

General instructions

Coaxial technique

Using a **coaxial technique** guarantees **better maneuverability** and **additional protection**. **Inserting a microcatheter inside a standard 4 to 5 French catheter is a way to ensure safe and precise movements throughout the entire procedure**. Proceed then with flushing with 5% dextrose solution. Depending on the procedure, the microcatheter will have to be disposed of after use, as it may become too adherent. In case of portal vein embolization or varicocele, for example, the catheter may be used again as long as the next catheterism is not too complex. Going back in a second time will not be necessary after a proper embolization, as only a few drops of glue will ensure a perfect result.

Glubran® 2 + Ethiodized Oil: how to prepare the mixture

Glubran® 2 needs to be combined with Ethiodized Oil not only in order to make it radiopaque but also to be able to modulate the rate of polymerization. Depending on how distal the target is, a different ratio between the products will be needed (Figs.11,12).

In our practice, a 5 ml Luer-Lock syringe and a plastic 3-way stopcock are the standard instruments we use to dilute the glue. Avoid using polycarbonate tools as Ethiodized Oil dissolves this kind of material. A Luer-Lock system not only allows for a firm placement of the syringe but also for easier removal, as the syringe itself can be used to extract the catheter. Glubran®2 and Ethiodized Oil can be mixed by using two separate syringes. In order to make the mixture homogeneous, it is important to proceed slowly, in four or five steps, to avoid polymerization. You can detect such an instance by noticing the mixture turning white. According to dilution, a different gauge may be needed.

Instructions for use (1)

- **Using catheter/microcatheter:**
 - Use the same setup everytime
 - Standard 4 or 5F catheter
 - Microcatheter is mandatory
 - Previous catheter flushing with Glucose or 5% Dextrose
 - Catheter becomes useless after embolization



Figure 11

Instructions for use (2)

- **Mixing with Ethiodized Oil:**
 - Makes the mixture radiopaque
 - Modulates the rate of polymerization
 - Plastic 3-way stopcock
 - No polycarbonate luer-locked syringes



Figure 12

In our experience, a 2.8 Progreat® catheter and a 5 ml syringe offer a good balance between fluidity and resistance. When using a smaller microcatheter such as a 2.0, for instance, the mixture may be quite difficult to inject. In this case, the content of the syringe can be transferred into a smaller one, such as a 3 ml. Using 1 ml syringes is not advisable in our opinion, as the injection may feel too easy and lack the proper resistance.

Embolization technique

Ensure perfect stability of the catheter and perform a detailed angiography prior to the procedure. In order to calculate the volume, concentration, and velocity of the final glue injection, we need to perform several tests using a contrast agent (Fig.13). It is important to understand that the fluidity of these two liquids is not the same, as contrast is quite less viscous. Remember to take this factor into account when you estimate the distribution that the liquid will achieve upon injection.

Preparation

- **Preparation before injection:**
 - Stable catheter in target vessel
 - Very detailed previous angiography:
 - + Collaterals and non-target vessels
 - Calculate approximately the volume, concentration and velocity of the final glue injection:
 - + By doing previous several manual contrast injections



Figure 13

For the same reason, it is strongly advisable to pay attention to the strength we apply to the injections: always make sure you try to perform them in a similar way, so that the distribution of the liquid will be similar when you move on to injecting the mixture.

Figure 13 shows an example of considerable bleeding from the left gastric artery. The patient is hemodynamically stable and the branch can be sacrificed without consequences because of the collaterals. This is a typical embolization and we have a variety of choices to treat such a case. We can use gel foam or coils for example, however, we consider such choices as time consuming, as you may have to use a lot of coils and still not achieve complete occlusion. In this case, two drops of glue will bear great results, quickly, efficiently, and without risk. Conclusively, every time you can sacrifice the bleeding branch, which is most cases, this is undoubtedly the best course of action. Naturally, things would be different with the hypogastric artery or a pelvic trauma, for example. Provided that we always need to perform a slow and regular injection under strict fluoroscopic guidance, we can use different techniques to achieve proper embolization of our vessel (Figs. 14,15). Firstly, it is worth pointing out that the presence of blood flow does not prevent us from employing glue in our procedure. In fact, it is the opposite. A blood flow means that we can avoid reflux and safely push in the distal spot, as this presentation will show through practical examples. In most cases, though, we will perform a free flow injection.

- 1) Take a 5 ml syringe of dextrose solution and flush the dead space first, then
- 2) take another 5 ml syringe filled with the Glubran[®]2 - Ethiodized Oil mixture and
- 3) start injecting slowly and continuously. Looking at the tip of the microcatheter, you will eventually see the mixture going distally, followed by a moment of stasis.
- 4) Your endpoint will be marked by some reflux happening at the tip or of the microcatheter or even a little before that point, and that is when you can stop injecting and
- 5) proceed to remove the microcatheter with your right hand by the 5 ml syringe itself. The presence of glue in the dead space is of no concern and,

in case of arteries, the 5 F catheter will be patent, which allows for better control through the catheter.

This is not the case with venous embolization when we are in presence of retrograde flow. For varicocele or pelvic congestion syndrome (PCS), when we remove the microcatheter we will likely occlude the 5 F catheter. This is not a problem but something we need to be aware of, since in that case we need to make sure not to push again, as we would be pushing something that is already polymerized and run the risk of migration. Keep in mind that this is indeed a false problem, as pushing again is impossible except with very small syringes. Provided that we perform the injection correctly and remember the difference in behavior between arteries and veins, this one-shot technique is ideal in many situations. Our second option is a multi-shot technique. After flushing the dead space with dextrose solution, we take only a small amount of mixture. As the dead space of a 2.7 microcatheter is about 0.6/0.7, a 0.2 ml is enough. We proceed with slowly injecting glue and dextrose solution in lay-

Embolization technique

- Slow and regular injection under strict fluoroscopic control:
- 3 techniques:
 - + Free-flow injection of boluses of a mixture of glue and ultrafluid Ethiodized Oil +++
 - "One-shot"
 - "Multi-shot"
 - + Blocked-flow injection to create vascular-tree casts under pressure
- No rush with catheter withdrawn
- Pull out curtly the catheter after getting your goal

Figure 14

ers, repeating the procedure as many times as needed. This will ensure that the dead space stays patent during the whole procedure. The drawback to this technique is not only that it is time-consuming, but also that the layers will rarely look neatly separated. We can never be sure whether the product at the end of the tip is glue or dextrose, and that is why I personally do not prefer this method, especially considering that maintaining the patency of the microcatheter is, in most cases, not mandatory. Carefully remove the microcatheter, not because it will stick as this is not a real risk, but in case any glue is left on the tip. If so, removing the catheter too quickly may break the glue and cause it to migrate to the distal spot, especially in case of arterial embolization.

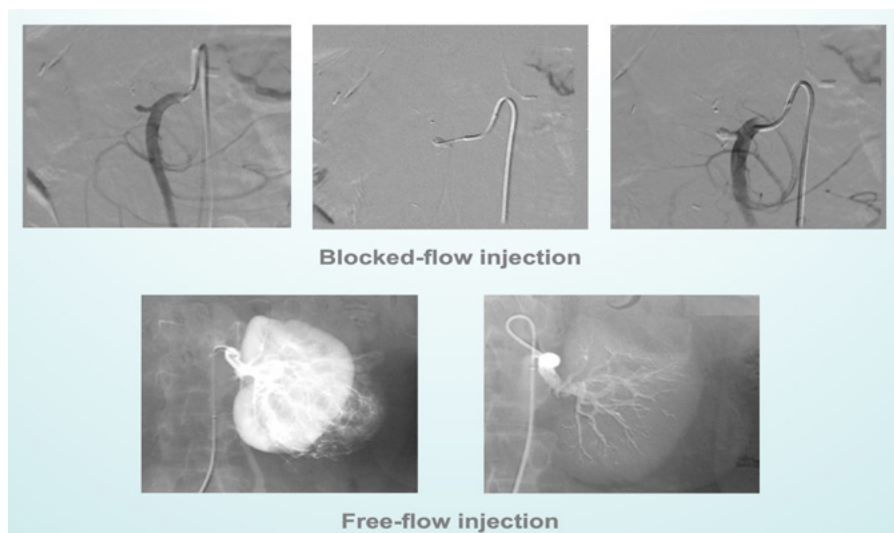


Figure 15