Personalized Healthcare Technology in Managing Post-operative Gastrointestinal Surgery Complications

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OBJECTIVE

- Explore the feasibility of 3D printing personalized internal drainage stents for the treatment of leaks following gastrointestinal surgery.

DESCRIPTION

- Advances in 3D printing technology have allowed the development of customized and personalized medical devices.
- Endoscopic internal drainage (EID) is a novel method to facilitate drainage of an abscess cavity into the lumen of the gastrointestinal tract by placing a double pigtail stent through the fistula opening.
- Current available stents are designed for biliary drainage and not for treatment of gastrointestinal leaks. They are available in manufacture-determined sizes and shapes for this purpose.

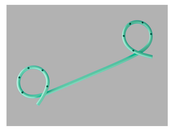


Figure 1. Available biliary stent in the market

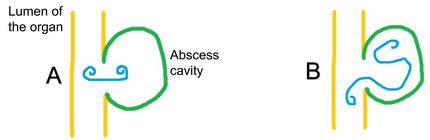


Figure 2. Illustration of stents used to drain an abscess following gastrointestinal surgery
(A) Standard stent (B) Customized stent

METHODS

- We retrospectively identified patients who underwent gastrointestinal surgery complicated by postoperative leaks and underwent serial EID for treatment.
- Computerized Topography (CT) scans were reviewed over a period of time sequentially and abscess cavities dimensions and characterizations were evaluated. **(Figure 1)**. Images were then segmented and recreated as 3D reconstructions.



Figure 3. CT scan sections of a patient with a leak following one anastomosis gastric bypass (OAGB). Green marker delineates the abscess cavity in order to segment it to a 3D image.

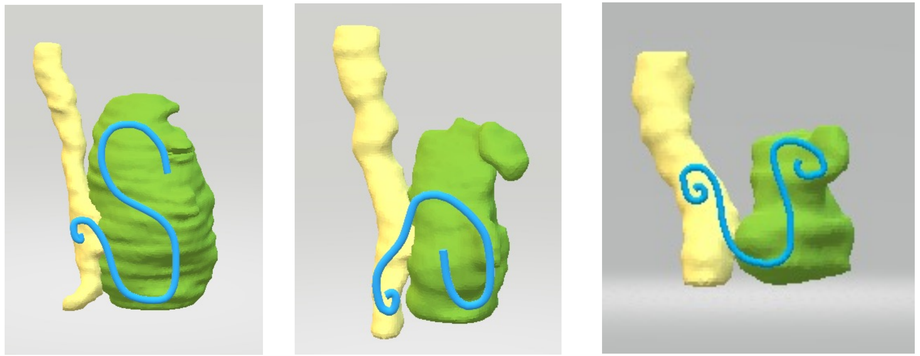


Figure 4. Sequential 3D construction of an abscess cavity and a gastrointestinal lumen in the same above patient over a period of 6 weeks. The stent was designed to maximize drainage at each interval.

- The stents will be designed, then their shape and size will be customized, according to each patient's needs at intervals.
- Length, diameters, and 3D configuration will be determined based on CT images, and will be modified over time based on progression of treatment.
- Stereolithography (SLA) 3D printing technique will be used to produce the stents.

RESULTS

- Physical production of stents is in progress.

CONCLUSION

- Customized stents can potentially improve drainage of intra-abdominal abscesses after GI surgery.
- This technology is a real-world application of personalized healthcare, creating a precise device for each unique patient at specific intervals over time.
- This proof-of-concept study is the first description of customizable 3D printed stents and may advance therapy for this complex clinical condition.