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MUSCULOSKELETAL IMAGING

ORIGINAL ARTICLE

Hydroxyapatite deposition disease around the hip: outcomes of CT-guided treatment

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PURPOSE
Hydroxyapatite deposition disease (HADD) around the hip joint is a self-limiting condition usually treated conservatively. The aim of the present study is to directly compare the outcomes of CT-guided and conservative treatments in cases of refractory hip HADD.

METHODS
Two groups of patients with refractory hip HADD were prospectively constructed from a pool of 484 patients referred for greater trochanter pain syndrome, based on the presence of calcifications around the hip and the failure of conservative treatment. Study group included 22 hips, which underwent CT-guided barbotage and steroid injection treatment, whereas control group consisted of 28 hips that were treated conservatively. Evaluation of the outcome of both groups was performed over a one-year follow-up period with the use of a score measuring clinical improvement in terms of pain and functional impairment.

RESULTS
Three weeks after the initiation of treatment, study group exhibited significantly higher scores compared with the control group ($P < 0.001$). Improvement scores of the control group were similar to the study group after three months of treatment ($P > 0.1$).

CONCLUSION
CT-guided treatment provides relief of debilitating symptoms in the acute phase.

Deposition of calcium crystals in the form of hydroxyapatite/basic calcium deposition disease (HADD) can occur at a wide variety of anatomical locations, ranging from common sites such as the shoulder (1) to rare sites such as the tibialis posterior (2), longus colli muscles (3), and the metatarsophalangeal joint (4).

Hip is commonly affected by HADD. Lesions can affect hip abductors (5) and adductors (6) causing a variety of clinical manifestations, ranging from asymptomatic to acute painful disease, presenting as greater trochanter pain syndrome and nerve compression syndromes (7, 8). First line imaging modalities for the detection of such calcifications are X-rays and computed tomography (CT). However, HADD can be occasionally identified on hip magnetic resonance imaging (MRI) examinations.

Treatment of hip HADD is usually conservative with the prescription of paracetamol and/or nonsteroidal anti-inflammatory drugs (NSAIDs). However, in symptomatic cases where conservative treatment is not effective, barbotage and steroid injections can be applied under CT-guidance in order to alleviate the symptoms and promote remission of the underlying inflammation. To the best of our knowledge, no literature reports exist on the outcomes of CT-guided injection of symptomatic HADD of the hip, compared with conservative treatment. The aim of the present study is to directly compare the outcomes of CT-guided and conservative treatments in cases of refractory hip HADD.

Methods

Patients

From January 2005 to December 2014, a prospective nonrandomized study was performed. From a group of 484 consecutive patients with a clinical diagnosis of greater trochanter pain syndrome, 192 patients with extra-articular calcifications around the hip were isolated. Ethical approval for this study has been granted by the ethics com-

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mittee of our hospital according to the Helsinki declaration. Only patients with persistent symptoms were included in the study. Patients with gluteus tendon tears, isolated peri-trochanteric bursitis and any intra-articular cause of pain were excluded by means of previous MRI examination. Forty-three patients with calcifications within the soft tissues around the hip were included in the study. The inclusion criteria were: a) presence of calcifications around the hip joint on X-rays and/or MRI; b) failed conservative treatment with per os analgesics/ NSAIDs and physiotherapy for at least four weeks after the onset of symptoms; c) body mass index $\geq$28 kg/m^2 and peripheral obesity; and d) deep location of the calcifications which would be difficult to depict with ultrasonography (US). According to the previously mentioned criteria, 19 patients (22 hips) aged 51.9±11.4 years (5 males, 14 females) comprised the study group and underwent CT-guided treatment. Control group consisted of 24 patients (28 hips) aged 56±7.7 years (8 males and 16 females), who refused to receive the suggested treatment and continued on conservative treatment with NSAIDs and physiotherapy.

Evaluation of the treatment outcome was performed by using a score measuring the clinical improvement in terms of pain and functional impairment, compared with the immediate pretreatment period, at three weeks, three months, six months, and one year, as follows: 1, no improvement; 2, <50% improvement; 3, 50%–70% improvement; 4, >70% improvement. No follow-up imaging examinations were performed. In cases where bilateral treatment was performed, the outcome represents the overall therapy response. Patients were self-evaluated according to the above mentioned criteria and delivered the score to the senior author by phone contact.

Main points

- Hydroxyapatite deposition disease (HADD) around the hip can be treated with CT-guided barbotage.
- In the acute phase, CT-guided treatment offers relief from symptoms compared with conservative treatment.
- There is no difference in the long-term outcome of hip HADD between CT-guided and conservative treatments.

Table 1. Characteristics of patients in the study group

Patient No	Age	Sex	Location (R/L)	Pain duration*
1	48	F	Gluteus medius and minimus (R)	2 m
2	58	F	Gluteus medius and minimus (R)	3 m
3	55	F	Straight head rectus femoris (R)	3 m
4**	59	F	Gluteus medius (R) gluteus minimus (L)	7 w
5	50	M	Gluteus minimus (R)	8 w
6**	54	M	Gluteus minimus	6 m
7	50	M	Gluteus minimus (L)	6 w
8	60	F	Gluteus medius (R)	2 m
9	45	F	Gluteus minimus (R)	6 w
10	40	F	Gluteus medius (R)	2 m
11	45	F	Gluteus medius (L)	2 m
12	57	F	Gluteus medius (R)	6 w
13**	32	F	Gluteus minimus	12 m
14	47	M	Gluteus medius (L)	6 w
15	70	F	Gluteus minimus (R)	12 m
16	79	F	Gluteus minimus (L)	2 m
17	48	F	Gluteus medius (L)	8 m
18	56	F	Gluteus medius (R)	6 m
19	33	M	Gluteus medius (R)	4 m

R, right; L, left; F, female; M, male; m, months; w, weeks.
*At the time of CT-guided treatment; **Bilateral treatment.

CT-guided treatment

Before the procedure, aseptic cleaning utilizing surgical gloves and povidone-iodine solution (10%, repeated twice) and local anesthesia (23G needle, 2% lidocaine), were performed. Under CT-guidance (low dose technique), a CHIBA type needle (18G) was inserted within the calcification area. Axial scans were used to confirm the location of the needle within the calcifications; then, lidocaine was injected, calcifications were fragmented by rotating the needle tip, and saline was injected and aspirated. Lavage was repeated until the aspirated fluid ran clear without visible calcific material. After the end of barbotage, the needle was withdrawn a few millimeters until a "pop" feeling was produced, suggesting intrabursal location, where a mixture of triamcinolone 40 mg (1 mL) with 0.5% bupivacaine (6 mL) and 0.5% lidocaine (1 mL) was injected. Dry needling was not attempted within tendon degeneration areas. All patients underwent the same technique by a single radiologist with 27 years of experience on musculoskeletal imaging and intervention. The procedures were performed with a 16-row scanner (Siemens Somatom) and a 64-row scanner (GE Lightspeed) applying a low dose protocol of 100 effective mAs and 120 KVp for radiation protection reasons. The duration of the procedure did not exceed 10 min in each case.

After the procedure, all patients were instructed to remain in the department for 30 min and to consume analgesics in case of local pain, only for the first 48 hrs in the post-treatment period. One-week excessive loading protection was suggested to all patients in both groups, after which physiotherapy was advised aiming at strengthening the gluteus muscles.

Statistical analysis

Data were analyzed with the use of IBM SPSS Statistics for Windows v.22 (IBM Corp.) and differences between mean improvement scores for each follow-up time point were evaluated with the use of Mann-Whitney U test. Statistical significance was denoted by a *P* value less than 0.05.

Results

Characteristics of study patients are shown in Table 1. Study group comprised

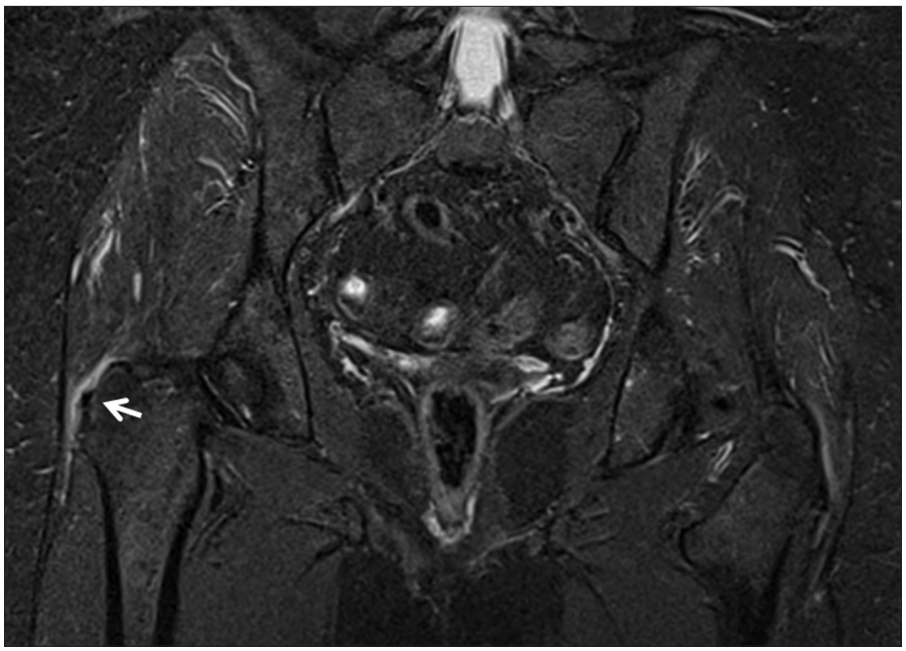

Figure 1. A 56-year-old female patient with right hip pain lasting for six months. The patient received CT-guided treatment twice within a period of four weeks. The coronal short tau inversion recovery (STIR) image shows calcification at the gluteus medius tendon, surrounded by soft tissue edema *(arrow)*.

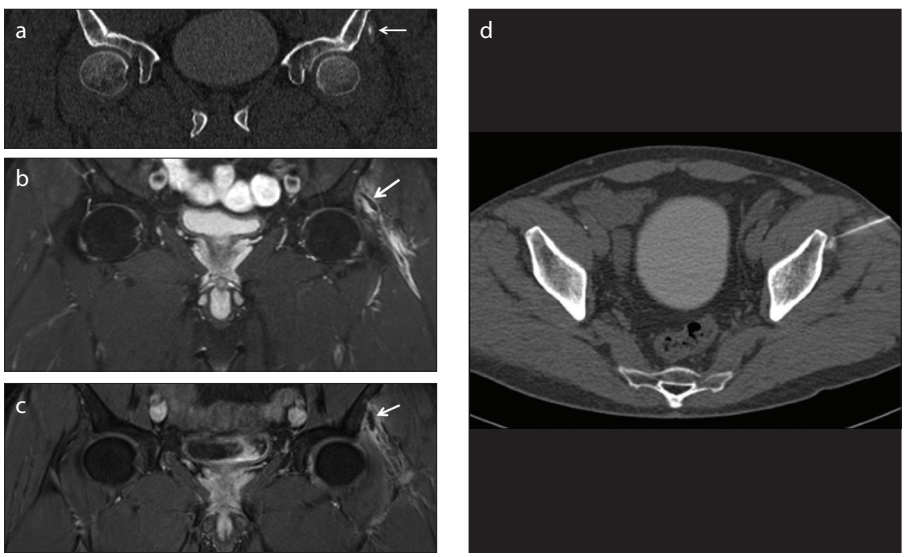

Figure 2. a–d. A 50-year-old male patient with unbearable left side pain, with no response to conservative treatment. The coronal CT reconstruction **(a)**, STIR **(b)**, and fat suppressed contrast-enhanced T1-weighted **(c)** images show the calcification within the gluteus minimus tendon, with surrounding soft tissue edema (*arrow* in **a–c**). Positioning of the needle under CT guidance is shown **(d)**. The hyperdense bladder is the result of intravenous administration of gadolinium-DTPA contrast a few hours before the CT examination.

11 gluteus medius lesions, 10 gluteus minimus lesions, and one calcification of the straight head of rectus femoris. Control group comprised 13 gluteus minimus lesions, 13 gluteus medius lesions, and two gluteus maximus lesions (Figs. 1–3). No statistically significant difference was found between the mean ages of the two groups ($P = 0.149$).

At three weeks post-treatment, mean improvement scores of the study group were significantly higher compared with the control group ($P < 0.001$). However, starting from three months and over the rest of the course of the follow-up, scores of the two groups showed no statistically significant difference ($P > 0.1$) (Fig. 4). Improvement scores at all follow-up time points are shown in Table 2. No complications were observed in any of the patients.

Discussion

In this study we examined the outcomes of CT-guided treatment of HADD around the hip and showed that patients treated with CT-guided barbotage and injections reported a higher improvement score than conservatively treated patients, only in the acute phase. In the long run, both conservative and interventional treatments yielded the same outcome in terms of function and pain.

HADD around the hip is a self-limiting condition, which usually subsides with conservative treatment (9). Clinically it usually presents with acute pain and reduction in range of motion (8, 9). Patients are commonly referred for further examination of the so called "greater trochanter pain syndrome," where MRI can be of value, aiding the differential diagnosis of this diverse group of clinical entities (10, 11). The differential diagnosis includes lateral snapping hip syndrome, bursitis resulting from rheumatologic disorders and tendinopathy/tears of gluteus medius and minimus. The imaging findings of hip HADD vary among different modalities. MRI shows low signal intensity calcifications on all pulse sequences, often surrounded by soft tissue edema, better depicted with short tau inversion recovery sequence. Reactive subgluteal bursitis may also be a feature of the disease. A gradient echo pulse sequence can be added to the protocol, as it is superior to conventional pulse sequences in highlighting the calcifications. US scans revealing hyperechoic microcalcifications can be utilized for both the diagnosis and the guidance of interventional procedures for the treatment of superficially located calcifications. Although CT should not be used for the diagnosis of HADD, it can be used to assist interventional procedures for the treatment of deep calcifications (such as those around the hip), which are very difficult to visualize with the use of US (7). Finally, cases of hip HADD can occasionally mimic clinically neoplastic disorders, requiring the awareness of the clinician and a combination of imaging modalities such as MRI and CT in order to differentiate HADD from malignant conditions (12).

A variety of treatment options exist for the management of hip HADD. Although it has been proposed that all cases of hip HADD can be treated conservatively as pain will eventually subside (9), there are cases where pain during the acute phase of the

Figure 3. a–c. A 55-year-old female with right side pain lasting for three months. The axial T1-weighted **(a)**, coronal STIR **(b)**, and sagittal fat suppressed proton density weighted **(c)** images show calcification within the musculotendinous junction of the straight head of the right rectus femoris (*arrow* in **a–c**) with surrounding soft tissue edema.

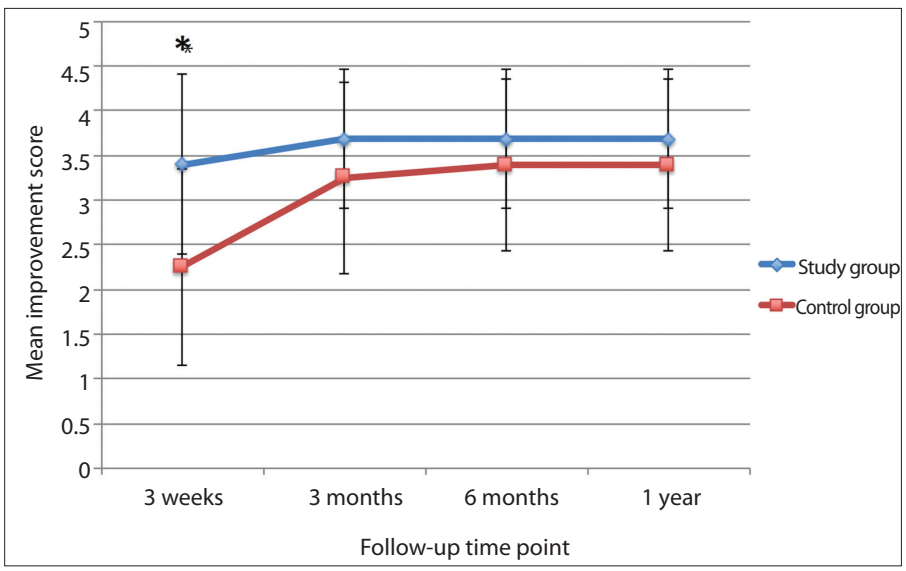

Figure 4. Graph illustrating mean improvement scores of both groups over the course of the follow-up. Each dot represents a mean value and error bars represent standard deviations. *Asterisk* denotes statistical significance ($P < 0.05$).

Table 2. Mean improvement scores of study and control groups

Group	3 weeks	3 months	6 months	1 year
Study	3.4±1	3.68±0.78	3.68±0.78	3.68±0.78
Control	2.25±1.1	3.25±1.07	3.39±0.96	3.39±0.96

Values represent mean±standard deviation.

disease is debilitating and NSAIDs are not sufficient to alleviate the symptoms. In such cases, treatment with US-guided (mainly in cases of superficial calcifications) or CT-guided (in cases of deep calcifications) steroid injections have been described in case reports or limited case series (11, 13). In the study of Park et al. (13) two patients were treated with US-guided injections, reporting complete symptom relief within the first post-treatment month, whereas Pierannunzii et al. (11) treated a proximal rectus femoris calcification with two consecutive CT-guided injections, reporting fast symptom relief after the second injection. Finally, arthroscopic treatment has also been reported as an option for refractory cases (13). However, to the best of our knowledge, no prior study directly compared the effects of conservative and image-guided treatments.

Our study is the first to clearly demonstrate that in the long run, both treatment options have a similar outcome. However, we also demonstrate that in the acute phase, the result of CT-guided barbotage and steroid injection is superior to NSAIDs and physiotherapy. Our results are in line with Choudur and Munk (12) who used CT-guided steroid injections in order to treat a limited number of patients (three females and one male) and reported an excellent response to treatment with complete resolution of symptoms within six months. Moreover, as in our patient groups, the resolution of symptoms in their patients did not justify any follow-up imaging examinations. However, Choudur and Munk (12) did not include a control group of patients receiving conservative treatment and their sample size was limited to conduct conclusions about the treatment outcomes. In addition, their treatment technique did not include barbotage of the calcifications. Our result regarding the similar long-term outcome can probably be attributed to the self-limiting nature of the disorder. The quick recovery noticed in the study group is apparently the result of the steroid action within bursae and barbotage, which reduced the inflammatory reaction.

Our study has strengths and limitations. Its major strength is the prospective selection of patients for both groups and its major limitation is the low number of patients for both groups. However, this can be justified by the frequency of hip HADD, which is low compared with the location around the shoulder. Moreover, the lack of follow-up imaging could be considered as another limitation. The decision not to proceed with further imaging was made based on the relevant results which show that in cases of shoulder HADD, no imaging follow-up is required if the desirable outcome is improvement in terms of function and pain (14, 15). Lanza et al. (16) also suggested that follow-up examinations should be performed only with recurrent symptomatology. Thus,

no clinically relevant information would be added by subjecting the patient to further examinations.

In conclusion, we showed that CT-guided barbotage and injection treatment of HADD lesions around the hip has the same long-term outcome as conservative treatment, but provides relief of debilitating symptoms in the acute phase. Further studies are required to compare the outcome of isolated steroid injections and steroid injections combined with barbotage.

Conflict of interest disclosure

The authors declared no conflicts of interest.

References

1. Speed CA, Hazleman BL. Calcific tendinitis of the shoulder. N Engl J Med 1999; 340:1582–1584. [CrossRef]
2. Jakhere SG, Yadav D, Vasudeo Bharambay H. Acute calcific tendinitis of tibialis posterior tendon (TPT): A rare site of involvement. Eur J Radiol Extra 2011; 77:e17–e20. [CrossRef]
3. Zibis AH, Giannis D, Malizos KN, Kitsioulis P, Arvanitis DL. Acute calcific tendinitis of the longus colli muscle: Case report and review of the literature. Eur Spine J 2013; 22(Suppl 3):434–438. [CrossRef]
4. Mines D, Abbuhl SB. Hydroxyapatite pseudopodagra in a young man: acute calcific periarthritis of the first metatarsophalangeal joint. Am J Emerg Med 1996; 14:180–182. [CrossRef]
5. Hoffmann A, Pfirrmann CWA. The hip abductors at MR imaging. Eur J Radiol 2012; 81:3755–3762. [CrossRef]
6. Tamangani J, Davies AM, James SLJ, Christie-Large M. Calcific tendonitis of the adductor brevis insertion. Clin Radiol 2009; 64:940–943. [CrossRef]
7. Ea H-K, Lioté F. Diagnosis and clinical manifestations of calcium pyrophosphate and basic calcium phosphate crystal deposition diseases. Rheum Dis Clin N Am 2014; 40:207–229. [CrossRef]
8. Gong Y, Yang C, Jingyu W, et al. Calcific tendinitis of the gluteus maximus tendon with sciatic pain. Eur J Radiol Extra 2010; 76:e59–e60. [CrossRef]
9. Paik NC. Acute calcific tendinitis of the gluteus medius: an uncommon source for back, buttock, and thigh pain. Semin Arthritis Rheum 2014; 43:824–829. [CrossRef]
10. Klontzas ME, Karantanas AH. Greater trochanter pain syndrome: A descriptive MR imaging study. Eur J Radiol 2014; 83:1850–1855. [CrossRef]
11. Pierannunzii L, Tramontana F, Gallazzi M. Case report: Calcific tendinitis of the rectus femoris: A rare cause of snapping hip. Clin Orthop Relat Res 2010; 468:2814–2818. [CrossRef]
12. Choudur HN, Munk PL. Image-guided corticosteroid injection of calcific tendonitis of gluteus maximus. J Clin Rheumatol 2006; 12:176–178. [CrossRef]
13. Park SM, Baek JH, Ko YB, Lee HJ, Park KJ, Ha YC. Management of acute calcific tendinitis around the hip joint. Am J Sport Med 2014; 42:2659–2665. [CrossRef]
14. Serafini G, Sconfienza LM, Lacelli F, Silvestri E, Aliprandi A, Sardanelli F. Rotator cuff calcific tendonitis: short-term and 10-year outcomes after two-needle us-guided percutaneous treatment--nonrandomized controlled trial. Radiology 2009; 252:157–164. [CrossRef]
15. Cacchio A, Rompe D, Serafini G, Sconfienza LM, Sardanelli F. US-guided percutaneous treatment of shoulder calcific tendonitis: some clarifications are needed. Radiology 2010; 254:990–991. [CrossRef]
16. Lanza E, Banfi G, Serafini G, et al. Ultrasound-guided percutaneous irrigation in rotator cuff calcific tendinopathy: what is the evidence? A systematic review with proposals for future reporting. Eur Radiol 2015; 25:2176–2183. [CrossRef]