



Research Article

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STUDY ON REGIONAL AND APPLIED ANATOMY OF KUKUNDARA MARMA

Ankit Tyagi^{1*}, Uma B Gopal²

¹PG. Scholar, Department of Rachana Sharira, Sri Dharamsthala Manjunateshwara college of Ayurveda and hospital, Hassan, Karnataka, India

²Professor, Department of Rachana Sharira, Sri Dharamsthala Manjunateshwara College of Ayurveda and Hospital, Hassan, Karnataka, India

Received on: 22/08/17 Accepted on: 26/10/17

***Corresponding author**

E-mail: Drankittyagi88@gmail.com

DOI: 10.7897/2277-4343.09114

ABSTRACT

Kukundara Marma, a Vaikalyakara Marma structurally categorized under Sandhi Marma. The location is said as on either side of 'Pristavamsha' on 'Jagana Bahirbaghaga', injury to which causes loss of movement and loss of sensation. Regarding its location and identification there is lot of discrepancy among the authors in interpreting particular structure. Hence there is a need to identify specific anatomical structure, its location and regional involvement to ascertain structural composition of Kukundara Marma and to evaluate its involvement in injury. The study was conducted in three steps as literary study, Regional anatomical study by dissection and further retrospective clinical observational study of thirty patients for confirmation of location and impact of Kukundara Marma injury. The data subjected for statistical evaluation showed that male & female accounted in this study was 53.3%, 46.7% respectively, while age group was 31-50, 60% Amongst the causes of injuries, trauma at lumbosacral region was 80%. Pain referral zone was more in leg region 43.3%, Chestahani found in 93% cases. Gait was abnormal in 93%. Examination was positive in 53.3% It was concluded that Cadaveric observation has favored in determining the Kukundara Marma as slightly movable complex sacroiliac joint. The exact location of Kukundara Marma marked over an area was present on the side of vertebral column & outer aspect of Gluteal region is substantiated by dissection and the soft tissue component predominantly involved was neurovascular structure which was present in close association with lower part of sacroiliac joint. Vaikalyakarata of Kukundara Marma has confirmed by observing the signs and symptoms of 30 cases who had injury to low back or gluteal region.

Keywords: Kukundara Marma, Sciatic Nerve, Chestanasha, Gluteal Artery

INTRODUCTION

Knowledge about Marma is important in surgical procedures like Agni Karma, Ksharakarma & Shastrakarma. It helps to perform these procedures without complication. In case of trauma it is useful in understanding the possible anatomical structure affected and possible deformities which can be produced. Hence the knowledge about Marma is essential.

As per classification of the 107 Marma, 20 are Sandhi (joint) Marma & Kukundara Marma is one among them. Injury to this Sandhi Marma can lead to various complications ranging from disabilities to death. Kukundara is one among the Vaikalyakara Marma, two in number, present on the either side of Pristavamsha (vertebral column), related to 'Jagana Bahirbaghaga' (dorso-lateral aspect of pelvic bone). As per Susruta, the Viddhalakshana (injury results) of Kukundara Marma leads to "sparshaagyanam adhakaye chest haopaghatha" (loss of sensation and movement of lower limbs), which needs further emphasis on the anatomical, functional and clinical grounds.¹

As per J.N Mishra, Kukundara Marma is one among lower three Pristha Marma highlighted in relation to dorsolateral aspect of pelvis.²As per Ghanekar, Kukundara Marma is situated in vulnerable area surrounded by bony prominence like ischial tuberosity, greater trochanter and iliac crest. Further the same author has interpreted Kukundara as ischial tuberosity.³As per Rasayogasagar, Kukundara is interpreted as anterior superior iliac spine.⁴As per J.N Mishra the location of Kukundara Marma

is interpreted as slightly below and on the lateral flanks of the hip bone.⁵the differences in opinion between the author in interpreting the particular structure involved has been revealed by doing cadaveric dissection of the gluteal region and also by taking retrospective study of injury to the region causing loss of motor and sensory function of lower limb.

Although in Samhita the gross regional and the effect of injury is explained, the detailed description regarding identification and involvement of particular Sandhi as related with Kukundara Marma is cleared and further clarification is given related to pramana of Kukundara Marma with respect to particular part as of Ardha angula(1/2) Pramana (measurement in depth as well as circumference). Further impact of trauma or injury to this particular part causing the effect in such a way that the person suffer from loss of sensation and loss of movement of lower part of body has been emphasized anatomically by doing the dissection of related area and also taking the support of contemporary science. The minimal information about the consequences of injuries in these parts which was available has been tried to clear.

Aims and Objectives

- To ascertain location and determine the structural composition of Kukundara Marma.
- To evaluate the structural component involved in Kukundara Marma injury and its impact in causing loss of sensation and loss of movement as per modern parlance and its application.

MATERIALS AND METHODS

Study was conducted in three steps

1. Conceptual study.
2. Regional anatomical study of Kukundara Marma by dissection (Ethical clearance was taken).
3. Retrospective clinical observational study of thirty patients with impact of injury to Kukundara Marma.

Method of Collection of Data

Study design—Retrospective Observational Survey Study

- 1) **Cadaveric study** -Done on the three cadavers to understand the surface and regional anatomy of Kukundara Marma.
- 2) Marking of Kukundara Marma point over Gluteal Region
 - a) On the basis of description available classical text location of Kukundara Marma was identified and marked
 - b) On the basis of Pramana, circular area on the identified area of Marma marked with radial width of 1cm diameter.
 - c) Nailing was done with metal pin with color paint up to 1cm from the tip of the nail and is drilled up to the 1cm depth in the region of Kukundara Marma.
 - d) Area of Kukundara Marma was dissected systematically from superficial skin to deeper layers. This 1cm area is cut opened methodically from skin to bone with the help of scalpel, toothed and plain forceps to see the structures as related to Kukundara Marma.
- 3) Analyzing the applied aspects of Kukundara Marma in the victims who had injury to Gluteal region

Inclusion Criteria

- Patients having loss of sensation and altered movement in lower limb with history of trauma to gluteal region.
- Patients irrespective of gender
- Age 18-70 years
- Patient irrespective of religion and socioeconomic status.
- Written consent form patient
- Case report proforma

Exclusion Criteria

- Pregnancy
- Infective and Neoplastic conditions of spine.
- Any surgical intervention.
- Metabolic and Congenital Abnormalities.
- Fibrosis condition
- Lumbar stenosis.
- Inflammatory systemic disease like rheumatoid arthritis

Ethical clearance number: SDM/IEC/9/2014-2015 on 04/04/2015

Assessment Criteria

Assessment was done in following phases by utilizing suitable test on the patients who full fill the criteria of injury to gluteal region, numbness or loss of sensation and pain radiating towards lower limb and altered movement.

- Suitable modified Straight Leg Raise test for assessing the pain.

- Straight Leg Raise Test and Double Leg Raise Test, Gapping test, Sacroiliac Squish Test, Patrick's FABERE Test, Posterior Shear (Thigh Thrust) Test
- Patellar, Achilles, Plantar Reflexes for assessing motor deficit.
- All the data thus collected were compiled on predesigned schedule and analyzed with the help of SPSS software and MS excel.

Test Used For Examination

Straight- Leg Raise and Double Leg Raise Test-Passive SLR test was performed and non-radiating localized pain was tried to provoke, then the angle at which pain produced was noted. Then passively raised both legs simultaneously the angle was noted again at which pain was produced. If the angle at which pain is felt is higher on double straight leg raise test than on the single, the lesion is assumed more likely due to sacroiliac involvement.

Posterior Shear (Thigh Thrust) Test-In this test patient lies supine and examiner stands at the painful side. The hip is flexed to 90° and knee is flexed. Posterior shearing stress was applied to the sacroiliac joint and ligaments by applying axial compression through femur. These tests stress the sacroiliac joint and associated ligaments.

Gapping (Sacroiliac Stretch) Test-In this test patient lies supine on the examination table, with the legs together. The hips are neutral and knees are extended. With crossed arms in scissor-like manner, the examiner places both the hands on the opposite anterior superior iliac spines of each ilium. A downward and lateral pressure is applied to both the ilia. This test stresses the anterior ligaments of sacroiliac joint bilaterally and may produce sacroiliac pain.

Sacroiliac Squish Test-In this test patient lies supine on the examination table, with the legs together. The hips are neutral and knees are extended. The examiner takes a bilateral contact over the lateral aspect of anterior superior iliac spines of each ilium and applies a lateral to medial pressure in anterior to posterior direction. This test stresses the posterior sacroiliac ligaments. Pain in sacroiliac, buttock, or thigh region may indicate a sprain of these ligaments.

Patrick's FABERE Test-The patient is supine on the examination table, with legs slightly apart. The hips are neutral and knees are extended. The examiner abducts and externally rotates the target side, then flexes that knee and place the ankle across the lower thigh of the opposite leg. The target knee is lowered toward the examination table. Pain around the sacroiliac or gluteal region may be results of sacroiliac joint irritation.

OBSERVATIONS

Cadaveric study

As per the methodologies mentioned in Cunningham manual of dissection, the dissection was carried out over three cadavers, Following features are found; Skin, Superficial fascia, Cutaneous nerves, Deep fascia, Gluteus maximus, Superior and inferior gluteal vessels & nerves, Gluteus medius, Gluteus minimus, Piriformis, Sciatic nerve, Quadratus femoris, Obturator internus, Sacrospinous ligament, Sacrotuberous ligament, Internal pudendal vessels & nerve, Sacroiliac ligament as shown Figure 1-9.



Figure 1: *Gluteal region and dermatomes marking*



Figure 2: *Skin and fascia reflected*



Figure 3: *Fat removed and Gluteus*

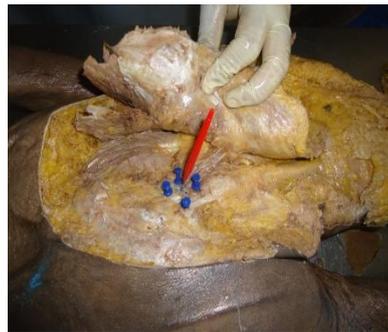


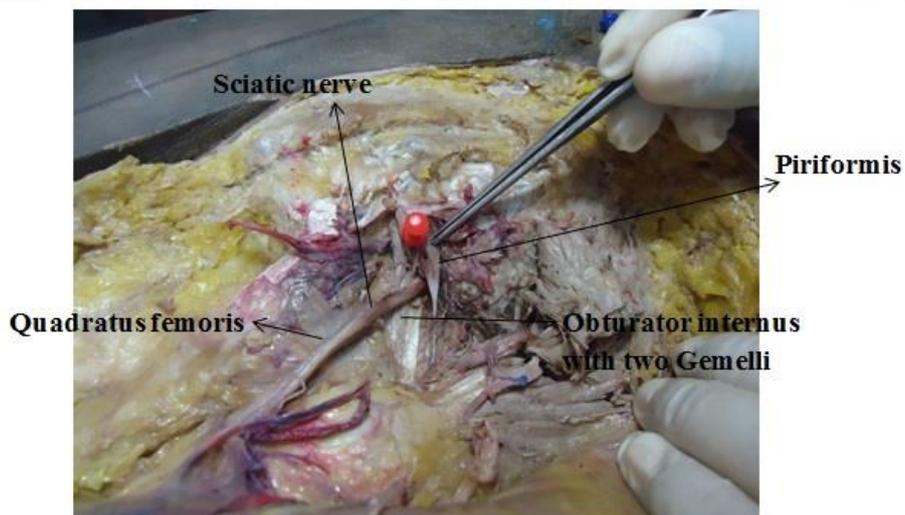
Figure 4: *Gluteus maximus reflected and Marma point maintained over muscle*



Figure 5: *Gluteus maximus reflected and Gluteus medius exposed*

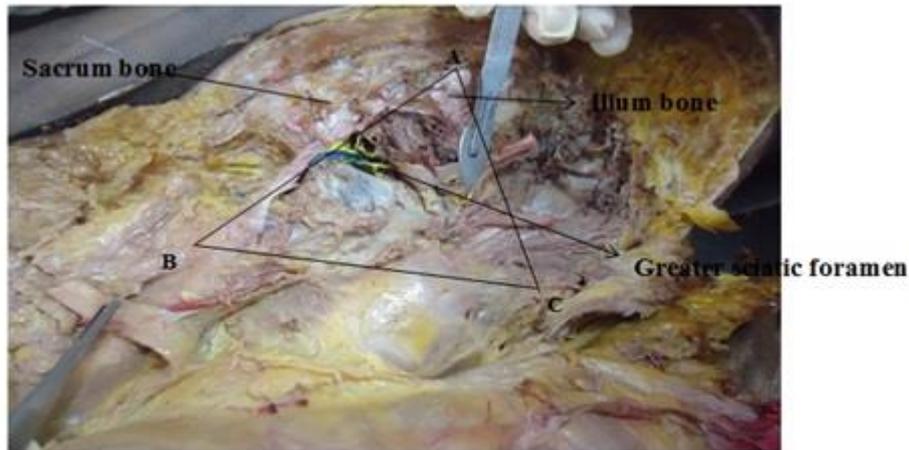


Figure 6: *Gluteus medius cut and vessels & nerve in gluteal region*



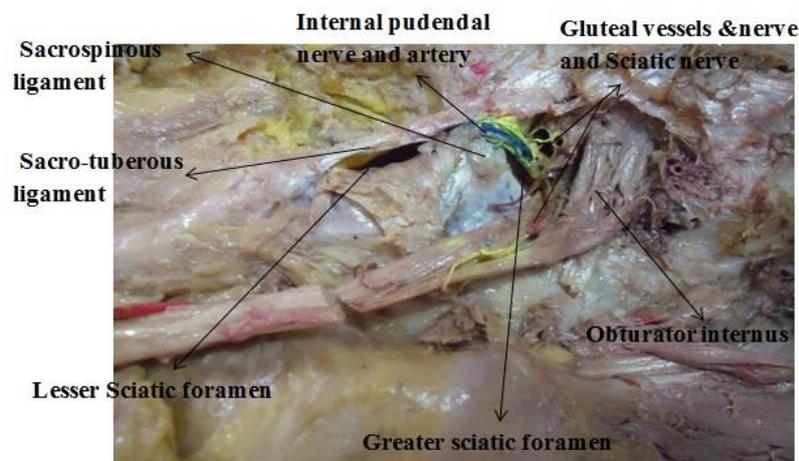
Structures in Gluteal region

Figure 7: *Structures in Gluteal region*



Surface marking of Sciatic nerve and Gluteal arteries, A-Posterior superior iliac spine, B-Ischial tuberosity, C-Apex of greater trochanter

Figure 8: Surface marking of Sciatic nerve



Deep structure of Gluteal region

Figure 9: Deep structures of Gluteal region

RETROSPECTIVE CLINICAL OBSERVATIONAL

The retrospective study over 30 patients reveals that male & female accounted in this study was 53.3% (n=16), 46.7% (n=14) respectively, while age group 31-50 60% (n=18) were more affected of the total cases. Amongst the causes of injuries, trauma at lumbosacral region was the largest cause 80% (n=24). Pain referral zone in our study was more in leg region 43.3% (n=13), Chestahani (impaired movement) found in 93% cases (n=28) but out of these 76.7% (n=23) were difficult to do the movement of lower limb without support.

Sparshagyanam (impaired sensation) in the present study were touch discrimination is altered in 6%(n=2), pain discrimination

absent in 6%(n=2), temperature discrimination altered in 3.3% (n=1), position discrimination altered in 3.3%(n=1). Gait was abnormal in 93% (n=28) out of these antalgic gait was present in 71%.

Regarding reflexes Right ankle reflex were altered in 10% (n=3), left ankle reflex were altered in 3.3% (n=2), Right plantar reflex were altered in 13% (n=4), left plantar altered in 3.3% (n=1) Examination were positive in 53.3% (n=16), posterior shear test was positive in 63.3% (n=19) out of 30, SLR & DSLR was positive in 93.3% (n=28) out of 30, gapping test was positive in 33.3% (n=10) out of 30, sacroiliac squish test was positive in 10% (n=3) out of 30 (table 4), FABER test was positive in 86.7% (n=26) out of 30 cases. (Table 1)

Table 1: General distribution chart of altered motor and sensory symptoms of lower limb

Symptoms	Altered	N
Difficulty in movement of lower limb without support	23	30
movement of lower limb with support	4	
unable to do the movement	1	
Touch discrimination	2	30
Pain discrimination	2	30
Temperature discrimination	1	30
Position discrimination	1	30
Joint reflexes right leg knee	4	30
Joint reflexes left leg knee	1	30
Joint reflexes right ankle	3	30
Joint reflexes left ankle	1	30
reflexes right plantar	4	30
reflexes left plantar	1	30
gait if abnormal	26	30
examination	16	30
Difficulty in movement of lower limb without support	23	30

DISCUSSION

Kukundara Marma is categorized under sandhi marma situated on either side of vertebral column (Prushthavamsa ubhayataha), on the outer aspect of Gluteal region (Jaganah bahirbhaga), with dimensions of 1/2 angula pramana. It can be understood that Prushthagata Kukundara marma is located in outer aspect of Gluteal region on the both sides of vertebral column. So anatomically this area is related with sandhi as main structure entity and most probable joint is sacroiliac joint. During cadaveric dissection it was observed that the marked area of marma was falling in the region from where Gluteal vessels and nerves along with sciatic nerve is emerging i.e. greater sciatic foramen formed by lower margin of sacroiliac joint (Figure 9). So it depends on the impact of injury and associated structures, injuries to the bone may produce fracture and fracture with dislocation. Injuries to muscles produce hemorrhage, pain, inflammation and sepsis. Similarly, injuries of ligaments and tendons are seen producing pain, functional disturbances and sometimes even disability. The arterial injuries produce loss of blood leading to shock and later death. The injuries of nerve lead to paralysis thus making a permanent disability. So, the injuries to the structures which are around the joint will lead to various symptoms.

Rachana (Regional anatomy)

On the basis of literary study and cadaveric dissection the panchatama (five constituents) of Kukundara marma is as below. Mamsa(muscles)-Gluteus Maximus, Gluteus medius, Gluteus minimus, Piriformis, Obturator internus; Sira (vessels and nerve)-Superior gluteal vessels & nerve, Inferior gluteal vessels & nerve Internal pudendal vessels & nerves, Sciatic nerve, nerve to quadratus femoris, nerve to piriformis, nerve to obturator internus; Snayu- Sacrotuberous ligament, Sacrospinous ligament, Sacroiliac ligaments; Asthi (bones)- Sacrum, Ilium; Sandhi(joints)-Sacroiliac joint. Kukundara marma, having the predominance of Sandhi component, can be understood by following peculiarities.

Sacroiliac joint is held by ligaments and by short muscles surrounding the joints as explained above. A nerve innervated at this region is predominantly sciatic nerve. If any injury or trauma occurs it may hamper the normal functions of nerves and ligaments, resulting in loss of movement of the lower limb. As per the present retrospective study conducted over 30 patients of injury to lower back or gluteal region, trauma at lumbo-sacral

region is commonest in 80% (n=24) followed by any other cause is 20% (n=6).

Viddha lakshana

The Viddhalakshana of Kukundara marma is "sparshaagyanam adhakaye chesthaopaghatha". In the present study 60% (n=18) are present in 31-50 age group. Chestahani found in 93% cases (n=28) but out of these 76.7% (n=23) are of grade 1, 13.3 % (n=4) grade 2, 3.3 % (n=1) are of grade 3. The assessment was done for muscles strength. Walking and posture is mainly control by gluteal region muscles because they stabilize and accelerate the pelvis, other muscles play synergistic role with these muscles.⁹In the clinical observation of patients with injury to sacroiliac joint it was seen that all the above said symptoms were seen along with movement of lower limb without support, movement of limb with support and some are unable to do the movement.

Sparshagyanam in the present study was divided in to four types of sensation i.e. Touch, Pain, Temperature, and Position.⁷ In this touch discrimination is altered in 6% (n=2), pain discrimination absent in 6% (n=2), temperature discrimination altered in 3.3% (n=1), position discrimination altered in 3.3% (n=1). This data related to loss of sensation/altered sensation suggest that the sensory information is not carried properly or it is completely absent. As per the author of clinical neuroanatomy the root cause for loss of sensation in the lower limb may stem from pinched nerve in the Kukundara marma pradesha(region) and which radiates towards low back, buttocks, thigh, groin, hip, leg and also foot. In the clinical observation of patients with injury to sacroiliac joint it was seen that all the above said symptoms were seen along with the transient numbness, prickling or tingling sensation. The pain was ranging from dull aching to sharp stabbing which was further observed increasing while the person was involved in physical activity.

Gait is manner of walking, stepping, and running. In the present study Gait is abnormal in 93 % (n=28) out of these lurching gait is present in 16.7 % (n=5), antalgic gait present in 71% (n=21). Antalgic gait refers pain during walking. Lurching gait occurs when *gluteus medius & minimus* is injured because these two muscles stabilize the pelvis during walking.⁸

Right ankle reflex is altered in 10% (n=3), left ankle reflex is altered in 3.3% (n=2). Right plantar reflex is altered in 13% (n=4), left plantar altered in 3.3% (n=1). Ankle area is

innervated by spinal nerve S1 and plantar area by spinal nerve L5, S1. Cutaneous nerve supply is *sural* nerve and medial & lateral plantar nerves respectively.⁹

In the present study examination is positive in 53.3% (n=16). The test used in clinical observation was sacroiliac stress test. Localized pain over the sacroiliac joint combined with three or more test giving positive findings has made diagnosis of sacroiliac joint syndrome.¹⁰

According to Laslett and Williams posterior shear or “Thigh thrust” test have the highest level of inter examiner reliability as compared to others. Posterior shear test is positive in 63.3% (n=19). This test stresses not only sacroiliac joint and associated ligaments also like sacrotuberous ligament.¹¹

Straight leg raise test and double leg raise test was positive in 93.3%(n=28). In this the angle at which pain was felt during passive SLR was noted and then by making the patient passively to raise both legs simultaneously the level of angulation was noted at the point of which pain provoked. As per the standard formula- if angle of DSLR > SLR the lesion more likely due to sacroiliac involvement.¹²⁰ On this basis the involvement of the region related to Viddha lakshana of Kukundara marma was able to analyze taking the support of above said test.

Gapping test (sacroiliac stretch) test was positive in 33.3% (n=10). This test stresses the anterior ligaments of the sacroiliac joint in case of strained ligaments or sacroiliac joint inflammation.¹²

Sacroiliac squish test was positive in 10% (n=3). This test stresses the posterior sacroiliac ligaments. Pain in sacroiliac, buttock or thigh region indicate sprain of these ligaments.¹²

Patrick's FABERE test was positive in 86.7% (n=26). This test stresses the sacroiliac joint and hip also, if pain is present in gluteal region, it is due to sacroiliac joint irritation.¹²

In supporting this as per a case study conducted by Dr.Julie cailliez et al “Study on Traumatic Sciatic Paralysis after Inferior Gluteal artery rupture”. There is discussion about the traumatic sciatic paralysis which can occur secondary to three main mechanisms like stretching, compression, severance. In this present study patient was suffered a force impact to the left buttock, he rapidly experienced swelling and burning pain radiating along the back of his left lower extremity. At initial clinical examination, 2 hours after trauma no abnormality was observed, but there was painful swelling in the left buttock.¹³

Pelvic x-rays show no fracture, fifteen hours after trauma patient's conditioned worsened rapidly, with increase hypoesthesia and onset of motor deficit of the common fibular nerve. Sciatic neuropathy after pelvic trauma without fracture occurs in around 5% cases.¹³ In the present study also it was observed that out of 30 observed cases of trauma to gluteal region and radiating pain towards the course of sciatic nerve with altered sensation and movement, 3 individuals were without any findings of fracture related to sciatic nerve.

Dr.Curtis W. Slipman et al conducted a study on Sacroiliac joint syndrome (SIJS) through fluoroscopically guided sacroiliac joint injection in 50 patients. Findings demonstrate that pain referral that SIJS involve pain to various site not limited to the lower lumbar region and buttock. Complaining of pain involving the lower lumbar region and buttock alone is 30%. Lower extremity pain complaints reported in 50% of patient.¹⁴ In the present

study by utilizing all kinds of tests it was observed that pain was present in the whole limb so out of 30 ,53.3% of the cases the result was positive and in par with involvement of sacroiliac joint causing sciatic irritation there by the symptoms.

It was also seen that the impact of injury to the sacroiliac joint was radiating in different direction like low back region, gluteal region, lower limb, up to the level of knee, posterior lateral part of calf and foot. There was diffused referral pain which was observed during examination of patient. The reasons for diffuseness of sacroiliac joint referral pain depends up on various factor like a) adjacent structure affected by intrinsic joint pathology, b) pain referral patterns dependent on the distinct location of injury in sacroiliac joint, c) joint innervation being highly variable and complex, d) pain referred in a sclerotomal fashion.¹⁴ In this study the referral pain was due to trauma to gluteal region and injury to sacroiliac joint.

CONCLUSION

Cadaveric observation has favored in determining the Kukundara Marma as slightly movable complex sacroiliac joint. The location marked over an area present on the side of vertebral column & outer aspect of Gluteal region was substantiated by dissection and the soft tissue component predominantly seen was neurovascular structure which was present in close association with lower part of joint (great sciatic notch). It has influenced over producing signs & symptoms related to injury of Marma. The discussion related to Vaikalyakaratra of Kukundara Marma has confirmed by retrospective clinical observation as mentioned previously by observing the signs and symptoms of 30 cases who had injury to low back or gluteal region and supportive studies like Traumatic sciatic paralysis after inferior gluteal artery rupture, vascular injury leading to compression on the sciatic nerve, the main nerve of the region and sensitive to trauma has lead to functional and sensory changes of lower limb. The Kukundara Marma was seen to influence the referral pain to wide range of area which includes low back region, gluteal region, and lower limb and also towards groin. This shows the importance related to neurovascular structures causing sensory and motor deficit and present with in the territory of Kukundara Marma pradesha i.e. 1/2angula pramana and within the surface marking area of neurovascular structure of Gluteal region.

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Cite this article as:

Ankit Tyagi and Uma B Gopal. Study on regional and applied anatomy of kukundara marma. *Int. J. Res. Ayurveda Pharm.* 2018;9(1):70-76 <http://dx.doi.org/10.7897/2277-4343.09114>

Source of support: Nil, Conflict of interest: None Declared

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