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Atrial Fibrillation and Atrial Flutter Ablation – an Unconventional Approach

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Abstract

Background: Radiofrequency cathether ablation (RFCA) of Atrial Fibrillation (AFib) and typical atrial flutter (AF) is traditionally performed via femoral vein approach and all devices are designed to be delivered via inferior access. In rare cases of congenital or iatrogenic obstruction of inferior vena cava (IVC), RFCA of arrhythmias is performed via transhepatic approach.

Case report: 87 year old male patient with history of IVC filter placement for recurrent deep venous thrombosis and AFib on amiodarone developed symptoms with worsening Afib burden resulting in deterioration of left ventricular ejection fraction.

Due to highly symptomatic pharmacological uncontrolled AFib, RFCA was decided in order to achieve long term success in restoring normal sinus rhythm. Transesophageal echocardiography on the day of procedure excluded clot or thrombus. Right femoral vein cannulation was performed, but advancing the guidewire through the IVC was extremely difficult. Peripheral venography revealed complete occlusion of the venous system with no flow through the IVC filter.

We present you a case report of pulmonary vein isolation succesfully performed via the left sublcavian.

Conclusion: To the best of our knowledge, this is the first case report of the following: (a) successful transseptal puncture in a patient with persistent AFib and complete iatrogenic obstruction of the IVC using a Baylis wire through superior access without any complications, (b) PVI and typical AF ablation via superior approach using a bidirectional contact sensing ablation catheter; monitoring of the contact force in this case being extremely practical and (c) use of Vascade sheath for closure of the left axillary vein.

Introduction

Radiofrequency Ablation (RFA) has become a well-recognized non-pharmacological treatment strategy for many cardiac arrhythmias [1] because of a high success rate and low risk of complications. RFA is recommended as first-line therapy in patients with paroxysmal or persistent AF with minimal structural heart disease [2].

Atrial Fibrillation (AFib) is the most common chronic rhythm disorder encountered in clinical practice [3]. Besides being often symptomatic due to high ventricular rates, it is responsible for functional limitation and cardiomyopathy induced by tachycardia [4]. In 1996, the Bordeaux group [5] noted that AFib is initiated by rapidly firing triggers located in the pulmonary veins. Pulmonary vein isolation (PVI) via catheter ablation via femoral approach is a widely applied technique.

Typical Atrial Flutter (AF) is generated by a large, counterclockwise reentry circuit in the right atrium and can be successfully eliminated by RFA of cavotricuspidisthmus (CTI) area which is slowly conducting. The success rate was shown to be more than 90% and the recurrence rate was less than 10% when complete block of the isthmus was achieved [6].

These procedures are typically performed via femoral vein approach and all devices are designed to be delivered via inferior access [7]. In rare cases of congenital or iatrogenic obstruction of inferior vena cava (IVC), RFA of arrhythmias are performed through a transhepatic approach.

Case Report

We present a case report of PVI and Posterior Wall Isolation performed via the left subclavian access. A 87 year old male patient with a history of recurrent AFib, coronary artery disease (CAD), IVC filter placement for recurrent deep venous thrombosis, essential hypertension (HTN) and cardiomyopathy (ejection fraction (EF)=40%) delete who was referred for an EP consult. Despite being on amiodarone, the patient developed symptomatic, persistent AFib (limitation in daily activities) with worsening AFib burden resulting in deterioration of left ventricular left ventricular EF. ECG recordings

Key Words

Atrial Fibrillation, Superior Vena Cava approach, Ablation, Atrial Flutter.

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during the office visit revealed AFib with aberrant conduction as supported by previous Holter monitoring.

The patient was scheduled for transesophageal echocardiography (TEE) cardioversion on amiodarone, but he spontaneously converted into normal sinus rhythm (NSR) and his symptoms improved. He continued to have bouts of breakthrough AFib and hence was referred to us for ablation.

Due to highly symptomatic pharmacological uncontrolled AFib, RFA was decided in order to achieve long term success in restoring NSR.TEE on the day of procedure excluded clot or thrombus. Right femoral vein cannulation with modified Seldinger technique was performed, but advancing the guidewire through the IVC was extremely difficult. Peripheral venography revealed complete occlusion of the venous system with no flow through the IVC filter. We discussed the options we had with the patient's family: transhepatic

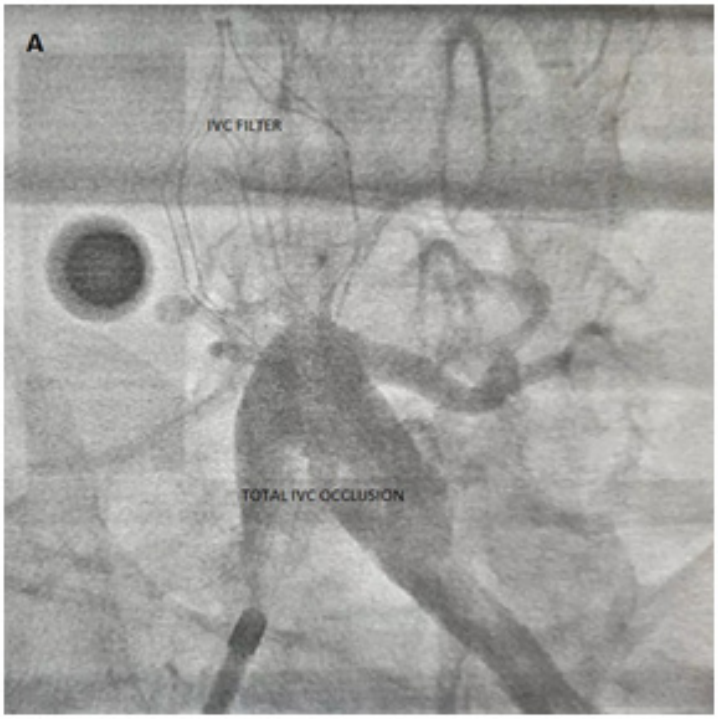

Figure 1: Peripheral venography revealed no flow through the IVC filter

access, subclavian access or referral for epicardial approach.

Taking into consideration that our patient was in therapeutic INR (for transhepatic approach the INR is vital to be within normal range) and, furthermore, that the patient's family required the procedure to be done as scheduled, it was decided to move forward with right subclavian access through which a deflectable catheter was advanced and positioned in the coronary sinus (CS) for left atrial (LA) pacing and recording purposes. Left subclavian venous access was found to be appropriate after peripheral venography. Left axillary vein was cannulated and a 10-French sheath and an Agilis sheath were advanced and positioned. Intra-cardiac Echo (ICE) catheter was advanced and positioned. Intravenous heparin bolus (100U/kg) was given to maintain active clotting time (ACT) between 250-300. ICE images were reversed (superior to inferior) in order to visualize the septum as coming from the IVC. We advanced a Baylis needle into the Agilis sheath. As we would advance the needle, the sheath would fall off the septum despite curve changes. Since extreme difficulty was faced to maintain the needle at the septum, we decided to use the Baylis wire instead of the needle. The Baylis wire was placed the septum and the transseptal puncture was performed. The puncture site was relatively superior on the septum. A 0.035mm caliber wire was advanced through the transseptal puncture site. It was difficult to get the dilator and the Agilis sheath across the septum so we exchanged the Agilus with the SL1, which was unfruitful too. The SL1 was replaced with a Vizigo sheath.

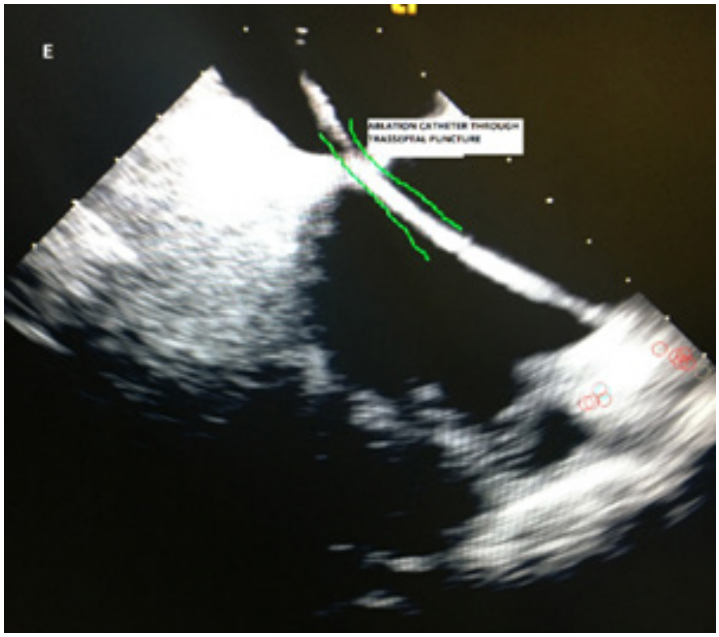

Figure 2: ICE image showing the bidirectional Ablation Catheter through the transseptal puncture.

Positioning the Vizigo Sheath right at the septum proved to be successful, following which a bidirectional ablation catheter was used to create a map (with Carto mapping system) of the LA. Following movement of the ablation catheter, patient developed AF, which appeared typical with proximal to distal activation. Patient was cardioverted to maintain stability during mapping. Superior and inferior pulmonary veins and the LA appendage were identified. Once the activated coagulation time was noted to be therapeutic, left superior and inferior pulmonary veins were isolated in pairs followed by the Right Superior and Inferior Pulmonary Veins. Fractionated electrograms and abnormal voltages were noted on the posterior wall during LA mapping; hence a posterior box isolation was done as well. Since the Vizigo sheath was right at the septum a circular catheter could not be advanced to confirm exit block. Pacing around every ablation lesion to ensure loss of capture was done followed by Adenosine testing.

Since the patient had developed Isthmus-dependent AF, the sheath was pulled back to the RA and under ICE guidance was positioned at the CTI. The bidirectional contact sensing ablation catheter was dropped at the CTI and ablation lesions extended from the tricuspid valve all the way to the IVC.

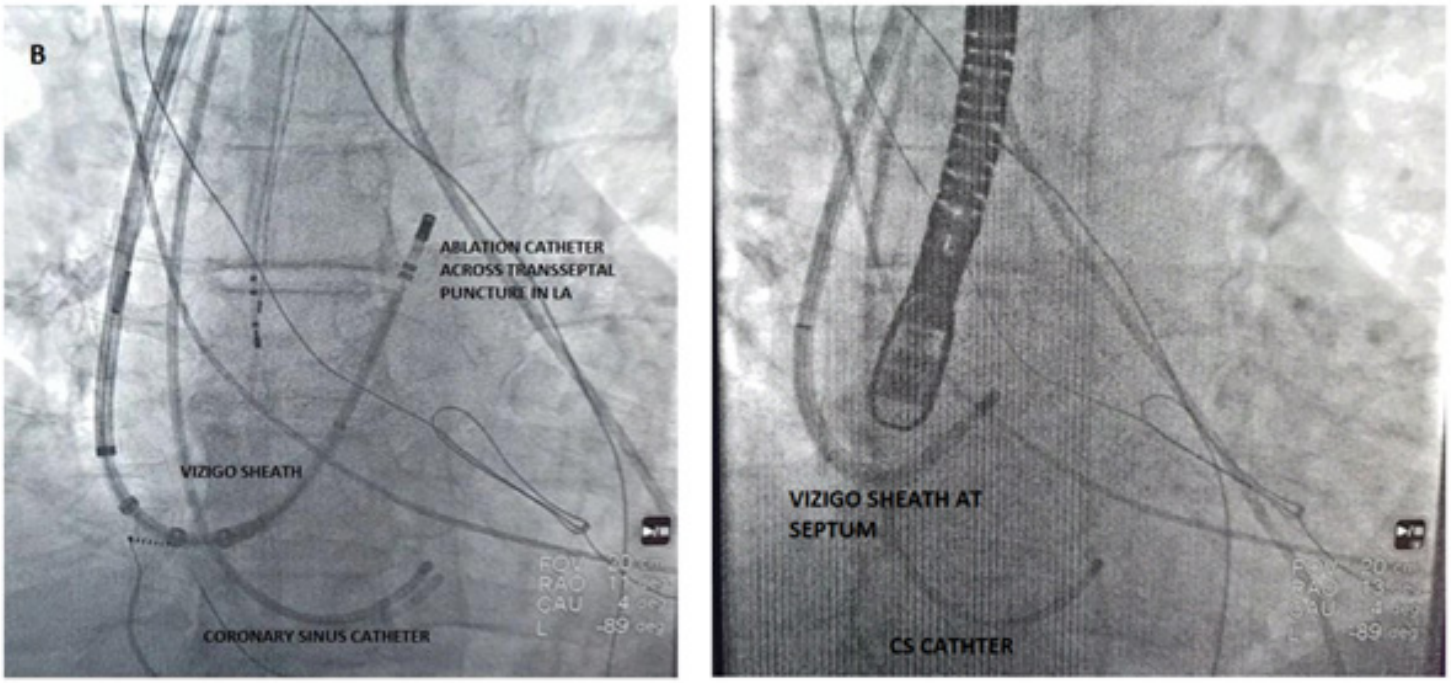

Figure 3: Fluoroscopic images showing placement of the catheters.

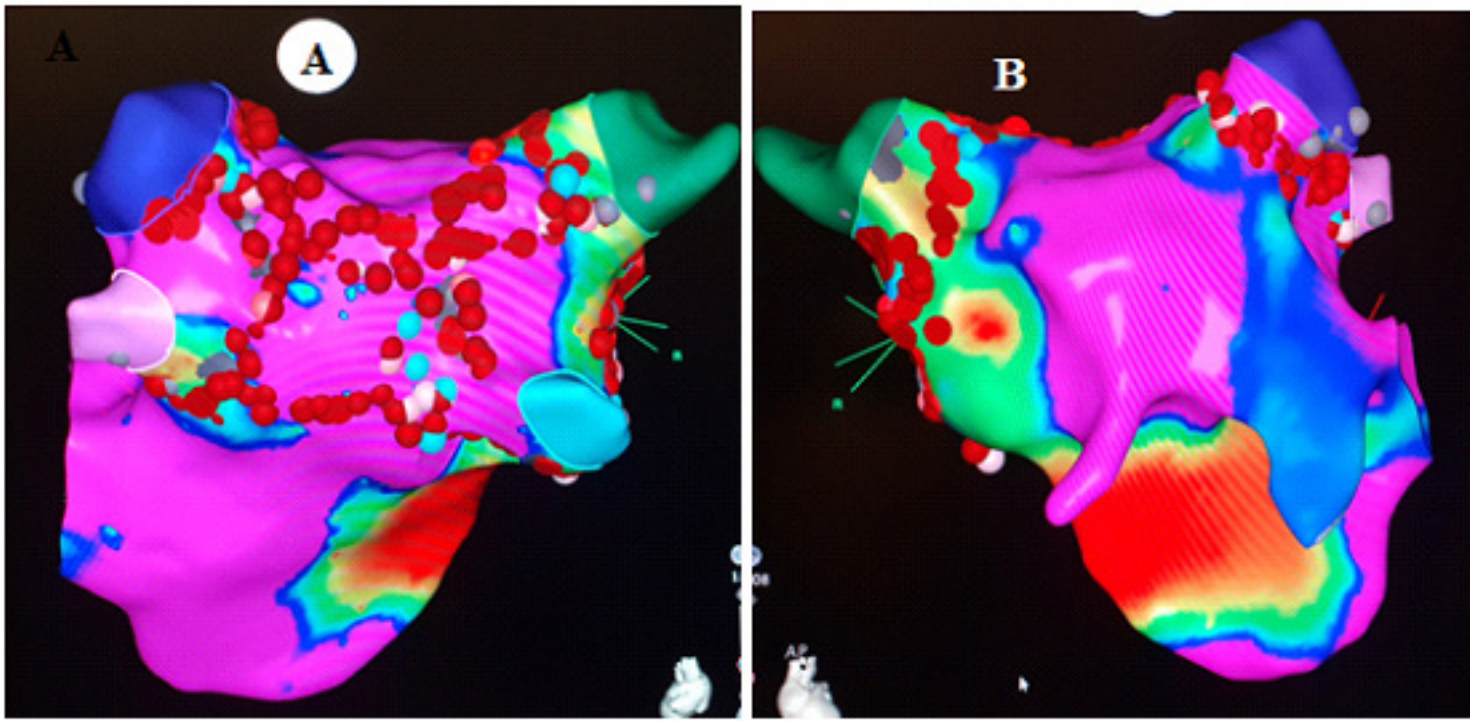

Figure 4: Electroanatomical mapping (Carto ® system) A. postero-anterior view showing PVI lines and the posterior box B. antero-posterior view

Differential pacing was performed on either side of the CTI with confirmation of bidirectional line of block. Attempts to induce recurrent tachycardia with burst pacing were unsuccessful.

After confirmation of absence of any pericardial effusion, protamine was given to reverse anticoagulation. Patient was placed under observation for two days. Post-operative period was uneventful with no recurrence of tachycardia. Patient was discharged and the two month follow-up revealed no complains or complications and the patient maintained NSR.

Discussion

Interruption of the IVC due to congenital malformations or prior therapeutic procedures is a rare clinical scenario encountered during RFA of arrhythmias and represents an impediment to access the heart via traditional femoral approach. Alternative access strategies

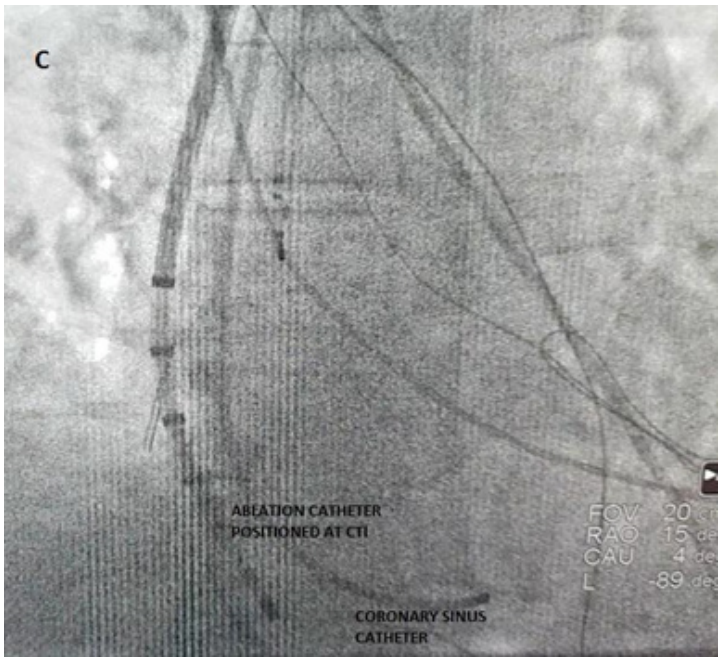

Figure 5: Fluoroscopic view of ablation catheter placement at CTI

have been outlined: Transhepatic IVC access, SVC access and the epicardial approach. [8,9] but all of them brought alongside new challenges. Need for multiple access sites for catheter placement, scarce experience with catheter manipulation, lack of stability while positioning the sheath at the transseptal puncture site and maintaining the optimal contact force during RFA are the main challenges that need to be circumvented during the superior access.

We took into consideration the transhepatic access which provides similar degrees of maneuverability and catheter manipulation as through the femoral approach [10], but it mandates INR to be within normal values. Due to limitations of our patient being in therapeutic INR, we proceeded with the SVC approach via left axillary vein.

Prime requirements included: multiple access sites for ICE placement, CS catheter, Agilis sheath (initially) and Vizigo sheath. RIJ Vein and left axillary vein were cannulated. Left subclavian vein cannulation was preferred over right subclavian vein (RSV) bearing in mind that none of the procedure instruments were designed for superior approach. Via RSV access we would need to double curve the Agilis sheath and Baylis wire in order to position them at the septum for the transseptal puncture.

Reversal of ICE images proved to be crucial during the procedure since it facilitated the visualization of the interatrial septum and LA as seen during the standard procedure via IVC approach.

Maintaining the stability of the sheath at the transeptal site while advancing the Baylis needle was difficult, as the sheath would get displaced inferiorly towards the RV/RVOT despite repeated attempts. Hence, we switched the Baylis needle with a Baylis wire for transeptal puncture. The Baylis wire has a diameter of 0.025 inch/0.635 mm; as a consequence the transseptal puncture was not wide enough for the dilator, the Agilis sheath or even the SL1 sheath to pass. Serial dilatation with larger French sheaths to finally position the Vizigo sheath at the transeptal site through which the bidirectional ablation catheter was advanced into the LA for mapping and RFCA.

All the available instruments, the Agilis sheath and Baylis needle, are curved and designed for transseptal puncture through IVC with limited degrees of maneuverability and catheter manipulation through the superior access. The Vizigo sheath was placed right at the septum maintaining appropriate contact force during RFA to ensure transmural lesions of adequate size is yet another concern during the course of the procedure. In our case, 10g of contact force was maintained on an average. This was confirmed using cartosound (ICE).

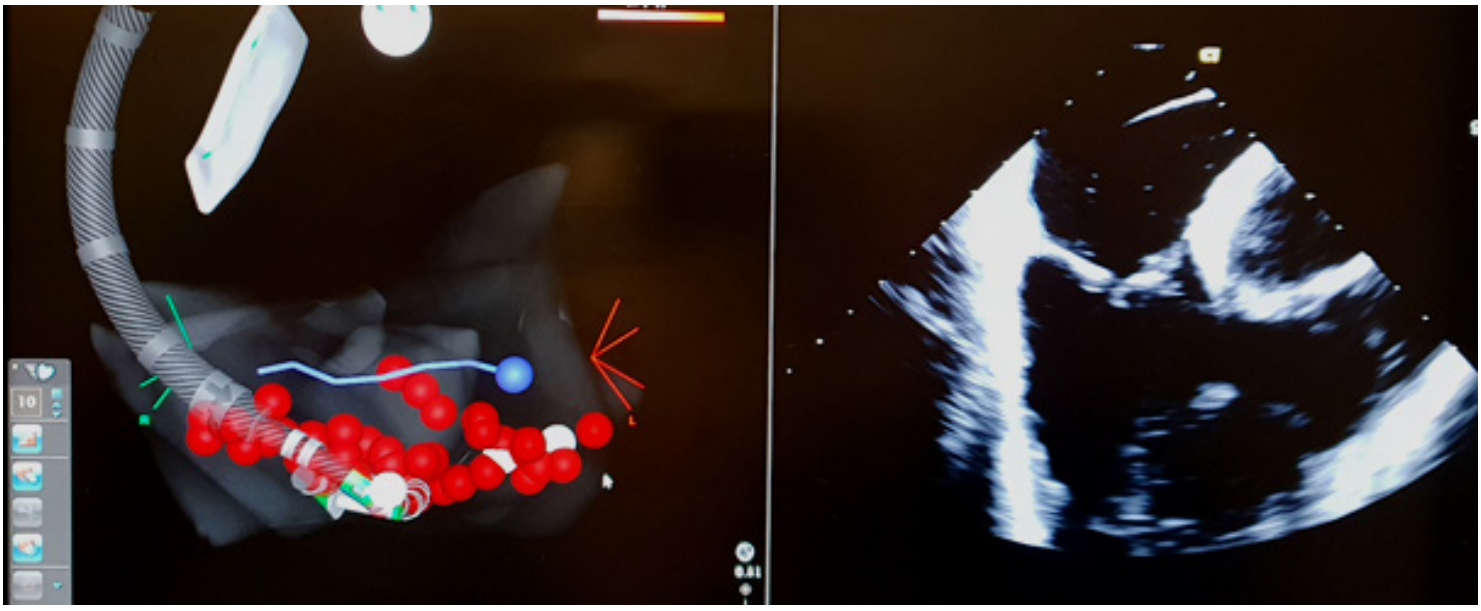

Figure 6: Left – CTI Ablation and testing of bidirectional line of block. Right- CTI as visulised on ICE.

After PVI, , ablation catheter placement at the CTI for the AF ablation was quite easy.

The subclavian vein approach provides less compressible site for haemostasis, therefore the closure of the access in patients with therapeutic INR is a serious concern in order to prevent hemorrhage and hematoma formation. Hence, two vascade sheaths were placed in the left axillary vein to successfully secure haemostasis.

Conclusion

To the best of our knowledge, this is the First case report of : (a) successful transseptal puncture in a patient with persistent AFib and complete iatrogenic obstruction of the IVC using a Baylis wire through superior access without any complications, (b) PVI and typical AF ablation via superior approach using a bidirectional contact sensing ablation catheter; monitoring of the contact force in this case being extremely practical and (c) use of Vascade sheath for closure of the left axillary vein.

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