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Telemedicine on Ice

*When a heart attack struck in the harsh Antarctic winter,
a UTMB cardiologist made a virtual house call*

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In his twenty-one years as a cardiologist at UTMB, Professor Masood Ahmad has had to schedule his appointments with patients around a lot of things. But one evening in late June 2003 was the first time he had to arrange a medical appointment to coincide with the availability of a satellite transmitter. That was because the patient about whose health he was consulting, James “Tony” Black, a meteorologist at the National Science Foundation’s Amundsen-Scott research station, was being seen via telemedicine from half a world away in Antarctica.

Sitting on an examining room table in his doctor’s office inside a snow-covered dome just yards from the South Pole, Black watched nervously as his primary care physician, Dr. William Silva, tinkered with a camera and checked the quality of the image produced by the ultrasound machine at Black’s side.

Black, thirty-five years old, came to see Silva on June 26, 2003, complaining of indigestion. From that and other symptoms, Silva suspected that Black was suffering from something far worse. Silva promptly conducted a physical examination, did some blood work, and administered an electrocardiogram, which creates a graphic record of the heart cycle. Based on these results and on Black’s medical history—his father had died of heart disease and Black himself had a tendency toward hypertension—Silva thought that Black had suffered a myocardial infarction.

Initially, Black resisted the idea that he had experienced a heart attack. He was, after all, still young and fit, and, to avoid his father’s fate, he exercised and ate a healthy diet. Silva couldn’t be absolutely certain of the diagnosis. In any event, assuming the physician was right, he couldn’t accurately determine how bad Black’s suspected heart attack had been. That required analysis by a specialist like Ahmad, who could observe the heart imaging procedure and correctly diagnose the problem and prescribe necessary treatment.

After several email exchanges between the two physicians, Ahmad arranged the tele-visit and went to the telemedicine console at UTMB’s emergency room. Bits and bytes of information beamed from Galveston and the South Pole to a satellite hovering 22,300 miles above the planet in geosynchronous orbit and bounced back to those two spots on earth became images, voices, and data. This technology permitted Ahmad, Black, and Silva to see and talk with each other and for Silva to send real-time moving ultrasound pictures of Black’s damaged heart to the desktop telemedicine console where Ahmad sat.

What Ahmad would see and recommend had life-and-death implications. Late June is in the dead of the frigid Antarctic winter, when the sun never shines. In the twenty-four hours of daily darkness, outdoor temperatures sometimes plummet to 100 degrees below zero Fahrenheit, nearly 190 degrees colder than the steamy summer weather where Ahmad was in Galveston. Howling Antarctic winds and blowing snow made a patient's evacuation virtually impossible. When it is this cold, snowy, and windy, the best the inhabitants of research stations at the bottom of the earth can hope for is an airdrop of supplies. Attempting a rescue in this unforgiving climate could cost hundreds of thousands of dollars and risk the lives of would-be rescuers and of the person being evacuated.

Black was seen by Ahmad thanks to a contract signed in October 2001. Raytheon Polar Services Co., of Centennial, Colo., the logistical support contractor for the National Science Foundation (NSF) in Antarctica, awarded UTMB the subcontract to provide specialty medical services via telemedicine to patients among the three thousand NSF researchers and support personnel who work and live in the three scientific stations that function year-round in Antarctica—Amundsen-Scott (South Pole), McMurdo, and Palmer—plus those staffers who operate two ice-breaker research vessels. (Each land-based station is staffed by a physician trained in emergency medicine and by a physician assistant, but—as Black's case illustrates—there is often a need for specialty care.)

It was no accident that Raytheon chose UTMB. The world's leader in telemedicine consultations, UTMB conducts on average almost thirty-three hundred live, interactive video telemedicine consultations each month. The vast majority of these televised patients are inmates of the Texas Department of Criminal Justice. (Under a contract with the state of Texas, UTMB provides health care for about 80 percent of the state's incarcerated population.) But every month the university's specialists also see more and more telemedicine patients in the free world, too, including those from treatment centers in medically underserved areas that are part of the university's network of Regional Maternal and Child Health clinics. They also see patients who are passengers on cruise ships or workers on offshore drilling rigs. Because of its many innovations in health care delivery and technology, the UTMB telemedicine program

has been inducted into the Smithsonian Permanent Research Collection for Innovation in Information Technology.

Since the contract was awarded, patients in Antarctica have seen UTMB's specialist physicians in fields including cardiology, dermatology, neurology, neurosurgery, ophthalmology, oral surgery, orthopaedics, urology, and vascular surgery, among others.

After the Raytheon deal was sealed, UTMB sent Jake Angelo, then-director of technology for the UTMB Telehealth Center, and Dr. Steven Viegas, UTMB professor and chief in the Hand Surgery Division in the Department of Orthopaedic Surgery and Rehabilitation, to the frozen tundra. Their journey involved stops at the Amundsen-Scott Station and the McMurdo Station to evaluate the telemedicine equipment there and make suggestions for improvements.

Said Dr. Ron Shemenski, Raytheon Polar Service's medical director: "By combining our technology and the expertise of UTMB's specialists, we can now bring health care that could mean the difference between life and death to employees working in the most extreme environment on earth." More than most people, Shemenski knows the difficulties and dangers associated with medical emergencies that occur during the harsh Antarctic winter. He himself was airlifted from Antarctica in April 2001 with acute pancreatitis.

Ahmad's initial consultation on Black's case took place on a warm, muggy night in Galveston. It was an evening of firsts. Silva, an internal medicine physician, assisted with his first echocardiogram. Ahmad, meanwhile, conducted his first remote echocardiogram procedure, which he compares to performing robotic surgery. Usually, a technician would acquire the images and the cardiologist would interpret the findings. In this instance, Ahmad served as both the technician and the specialist.

Ahmad painstakingly piloted Silva through the entire procedure, figuratively holding his hand, guiding the position of the transducer on the patient's chest and having Silva aim it in different directions while adjusting the settings on the machine to get different views of the heart. Silva didn't know how to position the probe or the patient or what angles and images would be needed to diagnose the patient. "I was driving," he said, "but Dr. Ahmad was steering." For his part, Ahmad said Silva did extremely well,

following Ahmad's lead so precisely that "we were able to obtain data that was of good quality and the transmission of data was excellent."

"We found that the patient had changes in his heart wall from long-standing high-blood pressure, which was another piece of information helpful in correctly diagnosing the patient," Ahmad continued. "It was reassuring to Dr. Silva and Mr. Black to know the limited extent of the damage, the exact location of the heart attack, and his overall heart function." The two physicians concluded that the heart functions were not as compromised as they originally feared and that the heart attack was mild enough to be treated without interventions such as open-heart surgery or balloon angioplasty and stenting.

According to Silva, the isolation at the pole requires a degree of self-sufficiency unlike that required in a more conventional job, but it also helps to create enduring bonds between the employees wintering together.

During Black's rehabilitation, for instance, the South Pole community came together to help in many ways. "I wasn't able to climb the stairs and the dining facility is ninety-two steps up in the new station building, as is my room," Black said. A co-worker gave up a room in the ground-level Biodome so Black wouldn't have to climb the stairs; others brought meals to him and kept him company in his walk-in-closet-sized room. Others volunteered their spare time in the clinic to allow Silva and his assistant, Heidi Lim, time to rest, eat, and see other patients.

More than a month after the initial consultation, Ahmad and Silva collaborated on a second echocardiogram, one

that showed that there had been marked improvement in Black's heart.

For those whom wires, networks, and video cables have joined, medicine and life will never be quite the same. "I enjoyed it," Ahmad said about the experience. "I learned a lot in the process about the business of the South Pole, weather, transmissions, and satellites. This is the beauty of telemedicine."

Once the Antarctic winter ended and it was again safe to travel, Silva and Black both left the South Pole station. Black said his outlook has been changed forever by this less-than-gentle intimation of his mortality. Now his long-term goal is to find a full-time position as a meteorologist stateside.

Silva, who plans to sign up for another tour on the ice, says: "Being the lone doc means sometimes having to deal with problems that lie far afield of my training in internal medicine. I've enjoyed learning about what I used to consider other people's jobs, though I feel quite out on a limb sometimes. It's great having the intellectual resources of the UTMB Galveston medical staff available."

Dr. Ben G. Raimer, UTMB vice president for community outreach, whose portfolio includes the telemedicine program, says the technology has revolutionized the practice of medicine while retaining an element of a simpler past. "Telemedicine means that no distance can prevent a patient from receiving top-notch medical care. Interestingly enough, it also allows us to combine the latest in whiz-bang technology with the old tradition of physicians making house calls on their patients. We're able to bring treatment to patients wherever they are—even if it's the South Pole."

Death-defying Case of the Secret South Pole Patient

How a UTMB surgeon, via telemedicine and in person, helped save a gravely ill man

In early September 2003, local and national news programs were abuzz with a tale about a medical crisis set in the frigid Antarctic terrain, where blizzards abounded and temperatures plunged to ninety degrees below zero. The drama focused on the ordeal of one of the fifty-eight scientists and support staff members at the United States' research facility at the South Pole who had a potentially life-threatening but as of then undisclosed illness—gallstones and a dangerously infected gallbladder.

Because of the harsh Antarctic climate, the news stories said, the sick man's departure was delayed for nearly a week. The reports hinted that there might be no way to rescue him in time from the Amundsen-Scott South Pole Station and bring him back to the developed world for emergency treatment. In fact, it wasn't clear to doctors whether the patient would survive until late October or the first week in November, when flying conditions were expected to improve. His only hope lay in a break in the notoriously treacherous Antarctic wind and blowing snow. Luckily, the weather turned cooperative, and it ultimately permitted a deHavilland Twin Otter turboprop airplane fitted with skis to land on open snow and ice on a runway that had been painstakingly groomed for four days by snow machines

and illuminated by improvised smudge pots to direct the plane toward the landing site.

Meanwhile, back in the United States, a bevy of reporters for CNN, MSN, ABC, and myriad other news outlets speculated, with studied vagueness, about the patient's condition and where he might be taken for treatment should the evacuation succeed. All this discussion occurred in the midst of a virtual fact blackout: the man reportedly wished to remain anonymous and didn't want the media to discuss the details of his case.

Finally, details began to leak out when reporters got a tip from the manager of an ambulance company in Punta Arenas, Chile's southernmost city. A second Twin Otter had flown the patient to Punta Arenas from Rothera Air Station on the Antarctic coast, tag-teaming with the first Otter that for ten hours had ferried the patient from the South Pole to Rothera. In Punta Arenas, the man had been put on a Lear jet bound for Houston. The patient's name was Barry McCue, and the world learned later that he was a fifty-one-year-old environmental health and safety coordinator for Denver-based Raytheon Polar Services Company, the logistics contractor for the U.S. Antarctic research program. Hearing the news about the Houston destination, some reporters speculated that one of the hospitals in the Texas Medical Center there was the patient's ultimate destination.

What the media did not know was that, behind the scenes, Dr. William H. Nealon, the UTMB professor of surgery who had been consulting via telemedicine since August 26 with McCue and Dr. William Silva, the single physician in residence at the South Pole station, had discreetly begun preparing for McCue's possible arrival in Galveston along with hospital staff working to ensure his privacy. Although Nealon had been treating the patient via telemedicine for nearly four weeks, other doctors elsewhere in the world could have handled McCue's case competently. In fact, eight physicians—from Denver, Baltimore, and Boston as well as Galveston—had conferred early on via teleconference. They all agreed that gallstones were causing the intense pain that, when it first struck, made McCue feel like he'd been hit in the stomach with a two-by-four.

It was Nealon's prior involvement via telemedicine with McCue's case and his expertise in diseases of the pancreas, bile ducts, and gallbladder that prompted the patient, his primary care doctor at the South Pole, and officials at Raytheon to choose the Galveston physician. McCue (who dropped the request for anonymity after his treatment at UTMB and subsequently spoke widely to the media) felt comfortable with Nealon. "The patient had gotten to know

me and Dr. Silva at the South Pole had gotten to know me," Nealon later explained, "and there was essentially a doctor/patient relationship sustained over eight thousand miles that they wanted to honor."

When McCue finally arrived at UTMB after forty-five hours in the air, Nealon and his team were ready for him. Almost four weeks after Nealon first dealt with the case, the situation was indeed potentially lethal—on that point, at least, the media was dead right.

After McCue got a brief rest, Nealon and his team performed a minimally invasive procedure called a laparoscopic cholecystectomy to remove the nearly destroyed, massively infected gallbladder. Complicating the procedure, however, was the fact that adjacent organs and tissues had enfolded themselves around the gallbladder to sequester poisonous tissue from the rest of the body. This resulted in distinct tissue planes and required extra care to separate these tissues from the gallbladder before it could be removed and to protect those tissues from injury in the process.

"We performed the gallbladder operation without a problem," Nealon said. He fulfilled a request of McCue's, which was to take pictures of the procedure. "The picture of the dead gallbladder was very impressive to him," Nealon said.

Next, Nealon performed a procedure known as an endoscopic retrograde cholangiopancreatography to remove stones from McCue's bile duct, the presence of which had put his pancreas at risk. After that, McCue's body began to heal. Just a few days later, he again was on a jet plane, this time headed to a daughter's home in Chicago, where he would recuperate.

Throughout his hospitalization, reporters called UTMB asking if the institution knew where McCue was being treated. But the privacy request and federal regulations contained in the Health Insurance Portability and Accountability Act (HIPAA) precluded UTMB representatives from even confirming whether he was a patient, much less from releasing any details of his treatment.

When McCue was released and lifted the request for privacy, he granted interviews about his harrowing experience with the New York Times, the Chicago Tribune, "The Early Show" on CBS, CNN with a televised interview with Paula Zahn, and many other news outlets. When he spoke of UTMB, McCue remembered his stay there almost fondly. "If it wasn't for getting surgery, stuff poked into me at all hours, and feeling really crummy after it was removed, I probably would have had fun," he said. "You really do have a great facility and the best people." ■