PsA are usually a tender, pulsatile mass in the region of an artery. There is often associated redness, pain with palpation and warmth of the skin. If there is the suspicion of a PsA, confirmation by US with Doppler examination is indicated. Invariably this study is diagnostic and all that is needed to diagnose and plan therapy. Typically, the US study shows arterial blood flow into the PsA that is chaotic and swirling in its appearance (Figure 1). When a PsA is small it often will spontaneously clot and resolve without therapy; however, larger PAs need therapy since it is unlikely that they will spontaneously resolve. The treatment options for large and/or symptomatic PAs should begin with minimally invasive options. There is literature that suggests that compression for 20-30 minutes with an US probe over the neck of the PsA can be effective. If this choice is pursued it is essential that there is complete occlusion of the arterial inflow to the PsA if success is to be achieved. We do not use this approach because it is quite painful for the patient, has a relatively high failure rate and is time consuming. Our preference is direct US guided puncture of the PsA with thrombin injection into the aneurysm lumen, followed by temporary balloon occlusion for PsA with large necks or those that fail to resolve after thrombin therapy (Figure 2). Alternatively, one can use a covered stent to isolate the PsA with or without thrombin injection, however, this is not an ideal approach for small children since there arterial diameter is small and increasing the risk of arterial occlusion and reduction future arterial growth leading to vessel narrowing. In our experience, a stent is unnecessary since there is a very high probability of success with directed thrombin therapy. As a last resort, there is the option of surgical ligation.

**TECHNIQUE**

In our experience, the procedure is often performed at bedside in the PICU and the patient is sedated or generally anesthetized. US is used to confirm the patency and location of the PsA. A skin entry site is identified and marked with washable ink. The skin is prepared and draped in sterile fashion and the entry site locally anesthetized with 1% lidocaine with a 27G or 30G needle. Then, using real-time US guidance a 27G puncture needle, 25G angiocatheter or 22G Chiba or spinal needle is guided into the PsA with the needle tip position away from the neck of the aneurysm to minimize the potential for thrombin to enter the arterial lumen (Figure 2A). We often use an angiocath so that the needle can be removed to avoid inadvertent movement of the needle through the far wall of the artery and inadvertent injection in a non-target area. Then, while observing with US, a single drop of thrombin is injected. Almost instantaneously one sees alteration of the flow pattern in the PsA. If, after a minute or two, Doppler shows residual blood flow in the PA the needle is repositioned into this area and a second drop is injected. This is repeated until there is complete cessation of flow. Once flow is no longer identified, it is worthwhile to wait about 5 minutes and re-evaluate the flow with Doppler (Figure 2B). If there is no flow identified the procedure is discontinued. If flow persists,
additional thrombin is injected and US follow up is obtained. If flow control is not achieved, alternative options are considered for the following day. It is rare that a PsA remains patent and another therapeutic option is needed.

**CONCLUSION**

Percutaneous thrombin injection is an effective approach to treat PsA of all types. At this time, percutaneous therapy is the procedure of choice.

**REFERENCES**