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Case Series

Unprecedented emergencies during radiofrequency ablation procedure: a case series

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ABSTRACT

Radiofrequency ablation (RFA) of nerves is an upcoming intervention for relieving chronic musculoskeletal pain. However, being relatively new not much publications are available on emergencies during the procedure. 66 years old male, a case of Osteoarthritis knee, underwent RFA genicular nerve of right knee. Conventional RFA of Superolateral, Inferomedial, Superomedial genicular nerves were done under C- arm guidance. Thirty minutes after the procedure, we found a boggy swelling developing over his right knee. It was a hematoma developing on the superomedial aspect of the right kneecap most likely due to injury to Superomedial genicular vessels accompanying the nerve. 67 years old female planned for RFA genicular nerves of both knees under C arm guidance. During the intervention, she complained of numbness around face, and suddenly went into disoriented state with muscle twitching and bluish discoloration of lips. Medicine consultation diagnosed the incident as LA associated systemic toxicity. 57 years old female with chief complaints of pain in left hemiplegic shoulder pain for 6 months duration admitted for suprascapular nerve block. During the procedure patient goes into hypotensive bradycardic episode. 65 years old female admitted for Medial calcaneal block for right heel pain. 24 hours after the procedure she has aggravated pain of foot. RFA is considered as a non-invasive, OPD based procedure for effective pain relief but it is also important to understand such unprecedented emergencies that can happen.

Keywords: Radiofrequency ablation, Hematoma, Local anaesthesia associated systemic toxicity

INTRODUCTION

Temperature controlled tissue destruction using a high frequency current of 500 kHz leads to Coagulative necrosis of tissue. This is the principle of Radiofrequency Ablation. In conventional RFA (C-RFA) the temperature of target tissue is raised above 45-50º C so as to produce thermal ablation of tissues. It is a new and innovative treatment option with the capacity to decrease pain and improve function and quality of life in patients- cancer pain, low back pain, hemiplegic shoulder pain, osteoarthritis, plantar fasciitis etc.[1,2] Thermal ablation of nerves by RFA has been shown to consistently provide short-term (3 to 6-month), and sometimes longer, pain relief in patients.[3]

Reasons why it is becoming increasing popular among the patients are because- it is minimally invasive, can be done even on those with recurrence of pain after surgery (specially in knee arthroplasty), target selective, short hospital stay and faster return to work.

Even though everything looks relatively safe with RFA, few case reports on unexpected emergencies have been

reported, although extremely rare. Here we present a series of unprecedented emergency cases that were encountered by us during our intervention with RFA for pain management in the Department of Physical Medicine and Rehabilitation (PMR), Regional Institute of Medical Sciences (RIMS), Imphal.

CASE SERIES

Case 1

A 66 years old male, a case of bilateral Osteoarthritis (OA) knee admitted with recurrent knee pain (more on right side) despite all conservative measures for last 3 years. He gives no history of any bleeding disorder/ anticoagulant therapy or any prior knee surgeries. His routine blood profile and coagulation studies were within normal limits. Systemic examination showed no significant abnormalities.

Figure 1: Steps of RFA genicular nerves procedure- Identification of bony landmarks under C-arm guidance.

Figure 2: Steps of RFA genicular nerves procedure- Identification of bony landmarks under C-arm guidance.

Local examination of knee before the intervention were-

On inspection

Patient lying supine with knee in extended position bilaterally, no flexion deformity, ankle in neutral position, toes slightly flexed. Patella placed normally, with no squinting observed. Bony landmarks around knee are prominent bilaterally. No obvious swelling around knee. On palpation there was no local rise of temperature. Crepitus was present bilaterally; patellar tap and fluctuation test were negative. Range of Motion: Right knee: 0-110 degree, Left knee: 0-120 degree. Special test for ligaments/ meniscus like Drawer test, McMurray's test, Stress test- Negative bilaterally. Thigh circumference at 15cm above knee joint is 36 cm bilateral.

Figure 3: Skin and subcutaneous tissue infiltration with Local Anaesthetic at the sites followed by conventional RFA- ablation of target nerves viz. superomedial, superolateral and infermedial genicular nerves for 90 seconds after confirming it with sensory and motor nerve stimulation.

Figure 4: Skin and subcutaneous tissue infiltration with Local Anaesthetic at the sites followed by conventional RFA- ablation of target nerves viz. superomedial, superolateral and infermedial genicular nerves for 90 seconds after confirming it with sensory and motor nerve stimulation.

X-ray of knee AP view in standing position showed reduced joint space in both knees in both tibiofemoral compartments (medial space reduction is more), with multiple osteophytes (Kellgren Lawrence Grade 3). Vitals-

BP measured 130/70 mmHg in right arm in supine position; PR in radial artery: 72/min, regular, good in volume, no radio-radial or radio-femoral delay, Sp02 98%, Visual Analog Scale 7/10, WOMAC Score 64, Diagnostic Block of Genicular Nerves VAS 3/10, WOMAC Score 40.

Figure 5: Knee hematoma developing post RFA of genicular nerves at 3 sites- superomedial, superolateral and inferomedial genicular nerves.

Figure 6: Identifying suprascapular notch using USG and inserting RFA cannula.

Intervention procedure

Patient in supine position with knees slightly flexed. The bony landmarks are identified using fluoroscopy (Figure 1 and 2) and skin is infiltrated with 2% Lignocaine, 2 ml at each site. After confirming position of RFA probe at target sites, c-RFA of genicular nerves is carried out. (Figure 3,4)

Vitals were monitored throughout the intervention. Patient was shifted to PMR ward 5 minutes after the intervention in supine position with stable vitals and no other subjective complaints.

Post- procedure

30 mins after the procedure, patient complained of pain and gradual knee swelling developing over his right knee. On general physical examination- Patient was conscious and oriented. Slight pallor was noted in bulbar conjunctiva, no icterus/cyanosis. BP had fallen to 100/70 mm Hg in right arm in supine position; PR 108/min, regular, feeble; SpO2 97%. Right knee local examination shows- Local rise of temperature. Knee was in slightly flexed attitude; ROM of right knee- painful. On palpation: Thigh circumference on Right side- 40 cm, ill- defined, firm swelling over medial thigh extending 7 cm from medial femoral condyle above; immobile, tender on palpation, non-pulsatile, non-pitting, fluctuation test negative (Figure 5). Peripheral pulses were palpable and comparable bilaterally.

Management

Complete blood count was sent, blood for cross matching also sent. Ice therapy and compression bandaging initiated, IV crystalloid fluids were started and injection Tranexamic acid 1g and injection Tramadol 100 mg was given IV. Swelling did not increase thereafter but patient had no pain relief at all so patient was rushed to the operation theatre of Department of PMR, RIMS. Knee USG was done which showed hypoechoic areas below muscle plane medially which was most likely a hematoma resulting from injury to SM genicular artery. Simultaneous aspiration of hematoma was done. Around 80 ml of thick blood was aspirated under aseptic and antiseptic conditions. This was followed by compression bandaging of right lower limb, leg was elevated, ice therapy given and patient shifted to ward (RICE protocol). Relief in knee pain noted, no further increase in knee swelling. From the second day, passive and active ROM exercises was started to achieve full ROM of knee and patient got discharged on third day.

Case 2

67 years old, thin built female, tea stall vendor by occupation, admitted for severe knee pain affecting her daily chores and earning capacity. She had no history of bleeding disorders or intake of anticoagulant medication and no surgeries around knee. No history of hypertension/ diabetes mellitus/ chronic diseases. No history of seizures/ drug allergy. On local examination- No local rise of temperature, knee rom 10-120° on right knee, left knee ROM full, crepitus present bilaterally, mild effusion present bilaterally, Genu Varum in right knee noted.

Investigation reports

X ray knee in AP view in standing showed KL grade 3 in left knee and KL grade 4 right knee. Blood investigations and vitals were all WNL. Local anaesthetic sensitivity was tested one day prior to intervention- no adverse reaction.

Pre intervention data

VAS score 8/10 both knees, WOMAC 80.

On diagnostic block with 2% Lignocaine there was 70% improvement in pain. She was hence planned for RFA genicular nerves of both knees.

Procedure

Patient in supine position with a pillow underneath both knees to keep it slightly flexed. Under C arm guidance target areas were identified and superficial skin infiltration done with 2% Lignocaine RF cannula inserted at the target sites, followed by sensory and motor stimulation (Figure 1,2,3). After confirming target sites, 3-4 ml of Bupivacaine 0.5% was given at these three sites (total of 10ml) before starting thermocoagulation. C-RFA started at 70-90 degrees for 30 secs at all three sites.

Patient was conscious and responding well during the procedure, until she complained of numbness around face, and suddenly went into disoriented state with muscle twitching and bluish discoloration of lips. Her BP increased to 170/120 mmHg and suddenly dropped to 100/60 mm Hg, PR also dropped to 54/min.

She was started on 100% oxygen via nasal mask immediately, iv fluids started with wide bore cannula and injection Hydrocortisone 100mg was given iv. Medicine and anaesthesia calls were sent immediately. This was diagnosed as a case of LA associated Systemic Toxicity (LAST).

Case 3

57 years old female, left sided hemiplegic following a stroke 1 year back admitted with chief complaint of pain in left shoulder for 6 months. Her examination findings revealed painful restriction in passive and active ROM of left shoulder leading to difficulties in his ADL. Her motor control of both upper and lower limbs were good. Spasticity of grade 1 was present in left biceps. She was hypertensive for last 10 years for which she was on Telmisartan 40 mg. Following failure of conservative management for her shoulder pain, she was planned for suprascapular nerve block of left side. Pre procedure her BP measured 144/86 mmHg and PR of 78/min, regular, good in volume.

For the procedure, she was in a sitting position with neck turned to right side, shoulder in neutral position, elbows flexed at 90 degree supported on the lap. Left shoulder and upper back were exposed to allow identification of proper landmarks. After cleaning and draping, the USG probe was placed over the Supraspinous fossa to identify the suprascapular notch (Figure 6). After identifying the notch, to confirm it and for proper placement of electrode over suprascapular nerve, RFA cannula 10 cm was inserted at the point followed by sensory and motor stimulation. She felt tingling sensation around shoulder when sensory stimulation was done, with abduction of arm noted with motor stimulation. Hence pulsed RFA of suprascpular nerve was started. 3-4 minutes into the procedure patient suddenly went pale, with bluish discoloration of lips, with profuse sweating and collapsed.

Patient did not respond to calls and physical stimuli. She was immediately shifted to supine position with legs elevated. His BP measured 70/50 mmHg with feeble pulse. IV crystalloids were started with large bore cannula, oxygen was started via mask. Emergency calls were sent. But 5 mins later she became conscious and started responding to her name. ECG was done bedside and random blood sugar were tested using Glucometer. No abnormalities were detected. No facial deviation/ slurring of speech/weakness of limbs. This was a case of Hypotensive bradycardic episode during suprascapular nerve ablation.

Case 4

65 years old female with right heel pain, admitted for Medial calcaneal nerve block (MCN) due to failure of all conservative measures. She was thinly built, with no other co-morbid conditions. Xray foot showed no significant abnormalities. Local examination showed tenderness at plantar fascia origin, overlying skin normal. No neurological deficit.

Procedure was carried in prone position. After proper aseptic and antiseptic conditions, continuous RFA of MCN was done for 2 cycles. No intra or post intervention complications.

24 hours later the next day she complains of burning and stinging sensation over her foot. On examination she had paraesthesia over her right foot sole. Injection site and foot showed no other abnormalities.

She was given Ice packs to relieve her stinging pain around the heel. Injection Tramadol 100mg was given IM and tablet Nortriptyline 10 mg+ Pregabalin 75 mg combination was started. 4 weeks later on OPD follow up her symptoms had subsided and she had little to almost nil heel pain. This was a case of neuropathy following RFA.

DISCUSSION

As fluoroscopic-guided genicular nerve RFA is a relatively novel procedure, long-term efficacy and data on adverse vascular complications are lacking. Till date there has been only one case of knee hematoma reported so far after RFA of genicular nerves of knee by Strand et al in 2019.[4] They also reported knee hematoma following RFA of genicular nerve of knee due to injury of superomedial genicular nerve.

The risk of vascular injury in RFA knee is a reasonable possibility due to the proximity of genicular vessels and nerves and the “sink effect” of nearby blood vessels which provides a constant blood flow to the RFA targets thus attenuating the lesioning temperature and leading to a superior coagulation effect.[4]

It is feasible that vascular complications of genicular arteries do exist but have been underreported in the current literature. The low incidence of vascular injury reported also have created a low suspicion of this complication as the differential diagnosis.

However, reports of knee hematoma after knee arthroplasty are fairly common, because of deranged clotting parameters / deranged liver function in aged patients or excessive use of anticoagulants to prevent venous thromboembolism.[5,6]

LAST is a life-threatening emergency when excessive amount of LA gets absorbed in systemic circulation or inadvertently enters systemic circulation. Severity of this event is determined by the vascular supply of injection sites, as well as the mass of drug deposition.

Distribution to organs is determined by degree of perfusion. Maximum cases available in literature are during intercostal nerve blocks, epidural block and brachial plexus block where vascular connection is rich with well-perfused tissues such as the brain, heart, liver, and lungs most severely affected. Also noteworthy is that within the plasma, it is the free portion of the drug that determines the clinical and toxic effects, hence the importance of checking serum protein levels before any nerve block with local anaesthesia.

LAST during genicular nerve block is also therefore a possibility due to close anatomic relation between the nerves and the vessels. No cases reported during genicular nerve block yet. This is the first case reported on LAST following genicular nerve block. The most likely cause of LAST in this case could have been inadvertent intravascular injection.[7]

Sudden, profound hypotensive and bradycardic events (HBEs) have been reported in more than 20% of patients undergoing shoulder arthroscopy in the sitting position. Reports of HBEs during interscalene block are available but none so far during RFA of SSN. In the literature, HBEs have been defined as a decrease in heart rate, of at least 30 beats/min within a 5-minute interval, any heart rate less than 50 beats/min, and/or a decrease in systolic blood pressure of more than 30 mmHg within a 5-minute interval or any systolic pressure below 90 mmHg. This event has been tried to be explained by various theories. The baroreceptors in the carotid sinus are considered to be stretch receptors that respond to deformation of the vessel wall in any direction. During neck movements and manipulation for shoulder procedures, mild stretches of both carotid receptors and Sternocleidomastoid tension receptors occur. This produces a strong inhibitory effect on the baroreflex arc. Secondly with age our ability to maintain hemodynamic balance during position changes becomes less effective. There's peripheral pooling of blood leading to venous stasis and orthostatic hypotension. Thirdly there could possibly be activation of the Bezold-Jarisch reflex from an empty hypercontractile ventricle, which causes stimulation of intramyocardial mechanoreceptors (C fibers) and produces an abrupt withdrawal of sympathetic outflow, increasing vagal tone and thus causing bradycardia and hypotension. In most HBEs, these symptoms appear to be transient and isolated events occur without the subsequent complications such as brain ischaemic injury, but there are a few cases reported where severe forms of HBEs have occurred, including asystole. Therefore, the high incidence and potential for catastrophic complications should be considered when shoulder intervention is performed in aged patients in the sitting position for long duration.[8-10]

Neuropathy after RFA has been published as case reports following Third Occipital Nerve ablation with RFA. Mechanical injury to the nerve can be secondary to direct needle trauma, compression of the nerve, or stretching of the nerve during positioning. There could also be nerve damage due to distortion in fascicular arrangement from both blunt and sharp beveled needles. It is more likely that the primary cause of neurotoxicity is from the intra-fascicular placement of the local anesthetic injectate or heating up of myelin sheath of nerves during RFA. Most cases are however self-limiting and they resolve within few days to weeks.[11,12]

CONCLUSION

RFA of nerves has been a life changing experience for patients with chronic pain, along with the doctors practising pain medicine. However, being a relatively novel technique, not much data are available on its long term sequelae and the emergencies that can occur. It is therefore important to report such cases to stay alert, keep them as differentials during emergencies and be prepared.

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