# MRI Findings of Giant Cell Tumor of Tendon Sheath and Other Benign Soft Tissue Tumors in Hand

Punthip Thammaroj MD*, Prathana Chowchuen MD*,
Chat Sumananont MD**, Thitima Nasang MD*

** Department of Radiology, Faculty of Medicine, Srinagarind Hospital, Khon Kaen University, Khon Kaen, Thailand*
*** Department of Orthopaedics, Faculty of Medicine, Srinagarind Hospital, Khon Kaen University, Khon Kaen, Thailand*

***Objective:*** *To describe and determine different magnetic resonance imaging (MRI) findings of giant cell tumor of tendon sheath (GCTTS) and other benign soft tissue tumors in hand.*
***Material and Method:*** *Between January 2008 and October 2014, 21 patients' data and MRI findings were retrospectively reviewed by two musculoskeletal radiologists; data including sex, age, location of mass, number of lesion, size, shape, fatty component, adhesion to the tendon, signal intensity, neurovascular, and osseous involvement was recorded. The present study was approved by the Ethics Committee for Human Research of Khon Kaen University.*
***Results:*** *The intra-observer and inter-observer reliability of MRI interpretation gave good agreements between two radiologists. Six patients had proven GCTTS and 15 patients had other benign soft tissue tumors, including four cases of hemangioma, four cases of lipoma, two cases each of fibroma and nodular fasciitis, and one case each of neulilemmoma, glomus tumor, and soft tissue chondroma. All GCTTS were solitary lesion with the diameter ranging from 1.2 to 6.4 cm, had well-circumscribed border and lobulation. All GCTTS were located at the volar aspect, attached to the flexor digitorum tendon. In MRI, they appeared as isointensity on T1-weighted images and hyperintensity on T2-weighted images with uniform or non-uniform enhancement. Osseous involvement was seen in all GCTTS cases. All other benign non-GCTTS showed variable MR characteristics. Two significant MRI findings on GCTTS were the presence of homogenous enhancement ($p<0.01$) and osseous involvement ($p<0.04$).*
***Conclusion:*** *Benign soft tissue tumors in hand gave variable and overlapping MRI features. Two major MRI findings of GCTTS are the presence of uniform enhancement and/or osseous involvement. These two MRI features may be helpful for differential diagnosis of GCTTS among well-circumscribed lobulated soft tissue mass arising from the tendon of the hands.*

***Keywords:*** *MRI, Hand, Giant cell tumor of tendon sheath, Hemangioma, Spindle cell lipoma, Neural lipoma, Neurilemmoma, Fibroma, Soft tissue chondroma, Glomus tumor, Nodular fasciitis*

***J Med Assoc Thai 2016; 99 (7): 816-22***
***Full text. e-Journal:*** *http://www.jmatonline.com*

Among 95% of soft tissue tumors of hand are benign and the most common type is giant cell tumor of tendon sheath (GCTTS), followed by hemangioma, lipoma, nerve sheath tumor, and fibroma, etc.

In general, the magnetic resonance imaging (MRI) is unable to differentiate each type of tumors. However, sometimes this modality can narrow the range of differential diagnosis based on the origin of soft tissue tumors, for example, skin, subcutaneous fat, tendon, and neurovascular bundle. Furthermore, in some types of tumors such as GCTTS, lipoma, and hemangioma, MRI can provide a specific diagnosis. Typically, GCTTS presents as a well-encapsulated and lobulated small mass, locating adjacent to or enveloping a tendon and usually shows hypo- to isointense on T1-weighted images (T1WI) equal to skeletal muscle and hypointense on T2-weighted images (T2WI) and enhancement on post intravenous gadolinium. Sometimes, the lesion shows blooming on gradient echo sequences, due to chronic hemorrhage with hemosiderin deposition within the lesion[1].

In Thailand, no previous study has been done on the comparative analysis of MR findings of GCTTS and other benign tumors of the hand. The purpose of the present study was, thus, to retrospectively review MRI findings of GCTTS and other benign soft tissue tumors and determine MRI characteristics to differentiate GCTTS from other benign soft tissue tumors of the hand.

***Correspondence to:***
*Thammaroj P, Department of Radiology, Srinagarind Hospital, Khon Kaen University, 123 Mitraparp Road, Khon Kaen 40002, Thailand.*
*Phone: +66-81-5929275, Fax: +66-43-348389*
*E-mail: w.punthip@gmail.com*

## Material and Method

Between January 2008 and October 2014, 21 patients diagnosed as having soft tissue tumors in

their hands at Srinagarind Hospital, Khon Kaen University, were included. The study was approved by the Ethics Committee for Human Research of Khon Kaen University. All medical records were reviewed for demographic and clinical data. The MRI findings were retrospectively reviewed by two experienced musculoskeletal radiologists using the Picture Archiving and Communication System. The MRI findings were evaluated for the number of lesions, tumor size, shape, distribution which was defined as digit or palm in location, presence of fatty tissue, signal intensity, pattern of enhancement, presence of hypointense area on all pulse sequences which representing for fibrous component, calcification or deposit of hemosiderin, adjacent structure involvement including tendon and degree of tendon attachment. Plain radiographs were used additionally for the evaluation of intratumoral calcification.

The MRI protocol included a combination of axial, sagittal, and coronal images using T1-weighted (T1WI) fast spin echo (FSE) with TR/TE range of 400 to 850/8 to 45, T2-weighted FSE (T2WI) with TR/TE range of 2,500 to 6,000/80 to 102, and Short Tau Inversion Recovery (STIR) or Spectral Attenuated Inversion Recovery (SPAIR); matrix size 256x160 to 256x244. Contrast-enhanced images of axial, sagittal, and coronal planes were obtained using T1WI FSE sequence with fat suppression after 0.1 mmol/kg of body weight of gadolinium injection. Field of view, slice thickness, and interslice gap varied along with diseased region and tumor size.

***Statistical analyses***

Demographic data and frequency of the MRI findings were presented by percentages. The inter-observer and intra-observer agreements were described using Kappa statistic. The intraclass correlation coefficient was used for estimating inter-rater reliability. The Fisher's exact test was used for measuring the relationship of the MRI features in GCTTS and other benign soft tissue tumors. The statistical analysis was performed using SPSS version 20. The $p$-value <0.05 was predetermined as statistically significant.

**Results**

Among the 21 patients, 13 (61.9%) were males and eight (38.1%) were females. The mean age of all patients was 37 years (ranging from 2 to 62 years). Six patients (28.6%) had pathologically proven GCTTS. The other 15 patients were non-GCTTS benign soft tissue tumors and included four cases of hemangioma, four cases of lipoma, two cases each of fibroma and nodular fasciitis, and one case each of neurilemmoma, glomus tumor, and soft tissue chondroma.

There was six patients with GCTTS, were four males and two females with age range of 19 to 55 years. The diameters of the tumor ranged from 1.2 to 6.4 cm. All of the lesions were solitary, well circumscribed border with lobulation. All lesions located at the volar aspect of the digits and equally distributed on right and left hands. Benign soft tissue tumors other than GCTTS occurred predominately on the left hand (R:L = 5:10). The lesions were often found at the volar than the dorsal aspect (V:D = 13:2). Masses located more frequently on the palmar hands than digits. Thirteen patients with hemangioma had a solitary lesion and two patients had multiple lesions. Except for one case of oval shaped neurilemmoma, all other lesions were lobulated lesions. Three cases of hemangioma and soft tissue chondroma had infiltrating border (Table 1).

On MR images, all GCTTS presented as an isointense lesion on T1WI and a hyperintense lesion on T2WI. Uniform enhancement was seen in five cases and non-uniform enhancement in one case. On all pulse sequences, hypointense area was seen in three cases. None of the GCTTS lesions had intra tumoral calcification or fatty component. In other benign soft tissue tumors, variable signal intensity on both T1WI and T2WI were revealed on post contrast images; three cases of lipoma were not enhanced. Uniform enhancement was seen in two cases of hemangioma and glomus tumor. The remaining 10 cases showed non-uniform enhancement (Table 2).

Osseous involvement including bony erosion and destruction were seen in all six cases of GCTTS. None of the GCTTS cases had neurovascular or soft tissue involvement. Osseous involvement was seen in seven cases of non-GCTTS benign soft tissue tumors (Table 3).

The intra-observer and inter-observer reliability of MRI interpretation gave good agreements between two radiologists. The coefficients of intra-observer were between 0.64 and 1.00 and inter-observer were between 0.85 and 1.00. Compared with other benign soft tissue tumors, GCTTS showed two remarkable MRI findings, homogenous enhancement after intravenous gadolinium injection ($p$ = 0.01) and osseous involvement ($p$ = 0.04).

**Table 1.** General demographic and clinical data, tumor distribution, number, shape, and border

| Tumors | n (%) | Age years (mean) | Size cm (mean) | R:L | V:D | Distribution digit:palm | Number single:multiple | Shape L:O | Border W:N |
|---|---|---|---|---|---|---|---|---|---|
| GCTTS | 6 (28.6) | 19-55 (40.2) | 1.2-6.4 (2.9) | 3:3 | 6:0 | 6:0 | 6:0 | 6:0 | 6:0 |
| Hemangioma | 4 (19.0) | 9-52 (20.5) | 1.5-10.4 (5.3) | 2:2 | 3:1 | 0:4 | 2:2 | 4:0 | 2:2 |
| Glomus tumor | 1 (4.8) | 44 | 0.7 | 1:0 | 0:1 | 1:0 | 1:0 | 1:0 | 1:0 |
| Spindle cell lipoma | 1 (4.8) | 55 | 7.3 | 0:1 | 1:0 | 1:0 | 1:0 | 1:0 | 1:0 |
| Neural lipoma | 2 (9.5) | 2-30 (16.0) | 3.4-4.5 (4.0) | 1:1 | 2:0 | 2:0 | 2:0 | 2:0 | 2:0 |
| Lipoma | 1 (4.8) | 54 | 6.3 | 0:1 | 1:0 | 1:0 | 1:0 | 1:0 | 1:0 |
| Fibroma | 2 (9.5) | 40-61 (50.5) | 3.9-5.3 (4.6) | 0:2 | 2:0 | 1:1 | 2:0 | 2:0 | 2:0 |
| Soft tissue chondroma | 1 (4.8) | 62 | 6.0 | 0:1 | 1:0 | 0:1 | 1:0 | 1:0 | 0:1 |
| Nodular fasciitis | 2 (9.5) | 36-51 (43.5) | 2.0-2.1 (2.1) | 0:2 | 2:0 | 0:2 | 2:0 | 2:0 | 2:0 |
| Neurilemmoma | 1 (4.8) | 20 | 4.6 | 1:0 | 1:0 | 0:1 | 1:0 | 0:1 | S1:0 |
| Total | 21 (100) | 2-62 (37.0) | 0.7-10.4 (4.0) | 8:13 | 19:2 | 12:9 | 19:2 | 20:1 | 18:3 |

GCTTS = giant cell tumor of tendon sheath; n = number of patients; R:L = right to left hand ratio; V:D = volar to dorsal aspect ratio; L:O = lobulation to oval shape ratio; W:N = well circumscribed to not well circumscribed border ratio

**Table 2.** MRI appearance in giant cell tumor of tendon sheath (GCTTS) and other benign tumors

| MRI findings (signal intensity) | | GCTTS (6) | | Other benign tumors (15) | | *p*-value |
|---|---|---|---|---|---|---|
| | | Number | Percent | Number | Percent | |
| T1WI | Isointense | 6 | 100 | 9 | 60.0 | 0.21 |
| | Hypointense | 0 | 0 | 0 | 0 | |
| | Hyperintense | 0 | 0 | 2 | 13.3 | |
| | Intermix signal | 0 | 0 | 4 | 26.7 | |
| T2WI | Isointense | 0 | 0 | 0 | 0 | 0.06 |
| | Hypointense | 0 | 0 | 1 | 6.7 | |
| | Hyperintense | 6 | 100 | 6 | 40.0 | |
| | Intermix signal | 0 | 0 | 8 | 53.3 | |
| Post Gd | None | 0 | 0 | 3 | 20.0 | 0.01 |
| | Uniform enhanced | 5 | 83.3 | 2 | 13.3 | |
| | Non-uniform enhanced | 1 | 16.7 | 10 | 66.7 | |
| Hypointense area on all pulse sequences | Present | 3 | 50.0 | 12 | 80.0 | 0.29 |
| | Absent | 3 | 50.0 | 3 | 20.0 | |
| Intratumoral calcification | Present | 0 | 0 | 1 | 6.7 | >0.90 |
| | Absent | 6 | 100 | 14 | 93.3 | |
| Fat component | Present | 0 | 0 | 7 | 46.7 | 0.06 |
| | Absent | 6 | 100 | 8 | 53.3 | |

MRI = magnetic resonance imaging; Gd = gadolinium

**Table 3.** Associated adjacent structure involvement

| Associated structures | GCTTS (%) (n = 6) | Other benign tumors (%) (n = 15) | *p*-value |
|---|---|---|---|
| Tendon attachment | 6 (100) | 10 (66.7) | 0.26 |
| Degree of attachment ≥180° | 6 (100) | 10 (66.7) | 0.26 |
| Intra-articular extension | 1 (6.7) | 0 | 0.28 |
| Soft tissue involvement | 0 | 4 (26.7) | 0.28 |
| Neurovascular involvement | 0 | 4 (26.7) | 0.28 |
| Osseous involvement | 6 (100) | 7 (46.7) | 0.04 |

GCTTS = giant cell tumor of tendon sheath

## Discussion

GCTTS is a localized form of pigmented villonodular synovitis, arising from the tendon or nearby the tendon. This tumor is the most common benign soft tissue tumor of the hand. In the present study, GCTTS were found equally on both right and left hands. All were solitary lesion without satellite or multiple lesions. All of them showed typically well-circumscribed, lobulated mass, arising from the volar aspect of the flexor tendons, or enveloping tendons. These features of GCTTS in the present study were

similar to those reported previously[1-7]. In addition, all lesions in this study attached to the tendon more than 180 degree, same as those reported by Middleton et al[8].

In MRI, many studies mention that signal intensity of GCTTS is usually hypo to isointense on T2WI, or approximately equal to that of the skeletal muscles due to hemosiderin pigment deposition[1-3,5,7,9]. In contrast to the present study, all of GCTTS showed hyperintense on T2WI or fluid sensitive sequences (Fig. 1). This might be explained by variable components. Relatively high composition of fibrous tissue, hemosiderin, and pigmented foam cells gave hypointense images[1-3,5-7,9]. In our study, half of GCTTS showed internal hypointense lesions, which represent fibrous tissue, hemosiderin, or calcification. This finding was comparable and no significant statistic difference between the GCTTS and other benign soft tissue tumors. This may partly due to the limitation of no use of gradient echo sequences in our study. Many literatures claimed that on the gradient echo sequences, the paramagnetic effect of hemosiderin is more exaggerated, resulting in areas of very hypointense due to the blooming artifact, in cases of GCTTS. In the present study, osseous involvement was seen in all our GCTTS cases. However, according to Reilly et al, 32% of GCTTS have no radiographic abnormality[10] (Fig. 2). Osseous involvement usually appears as cortical destruction with well-defined margins[7,10].

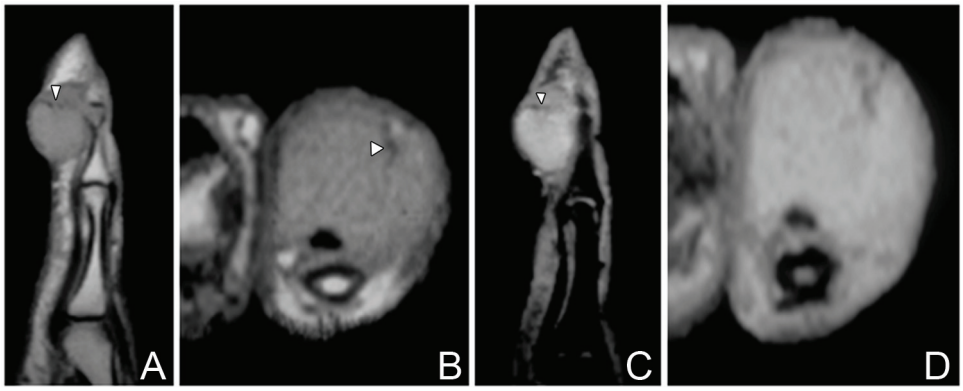


**Fig. 1** Giant cell tumor of tendon sheath at right little finger. (A) Sagittal T1WI (repetitive time (TR)/echo time (TE), 400/26.8) and (B) axial T1WI (TR/TE, 400/28.5) demonstrated lobulated, isointense soft tissue mass at the volar aspect of the digit. The lesion showed hyperintense on (C) sagittal short tau inversion recovery (STIR) (TR/TE, 2,500/45) image and homogenous enhancement on (D) axial T1WI (TR/TE, 500/21.2) fat suppressed post contrasted image. Focal hypointense striations, representing for hemosiderin deposition or fibrous tissue (arrow head).

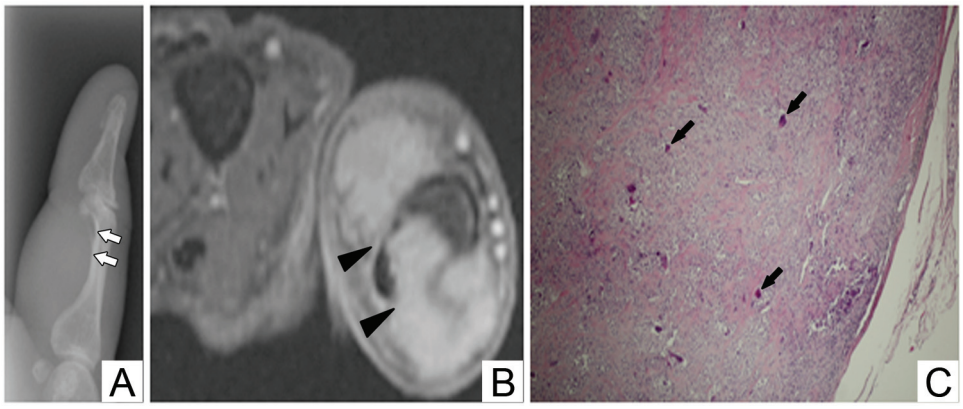


**Fig. 2** Giant cell tumor of tendon sheath at right thumb. (A) Lateral plain radiograph showed soft tissue density mass with subjacent osseous erosion at the proximal phalanx (white arrows). No intratumoral calcification is seen. (B) Axial T1WI (TR/TE, 500/11.1) fat suppressed post contrasted image showed homogenous enhancement. The lesion enveloped the tendon 270 degree (black arrow heads). (C) Histological appearance showed admixture of mononuclear histiocytoid cells, lymphocytes, and scattered multinucleated osteoclastic giant cells (black arrows).

Other benign soft tissue tumors of hands have variable MRI findings. The hemangioma, lipoma, spindle cell lipoma, neural lipoma, fibroma, neurilemmoma, nodular fasciitis, soft tissue chondroma, and glomus tumor in our study had MRI features similar to other studies[1-4,9,11-13].

Fibroma of tendon sheath is a hypocellular tumor with dense collagen matrix. This tumor is difficult to diagnose prospectively because the lesion shares imaging features with those of other tumors: most notably, GCTTS. Our lesions were well-circumscribed border with lobulation. Signal intensity of the lesions showed variable and presence of fibrous component, which showed hypointense on all pulse sequences, similar to other studies[2,12]. In our study, fibroma showed non-uniform enhancement, whereas other studies showed variable enhancement[2,12] (Fig. 3).

In conclusion, in MR imaging, GCTTS are seen as uniform enhancement with osseous involvement, which rather rare in other benign soft tissue tumors of hand. Together with those two characteristics, a soft tissue mass presenting with lobulation, well-circumscribed border, and arising from the tendon, can help diagnosis of GCTTS.

The present study had several limitations. There were some variabilities in MRI parameters due to technical limitations. We used only fat-spin-echo, not conventional spin echo techniques. There were no gradient echo sequences, which might help differentiating hemosiderin from fibrous tissue and calcification. Small sample size was possibly due to uncommon incidence of soft tissue tumor of the hand in the study area. Some patients underwent surgery before MRI was performed. In this study, MRI findings between the GCTTS and group of other benign soft tissue tumors were compared, not between each type of benign tumors, because of the small sample size of the latter.

**Conclusion**

Benign soft tissue tumors in hand have variable and overlapping MRI features. Nevertheless, two MRI findings of the presence of uniform enhancement and/or osseous involvement together with a well-circumscribed lobulated soft tissue mass arising from the tendon can help to diagnose GCTTS.

**What is already known on this topic?**

Information about MRI characteristics of benign tumors in the hand is well-established. However, vast majority of the studies have been done as describing MRI findings, not as comparative analysis.

**What this study adds?**

The findings support that GCTTS usually has MRI feature of osseous involvement.

**Potential conflicts of interest**

None.

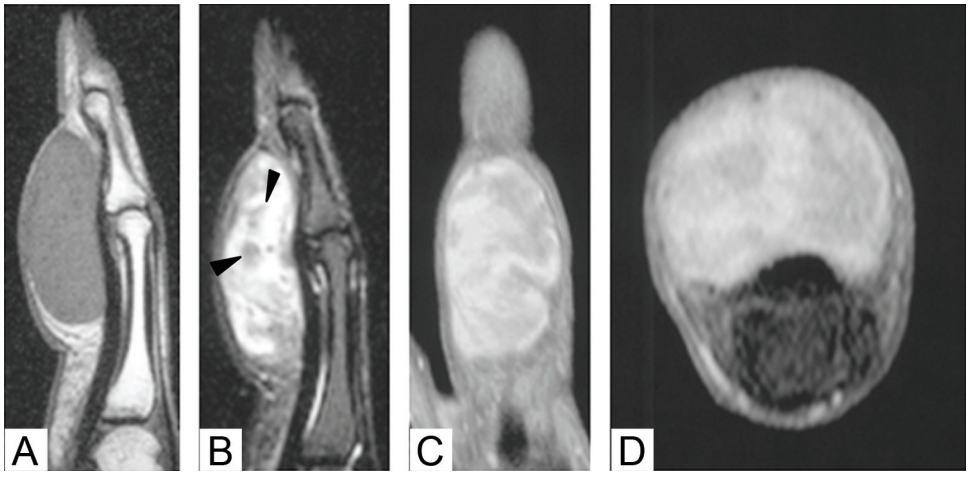


**Fig. 3** Fibroma of tendon sheath at left index finger. (A) Sagittal T1WI (TR/TE, 400/14) revealed well-circumscribed isointense soft tissue mass attaching to the flexor digitorum tendon at left index finger. (B) Sagittal STIR (TR/TE, 3,200/100) image, the lesion showed intermixed signal with multiple hypo to isointense areas, representing fibrous component within the mass (arrow heads). (C) Coronal and (D) axial T1WI (TR/TE, 488/8.4) fat suppressed post contrasted images showed non uniform enhancement. There is no osseous erosion.

**References**

1. Ergun T, Lakadamyali H, Derincek A, Tarhan NC, Ozturk A. Magnetic resonance imaging in the visualization of benign tumors and tumor-like lesions of hand and wrist. Curr Probl Diagn Radiol 2010; 39: 1-16.
2. Teh J, Whiteley G. MRI of soft tissue masses of the hand and wrist. Br J Radiol 2007; 80: 47-63.
3. Walker EA, Fenton ME, Salesky JS, Murphey MD. Magnetic resonance imaging of benign soft tissue neoplasms in adults. Radiol Clin North Am 2011; 49: 1197-217.
4. Miles SJ, Amifeyz R, Bhatia R, Leslie I. Benign soft tissue tumours of the hand. Orthop Trauma 2010; 24: 183-5.
5. Jelinek JS, Kransdorf MJ, Shmookler BM, Aboulafia AA, Malawer MM. Giant cell tumor of the tendon sheath: MR findings in nine cases. AJR Am J Roentgenol 1994; 162: 919-22.
6. Adams EL, Yoder EM, Kasdan ML. Giant cell tumor of the tendon sheath: experience with 65 cases. Eplasty 2012; 12: e50.
7. Wang CS, Duan Q, Xue YJ, Huang XM, Wang LL, Chen ZY, et al. Giant cell tumour of tendon sheath with bone invasion in extremities: analysis of clinical and imaging findings. Radiol Med 2015; 120: 745-52.
8. Middleton WD, Patel V, Teefey SA, Boyer MI. Giant cell tumors of the tendon sheath: analysis of sonographic findings. AJR Am J Roentgenol 2004; 183: 337-9.
9. Bicer OS, Herdem M, Bayram H, Ozkan C, Tekin M. The epidemiology of tumors and tumor-like lesions of the hand and the wrist. Clin Exp Med Sci 2013; 1: 347-52.
10. Reilly KE, Stern PJ, Dale JA. Recurrent giant cell tumors of the tendon sheath. J Hand Surg Am 1999; 24: 1298-302.
11. Kim DH. Glomus tumor of the finger tip and MRI appearance. Iowa Orthop J 1999; 19: 136-8.
12. Fox MG, Kransdorf MJ, Bancroft LW, Peterson JJ, Flemming DJ. MR imaging of fibroma of the tendon sheath. AJR Am J Roentgenol 2003; 180: 1449-53.
13. Turhan-Haktanir N, Demir Y, Haktanir A, Aktepe F, Sancaktar N. Concurrent soft tissue chondroma and periosteal chondroma of thumb. Eur J Gen Med 2009; 6: 257-61.

*ลักษณะภาพคลื่นแม่เหล็กไฟฟ้าของก้อนเนื้องอกชนิด giant cell tumor of tendon sheath และเนื้องอกชนิดดีอื่น ๆ ที่เกิดบริเวณมือ*

*พรรณทิพย์ ธรรมโรจน์, ปรารถนา เชาว์ชื่น, ชัช สุมนานนท์, ธิติมา นาแซง*

***วัตถุประสงค์:*** *เพื่อศึกษาลักษณะภาพและลักษณะที่แตกต่างของคลื่นแม่เหล็กไฟฟ้าของก้อนเนื้องอก giant cell tumor of tendon (GCTTS) และเนื้องอกชนิดดีอื่น ๆ ที่เกิดบริเวณมือ*

***วัสดุและวิธีการ:*** *ตั้งแต่เดือนมกราคม พ.ศ. 2551 ถึง ตุลาคม พ.ศ. 2557 ได้มีการศึกษาลักษณะภาพคลื่นแม่เหล็กไฟฟ้า และข้อมูลผู้ป่วยจำนวน 21 ราย ในแง่ของ เพศ อายุ ตำแหน่งของก้อน จำนวนก้อน ขนาด รูปร่าง ส่วนประกอบของไขมัน การยึดติดกับปลอกเอ็น ความเข้มของสัญญาณ (signal intensity) และความสัมพันธ์ของเส้นประสาทและกระดูก โดยรังสีแพทย์ 2 คน*

***ผลการศึกษา:*** *The intra-observer และ inter-observer reliability ของการแปลผลคลื่นแม่เหล็กไฟฟ้าอยู่ในเกณฑ์ที่ดี มีจำนวน 6 ราย เป็น GCTTS และอีก 15 ราย เป็นเนื้องอกชนิดดีอื่น ๆ โดยมี hemangioma 4 ราย lipoma 4 ราย fibroma 2 ราย nodular fasciitis 2 ราย neulilemmoma, glomus และ soft tissue chondroma อย่างละ 1 ราย ใน GCTTS ทั้งหมดมีลักษณะเป็นก้อนเดี่ยว ขอบชัดขรุขระ มีขนาด 1.2 ถึง 6.4 เซนติเมตร ติดอยู่กับเส้นเอ็น flexor digitorum ลักษณะภาพคลื่นแม่เหล็กไฟฟ้าแสดง isointense ใน T1-weighted images, hyperintense ใน T2-weighted images และ uniform หรือ non-uniform enhancement โดยทุกรายพบว่ามีกระดูกถูกทำลาย ส่วนเนื้องอกชนิดดีอื่น ๆ มีลักษณะภาพคลื่นแม่เหล็กไฟฟ้าที่มีความแตกต่างกันไป สองลักษณะที่มีนัยสำคัญทางสถิติของภาพคลื่นแม่เหล็กไฟฟ้าที่พบใน GCTTS คือ สีสม่ำเสมอทั่วก้อนหลังจากฉีดสารเปรียบต่าง (uniform enhancement) และกระดูกถูกทำลาย*

***สรุป:*** *เนื้องอกชนิดดีที่เกิดในมือมีภาพคลื่นแม่เหล็กไฟฟ้าที่มีลักษณะแตกต่างกันออกไป 2 ลักษณะที่สำคัญที่พบใน GCTTS คือ สีสม่ำเสมอทั่วก้อนหลังจากฉีดสารเปรียบต่าง และกระดูกถูกทำลาย โดย 2 ลักษณะนี้สามารถช่วยในการวินิจฉัยว่าเป็น GCTTS ในกรณีที่ผู้ป่วยมาด้วยเนื้องอกที่ติดกับเส้นเอ็น*