J Shoulder Elbow Surg (2019) 28, e190–e192

ELSEVIER

Journal of Shoulder and Elbow Surgery

www.elsevier.com/locate/ymse

Severe subacromial-subdeltoid inflammation with rice bodies associated with implantation of a bio-inductive collagen scaffold after rotator cuff repair

Steven J. Barad, MD*

Private Practice, Sacramento, CA, USA

Keywords: Bio-inductive implant; acute bursitis; subacromial-subdeltoid bursa; rice body; foreign body reaction; rotator cuff tear

Case report

A 48-year-old man underwent rotator cuff repair augmented with a Regeneten bio-inductive implant (Smith & Nephew, Andover, MA, USA). At 4 months after the procedure, an acute, massive swelling developed in the subacromial space associated with intense pain. The patient had no chills or fever, and the complete blood count showed a normal white blood cell (WBC) count. The sedimentation rate was normal, at 19 mm/h, but the C-reactive protein level was abnormal, at 24.9 mg/L (normal level < 8 mg/L). The finding of the rheumatoid factor test was negative. Aspiration of the bursa revealed bloody, turbid fluid that was submitted for cytologic analysis and Gram staining. The cell count included a markedly elevated WBC count (14,449 WBCs/μL, 54% neutrophils). Magnetic resonance imaging (MRI) showed a healed rotator cuff tendon with significant swelling with particulate debris in the subacromial-subdeltoid bursa (Fig. 1 and Fig. 2). The particulate debris resembled rice bodies.

Because infection was suggested, the patient underwent surgery to perform washout, débridement, and placement of tubes for drainage. The material retrieved during the surgical procedure looked purulent, containing multiple dense debris (Fig. 3). The patient received intravenous antibiotics while final cultures were awaited. Both the initial aspirate obtained in the office and the second aspirate obtained at the time of surgery were held for 14 days. Both failed to grow any organisms. With negative culture findings, the antibiotics were stopped and the patient began physical therapy. At 4 weeks, the swelling was completely gone. The C-reactive protein level at 6 weeks' follow-up had normalized. At 3 months' follow-up (7 months after rotator cuff repair), the pain had nearly completely disappeared and the patient had returned to work.

Discussion

The Regeneten implant has 3 essential components. The implant itself is highly purified collagen made of bovine tendon. It is made of collagen fibers processed to create a highly oriented and highly porous collagen scaffold cleansed of animal DNA.[1,15] By incorporating onto the host's rotator cuff tendon, thickness is added and strain is reduced.[3] Healing of the tendon is therefore thought to be facilitated. The construct has 2 other parts. Staples made of polyether ether ketone are used laterally on the patch to hold it in place along the greater tuberosity. Polyether ether ketone does not dissolve. However, allergic responses to

*Reprint requests: Steven J. Barad, MD, 8120 Timberlake Way, Ste 109, Sacramento, CA 95823, USA.

E-mail address: innakur8441@gmail.com.

https://doi.org/10.1016/j.jse.2019.02.019

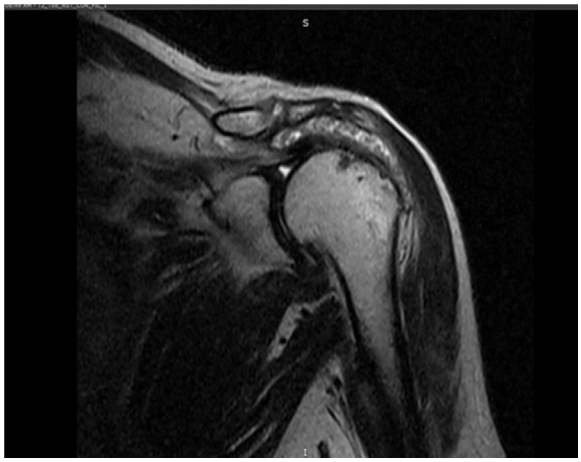

Figure 1 Coronal image in patient with rice body formation with bio-inductive collagen.

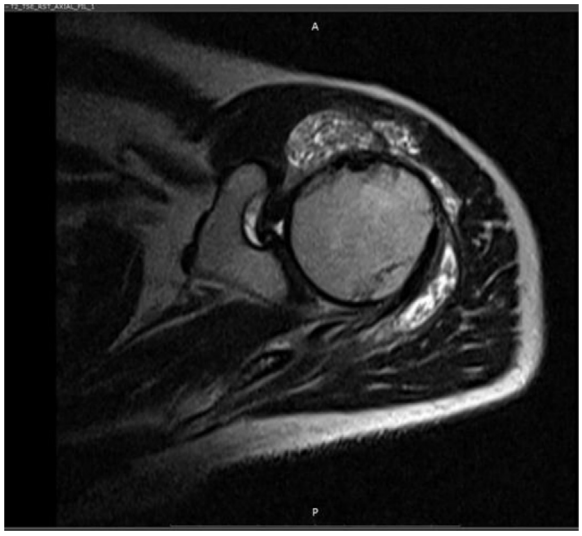

Figure 2 Axial image in patient with rice body formation with bio-inductive collagen.

implants made of this material have been reported in the literature.[9,12]

The medial side of the implant is held in place with several staples made of polylactic acid, a combination of both the L- and D-isomers of lactic acid. At 4 to 6 months, the staples begin to dissolve by a process of hydrolysis. The D-isomer delays the reaction as a material made only of the L form of lactic acid would dissolve more quickly. The process is usually complete by 1 year (C. Van Kampen, personal communication). Regardless of the time to degradation, the process of degradation is associated with a foreign body response that can evoke an inflammatory reaction.[5] Reactions to implants and suture material made of similar substances have been researched and well reported in the literature.[7,10,12,13,19] In a case report on a rotator cuff repair by Sivaloganathan et al,[16] a suture anchor made of poly-L-lactic acid appeared to cause

Figure 3 Fluid from subacromial bursa in patient with rice body formation with bio-inductive collagen.

severe inflammatory bursitis with rice body formation. They termed the MRI appearance the "risotto sign." Rice body formation may result from de novo formation within the synovial fluid.[11] Other authors have suggested that formation occurs as a result of microinfarction of the synovium and shedding, followed by fibrin encasement.[4] Formation of multiple rice bodies with massive subacromial-subdeltoid bursitis is an associated MRI finding in rheumatoid disease, chondrocalcinosis, seronegative arthritis, and septic conditions.[2,8,17,18] Rice body formation simply occurring as a result of chronic bursitis absent all the aforementioned conditions has been reported.[6,14] All these conditions seem to have inflammation as a common theme. In preliminary research regarding use of the Regeneten bio-inductive implant, acute bursal swelling did occur in 1 of 13 patients.[1] This patient was treated with an arthroscopic washout. No rice bodies were found, and the rotator cuff had healed. In a multicenter trial involving use of this biological scaffold to treat partial cuff tears, "significant bursal swelling" did develop in 1 of 33 patients at 3 months after implantation.[15] No rice bodies were reported in the MRI findings.

In this case report, multiple rice body–like particulate debris was noted on MRI as well as within the fluid retrieved at the time of washout. A T2 image showed isointense nodules consistent with rice body formation. The differential diagnosis of chondromatosis would have had a different MRI appearance.[6] Eosinophils were absent in the first aspirated fluid, which probably ruled out some type of allergic phenomena. Infection was ruled out by negative culture findings.

Conclusion

Augmentation of rotator cuff injuries with the Regeneten bio-inductive implant has been shown to facilitate healing[1,15] and can be very useful in the surgeon's treatment of rotator cuff pathology. However, the

potential for an acute and very painful inflammatory phase exists during the course of recovery. Although the exact cause of this severe inflammation remains unknown, the timing might suggest some type of exaggerated host response during the degradation of the polylactic acid staples. The potential for an acute, significant painful phase in a patient's recovery should be part of the informed-consent process when using the Regeneten implant.

Disclaimer

The author, his immediate family, and any research foundations with which he is affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

References

1. Boker DJ, Sonnebend D, Deady L, Cass B, Young A, Van Kampen C, et al. Evidence of healing of partial-thickness rotator cuff tears following arthroscopic augmentation with a collagen implant: a 2-year MRI follow-up. Muscles Ligaments Tendons J 2006;6:16-25. https://doi.org/10.11138/mltj/2016.6.1.016
2. Chen A, Wong LY, Sheu CY, Chen BF. Distinguishing multiple rice body formation in chronic subacromial-subdeltoid bursitis from synovial chondromatosis. Skeletal Radiol 2002;31:119-21. https://doi.org/10.1007/s002560100412
3. Chen Q. Proof-of-concept finite element modeling of effect of tissue induction on rotator cuff tears. Rochester, MN:: Material and Structural Testing Core, Mayo Clinic; 2016.
4. Cheung HS, Ryan LM, Kozin F, McCarty DJ. Synovial origins of rice bodies in joint fluid. Arthritis Rheum 1980;23:72-6.
5. Ciccone W, Motz C, Bentley C, Tasto J. Bioabsorbable implants in orthopedics: new developments and clinical applications. J Am Orthop Surg 2001;9:280-8.
6. Griffith JF, Peh WC, Evans NS, Smallman LA, Wong RW, Thomas AM. Multiple rice body formation in chronic subacromial/subdeltoid bursitis: MR appearances. Clin Radiol 1996;51:511.
7. Holzheimer RG. Adverse events of sutures: possible interactions of biomaterials? Eur J Med Res 2005;10:521-6.
8. Jeong YM, Cho HY, Lee SW, Hwang YM, Kim YK. *Candida* septic arthritis with rice body formation: a case report and review of literature. Korean J Rad 2013;14:465-9. https://doi.org/10.3348/kjr.2013.14.3.465
9. Kofler L, Wambacher M, Schweinzer K. Allergic reaction to polyether ether ketone following cross reactivity to epoxy resin. J Cutan Med Surg 2017;2:78-9. https://doi.org/10.1177/1203475416665606
10. Kudoban O. Early skin reaction to polydiaxonone suture material following septorhinoplasty. Am J Case Rep 2015;16:276-8. https://doi.org/10.12659/AJCR.893895
11. Lock AM, Gao R, Musson DS. Induction of immune gene expression and inflammatory mediator release by commonly used surgical suture materials: an experimental in vitro study. Patient Saf Surg 2017;11:16. https://doi.org/10.1186/s13037-017-0132-2
12. Moldonado-Naranjo AL, Healy AT, Kaifas IH. Polyetheretherketone (PEEK) intervertebral cage as a cause of chronic systemic allergy: a case report. J Spine 2015;15:e1-3. https://doi.org/10.1016/j.spinee.2015.04.011
13. Popert AJ, Scott DL, Wainwright AC, Walton KW, Williamson N, Chapman JH. Frequency of occurrence, mode of development, and significance of rice bodies in rheumatoid joints. Ann Rheum Dis 1982;41:109-17.
14. Sahlstrand T, Save-Soderbergh J. Subacromial bursitis with loose bodies as a cause of refractory painful-arc syndrome. A case report. J Bone Joint Surg Am 1980;62:1194-6.
15. Schlegel TF, Abrams JS, Bushnell BD, Brock JL, Ho CP. Radiologic and clinical evaluation of a bioabsorbable collagen implant to treat partial-thickness tears: a prospective multicenter study. J Shoulder Elbow Surg 2018;27:242-51. https://doi.org/10.1016/j.jse.2017.08.023
16. Sivaloganathan S, Amr R, Shrivastava R, Relwani J. The risotto sign—a severe inflammatory bursitis with rice body formation, complicating a rotator cuff repair with a bioabsorbable suture anchor. JRSM Open 2015;6. 2054270414562986, https://doi.org/10.1177%2F2054270414562986
17. Steinfield R, Rock MG, Younge DA, Cofield RH. Massive subacromial bursitis with rice bodies. Report of three cases, one bilateral. Clin Orthop Relat Res 1994;301:185-90.
18. Thevenon A, Cocheteux P, Duquesnoy B, Mestdagh H, Lecomte-Houcke M, Delcambre B. Subacromial bursitis with rice bodies as a presenting feature of seronegative rheumatoid arthritis. Arthritis Rheum 1987;30:715-6.
19. Urruella AM, Rapp T, Egol KA. Massive subacromial-subdeltoid bursitis with rice bodies secondary to an orthopedic implant. Am J Orthop (Belle Meade NJ) 2012;41:418-21.