FDA Executive Summary

Prepared for the
Fall 2024 Review by the
FDA's Pediatric Advisory Committee

Flourish™ Pediatric Esophageal Atresia Device (H150003)

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I. INTRODUCTION

In accordance with the Pediatric Medical Device Safety and Improvement Act, this review provides a safety update based on the post-market experience of the Humanitarian Device Exemption (HDE) device, Flourish™, since the 2023 Pediatric Advisory Committee (PAC) update.

In our 2023 update to the PAC, the Food and Drug Administration (FDA) reported that the manufacturer of the Flourish device (Cook Medical) withdrew Flourish from the U.S. market in June 2023. The purpose of this review is to provide the PAC with a summary of available post-market data. This abbreviated executive summary includes a description of the device status and remaining available clinical data, including the completed Post-Approval Study (PAS) and data from patients treated outside of the PAS (non-PAS).

II. INDICATIONS FOR USE

The Flourish Pediatric Esophageal Atresia Device is indicated for use in lengthening atretic esophageal ends and creating an anastomosis with a non-surgical procedure in pediatric patients, up to one year of age with esophageal atresia without a tracheoesophageal fistula (TEF) or in pediatric patients up to one year of age for whom a concurrent TEF has been closed as a result of a prior procedure. This device is indicated for atretic segments < 4 cm apart.

III. BRIEF DEVICE DESCRIPTION

The Flourish device consists of an esophageal catheter and a gastric catheter. The esophageal catheter is a 10 Fr catheter with an inner magnet catheter. The inner catheter is fitted with bullet-shaped neodymium iron boron magnet, which features a central hole for insertion of a wire guide. The "Suction/Contrast Only" port is for suction of saliva, and for injection of contrast to confirm anastomosis.

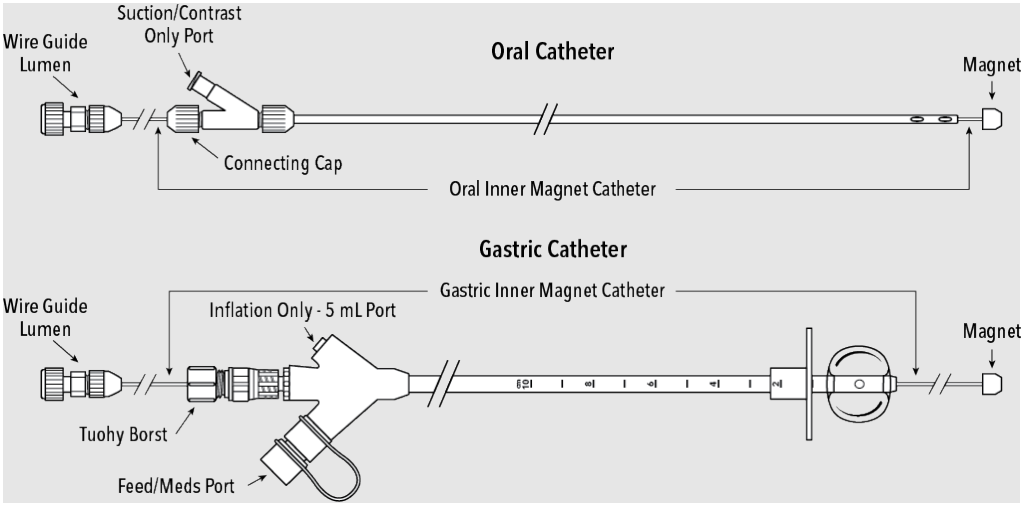

Figure 1. Flourish Device

The gastric catheter is a modified two-lumen 18 Fr/5 mL balloon retention catheter. One lumen is for balloon inflation/deflation. The second lumen is modified by the addition of the gastric magnet catheter, essentially creating a lumen within a lumen. This modified arrangement allows for initial placement of a wire to guide introduction of the gastric magnet catheter assembly. Feed is delivered through the accessory" Feed/Meds" port adjacent to the adapted central port. The inflated balloon holds 5 mL of liquid. The distal end of the internal catheters is fitted with bullet-shaped neodymium iron boron magnet, which features a central hole for insertion of a wire guide. When the two catheters are aligned tip to tip the magnets have opposite polarities; thus attracting each other. They are cylindrically shaped. The oral catheter is fitted with a Connecting Cap to allow locking and unlocking of the inner magnet catheter. The gastric catheter is fitted with a Tuohy-Borst adapter to allow locking/unlocking of the inner magnet catheter.

Principles of Operation

In a candidate infant, the distance between the atretic segments is assessed under fluoroscopy using radiopaque flexible catheters and metal probes. After identification of the pouches, the oral/esophageal catheter is inserted orally and advanced until the magnet is located at the distal end of the upper pouch. The gastric catheter is inserted over a wire guide, under fluoroscopy through a mature stoma and advanced until the magnet is located at the distal end of the lower pouch. The gastric catheter is secured to the stomach wall internally with a balloon and externally with a bolster (Figure 1. Flourish Device).

Within three to thirteen days, the traction caused by the magnets allows the esophageal sacs to approximate. Daily biplane chest radiographs are taken to assess the distance between magnets. Once approximated, the surrounding tissues grow together while the tissue between the magnets undergoes necroses, causing development of an anastomosis, thereby creating a connected passage from mouth to stomach.

Once an anastomosis has been confirmed through fluoroscopy, the magnets are removed. The proximal end of the oral/esophageal inner magnet catheter is cut. A new wire is introduced through the oral/esophageal inner magnet catheter through the newly formed anastomosis and exits through the gastrostomy port. The oral/esophageal catheter is pushed distally toward the stomach until magnets are in the stomach, below the anastomosis. Then, the oral/esophageal inner magnet catheter is gently pushed, and the gastric catheter is pulled until the system exits from gastrostomy site, thus removing the gastrostomy tube, oral/esophageal and gastric inner magnet catheters, and the magnet pair as a unit. A new orogastric tube or nasogastric tube is placed for one to three days.

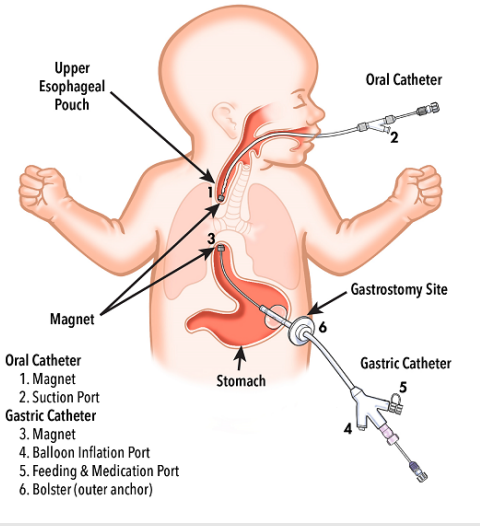

Figure 2. Device Illustration

IV. DEVICE STATUS

The sponsor withdrew Flourish from the U.S. market on June 16, 2023 and has confirmed that no new devices have been shipped, sold, and/or implanted since the market withdrawal date.

V. POST-MARKET CLINICAL DATA

In this section, we provide a summary of the completed PAS and limited data provided by the sponsor on non-PAS patients.

PAS

This is a single-arm, observational study in which 21 patients were enrolled across 10 clinical sites, including 9 sites in the U.S. Following treatment with the Flourish device, PAS patients were followed for 2 years, during which relevant clinical data were extracted from medical records. After treatment with Flourish, successful anastomosis formation was achieved in 52% of patients (11/21). The sponsor evaluated a number of factors that could be related to anastomosis formation (i.e., atretic gap size, sex, race, age, birth weight, EA type, etc.) and found no predictors of treatment success. Of the patients who achieved anastomosis formation, all (100%, 11/11) went on to develop stricture formation and 18.2% (2/11) developed a peri-anastomotic leak. The pattern of clinical response and challenges of device use are consistent with prior reports and no new concerns were identified.

Non-PAS

Outside of the post-approval study, 22 patients had Flourish placement to treat esophageal atresia (EA). Successful anastomosis formation was reported in 59% (13/22) of patients, which is similar to the 52% reported in PAS patients. There were no reported deaths. Limited data are

available on these patients who are not enrolled in the PAS, with incomplete safety data on clinical outcomes. For example, there were zero reports of stricture formation or peri-anastomotic leaks, which may be due to a reporting bias.

VI. SUMMARY

The Flourish device was approved on limited, but encouraging, pre-market data in selected patients by highly skilled operators. In the pre-market data from literature and compassionate/emergency use cases, esophageal anastomosis was achieved in all the described cases, both as first line, as well as second line therapy. The probable benefits of earlier anastomotic repair and fewer surgical complications outweighed the risks of a high rate of anastomotic strictures requiring balloon dilation and/or esophageal stenting in the appropriate patient. However, the post-market data show that in real-world use of the device, there is variability in results that were not expected. In the PAS, esophageal anastomosis was achieved in approximately half of the patients, with all patients with initial success developing subsequent strictures at the treated site. The non-PAS data mirrors the PAS for probable benefit, with likely underreporting of safety events. Stricture development may be a foreseeable outcome given the nature of the disease and the intervention which would not be expected to create a normal tubular epithelial lined esophagus. The lack of reporting of strictures in the non-PAS data may reflect clinician anticipation of this outcome which may restore gastrointestinal continuity with the recognition that this "safety consideration" can be managed with dilation. These cumulative results are consistent with what FDA has reported to the PAC in previous years, and no new clinical concerns raised by the post-market data. This is a very challenging patient population, and the device appears to offer benefits to certain patients with acceptable risk. However, the sponsor withdrew the Flourish device on June 16, 2023.

Given that the Flourish device is no longer marketed in the U.S., this summary will be FDA’s final update to the PAC on the Flourish device.