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Delaminated rotator cuff tears can be easily missed! - A case report

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Abstract
Delaminated rotator cuff tear is defined as a tear occurring between rotator cuff layers. Its prevalence is controversial due to substantial variations in its definition. Diagnosing delamination on preoperative imaging can be challenging as conventional MRI has poor yield in identifying them. A 69-year-old man sustained a rotator cuff tear following a fall on outstretch arm. Diagnostic arthroscopy revealed a delaminated full thickness tear (Type 1b) of the supraspinatus which was inconsistent with the preoperative MRI finding. En masse repair of the tear via the double row suture technique was then performed. The patient was pain free and was independent with activities of daily living at 6-month follow-up. Delamination in rotator cuff tear is a negative prognostic factor for post repair outcomes and can be missed if not specifically sought for. This report aims to share our experience on how to improve diagnosis rates for these tears.

Keywords: Rotator cuff tears, shoulder, delamination.

Introduction
Delaminated rotator cuff tear refers to a form of degeneration within the rotator cuff tendon and is generally defined as a tear occurring between rotator cuff layers.
The prevalence of delamination in rotator cuff tears has been reported to range from 38% to 92% [1], and this could be attributed to substantial variations in its definition among various studies [2, 3]. Diagnosing delamination is made more challenging due to limitations in conventional imaging techniques to identify them. Notably, while no studies evaluated the sensitivity and specificity of conventional MRI to diagnose the presence of delaminated tears, the prevalence of delamination detected on conventional MRI was only 1.8% [4], which is significantly lower than that in the orthopedic literature which identifies delaminated tears on the basis of surgical findings.
However, it is important to identify delaminated tears as they are found to be a negative prognostic factor in post rotator cuff repair outcomes [5] and repairing both layers is essential in keeping retear rates low. We present a case of a delaminated rotator cuff tear that was missed on MRI but subsequently identified and repaired, with good functional outcomes post-operatively.

Case presentation and investigations
A 69-year-old man with no significant medical history presented with severe left shoulder pain for one month following a fall on outstretch arm during a family holiday. Subsequently, he experienced severe pain in his left shoulder, leading to weakness and significant impairment to his activities of daily living (ADL). He denied any history of shoulder symptoms or any previous trauma prior to this episode. On examination, active range of movement was notably decreased due to pain, forward flexion was 0-90°, abduction was 0-80°, and external rotation was 0-20°. In terms of power, left supraspinatus and infraspinatus were found to be weaker compared to the contralateral side (4/5). Additionally, shoulder impingement tests were positive. Other than that, there were no signs of shoulder instability or tenderness over the biceps tendon.
After obtaining conventional shoulder MRI scan, a diagnosis of a small supraspinatus full thickness tear was made. MRI scan revealed a 2cm tear along the coronal plane and a 1 cm tear along the anterior posterior plane of the supraspinatus. (Fig 1.) No other findings such as delamination was noted. Subsequently, the patient was scheduled for a left arthroscopic rotator cuff repair surgery.

Arthroscopic evaluation and treatment

The surgery was performed under aseptic precautions, with the patient under general anesthesia in a beach chair position. Standard arthroscopic portals (Anterosuperior, posterior, anterolateral and lateral) were established. Arthroscopic examination was performed following debridement of the rotator interval. (Fig 2.) Examination of the undersurface of the supraspinatus was unremarkable, inconsistent with the MRI findings of a full thickness supraspinatus tear. However, on abduction of the arm, a small tear was seen. (Fig 3) On examination of the subacromial space, the bursal side of the supraspinatus was visibly torn and retracted. (Fig 4) As a result of the identification of the small tear on the articular side of the supraspinatus, a diagnosis of a type 1b delaminated tear (Full thickness tear in which bursal layer is more medially retracted than the articular layer) according to Choo *et al.*' s classification was made [1]. It is important to note that a diagnosis of a partial tear on the bursal side of the rotator cuff could have been made if the articular side was not examined carefully during diagnostic arthroscopy.

Following the identification of the delaminated rotator cuff tear, the tendon was mobilized with the arthroscopic tendon grasper and en masse repair of the tear via the double row suture technique was performed. The medial suture is carefully passed through the entire articular and bursal layers and bridged with lateral anchors. Subsequently, the patient's left shoulder was immobilized with a sling and was admitted to the Orthopaedic ward for postoperative recovery. He was discharged the next day and started his postoperative rehabilitation program. He was placed in an arm sling and began doing pendulum exercises with passive range of motion exercises as tolerated. The sling was removed after 6 weeks, and he was started on gradually increasing active shoulder range of motion exercises. Strengthening exercises were initiated at 12 weeks after the surgery.

Outcome and follow-up

The patient was scheduled for post-operative assessment at 3- and 6-months follow-up. At 6 months post-operatively, the patient was well and did not complain of any pain. He was compliant to his rehabilitation and strengthening exercises and was able to perform all ADLs without any difficulties. On examination, there was significant improvement to all active ranges of motion of the shoulder, with flexion of 0-130°, abduction of 0-130° and external rotation of 0-35°. While the ranges of motions remained limited, this is not unexpected as the patient underwent a more gradual rehabilitation program given the complex nature of a delaminating tear. In terms of power, both supraspinatus and infraspinatus were noted to have regained full power (5/5). The patient was satisfied with the result and returned to his home country. He subsequently did not return and was lost to follow-up.

Fig 1: MRI of the left shoulder. The full-thickness tear is small, and the delamination is not evident, hence it is easy to misdiagnose such a tear. In retrospect, the delaminated layer is seen as pointed by the red arrow.

Fig 2: Arthroscopic findings. Left to right: (a) Intact biceps and superior labrum (b) Intact labrum, MGHL and subscapularis (c) Debridement of the rotator interval

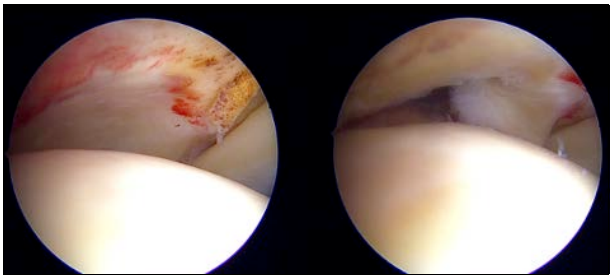

Fig 3: Arthroscopic findings. Left to Right: (a) Undersurface of supraspinatus intact (b) Small tear seen on abduction of the arm

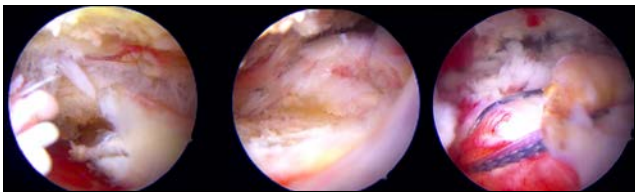

Fig 4: Arthroscopic findings. Left to Right: (a) (b) Torn bursal side of the supraspinatus tendon visualized in the subacromial space. (c) Post-repair of supraspinatus tear

Discussion

From diagnosis to surgical repair, delaminated rotator cuff tears remain difficult to manage. Delamination is easily missed in the preoperative investigations and can be overlooked if it is not specifically sought for intra-operatively [6]. While limitations in standard imaging techniques in identifying delaminated tears seems to exist, the problem of missing delamination pre-operatively might be exacerbated by the existence of two separate classification systems for arthroscopic finding and

radiological finding respectively [6]. Choo *et al*. classified delaminated rotator cuff tears into 6 types based on MRI findings, according to the degree of tear and retraction degree of the bursal and articular layer respectively on the coronal plane [1]. Han *et al*. described delamination based on arthroscopic findings in the three-dimensional plane. Notably, he further classified delaminate tears based on the presence of a posterior delamination (Type A2 or Type B2) [3]. Given that most delamination occurs in the posterior region of the torn site, delamination could be missed by radiologists using Choo's classification system, which does not take into account partial tears along the axial/transverse cuts [3].

In our case report, we highlighted the issue by illustrating a case of a missed delaminated tear preoperative that was identified and repaired intra-operatively, resulting in good post-operative outcomes. The initial MRI was suggestive of a conventional small-sized tear and the danger here is that a small tear may be dismissed as simple and treated non-surgically. Furthermore, any attempts to repair them may be undertaken by inexperienced surgeons who may miss the delamination intra-operatively or may be unable to repair them well, possibly leading to sub-optimal postoperative outcomes.

Pre-operative detection of delaminated tears is important as it affects surgical planning and can serve as a guide for surgeons to localize the site of the lesion intra-operatively. However, there are few studies evaluating the use of pre-operative imaging to diagnose delaminated tears. As previously mentioned, and evident in our case report, convention MRI has limited utility in diagnosing delaminated tears. MR arthrography (MRA) has emerged as a viable imaging modality to diagnose delaminated tears, with Choo *et al* reporting its sensitivity and specificity to be 92% and 94% respectively [1]. However, MRA cannot replace conventional MRI as one of the first line imaging for rotator cuff tears due to practical concerns, such as the risk of adverse reactions to contrast as well as additional radiologist time. Given the limitations in pre-operative imaging techniques, shoulder surgeons should perform diagnostic arthroscopy more objectively.

Arthroscopic examination intra-operatively serves as the final checkpoint to identify any previously undiagnosed pathology. Therefore, it is important for shoulder surgeons to be aware that delamination may be missed out on pre-operative imaging, and thus search for them intra-operatively. Several authors have proposed various ways to increase the accuracy in picking up delaminated tears. For instance, Han *et al*. proposed that using a 30° scope introduced through the back of the shoulder makes it difficult to diagnose tendon delamination, which occurs more commonly at the level of the infraspinatus posteriorly, and recommended alternating between posterolateral and lateral portals to potentially reveal any posterior delamination [3, 7]. Boileau *et al*. also recommended placing the arthroscope in the lateral portal at the time of repair to reveal any delamination [2]. In terms of location of the tear, Tanaka *et al*. found that the larger the size of the tear, the more frequently the appearance of the delamination was limited to the posterior part and Han *et al*. also found that 88% cases of delamination develop in the posterior region of the torn site, compared to 42% in the anterior area [3, 8]. Therefore, shoulder surgeons should examine the posterior side of the rotator cuff more thoroughly. In our case report, delamination was identified when the shoulder was abducted and we postulate that abduction of the shoulder may help to reveal any possible delamination. Biomechanical studies found that the degree of glenohumeral abduction creates a difference in strain and thus shearing force between the layers of the rotator cuff, thereby contributing to the pathogenesis of delamination [6, 9]. Hence, abducting the shoulder during arthroscopic evaluation might accentuate the difference in the degree of retraction of each rotator cuff layer, thereby making any possible delamination more apparent.

Due the growing prevalence rotator cuff tears worldwide, it may be counter-productive and time-consuming to investigate every patient extensively for delaminated tears. Hence, identifying high risk profiles for delamination and investigating them more cautiously can be useful and practical. The relationship between patient demographics and prevalence of delamination is controversial, with Matsuki *et al*. noted that delaminated rotator cuff tears are higher in the elderly and in women, while two other studies showed that prevalence of delaminated rotator cuff tear showed no significant correlation with patient demographics [6, 7]. On the other hand, Iwashita *et al*. found a significantly higher incidence of delamination in patients with more than 2 tendons involved while Boileau *et al*. found that tendon delamination increases with tear size and degree of retraction [2, 10] Boileau *et al*. so found that active external rotation was significantly lower in tears with delamination, and this was evident in the current case study which shows that external rotation was more significantly impaired as compared to forward flexion and abduction [2]. Therefore, shoulder surgeon should be more cautious when evaluating patients presenting with larger tears and multiple tendon involvement, as well as patients presenting with severe limitations in external rotation.

Conclusion

Delamination in rotator cuff tear is a negative prognostic factor for post repair outcomes and can be missed if not specifically sought for. Careful arthroscopic evaluation should be conducted by shoulder surgeons in view of the limitations in preoperative imaging. Prompt identification of delaminated tears and instituting appropriate suture repair technique can lead to favorable outcomes following surgery.

Acknowledgments

None.

Conflict of Interest

None.

References

1. Choo HJ, Lee SJ, Kim JH. Delaminated tears of the rotator cuff: prevalence, characteristics, and diagnostic accuracy using indirect MR arthrography. AJR Am J Roentgenol. 2015;204:360-366. 2015/01/24. DOI: 10.2214/ajr.14.12555.
2. Boileau P, Andreani O, Schramm M. The Effect of Tendon Delamination on Rotator Cuff Healing. Am J Sports Med. 2019;47:1074-1081. 2019/04/04. DOI: 10.1177/0363546519835491.
3. Han Y, Shin JH, Seok CW. Is posterior delamination in arthroscopic rotator cuff repair hidden to the posterior

viewing portal? Arthroscopy. 2013;29:1740-1747. 2013/11/12. DOI: 10.1016/j.arthro.2013.08.021.
4. Walz DM, Miller TT, Chen S. MR imaging of delamination tears of the rotator cuff tendons. Skeletal Radiol. 2007;36:411-416. 2007/03/06. DOI: 10.1007/s00256-006-0265-3.
5. Flurin P-H, Landreau P, Gregory T. Cuff Integrity after Arthroscopic Rotator Cuff Repair: Correlation with Clinical Results in 576 Cases. Arthroscopy: The Journal of Arthroscopic & Related Surgery. 2007;23:340-346. DOI: https://doi.org/10.1016/j.arthro.2007.01.005.
6. Kim JH, Jung SH. Delaminated Rotator Cuff Tear: Concurrent Concept and Treatment. Clin Shoulder Elb. 2019;22:159-170. 2019/09/01. DOI: 10.5397/cise.2019.22.3.159.
7. Matsuki K, Murata R, Ochiai N. Histological Assessment of Delamination Observed in Rotator Cuff Tears. Katakansetsu. 2006;30:461-464. DOI: 10.11296/katakansetsu1977.30.3_461.
8. Tanaka M, Nimura A, Takahashi N. Location and thickness of delaminated rotator cuff tears: Cross-sectional analysis with surgery record review. JSES Open Access. 2018;2:84-90. 2019/01/25. DOI: 10.1016/j.jses.2017.11.004.
9. Reilly P, Amis AA, Wallace AL. Mechanical factors in the initiation and propagation of tears of the rotator cuff. Quantification of strains of the supraspinatus tendon *in vitro*. J Bone Joint Surg Br. 2003;85:594-599. 2003/06/10. DOI: 10.1302/0301-620x.85b4.12062.
10. Iwashita S, Hashiguchi H, Okubo A. Characteristics of the patients with delaminated rotator cuff tear. Sicot J. 2018;4:28. 2018/07/12. DOI: 10.1051/sicotj/2018022.

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