



## Characteristics of dynamic magnetic resonance imaging of symptomatic chronic calcifying tendinitis: preliminary case reports

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**Background:** The symptoms of chronic calcifying tendinitis consist of shoulder contracture and impingement sign. However, there have been no reports about the use of imaging studies to differentiate these 2 clinical symptoms. A “burning sign” caused by abnormal blood flow was previously reported in the shoulder joint in patients with frozen shoulder by dynamic magnetic resonance imaging. This burning sign was related to pain. The purpose of this study was to investigate the dynamic magnetic resonance imaging findings in patients with symptomatic chronic calcifying tendinitis and to examine the relationship between the location of the burning sign and the physical findings.

**Methods:** We retrospectively analyzed data for 6 patients with symptomatic chronic calcifying tendinitis (mean age, 55.5 ± 9.3 years; 4 women). The range of shoulder motion, impingement sign, and location of the burning sign were assessed.

**Results:** Four patients had an impingement sign without shoulder contracture, and the other 2 patients had shoulder contracture. All the patients with an impingement sign also had a burning sign around the calcium deposit and no enhancement in the rotator interval and axillary pouch. Conversely, all the patients with contracture had a burning sign in the rotator interval and axillary pouch and no enhancement around the calcium deposit.

**Conclusions:** Dynamic magnetic resonance imaging identified 2 types of findings in patients with symptomatic chronic calcifying tendinitis: a burning sign in the rotator interval and axillary pouch or around the calcium deposit. The former pattern may be related to shoulder contracture, whereas the latter may be related to impingement sign.

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Calcifying tendinitis is a common shoulder condition, with a reported incidence of asymptomatic calcifications of 2.7%.<sup>1</sup> Calcifying tendinitis is classified as acute (duration of <1 month), sub-acute (duration of 1–6 months), or chronic (duration of >6 months).<sup>2</sup> The symptoms of chronic calcifying tendinitis consist of shoulder contracture and an impingement sign, and it is necessary to distinguish these 2 symptoms to allow appropriate treatment. Physical examination and injection of local anesthesia into the subacromial bursa can be used to differentiate these 2 symptoms and to decide on a treatment strategy. However, no studies have reported on the use of imaging to differentiate between them.

Sasanuma et al<sup>4</sup> examined the dynamic magnetic resonance imaging (MRI) findings in patients with frozen shoulder and

reported that frozen shoulder was associated with an abnormal cluster of blood flow and dispersion of contrast medium around the rotator interval, axillary pouch, and groove from the early phase to the late phase. They called this phenomenon the “burning sign” and reported that an obvious burning sign in the rotator interval was associated with a high pain score. The burning sign indicated by abnormal vessels in dynamic MRI may thus be used to indicate the pathology in patients with shoulder disease.

The current preliminary study was therefore performed to investigate the dynamic MRI findings in patients with symptomatic chronic calcifying tendinitis and to examine the relationship between the location of the burning sign and the physical findings.

### Materials and methods

This study was conducted in the Orthopedic Department of Jichi Medical University. The institutional review board of the ethics committee at our institution approved the study and waived the

This study was approved by the Jichi Medical University Institutional Review Board (protocol no. A19-088).

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**Table 1**  
Patients' characteristics

Case	Age, yr	Sex	Side	ROM			Impingement sign	Location of enhancement on dynamic MRI		
				AE, degrees	ER, degrees	IR		RI	AP	Calcium
1	51	M	L	160	60	T12	+	–	–	+
2	68	F	L	140	70	T8	+	–	–	+
3	41	M	L	140	65	T10	+	–	–	+
4	62	F	R	150	60	T10	+	–	–	+
5	62	F	R	80	0	L5	–	+	+	–
6	49	F	L	90	10	L5	–	+	+	–

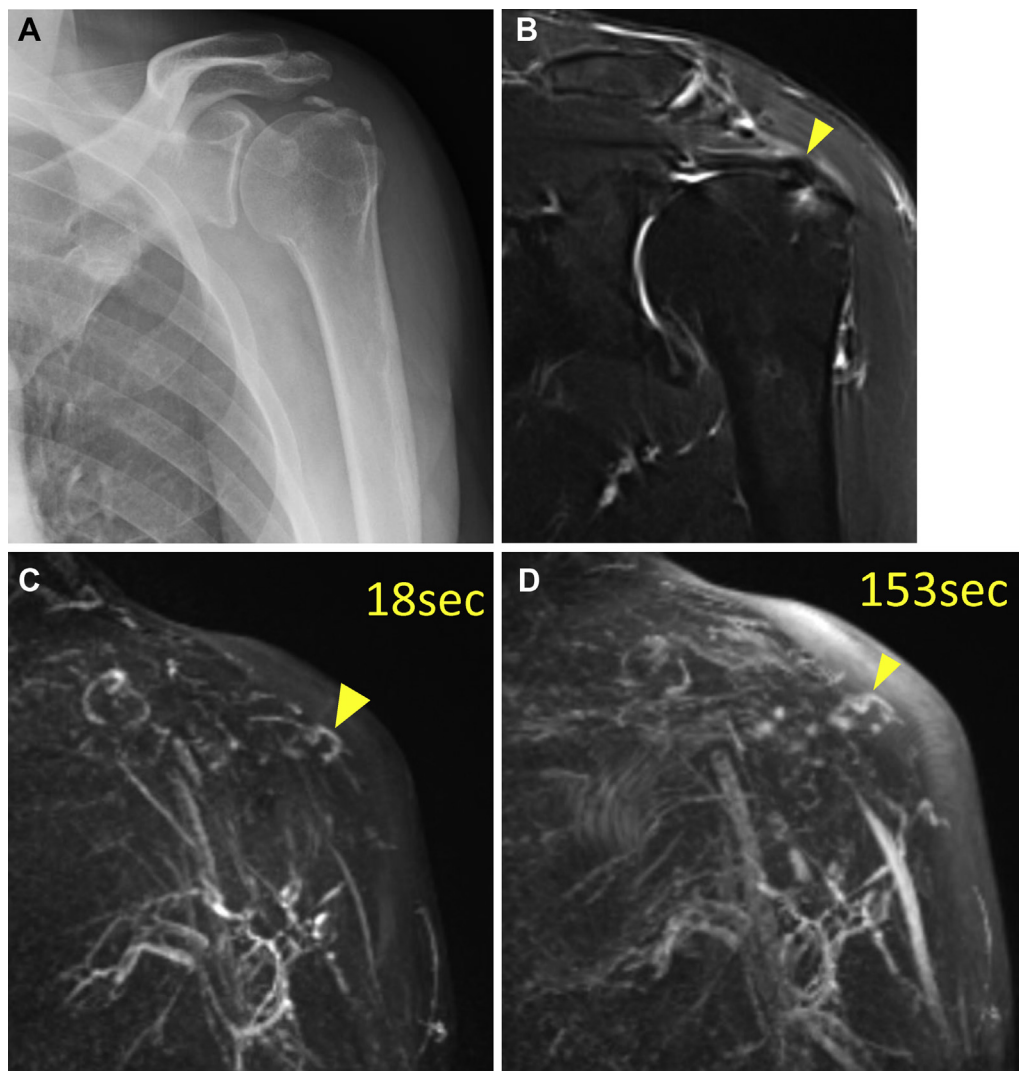
M, male; F, female; L, left; R, right; ROM, range of motion; AE, anterior elevation; ER, external rotation; IR, internal rotation; MRI, magnetic resonance imaging; RI, rotator interval; AP, axillary pouch.

requirement for formal written informed consent because of the retrospective nature of the study (protocol A19-088).

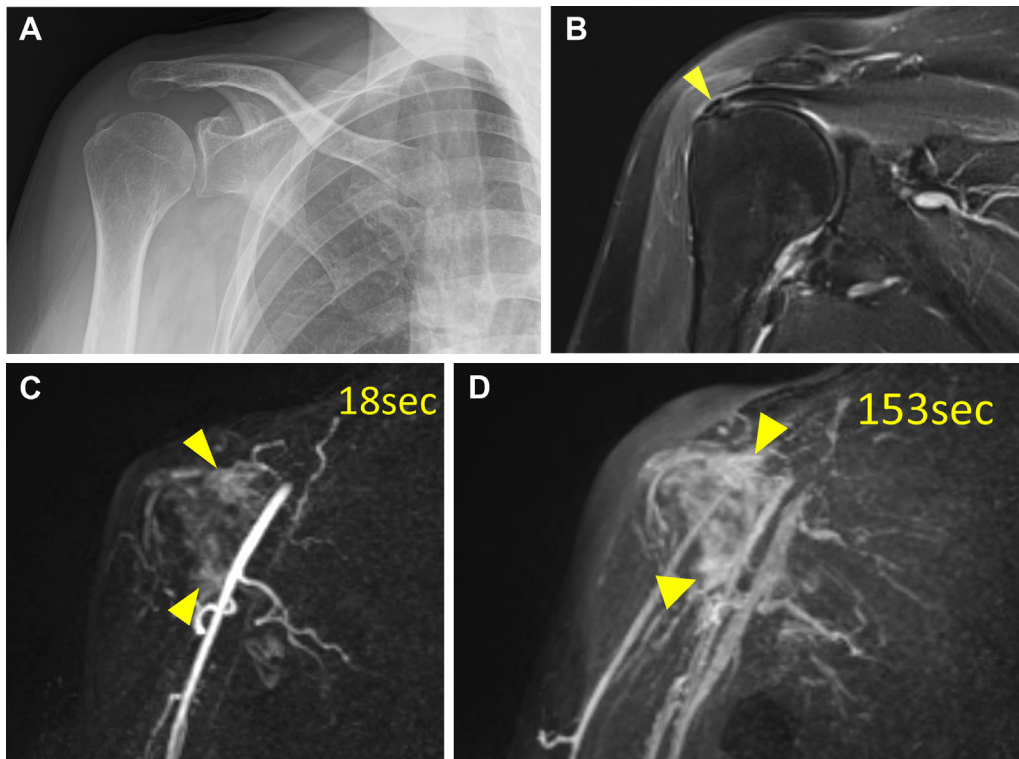
Data for 6 patients with chronic symptomatic calcifying tendinitis from January 2019 to December 2019 were analyzed retrospectively using the electronic medical database. Patients who had

symptomatic calcifying tendinitis for >6 months were included. Patients with rotator cuff tear, shoulder osteoarthritis, and a history of shoulder surgery were excluded.

We assessed the range of shoulder motion (active anterior elevation, external rotation at side, and internal rotation of thumb



**Figure 1** Case 1: A 51-year-old man with symptomatic chronic calcifying tendinitis with a main symptom of shoulder impingement. (A) Initial radiograph of the left shoulder showed a calcium deposit in the supraspinatus tendon. (B) T2 fat-suppression oblique coronal view before intravenous gadolinium injection revealed the calcium deposit in the supraspinatus tendon (▶). (C) Dynamic magnetic resonance imaging findings of the oblique coronal view at 18 seconds (early phase) after intravenous gadolinium injection showed light abnormal enhancement around the calcium deposit (▶). (D) Dynamic magnetic resonance imaging findings at 153 seconds (late phase) showed strong enhancement around the calcium deposit (▶).



**Figure 2** Case 5: A 62-year-old woman with symptomatic chronic calcifying tendinitis with a main symptom of shoulder contracture. (A) Initial radiograph of the right shoulder showed a calcium deposit. (B) T2 fat-suppression oblique coronal view before intravenous gadolinium injection revealed the calcium deposit in the supraspinatus tendon (►). (C) Dynamic magnetic resonance imaging findings of the oblique coronal view at 18 seconds (early phase) after intravenous gadolinium injection showed mild abnormal enhancement in the rotator interval and axillary pouch (►). (D) Dynamic magnetic resonance imaging findings at 153 seconds (late phase) showed strong enhancement in the rotator interval and axillary pouch (►).

vertebral level) and identified the impingement sign using the Neer test.

All patients underwent 1.5-tesla MRI (MAGNETOM Aera; Siemens Healthineers, Erlangen, Germany). After bolus intravenous injection of gadolinium-chelated contrast material, 3D fast low-angle images (repetition time, 3.1 milliseconds [ms]; echo time, 1.26 ms) were obtained in the oblique coronal plane every 9 seconds for a total of 3 minutes. The early, middle, and late phases were defined as 18, 81, and 153 seconds after the initiation of imaging, respectively. We assessed the burning sign on dynamic MRI in the late phase at the rotator interval, axillary pouch, and around calcium deposits.

## Results

The mean age of the patients was  $55.5 \pm 9.3$  years (range, 41–68 years), including 2 men and 4 women. The mean illness duration was  $42.3 \pm 30$  months (range, 6–120 months). Four patients had an impingement sign without shoulder contracture, and the other 2 patients had shoulder contracture. All the patients with an impingement sign had a burning sign around the calcium deposit and no enhancement in the rotator interval and axillary pouch. Conversely, all the patients with contracture had a burning sign in the rotator interval and axillary pouch but no enhancement around the calcium deposit (Table 1).

### Case presentations

#### Case 1

A 51-year-old right-handed man had complained of continuous left shoulder pain for 7 years. He had visited 3 other hospitals

before coming to our hospital. Conservative treatment was performed, including administration of nonsteroidal anti-inflammatory drugs, steroid injections into the subacromial bursa, and rehabilitation. However, the patient still had severe shoulder pain with an active range of shoulder motion as follows: anterior elevation,  $160^\circ$ ; external rotation at side,  $60^\circ$ ; and internal rotation, T12. He had an impingement sign including a positive Neer test. Initial radiographs revealed a calcium deposit between the acromion and humeral head. Dynamic MRI showed a burning sign around the calcium deposit after intravenous gadolinium injection (Fig. 1).

#### Case 5

A 62-year-old right-handed woman had complained of continuous right shoulder pain for 8 months and had visited 2 other hospitals before coming to our hospital. Despite conservative treatment as in case 1, the patient had severe shoulder pain and an active range of shoulder motion as follows: anterior elevation,  $60^\circ$ ; external rotation at side,  $0^\circ$ ; and internal rotation, buttock. Physical examination revealed shoulder contracture. Initial radiographs revealed a calcium deposit between the acromion and humeral head. Dynamic MRI showed a burning sign at the rotator interval and axillary pouch after intravenous gadolinium injection (Fig. 2).

## Discussion

This study provides the first case reports demonstrating the dynamic MRI findings in patients with symptomatic chronic calcifying tendinitis. There were 2 types of dynamic MRI findings: a burning sign in the rotator interval and axillary pouch, and a burning sign around the calcium deposit. The current findings

suggest that the former may be related to shoulder contracture, whereas the latter may be related to the impingement sign.

Although no previous studies have investigated the dynamic MRI findings in patients with calcifying tendinitis, 2 studies examined the dynamic MRI findings in patients with frozen shoulder and rotator cuff tear. One study showed normal visualization of blood flow around the shoulder joint in healthy shoulders but a frequent burning sign in the rotator interval, axillary pouch, and bicipital groove in patients with frozen shoulder.<sup>4</sup> This previous study also reported that an obvious burning sign in the rotator interval was associated with a high pain score. Furthermore, Sasanuma et al<sup>5</sup> compared the dynamic MRI findings in patients with symptomatic rotator cuff tear and frozen shoulder. The burning sign occurred in the rotator interval and axillary pouch in all cases of frozen shoulder but in only about 50% of cases of symptomatic rotator cuff tear. All cases of the burning sign in patients with symptomatic rotator cuff tear occurred in the rotator interval and were associated with the pain score and the range of shoulder motion. These 2 previous reports also demonstrated a relationship between the burning sign and pain.

Another study also showed a relationship between abnormal blood flow and pain. Okuno et al<sup>3</sup> performed angiography in patients with frozen shoulder and identified abnormal neovessels at the rotator interval in all patients. Furthermore, night pain was decreased by transcatheter arterial embolization at 1 week after the procedure.

The current case series identified 2 types of dynamic MRI findings: a burning sign in the rotator interval and axillary pouch, and a burning sign around the calcium deposit. Notably, patients with symptomatic chronic calcifying tendinitis with contracture showed the former type, whereas those with an impingement sign had the latter type. In terms of the relationship between the burning sign and pain,<sup>4,5</sup> it is possible that dynamic MRI findings may be useful for distinguishing between contracture-type and impingement-type symptomatic chronic calcifying tendinitis.

In addition to distinguishing the pathology, dynamic MRI may also be useful for determining the appropriate treatment strategy. For example, symptomatic chronic calcifying tendinitis characterized by a burning sign in the rotator interval and axillary pouch but not around the calcium deposit may be managed by shoulder joint

manipulation or capsule release without removal of the calcium deposit.

The current study was a preliminary study, and further studies with more patients are needed to confirm the current findings.

## Conclusion

This study presents the first case reports of the dynamic MRI findings in patients with symptomatic chronic calcifying tendinitis. We identified 2 distinct types of dynamic MRI findings: a burning sign in the rotator interval and axillary pouch and a burning sign around the calcium deposit, which may be related to shoulder contracture and the impingement sign, respectively.

## Disclaimer

The authors, their immediate families, and any research foundations with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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