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# Hydrodissection - Practical applications in ultrasound-guided breast interventions

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ABSTRACT

Hydrodissection is a procedural tactic utilized in various interventions. It is a technique which helps separate structures in order to safely perform a certain procedure. This article will provide a review of hydrodissection, how to perform this technique, and why it can be useful in breast interventions.

## 1. Introduction

Ultrasound-guided breast interventions can be challenging, particularly when the biopsy target is close to the skin, nipple, vessels, pectoralis muscle, or implant. While there are several approaches to such challenging procedures, an under-reported but extremely versatile technique is the use of hydrodissection during breast biopsies and in preoperative localizations. This manuscript will review the concept of hydrodissection, describe the technical aspects of hydrodissection, and present various case scenarios where hydrodissection was used in breast interventions (Table 1).

For the purpose of this manuscript, hydrodissection is defined as the act of separating a biopsy target from its surrounding tissue with a sterile liquid [1]. Hydrodissection has been used in medical interventions that range from treating peripheral nerve entrapment to protecting surrounding structures during body, mediastinum, or spine procedures [2–4]. For example, hydrodissection has specifically been described as an interventional tool during percutaneous abdominal biopsies to displace adjacent bowel and solid organs to safely complete the procedure [5]. The most commonly reported instilled solutions for hydrodissection include sterile water, saline, dextrose, and diluted contrast [6,7].

Hydrodissection has more recently been reported during breast interventions such as cryoablation and thermoablation [8–12]. For example, during breast microwave ablation of subareolar intraductal papillomas, a slow infusion of 20–100 mL of saline around the dilated duct and nipple has been described to protect the nipple areolar complex from thermal damage [12]. Similarly, Ward et al. described the use of saline hydrodissection in order to protect the overlying skin during ultrasound-guided cryoablation of malignant breast masses [10]. Hydrodissection can also be employed during diagnostic breast interventions such as biopsies or preoperative localizations, which has not been previously reported in the literature.

## 2. Technique

Hydrodissection during breast interventions can be performed with either lidocaine or sterile saline. At our institution, we commonly have two 10 mL syringes of lidocaine available, one with lidocaine 0.9% buffered with sodium bicarbonate, and the second with lidocaine with epinephrine. The buffered lidocaine is used to anesthetize the dermis and parenchyma to reduce procedural pain [13]. The lidocaine with epinephrine is used deeper to prolong the duration of the medication and reduce bleeding [14]. In general, the full 10 mL syringes of lidocaine are not used during the initial anesthetic administration and this remaining lidocaine can be used for hydrodissection purposes. In addition, having a syringe of sterile saline available can be useful as the instilled lidocaine will slowly infiltrate into the tissues and a repeat bolus of saline may be required.

## 3. Case review

### 3.1. Diagnostic breast interventions

Biopsy of deep breast masses often requires a skin incision further

*Abbreviations:* BIA-ALCL, Breast implant associated anaplastic large cell lymphoma.

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**Table 1**
Hydrodissection by target location.

| Target location | Where to perform hydrodissection | Cine clip |
|---|---|---|
| Deep against the pectoralis muscle | Below the target to elevate from the pectoralis muscle | Video 1 |
| Superficial or subdermal | Above the target to separate from the overlying skin | Video 2 |
| Near or adherent to the implant capsule | Between the target and implant capsule to elevate the target | Video 3 |
| Within the fibrous implant capsule | Between the implant fibrous capsule and the implant envelope to separate the two structures | Video 4 |

away from the ultrasound probe in order to allow the biopsy needle to traverse the breast at a relatively parallel trajectory with respect to the chest wall [15]. Having a needle parallel to the chest wall ensures that the needle will not enter the pectoralis muscle or thoracic cavity. However, sometimes despite performing this technique, it is still difficult to obtain an adequately safe trajectory. Alternatively, deep breast masses can be elevated off of the pectoralis fascia with hydrodissection by a bolus of fluid between the biopsy target and pectoralis muscle (Fig. 1 and Video 1) [16]. After the first few samples, the mass may slowly resume its original position against the pectoralis muscle, and additional boluses may be required prior to further sampling.

For very superficial masses just below the dermis, hydrodissection can be utilized to separate the biopsy target from the overlying dermal layer to avoid the biopsy needle inadvertently piercing the dermis (Fig. 2 and Video 2). Furthermore, given the displacement of the biopsy target with hydrodissection, the central portion of the target can be preferentially biopsied rather than only the inferior aspect. Because the hydrodissection occurs between the target and the dermis, one must take caution to ensure that no air is inadvertently instilled superficial to the target as this would result in the target being obscured by shadowing.

Patients with mastectomies, with or without implant reconstruction,

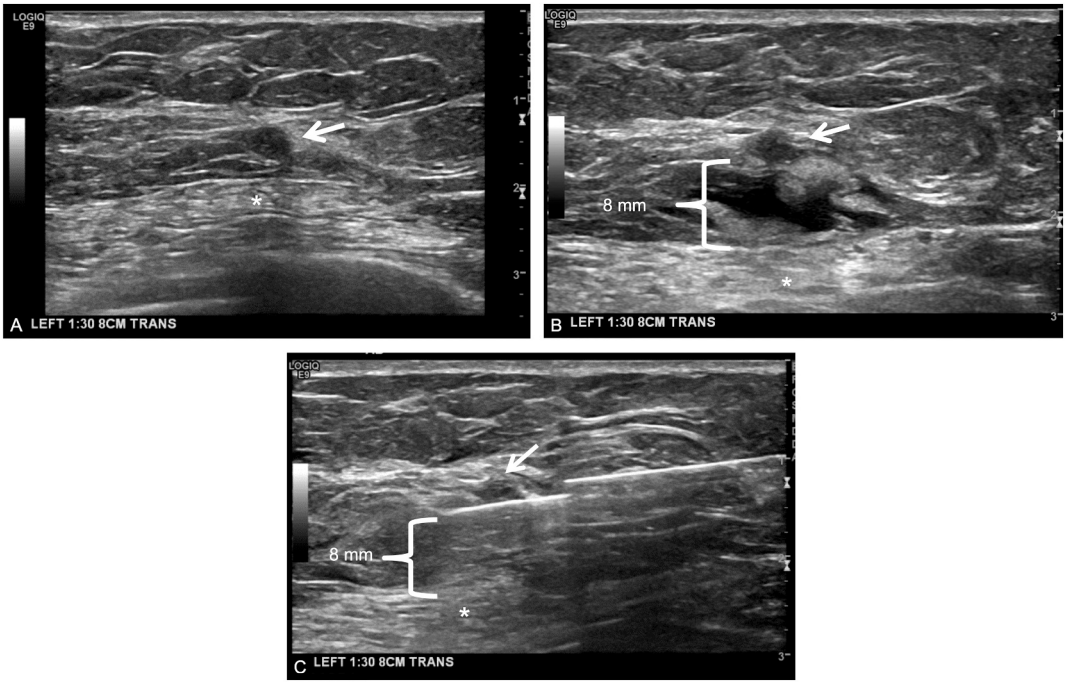


**Fig. 1.** Hydrodissection for deep breast biopsy targets. (A) A 58-year-old woman presents with a new hypoechoic mass (arrow), which is adjacent to the pectoralis muscle (asterisk) on the preprocedural ultrasound image. (B) Post-hydrodissection image shows elevation of the mass from the muscle (asterisk) by 8 mm (bracket). (C) Biopsy image shows that a safe distance is preserved (bracket) between the biopsy needle and the pectoralis muscle (asterisk) using the hydrodissection. Video 1 shows the elevation of the mass from the pectoralis muscle.

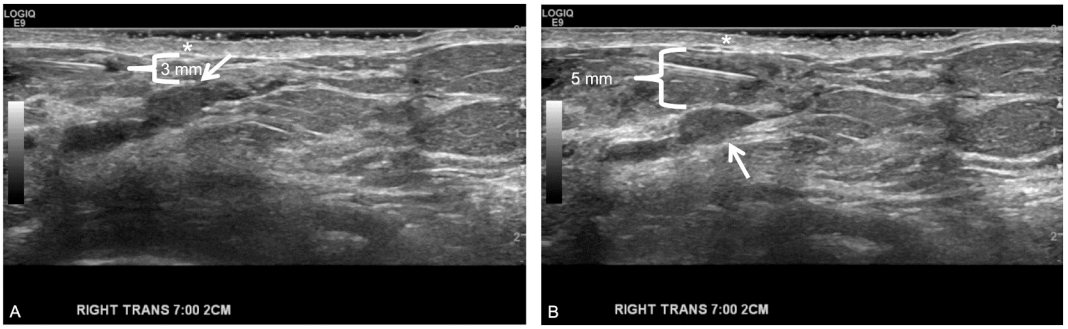


**Fig. 2.** Hydrodissection for superficial breast targets near the nipple areolar complex. (A) A 65-year-old woman presents with an intraductal mass (arrow) approximately 3 mm (bracket) deep to the overlying dermis (asterisk). (B) Pre-biopsy hydrodissection increases the space to 5 mm (bracket) between the target (arrow) and the skin (asterisk). Video 2 shows successful displacement of the intraductal mass from the skin surface.

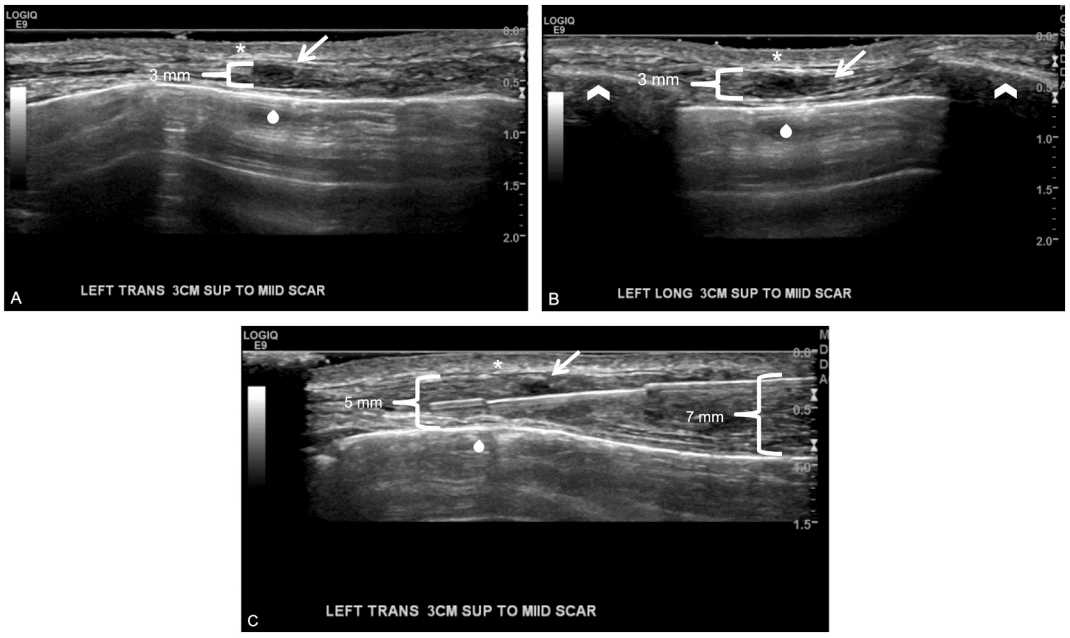


**Fig. 3.** Hydrodissection for intercostal targets. (A) A 45-year-old woman with a history of left mastectomy for breast cancer, now presents with recurrent lobular cancer and a 3 mm satellite mass (arrow), immediately deep to the dermis (asterisk) and above the pleura (tear drop) on the transverse pre-procedure ultrasound. (B) Pre-procedural ultrasound image in the longitudinal plane shows the 3 mm mass (arrow) in the intercostal space between the adjacent ribs (chevrons). (C) Intra-procedural image shows an increase in the distance between the skin (asterisk) and the rib (chevron) and pleura (tear drop) provided by hydrodissection (bracket) which had increased to 5–7 mm. This allowed for reasonable space to insert the biopsy needle and adequately sample the target (arrow).

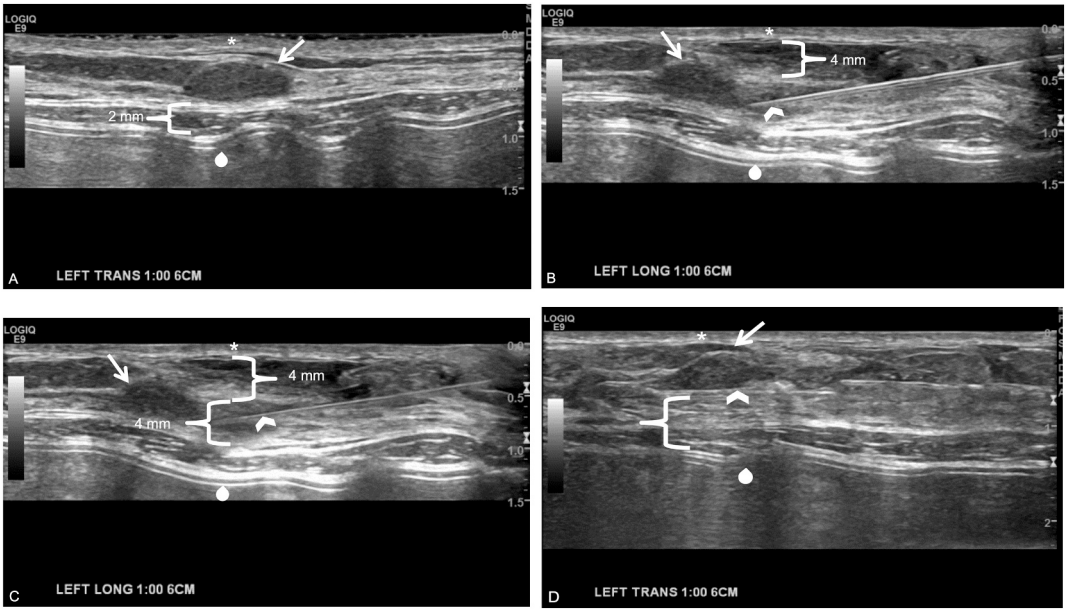


**Fig. 4.** Hydrodissection for masses near an implant. (A) A 48-year-old woman presents with a palpable left breast mass (arrow) adjacent to a prepectoral implant (tear drop) and deep to the overlying dermis (asterisk). (B) Pre-biopsy hydrodissection superficial to the target increased the space (bracket) between the mass (arrow) and the overlying skin (asterisk) by 4 mm. The hydrodissection needle (chevron) is seen at the inferior aspect of the mass. (C) The hydrodissection needle (chevron) is then placed deep to the target (arrow) for a second site of hydrodissection to increase the space (lower bracket) between the mass (arrow) and the underlying implant (tear drop) by 4 mm. (D) Biopsy image shows that the biopsy device (chevron) is parallel to the implant (tear drop) with increased distance (bracket) between the implant and target (arrow).

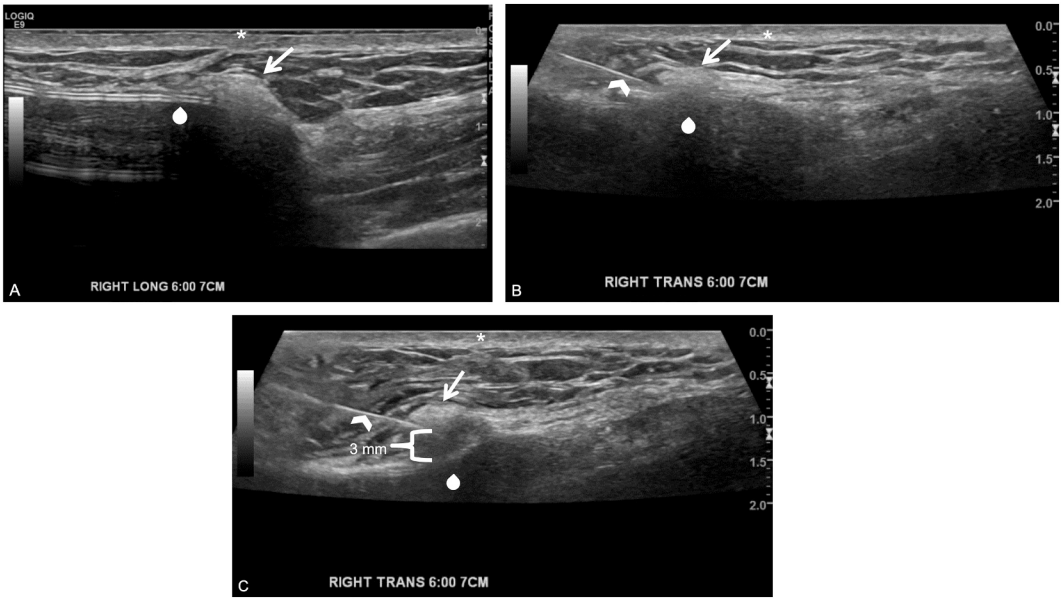


**Fig. 5.** Hydrodissection for masses adherent to an implant capsule. (A) A 61-year-old woman with a history of bilateral mastectomies and silicone implant reconstructions presents with a hyperechoic mass (arrow) located just deep to the skin (asterisk) and adherent to the implant (tear drop). (B) The hydrodissection needle (chevron) is placed between the target (arrow) and the implant (tear drop). (C) A bolus of saline elevates the target (arrow) safely from the implant (tear drop) for biopsy by 3 mm (bracket). Video 3 shows the echogenic mass being elevated off of the implant capsule.

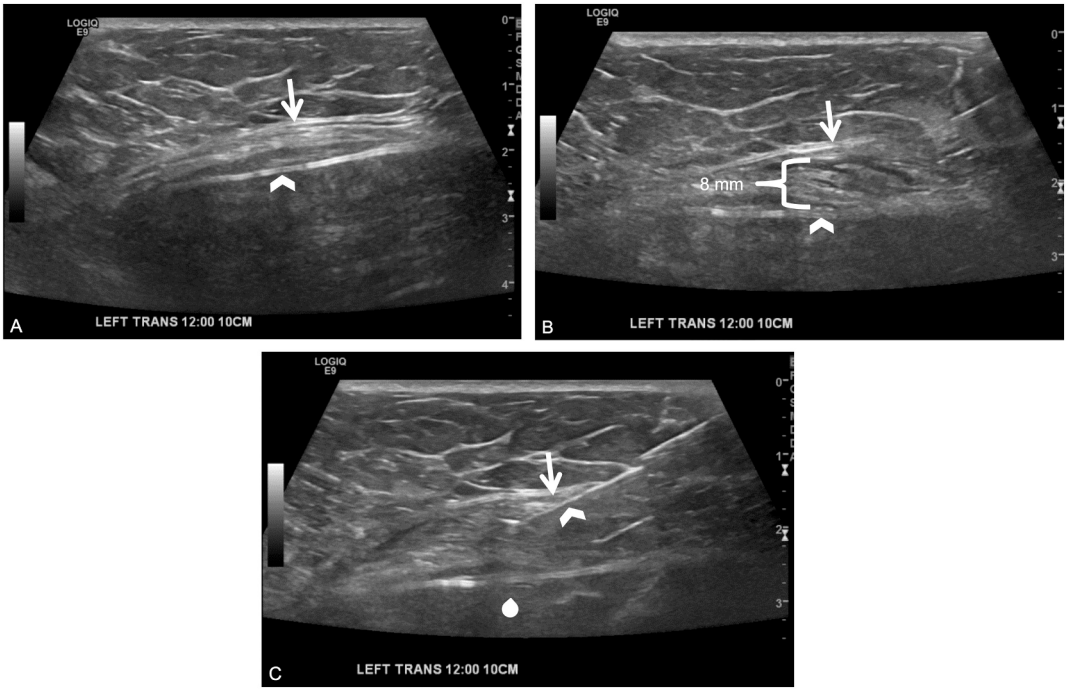


**Fig. 6.** Hydrodissection for fibrous implant capsule biospy. (A) A 55-year-old female presents with silicone breast implant hardening and associated skin swelling and nipple changes, but no peri-implant effusion on ultrasound. Plastic surgery requested a fibrous implant capsule (arrow) biopsy to exclude BIA-ALCL prior to explantation. The implant elastomer shell is echogenic and visible (chevron) deep to the capsule. (B) Procedural image shows elevation of the capsule (arrow) by 8 mm (bracket) from the implant elastomer shell (chevron). (C) The implant capsule (arrow) can be seen within the trough of the biopsy needle (chevron), with a safe distance maintained from the implant (tear drop). Video 4 shows separation of the implant fibrous capsule from the implant envelope to allow room for the insertion of a biopsy device.

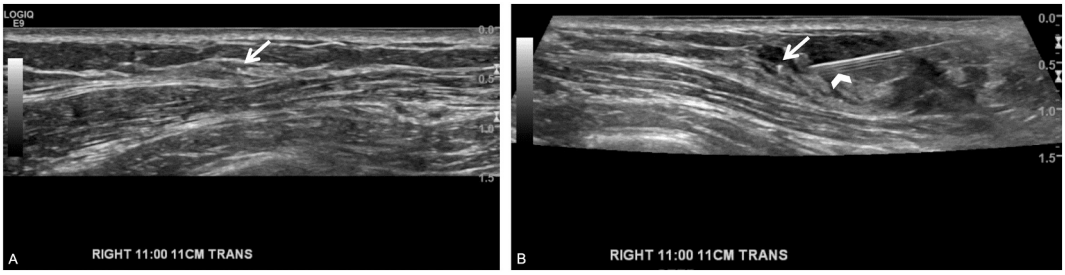


**Fig. 7.** Hydrodissection to aid with biopsy clip visualization. (A) A 54-year-old woman status post neoadjuvant chemotherapy presents for preoperative localization of the previously placed clip, but the echogenic biopsy clip (arrow) is questionably identified on the pre-localization ultrasound. (B) Fluid instilled with the hydrodissection needle (chevron) surrounds the echogenic clip (arrow), which is more confidently visualized with the posterior reverberation artifact. Video 5 shows the clip being surrounded by fluid and the application of gentle tapping on the biopsy clip by the hydrodissection needle for added confirmation of the target.

often have only a thin layer of residual subcutaneous tissue between the dermis and the implant or chest wall. For these patients, hydrodissection can be used both superficial and deep to the target to create adequate space for the biopsy needle (Fig. 3). Since there is typically minimal tissue present, repeated small boluses may need to be instilled as the fluid tends to drain from the incision site. Additionally, if needed, the patient should be reassured that the leaking fluid is the sterile saline or local lidocaine and not blood.

Procedures in patients with breast implants can be challenging if the target is located near or on the implant capsule. Most cases can be managed in a similar fashion to patients with mastectomies, where liquid is instilled above and below the target (Fig. 4). When a target is adherent to the capsule, hydrodissection is used to instill fluid below the target to elevate the adherent target from the implant (Fig. 5 and Video 3).

Hydrodissection can also be utilized in patients with suspected breast implant associated anaplastic large cell lymphoma (BIA-ALCL). Specifically, when the typical finding of peri-implant fluid is not present, and a fibrous capsule biopsy is warranted. In such scenarios, hydrodissection can be used to displace the fibrous capsule away from the implant for safe capsule biopsy, or to displace the fibrous capsule from the overlying pectoralis muscle and underlying implant in the case of retropectoral implants (Fig. 6 and Video 4).

### 3.2. *Preoperative localizations*

Ultrasound-guided pre-operative localizations are performed to assist with surgical target removal [17]. In the setting of malignancy and subsequent neoadjuvant therapy, the target is often no longer visible and only the clip remains to be identified sonographically. Nonconventional methods to verify clip location include, the use of iodinated contrast under ultrasound with subsequent mammogram to confirm that the sonographic target is correct [18]. If contrast is not readily accessible, or a patient reports an allergy, hydrodissection can be considered. In this scenario, the lidocaine is slowly bolused at the site of the suspected clip under sonographic guidance. As the fluid surrounds the targeted marker, the clip is better visualized as it is echogenic with posterior reverberation compared to the surrounding instilled anechoic fluid (Fig. 7). Additional confirmation can be performed by gently tapping the clip with the lidocaine needle, proving that it is truly the target and not artifact (Video 5) [19].

## 4. Conclusion

While there are several approaches to challenging breast procedures, an under-reported but versatile technique is the use of hydrodissection during these breast interventions. In ultrasound-guided breast biopsies, hydrodissection can be used to displace adjacent structures from the target, preventing injury to dermis or chest wall, or iatrogenic implant rupture, while bringing targets into accessible locations and reducing sampling error. Additionally, hydrodissection can help confirm the presence of a clip for localization in the setting of complete neoadjuvant response.

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