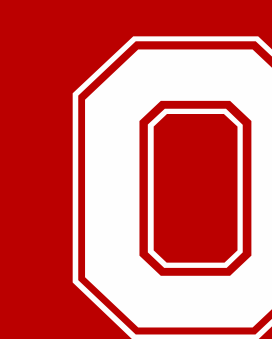


3D-Printed Fistula Plug as a Solution for Fistula Following Laryngectomy

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Background

Acquired fistulae are common in laryngectomy patients, occurring in 12 – 34% of patients. Most efforts to manage fistula focus on wound care and operative intervention for definitive reconstruction. We describe a case of an 83-year-old patient who underwent total laryngectomy and partial esophagectomy who developed an acquired fistula that resulted in recurrent aspiration pneumonias. This was successfully managed with a custom 3D printed fistula plug, presented below.

Methods

Description of Case

The patient presented to an outside facility with altered mental status, fever, coughing, and hypotension. This was discovered to be caused by an aspiration pneumonia, at which time he was transferred to our facility. While under our care his fistula was plugged with a red rubber catheter. On hospital day 3, the patient was afebrile and stable for discharge with the catheter in place. He followed up outpatient to receive his 3D printed plug.

Fistula Plug Design

Measurements were taken while the patient was hospitalized. The fistula plugs were designed to have a retaining tip, to keep the plug from coming out with coughing, as well as a safety button to prevent aspiration of the plug. Molds of the plugs were then digitally created using Materialise 3Matic software [Leuven, Belgium] and 3D printed. A medical grade silicone was poured into the molds to create the final plugs.

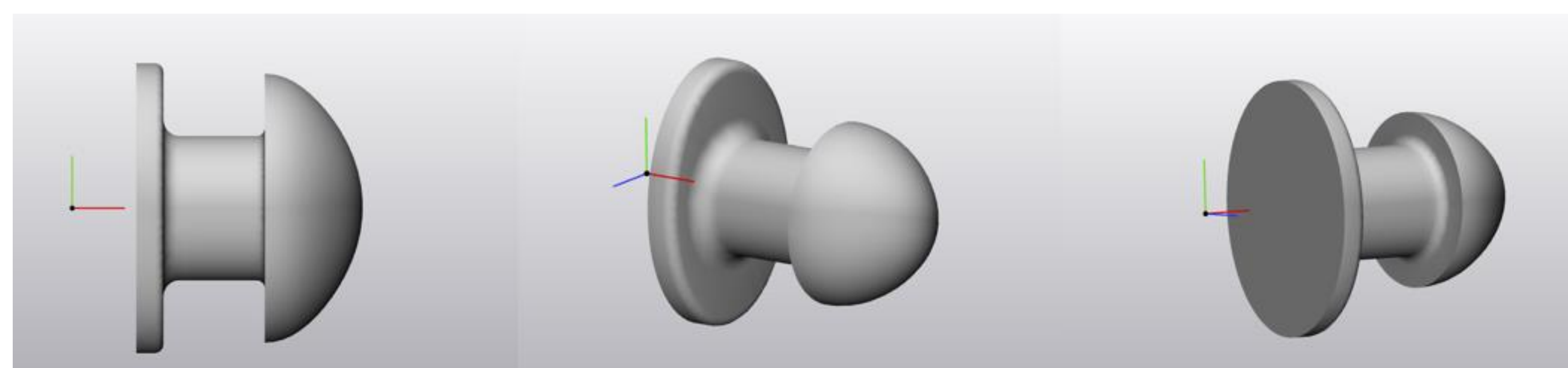


Figure 1. Digital design of the fistula plug, shown from different angles.

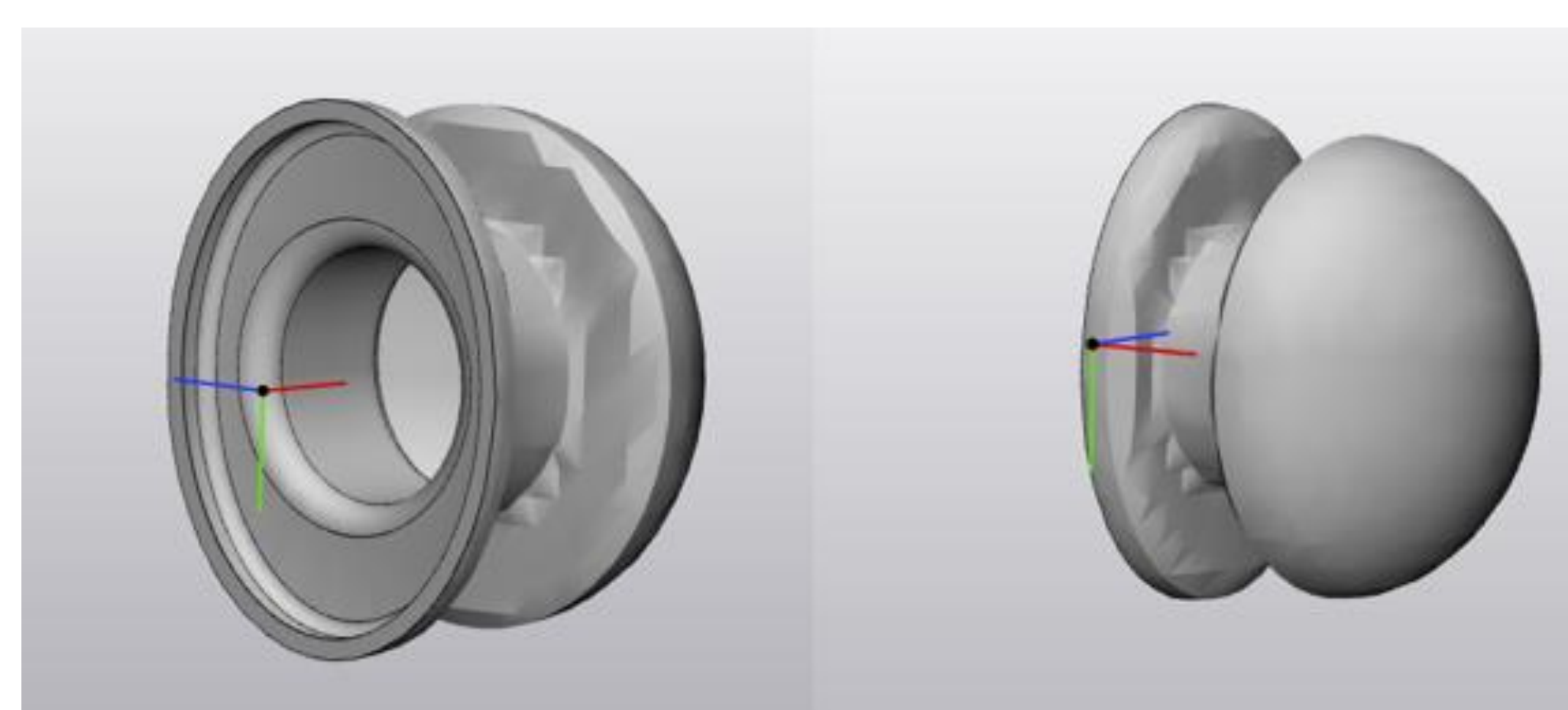


Figure 2. Digital design of the mold for the fistula plug

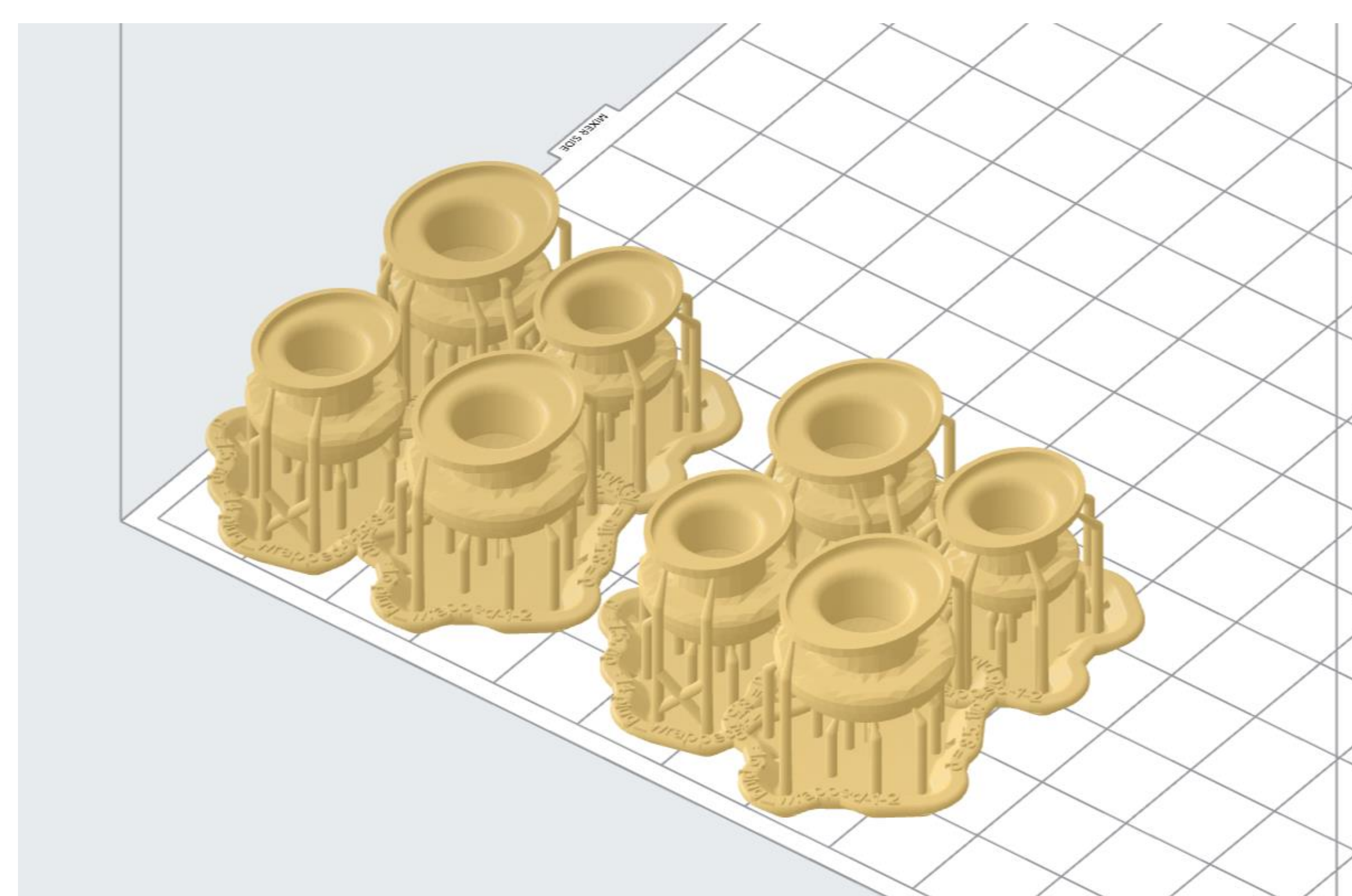


Figure 3. Various sizes of the fistula plug mold on the digital build platform, with supports present, ready for printing



Figure 4. The final fistula plug being used by the patient, with a suture stitch for additional safety

Results

The patient presented in clinic 2 weeks after discharge. At this time, he still had a red rubber catheter in place. The initial fistula plug was too small, so additional measurements were taken. At the second fitting one week later, the plug was a good fit and was left in place to seal the fistula with a safety stitch attached.

In the 4 months since fistula plug placement, the patient has had no additional aspiration events or hospitalizations. There are no plans for any definitive closure of the fistula.

Conclusions

- 3D printed customized fistula plugs are a viable option for patients who have acquired fistulas
- These inexpensive and easy to produce plugs prevent potentially fatal aspiration events and pneumonias
- They can be used long term: this patient has used his plug for 4 months with good results.
- Fistula plugs are good options for patients who are not surgical candidates for closure of their fistulae.

References

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