Cooled Radiofrequency Ablation of the Hip Joint: A Boon for the Patient

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ABSTRACT

Objective: The purpose of this article is to understand the principles of cooled radiofrequency ablation (C-RFA) and the description of the procedure of hip C-RFA.

Cooled radiofrequency ablation uses a constant flow of ambient water circulated through the electrode via a peristaltic pump to maintain a lower tissue temperature by creating a heat sink, but still allowing neurolysis to occur. Cooled radiofrequency ablation lesions are spherical and project several millimeters beyond the electrode tip as compared to thermal-radiofrequency ablation (T-RFA), thereby increasing the probability of successful denervation of the target nerve. Cooled radiofrequency ablation is a preferred technique for ablation of articular branches of the hip joint. Chronic pain in the hip occurs mainly due to osteoarthritis along with other causes like rheumatoid arthritis, osteonecrosis, chronic infectious coxarthrosis, posttraumatic pain, and persistent postoperative pain following total hip arthroplasty (THA).

Keywords: Cooled radiofrequency ablation, Hip, Lesions, Neurolysis.

INTRODUCTION

The use of radiofrequency (RF) in pain management dates back to 1965 when it was used for the management of percutaneous lateral cordotomy for unilateral pain in cancer patients.¹ A few years later RF treatment of trigeminal neuralgia was described.² The first use of RF current for spinal pain was reported by Shealy,³ by RF ablation of the medial branch for lumbar facet joints.

Hip pain occurs commonly with advancing age. Osteoarthritis (OA) of the hip is associated with pain, stiffness, restriction of mobility, atrophy of muscles, and instability.⁴ Chronic pain in the hip occurs due to different causes like rheumatoid arthritis, posttrauma, chronic infections, etc.⁵

PRINCIPLE OF COOLED RADIOFREQUENCY ABLATION

The principle of cooled radiofrequency ablation (C-RFA) lies in the fact that the temperature used to ablate the desired tissue is less when compared to conventional RF ablation. This is achieved by the movement of water through the electrode with the assistance of a peristaltic pump.⁶ ⁷

By removing heat from tissues immediately adjacent to the electrode tip, a lower lesioning temperature is maintained, resulting in less tissue charring adjacent to the electrode and therefore less tissue impedance.⁶ ⁷

Tip temperature control in thermal-radiofrequency ablation (T-RFA) is achieved by reduction of wattage or strength of electricity; once the set temperature is reached, wattage start falling to prevent tissue charring. In C-RFA temperature control is done by circulating water, so lesion can be continued at higher wattage. Thus, the volume of tissue heated and the resultant thermal lesion size is substantially larger with C-RFA as compared to T-RFA.⁸ The lesions produced by C-RFA are larger in size and hence improve the chances of successful denervation of the target nerve.⁹ The lesion characteristics in C-RFA also allow the electrode to be positioned at any angle to make contact with the target neural structure.⁰ Together, these make the technique easier to perform.

HIP JOINT—RELEVANT ANATOMY

The hip joint is a ball and socket joint formed by an articulation between the pelvic acetabulum and the head of the femur. The innervation of the joint is complex. Specifically, the anteromedial innervation is supplied by the branches of the obturator nerve, while the posterior innervation is primarily derived from branches of the sciatic nerve. Groin hip pain has been thought to be generated by articular branches of the obturator nerve while trochanteric (lateral) pain may be carried by articular branches of the femoral nerve.¹⁰ ¹¹

INDICATIONS

Hip pain due to:

• Advanced OA of hip
• Avascular necrosis of hip
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CONTRAINDICATIONS

Absolute contraindication includes:
- Local or systemic infection
- Coagulopathy and patient on anticoagulants without adequate recommended drug-free period
- Lack of consent
  Relative contraindication includes:
- Pregnancy
- Uncooperative patient
- Allergy to any drugs used for procedure
- Unstable vital parameters
- Previous surgery or anatomical variation

PROCEDURE OF CRFA OF HIP JOINT

- The patient is made to lie down in the supine position and then standard basic monitoring is attached as recommended by the American Society of Anesthesiologists.
- The X-ray tube of the C-arm is placed under the patient and adequate distance is maintained between image intensifier to allow free movement of the operator’s hand.
- An anteroposterior image is taken and the pelvic bone, acetabulum, pubic bone, head of femur, and greater trochanter are visualized on the specific side where the RF lesion needs to be done.
- The target site for ablation of the articular branches of the femoral nerve is at 12 o’clock position on the superior acetabulum of the hip joint.
- A marker is then placed at the target site and skin infiltration is done with lignocaine 1%.
- The femoral artery is palpated and the cooled RF probe is introduced lateral to the pulsations of the artery.
- The next target is to ablate the articular branches of the obturator nerve.
- The cooled RF needle is placed at the incisura target site below the inferior junction of the pubis and the ischium, which appears as a teardrop shape in the AP view.
- The needle is advanced to meet a bony endpoint just below the teardrop.

COMPLICATIONS

- Loss of sensation in the cutaneous distribution of the obturator nerve and femoral nerve (extra-articular sensory loss)
- Hematoma of inguinal areas
- Ablation of the motor branches of the femoral nerve
- Infection

CONCLUSION

Cooled radiofrequency ablation is a novel treatment option for chronic painful conditions of the hip. The larger lesion size coupled with an easier technique and longer duration of pain relief compared to conventional RF makes it an effective tool in the arsenal of a pain physician.

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Fig. 1: Target for ablation of femoral nerve articular branches

Fig. 2: Target for ablation of obturator nerve articular branches
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