

Left Atrial Appendage Tachycardia Termination With A LARIAT Suture Ligation

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Abstract

Left atrial appendage (LAA) is a known trigger for left atrial tachycardia (AT). The use of LARIAT epicardial suture for termination of AT arising from LAA is not yet reported.

A 66-year-old female had a history of hypertension, diabetes, sick sinus syndrome, labile INR, and symptomatic persistent AF. She underwent radiofrequency ablation after failed cardioversion and multiple antiarrhythmics. She was in AT originating from LAA on activation map. Radiofrequency endocardial LAA isolation was performed. However, the AT recurred with increased burden and symptoms. Due to her multiple hospitalization for spontaneous bleeds and labile INR, a Lariat epicardial suture ligation of her LAA was performed. With application of the Lariat suture, electrical isolation was achieved and the AT terminated. She remained AT free at 18 months.

Our case is the first to illustrate the utility of LARIAT suture in electrical isolation of the LAA in addition to its mechanical exclusion.

Introduction

The Left atrial appendage (LAA) is a known trigger for left atrial arrhythmia. While endocardial radiofrequency ablation of the LAA is well known to control atrial arrhythmias, the use of LARIAT epicardial suture for termination of AT arising from LAA is not yet reported.

Case Report

A 66 year old female with recurrent symptomatic persistent atrial fibrillation (AF) and atrial tachycardia (AT) who failed cardioversion and multiple anti-arrhythmic medications including: propafenone, dofetilide, dronedarone and sotalol with several symptomatic breakthrough episodes.

Her past medical history included also: hypertension, diabetes mellitus, non critical coronary artery disease, obstructive sleep apnea, chronic obstructive pulmonary disease, colon cancer s/p colectomy, sick sinus syndrome s/p dual-chamber pacemaker, chronic anticoagulation with warfarin for AF and recurrent lower extremity deep venous thrombosis (DVT).

Key Words:

Atrial Tachycardia, LARIAT, Left Atrial Appendage.

Disclosures:
None.

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Physical examination and labs were unremarkable. After a lengthy discussion for the available options of her symptomatic arrhythmia she requested a radiofrequency ablation. Her CT scan showed normal pulmonary veins anatomy and a moderately enlarged left atrium with no thrombus. During her procedure and just after transseptal puncture, a thrombus was noted on the sheath inside the left atrium (despite INR=2.0 and 10,000 Units of Unfractionated IV Heparin bolus at transseptal puncture). The procedure was aborted and the patient was maintained on a higher INR goal (2.5-3.5).

Unfortunately, with a supratherapeutic INR, a hematoma developed over her left elbow that had resolved later. She was rescheduled for the ablation procedure 3 months later. She was found in atrial tachycardia, cycle length (CL)= 470ms (127bpm) at the beginning of the procedure. This was tracked by her PPM (upper tracking rate 130bpm). Activation map of the tachycardia showed a reentrant tachycardia around the base and neck of the left atrial appendage (LAA) (Figure 1). She had extensive left atrial scar on voltage map. Isolation of the left atrial appendage with radiofrequency ablation successfully terminated the tachycardia and the patient converted to NSR. We continued the procedure with an isolation of her pulmonary veins and a cavo-tricuspid isthmus ablation for an induced right sided flutter.

Two weeks later, she presented with groin pain and hematoma. She was on enoxaparin subcutaneous injections for subtherapeutic INRs. CT scan showed a subacute right anterior thigh hematoma (5.9 x 2.7 cm) with no intra or retroperitoneal extension. Due to fluctuations in INRs a recommendation for new oral anticoagulants was made but the patient couldn't afford it. The bleeding events unfortunately continued. With an INR of 3.5, she was admitted to an outside

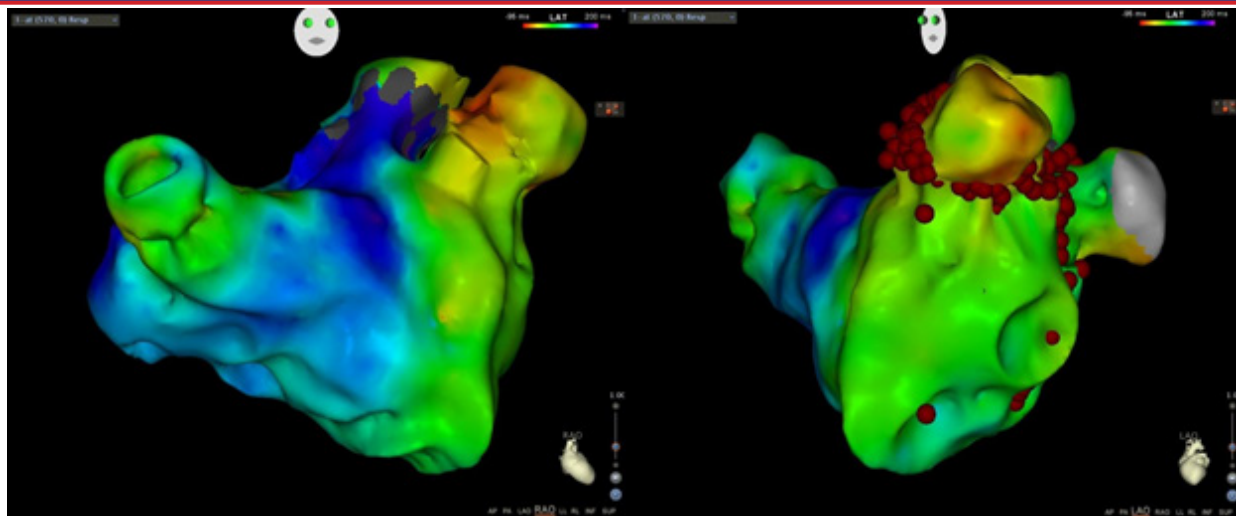


Figure 1: RAO and LAO views of the AT Activation Map. Origin from the left atrial appendage. Ablation points of the LAA ablation were listed in the LAO view

hospital for hematomas in her psoas muscle and rectus abdominis sheath.

She was in sinus rhythm at that time. She was restarted on warfarin 2 weeks after the last bleeding event. Three months later the patient was found with a recurrent atrial tachycardia with a similar cycle length around 470ms. The burden increased and later become persistent with atrial fibrillation reaching a 73% of the time on device interrogation.

With recurrent atrial tachycardia that is most likely originating from the left atrial appendage, multiple bleeding episodes from the elbow, psoas, groin and rectus sheath; increased HAS-BLED score of 5 we discussed the treatment options with our patient and she agreed for a LARIAT suture ligation for her left atrial appendage.

On the day of the procedure, and after intubation a negative transesophageal echocardiogram for thrombus, the patient was noted in atrial tachycardia. The CL was 470ms with ventricular pacing. The Lariat device (SentreHEART, Redwood, California, USA) consists of a compliant occlusion balloon catheter (EndoCATH), magnet-tipped guidewires and a 12-F suture delivery device (LARIAT). The procedure was done as described previously.¹ To place the suture across the LAA, a pericardial and transseptal accesses were obtained separately. The endocardial magnet-tipped guidewire was advanced into the apex of the LAA. The other magnet tipped guide wire was

advanced pericardially to the tip of the LAA to establish a stable connection between the two magnet tips. A snare was then advanced over the LAA and after confirmation of closure, a pre-tied suture for LAA ligation was released and tightened (Figure 2). The tachycardia, which was present throughout the procedure, terminated two minutes after tightening the appendage and with further application of the suture (Figure 3). She remained in normal sinus rhythm during her uneventful post procedure stay.

During long term follow-up (18 months), her device interrogation always showed great control of her atrial arrhythmia. The total AT/AF burden decreased to 0.7%. She remains in AV sequential pacing 98% of the time with normal left ventricular function. Post her LAA suture ligation she remained doing well off anticoagulation and was kept only on Aspirin and Metoprolol.

Discussion

Our case demonstrated the termination of left atrial appendage reentrant tachycardia following appendage ligation with Lariat suture delivery device. In our case, initial isolation of the appendage was performed using radiofrequency ablation. However reconnection occurred and electrical isolation was maintained with Lariat suture.

Although this case was mainly performed in the setting of recurrent bleeding episodes, however, this may open the potential use of Lariat epicardial suture ligation for the treatment of atrial tachycardia

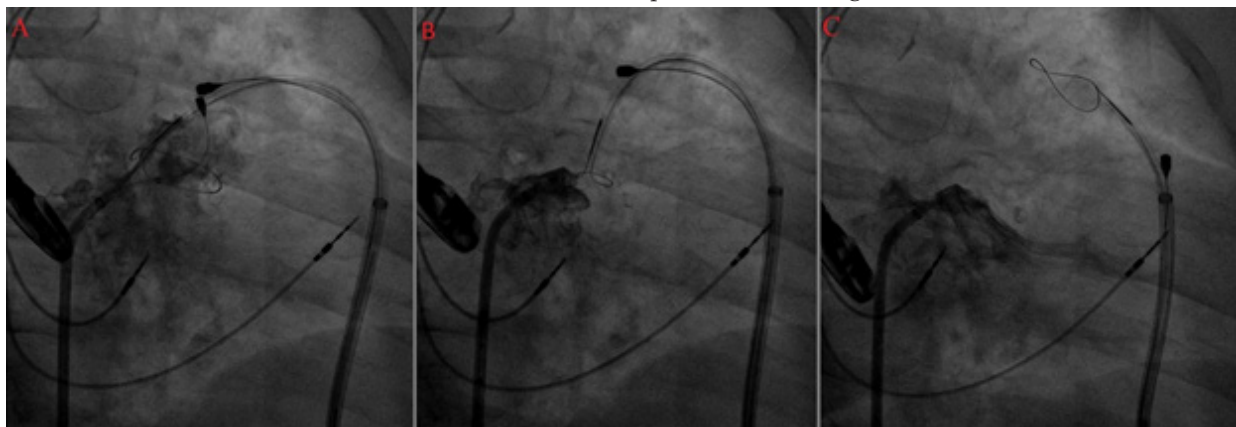


Figure 2:

Left Atrial Appendage ligation with the Lariat Suture: A- The endocardial and epicardial magnet-tipped guidewires are connected and the Lariat device is placed around the neck of the appendage. **B-** Lariat device is tightened without releasing the suture, note that the balloon was deflated and the magnet-tipped guidewires are pulled back. **C-** After the satisfactory position, the Lariat suture was released, atrigram showing the final result

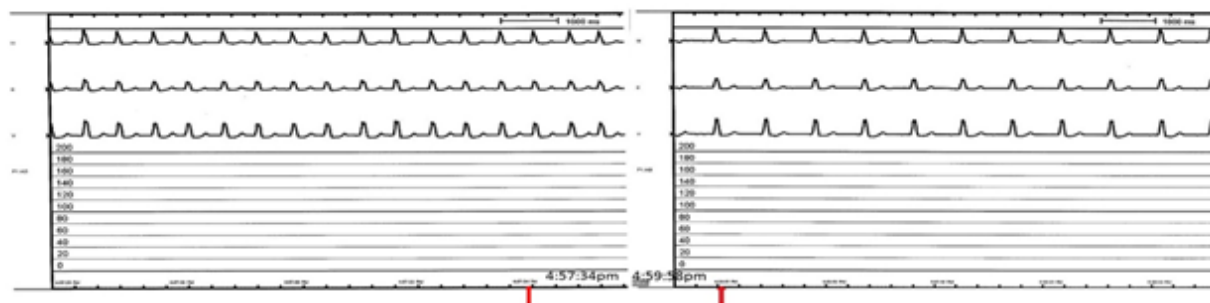


Figure 3: Electrical Isolation of the LAA with Lariat: termination of the AT was noted 2 minutes after tightening the appendage with Lariat Device/Suture

arising from the left atrial appendage. To our knowledge, this is the first case report that demonstrates this phenomenon.

LAA triggers are well known to be an important contributor for initiation and maintenance of persistent atrial arrhythmias.^{2,3} If the LAA was found to be a trigger (like in this case), endocardial isolation of the left atrial appendage reduces the risk of AF/AT.² However, endocardial isolation of the LAA is extremely challenging as it carry a significant risk of perforation, in addition to electromechanical dissociation which may subsequently contribute to thrombus formation.² In our patient with recurrent bleeding episodes, the choice of a LAA ligation with Lariat suture was optimal as it provided both mechanical as well as electrical isolation of the LAA. The later most likely decreased the risk of stroke in this patient with persistent arrhythmia.

A prior case report demonstrated the termination of the atrial tachycardia immediately after the placement of the AtriClip device.⁴ Similarly in preclinical studies epicardial LAA exclusion has been shown to result in LAA electrical isolation.⁵ In a recent study performed at our center, we demonstrated that 90% of patients had a reduction in the LAA voltage with lariat suture ligation. We were also able to demonstrate the lack of left atrial capture during bipolar pacing from the occluded LAA in 90% of the patients tested.⁶ Although various other delivery devices like the watchman device and the amplatzer cardiac plug are good mechanical closure alternatives and help to prevent risk of thromboembolism, however electrical isolation cannot be achieved. Arrhythmia control was extremely helpful in our patient and she was able to remain asymptomatic while off antiarrhythmic and anticoagulation. This was recently proven in our prospective observational study, LAALA-AF, which involved 138 patients with persistent AF. A higher freedom of AF at 1 year off antiarrhythmic was noted in the Lariat group (65% VS 39%, $p=0.002$) in addition to less need for a repeat ablation for recurrence (16% VS 33%, $p=0.018$).⁷

Procedure wise, Lariat ligation suture was shown to have a high success rate (96%, 89 patients) and limited adverse events rate of 3.3% (bleeding).⁸ This rate was even lower in a large survey conducted in 11 US sites that involved 441 patients. The bleeding rates decreased from 3.3% (2% need for transfusion and 1.3% need for open heart surgery) to none in the remaining 231 patients and was referred to the switch from an 18-gauge Pajunk needle to micropuncture for the pericardial access.⁹ The use of micropuncture needle (performed in this case) was further recommended in a multi-center study including our center. With its use, a decreased incidence of major complications and the need for surgical repair was noted.¹⁰

Conclusions

In conclusion, our case is the first reported which demonstrates

termination of a LAA reentrant tachycardia with a Lariat suture. It may be important to consider the electrical isolation as additional benefit to patients who are selected for appendage occlusion.

References

1. Singh Sheldon M, DukkupatiSrinivas R, d'AvilaAndre, DoshiShephal K, ReddyVivek Y. Percutaneous left atrial appendage closure with an epicardial suture ligation approach: a prospective randomized pre-clinical feasibility study. *Heart Rhythm*. 2010;7 (3):370–6.
2. Di Biase Luigi, BurkhardtJ David, MohantyPrasant, SanchezJavier, MohantySanghamitra, HortonRodney, GallinghouseG Joseph, BaileyShane M, ZagrodzkyJason D, SantangeliPasquale, HaoSteven, HongoRichard, BeheirySalwa, ThemistoclakisSakis, BonsoAldo, RossilloAntonio, CorradoAndrea, RavieleAntonio, Al-AhmadAmin, WangPaul, CummingsJennifer E, SchweikertRobert A, PelargonioGemma, Dello RussoAntonio, CasellaMichela, SantarelliPietro, LewisWilliam R, NataleAndrea. Left atrial appendage: an underrecognized trigger site of atrial fibrillation. *Circulation*. 2010;122 (2):109–18.
3. Hocini Méléze, ShahAshok J, NaultIsabelle, SandersPrashanthan, WrightMatthew, NarayanSanjiv M, TakahashiYoshihide, JaïsPierre, MatsuoSeiichiro, KnechtSébastien, SacherFrédéric, LimKang-Teng, ClémentyJacques, HaïssaguerreMichel. Localized reentry within the left atrial appendage: arrhythmogenic role in patients undergoing ablation of persistent atrial fibrillation. *Heart Rhythm*. 2011;8 (12):1853–61.
4. Benussi Stefano, MazzonePatrizio, MaccabelliGiuseppe, VergaraPasquale, GrimaldiAntonio, PozzoliAlberto, SpagnoloPietro, AlfieriOttavio, Della BellaPaolo. Thoracoscopic appendage exclusion with an atriclip device as a solo treatment for focal atrial tachycardia. *Circulation*. 2011;123 (14):1575–8.
5. Bruce Charles J, StantonChristopher M, AsirvathamSamuel J, DanielsenAndrew J, JohnsonSusan B, PackerDouglas L, FriedmanPaul A. Percutaneous epicardial left atrial appendage closure: intermediate-term results. *J. Cardiovasc. Electrophysiol*. 2011;22 (1):64–70.
6. Han Frederick T, BartusKrzysztof, LakkireddyDhanunjaya, RojasFrancia, BednarekJacek, KapelakBoguslaw, BartusMagdalena, SadowskiJerzy, BadhwarNitish, EarnestMathew, ValderrabanoMiguel, LeeRandall J. The effects of LAA ligation on LAA electrical activity. *Heart Rhythm*. 2014;11 (5):864–70.
7. Dhanunjaya Lakkireddy, A.S.M, ArunKanmanthareddy, RandallLee MD, NitishBadhwar, KrzysztofBartus, DonitaAtkins, SudharaniBommana, JieCheng, AbdiRasekh, AALicata, Luigi DiBiase MD, AndreaNatale, JayantNath, RyanFerrell, MatthewEarnest, Yeruva MadhuReddy MD. Left Atrial Appendage Ligation and Ablation for Persistent Atrial Fibrillation, The LAALA-AF Registry. *JACC Clinical Electrophysiology*. 2015;Volume 1, (Issue 3):153–160.
8. Bartus Krzysztof, HanFrederick T, BednarekJacek, MycJacek, KapelakBoguslaw, SadowskiJerzy, LelakowskiJacek, BartusStanislaw, YakubovSteven J, LeeRandall J. Percutaneous left atrial appendage suture ligation using the LARIAT device in patients with atrial fibrillation: initial clinical experience. *J. Am. Coll. Cardiol*. 2013;62 (2):108–18.

9. Rasekh Abdi, KarSaibal, NagarajHosakote, BadhwarNitish, MassumiAli, LakkireddyDhanunjaya. Differences in experience with a new delivery device for LAA ligation among various U.S. centers. *J. Am. Coll. Cardiol.* 2015;65 (4):404–5.
10. Gunda Sampath, ReddyMadhu, PillarisettiJayasree, AtouiMoustapha, BadhwarNitish, SwarupVijay, DiBiaseLuigi, MohantySanghamitra, MohantyPrashanth, NagarajHosakote, EllisChristopher, RasekhAbdi, ChengJie, BartusKrzysztof, LeeRandall, NataleAndrea, LakkireddyDhanunjaya. Differences in complication rates between large bore needle and a long micropuncture needle during epicardial access: time to change clinical practice?. *Circ Arrhythm Electrophysiol.* 2015;8 (4):890–5.