liang LB, Yee TS et al. Comparing the Outcome of Monitored Anaesthesia Care and Local Anaesthesia for Carpal Tunnel Syndrome Surgery by Neurosurgeons. Med J Malaysia. 2019; 76(6).
10. Wu YT, Ho CW, Chen YL et al. Ultrasound-guided Pulsed Radiofrequency Stimulation of the Suprascapular Nerve for Adhesive Capsulitis: A Prospective, Randomised Controlled Trial. Anesthesia & Analgesia. 2014; 119(3): 686-692.
11. Cosman ER. A Comment on the History of the Pulsed Radiofrequency Technique for Pain Therapy. Anesthesiology. 2005;103: 1312.
12. Russell J. Radiofrequency Ablation. John Hopkins Medicine. Available at https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/radiofrequency-ablation. Accessed on 04.01.2023.
13. Radiofrequency Ablation for Pain Management. Cleveland Clinic. Available at https://my.clevelandclinic.org/health/treatments/17411-radiofrequency-ablation. Accessed on 04.01.2023.
14. Viswanathan S, Shanker HK. Long-term Functional Outcomes Following Radiofrequency Microtenotomy for Lateral Epicondylitis of Elbow. Cureus. 2022; 14(10).
15. Tasto JP, Cummings J, Medlock V et al. Microtenotomy Using a Radiofrequency Prove to Treat Lateral Epicondylitis. Arthroscopy: The Journal of Arthroscopic and Related Surgery. 2005; 21(7): 581-860.
16. Lin CL, Lee JS, Su WR et al. Clinical and Ultrasonographic Results of Ultrasonographically Guided Percutaneous Radiofrequency Lesioning in the Treatment of Recalcitrant Lateral Epicondylitis. The American Journal of Sports Medicine. 2011; 39(11): 2429-2435.
17. Tasto JP, Richmond JM, Cummings JR et al. Radiofrequency Microtenotomy for Elbow Epicondylitis: Midterm Results. Am J Orthop. 2016; 45(1): 29-33.
18. Yadav N, Philip FA, Gogia V et al. Radiofrequency Ablation in Drug Resistant Chemotherapy-induced Peripheral Neuropathy: A Case Report and Review of Literature. Indian J Palliat Care. 2010; 16(1): 48-51.
19. Haider N, Mekasha D, Chiravuri S et al. Pulsed Radiofrequency of the Median Nerve Under Ultrasound Guidance. Pain Physician. 2007; 10: 765-770.

20. Radiofrequency Ablation. Medical Device Authority Malaysia. Available at https://mdar.mda.gov.my/frontend/web/index.php?r=carian%2Findex&CompletedApplicationAllmdrSearch%5BglobalSearch%5D=radiofrequency. Accessed on 05.01.2023.
21. Radiofrequency Ablation. United States of Food and Drug Administration. Available at https://www.accessdata.fda.gov/scrIpts/cdrh/cfdocs/cfRL/rl.cfm. Accessed on 05.01.2023.
22. Radiofrequency Ablation Cost. Available at https://www.howmuchisit.org/radiofrequency-ablation-cost/. Accessed on 05.01.2023.

Prepared by

Fatin Nabila Mokhtar
Assistant Director
Health Technology Assessment Section (MaHTAS)
Medical Development Division
Ministry of Health Malaysia

Reviewed by

Dr. Izzuna Mudla Mohamed Ghazali
Public Health Physician & Deputy Director
Health Technology Assessment Section (MaHTAS)
Medical Development Division
Ministry of Health Malaysia

9 January 2023