



# HeadWay

NEWS FOR PHYSICIANS FROM JOHNS HOPKINS OTOLARYNGOLOGY-HEAD AND NECK SURGERY

## Constructing a New Trachea to Avoid Permanent Tracheostomy

Using a thermoplastic polymer and the patient's rib cartilage and vascularized fascia, Johns Hopkins facial plastic and reconstructive surgeon Kofi Boahene and team successfully replaced the patient's trachea.



Johns Hopkins facial plastic and reconstructive surgeon **Kofi Boahene**'s patient had been told he had no choice but to live the rest of his life with his tracheostomy, the result of a car accident that crushed his trachea. But Boahene wanted to try a different idea — a new tack based on work he's done to create replacement noses for patients who've lost them to cancer.

Tracheostomies can be lifesaving, Boahene explains, but they also have a host of drawbacks. Patients must cover the opening to speak, they

can't swim, and to even take a shower they risk water entering the lungs. Researchers have tried for years to create synthetic tracheas to help patients avoid this option. But tracheas created with tissue engineering efforts have failed due to a lack of blood supply, which causes cells seeded onto scaffolds to die and leads to a lack of internal strength. These constructs collapse with normal breath. Cadaver transplants aren't a viable option for many patients, as the immunosuppressive regimens patients must take have undesirable side effects.

To overcome these issues, Boahene and his colleagues first took 3D images of the patient's existing trachea. The researchers used those images as a guide to craft the same thermoplastic polymer that Boahene uses to form new noses — a material that's gradually absorbed over the course of a year when placed in the body — into a scaffold for a new trachea.

To strengthen this material internally, the team harvested sections of the patient's rib cartilage, placing it within the scaffold in rings much like those in a native trachea. They used a flap of the patient's own vascularized fascia to line this construct, then implanted it in the patient's forearm for the cells to grow and embed themselves into the

polymer, creating a unified composite.

In six weeks, Boahene and his colleagues, including laryngologist **Alexander Hillel**, harvested the new trachea and implanted it in the patient, connecting it immediately to the patient's blood supply to keep it vascularized. They monitored this new tissue over the next several months as it slowly replaced the biodegradable polymer to make sure it remained stable and healthy. One year after it was transferred into the patient's chest, the researchers removed his tracheostomy, allowing him to breathe through his new trachea for the first time.

An additional year later, the patient is living life to the fullest without his tracheostomy, a feat he'd previously been told was impossible.

"We knew the operation was a marked success when our patient was more worried about his scar than how well he could breathe," Boahene says. "Being able to provide innovative solutions is something we strive to give our patients." ■



"BEING ABLE TO PROVIDE INNOVATIVE SOLUTIONS IS SOMETHING WE STRIVE TO GIVE OUR PATIENTS."

—KOFI BOAHENE



To refer a patient or learn more, please call 443-290-5485.

# After Surgery Preserved Her Father's Voice, She Wants to Ensure the Same Care for Others

As a longtime health care executive, Naomi Kelman knows the importance of being creative and open-minded to solve problems. That is why she and her husband, Attila Kelman, give regularly to the Johns Hopkins Department of Otolaryngology–Head and Neck Surgery in support of **Ralph Tufano**, director of the Division of Head and Neck Endocrine Surgery. The Kelmans have also included the department in their estate plans.

“The way Dr. Tufano and his team responded to my father’s situation made us advocates for the department,” says Naomi. “We want to enable others to get the kind of care that my father did.”

In early 2016, Naomi’s father, Harvey Kelman, was diagnosed with thyroid cancer that was threatening his larynx (voice box). While the cancer could be treated, Harvey was very concerned about maintaining his quality of life. As a physician with a specialty in psychoanalysis, Harvey had spent a lifetime listening to others. Now, he had one request that he wanted his Johns Hopkins care team to hear: Keep his voice.

Harvey was living in Fulton, Maryland, not far from where he and his late wife raised their four daughters in Silver Spring, Maryland. Naomi, his eldest daughter and her husband, who live in California, were visiting every four to six weeks to see Naomi’s dad.

“My dad loved cooking, especially baking with chocolate,” says Naomi. “He was a huge fan of Julia Child and

The Great British Baking Show. We often joked that we’d come for a visit and leave many pounds heavier because he would test his recipes on us.”

Traditional thyroid cancer surgery would be especially tricky in Harvey’s case, given how far the cancer had spread and how close it was to his voice box. Plus, the standard treatment for thyroid cancer, radioactive iodine, was challenging because Harvey had an allergy to iodine.

“Dr. Tufano spent a lot of time talking through the options and listened carefully and respected what it was that my father wanted,” says Naomi. “In the end, Dr. Tufano did a very delicate surgery, and — in combination with follow-up radiation — my father had the quality of life that he wanted, and he was really happy about the results.”

Naomi and Attila credit Johns Hopkins and Dr. Tufano with giving them extra time with her father that they may not have had. He was able to continue doing the things he loved like gardening, cooking and spending time with his daughters and grandchildren.

Despite it being such a tough time for her family, Naomi says Johns Hopkins staff members cared for her father as an individual, and her family felt empathy, comfort and encouragement from the staff at a “very scary time.”

Today, Naomi says, “Our giving remains very much about my dad, Dr. Tufano and his team. We support the things they are doing to help people



The care received by Naomi Kelman’s father — Harvey Kelman, shown here — inspired Naomi and her husband, Attila, to include the Johns Hopkins Department of Otolaryngology–Head and Neck Surgery in their estate plans.

who are in similar situations, and want other people to have similar positive outcomes.”

Tufano says such support allows him and his team to do cutting-edge research. “Many of the pilot studies and initial projects to better personalize care and transform the way we deliver that care came about because of these relationships. All of my patients and I are forever grateful.”

To learn more about supporting the Department of Otolaryngology–Head and Neck Surgery, please call 410-955-0173. ■

## What will your legacy be?

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## NEW TECHNOLOGY

# A Smart Otoscope to Better Diagnose Ear Infections

Using artificial intelligence and machine learning, Johns Hopkins physicians are developing a tool for more sensitive and specific diagnosis.

Because ear infections can be complicated to diagnose, otolaryngologist–head and neck surgeon **James Clark** occasionally sees patients who have been misdiagnosed with acute otitis media (AOM) or otitis media with effusion (OME). “After two or three courses of antibiotics, they come to a specialist like me because they are not improving,” says Clark.

To help alleviate the complexity of accurately identifying these conditions, in early 2019, Clark set out with **Therese Canares**, director of pediatric emergency medicine digital health innovation at Johns Hopkins, to develop a “smart” otoscope to diagnose AOM and OME using artificial intelligence. “I thought using technology might offer a solution,” says Clark.

The clinicians joined a program at the Johns Hopkins Technology Innovation Center that matches researchers and health care providers with business, design and technical experts to develop software for improved patient care. Clark and Canares labeled 100 images of healthy and infected ear drums so that a computer using machine-learning could create an artificial intelligence algorithm. Once complete, initial testing showed the algorithm detects ear infections at the same sensitivity and specificity as a fellowship-trained otolaryngologist.

By October 2020, the team produced a prototype featuring a high-definition camera and screen, and wireless internet connectivity. After recording images of an eardrum, the

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# A Full Spectrum of Care for Patients with Swallowing Disorders

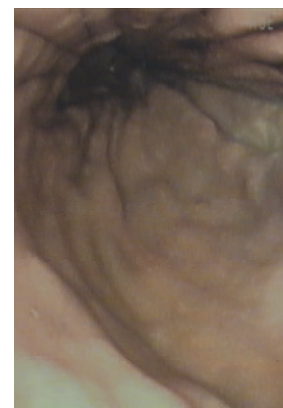
As one of the most comprehensive programs for swallowing disorders in the mid-Atlantic, laryngologist Shumon Dhar and his colleagues offer an array of diagnostic and therapeutic options.

For people with dysphagia, eating is often fraught with pain or fear, says Johns Hopkins laryngologist **Shumon Dhar**. Because dysphagia can have detrimental long-term effects, he says, including significant weight loss, decreased nutrition, aspiration pneumonia and prolonged hospitalization, Dhar and a multidisciplinary team of colleagues work together to treat dysphagia using a variety of approaches.

“Swallowing starts at the mouth and ends at the stomach,” Dhar says, “so we need a diverse group of experts and tools at our disposal to effectively treat swallowing problems in a holistic way.”

As dysphagia is a symptom that can arise from many potential causes, he says, accurate diagnosis is key in getting patients relief. Johns Hopkins offers the most comprehensive diagnostic program in the mid-Atlantic region, using some methods and tools that aren’t widely available elsewhere.

An integral part of the workup is swallowing fluoroscopy or a barium swallow study performed by a radiologist, sometimes in conjunction with a

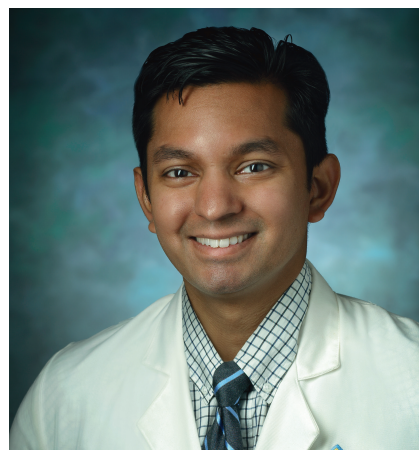


Shumon Dhar and colleagues recently began offering transnasal esophagoscopy (TNE), a thorough examination of the esophagus and stomach via an ultrathin endoscope inserted through the nose. Above, from left to right: a balloon dilation of stricture during TNE, a biopsy of the esophagus during TNE and the body of the stomach during TNE.

speech language pathologist. These tests allow Dhar and his colleagues to identify anatomical and physiologic abnormalities in real time. Sometimes these studies can lend themselves to on-the-spot therapy, with patients receiving some relief from learning swallowing maneuvers and strategies taught during the tests.

Because one of the most common causes of dysphagia is gastroesophageal reflux disease, patients can benefit from objective pH testing using either a hardwired transnasal probe or a high-tech capsule attached to the esophagus during endoscopy. Motility problems (or problems of movement of the esophagus) are diagnosed with high-resolution manometry using a probe in the esophagus that records pressure generated during the swallowing process.

At the Johns Hopkins Health Care & Surgery Center – Green Spring Station, Dhar



Shumon Dhar

and his colleagues recently began offering transnasal esophagoscopy (TNE), a procedure unique to the region that allows doctors to thoroughly examine the esophagus and stomach through an ultrathin endoscope inserted through the nose. Not only do patients stay awake during this in-office procedure, avoiding potential side effects from anesthesia, but TNE can be combined with other diagnostic and therapeutic procedures, including biopsy of the larynx or esophagus, balloon

dilation of the esophagus, therapeutic injections of botulinum toxin or steroids, or secondary tracheoesophageal prosthesis evaluation and placement.

Once patients have the correct diagnosis, many cases of dysphagia can be treated noninvasively with swallowing therapy delivered by Johns

*continued on back cover*

smart otoscope sends the images to the cloud, where they are saved and then analyzed by the algorithm. A diagnosis is then sent back to the otoscope in real time and displayed on the screen. Clark says the technology may be beneficial for in-person appointments, telemedicine and urgent care settings.

“It can be difficult to explain to parents what’s going on in the ear

without a picture,” he says. “The images can be shared with parents during the exam so they better understand why the child may or may not need an antibiotic.”

Alternatively, the technology could be used by a caregiver in the home to share high-resolution images with a physician in real time during a telehealth visit. In an urgent care setting,

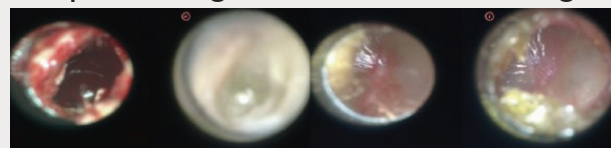
the device has potential to enhance speed and accuracy of diagnosis and treatment. “The clinician could prescribe an antibiotic right away if needed, and the patient could go home,” says Clark.

Since 2019, the team has secured \$450,000 in funding. Most recently, they submitted a provisional patent application for the technology

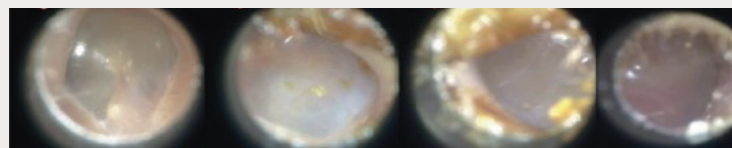
through Johns Hopkins Technology Ventures. The next step is gathering efficacy data on the prototype.

“The best thing about being at Hopkins is if you’re interested in something, there’s always someone you can call or email, and they will help you out,” says Clark. “There’s an openness to trying new technology across our health system, and that has been awesome.”

## Sample of Images Used to Train the Algorithm



These images were labeled as abnormal.



These images were labeled as normal.



To refer a patient or learn more, please call 443-290-5485.

Please include the following patient information:

- Name
- Date of birth
- Medical problem
- Patient’s contact information
- Physician office contact information

## A Full Spectrum of Care for Patients with Swallowing Disorders

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Hopkins' team of speech language pathologists or with medication. Other disease processes may require sedated endoscopic management or surgery performed by Dhar or one of his colleagues. "We offer the whole gamut of options within our team," he says.

Getting patients back to living life to the fullest extent possible is their ultimate goal, Dhar says. "It's extremely gratifying as a physician when we hear that patients with the most profound swallowing difficulties can eat meals with their families again." ■

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WINTER 2021

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