229 people, 15 000 body parts: pathologists help solve Swissair 111's grisly puzzles

Nancy Robb

In brief

Only 1 of the 229 passengers and crew members killed when Swissair Flight 111 crashed off Nova Scotia in September was visually identifiable. Identifying everyone else on board involved medical and dental detective work of the first order.

Dr. John Butt is dreading his 5 o'clock appointment with a Russian family that lost a daughter when Swissair Flight 111 plunged into the ocean off Nova Scotia last Sept. 2. All 229 people on board were killed.

As the province's chief medical examiner, Butt was responsible for identifying body parts found by divers. He and colleagues imported from across the country faced a daunting task, because only one body was identifiable by sight. The cost has been huge — Butt alone has spent more than his office's annual budget of $800 000 on the investigation — but the intangible costs are even higher.

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Dr. John Butt was "profoundly affected" by the Swissair disaster

The Russian family, 1 of about 30 he was in touch with personally during October and November, has been especially distraught, making at least 3 trips to Halifax. This time Butt will be able to tell them that the woman's remains have finally been identified, but he must brace himself for the difficult task of explaining that all that's left of a beloved daughter is a left leg and right foot and ankle. "When I go and talk to this family this afternoon they're going to ask me what there was — I know damn well they are — and I'm going to have to tell them."

Since the jetliner's plunge into the choppy waters off St. Margaret's Bay, teams of pathologists, RCMP officers, dentists, radiologists, DNA specialists and others have sifted through body parts stored at a temporary morgue at CFB Shearwater, an air base near Halifax. Despite the grisly and daunting challenge, the scores of experts working at the morgue and RCMP forensic labs across Canada identified nearly all the victims within 10 weeks. Butt says about 90 have been identified through dental records, 30 through fingerprints and antemortem x-rays, and more than 100 through DNA analysis in what has been called the largest DNA identification project ever undertaken in Canada.

"We're ready, basically, to say that we have identified everybody, and that means the repatriation of remains will really begin in earnest," Butt said during a Nov. 19 interview.

Butt learned about the crash 20 minutes after the jet went down. He packed enough clothes for 3 days, drove to his office and waited by the phone, eventually ending up at the province's Emergency Measures Office, where he developed a management plan as RCMP, military, Coast Guard and emergency personnel launched search, rescue and recovery operations. Before dawn Butt reported to CFB Shearwater, where a morgue was being constructed in one of the hangars.

"In the early hours after a disaster, there's a surreal feeling of 'Did this really happen? Do we need to react? Is this a test of some kind?'" says Dr. Jim Young, Ontario's chief coroner. Young had a busy year — last January he was responsible for emergency measures during Eastern Ontario's awesome ice storm.

With a team of forensic experts in tow, Young spent more than 3 weeks in Halifax participating in the identification process. When he arrived 3 days after the crash, more than 100 people were already working at the morgue.

"They were tired but very energized," he recalls. "I was

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Troops and Mountie gather debris from Swissair 111 along the Nova Scotia coast

very surprised at how far along and how well developed the group was at that point. They had devised [cataloguing and classification] systems and figured out how to integrate them."

As human remains were recovered from the sea or coastline, they were numbered, placed in body bags and transported to CFB Shearwater to be stored in refrigerated trucks. On some occasions, says Butt, as many as 6 teams were examining remains in the hangar's hastily constructed autopsy and x-ray suites.

The core teams comprised a pathologist and assistant, a nurse to record information and an RCMP photographer. Dentists, radiologists, x-ray technicians, fingerprint technicians and DNA specialists came and went as required.

What fuselage? What bodies?

They didn't have much to go on. "There was nothing to associate the individual," Butt says. "The only thing we could have had reliably was jewellery, and that was largely rings. Other things were too loose." Necklaces, bracelets, and paper ID had disappeared, and clothing was tattered beyond recognition.

Nor did the shattered wreckage provide any clues. "Five or 6 days after the crash, my instructions were: 'If you can see into the fuselage, don't remove any bodies until we see where they are seated,'" Butt says. "Wasn't that naïve. What fuselage? What bodies? What seats?"

Butt had hoped to perform DNA testing on all the remains, but he soon realized this would be impractical. He says the morgue received an estimated 15 000 body parts but many, such as pieces of skin, were too small to process.

Remains were placed in 4 categories: visually identifiable, identifiable part, large but unidentifiable, and small but unidentifiable. "Within 24 hours we had to discard the idea of doing DNA testing on everything," Butt says. "I felt a little hollow inside about that decision."

There were some similarities among other remains. The impact of the crash broke upper and lower jaws, usually removed at least one arm, divided the pelvis and lower limbs, and fractured or dismembered both feet.

Dentists get involved

As doctors and technicians began poring over the material, the RCMP contacted next of kin for medical histories and dental records, and for blood samples to allow for DNA comparison. In a massive undertaking, police from 12 countries, mainly Western Europe and the US, searched victims' homes for latent fingerprints and personal effects, such as hairbrushes, which might contain DNA.

The large number of antemortem dental x-rays led to the identification of 90 victims by the end of October. "The other thing that came along was an amazing number of exfoliated epidermal gloves," Butt says. "This created a washer-woman effect on the hands, leaving very good ridge detail for fingerprints." Amazingly, these gloves existed on the floor of the ocean for 2 months.

Many names were linked with remains through the 200 impressions of latent prints collected by police in victims' homes. In addition, the US Federal Bureau of Investigation scanned its fingerprint collection for possible matches and found 76 prints from people with names similar to those of victims; from those, 12 people were identified.

Butt says x-ray identification provided the least success because of a lack of antemortem x-rays. "A lot of the passengers were young, under 45," explains Dr. Don Cheverie, lead radiologist at the morgue and deputy chief of radiology at the Dartmouth General Hospital. "If people went looking for x-rays, they probably wouldn't have found any or wouldn't have known where to look."

As the remains came in, the pathologist identified the part and decided whether an x-ray should be taken. Radiologists then tried to match that x-ray to antemortem films.

One victim at a time

Cheverie says radiologists were able to identify 8 victims — though 3 have not been certified — based on 50 antemortem films. One victim, for instance, had broken his thigh bone and had a nail in it, while another had screws and pins in her forefoot and a third had lost a toe to amputation.

"Dr. Butt said if we could identify just one victim, it would make it all worth while," Cheverie says. "I was re-

lieved when we had the first one under our belt, because it was someone no one else had been able to identify."

Radiology proved useful in other ways. Radiologists found teeth that hadn't been apparent to the pathologist and were used for dental identification. X-rays may also help determine the nature and cause of the crash by revealing patterns of injury and the presence of intoxicants or foreign material like bullets or bomb fragments.

"That wasn't a factor in this case, but we didn't know that when we started out," Cheverie says. "By doing the x-rays, you have evidence that you can go back and look at long after the remains have been released."

The dental, x-ray and fingerprint identifications helped expedite the efforts of DNA specialists working in RCMP forensic labs. "The only way remains could be united is on the basis of DNA," says Butt. "Having been tested, the reference specimen would allow for an identifiable 'thumbprint.' Anything that turned up with the same 'thumbprint' would allow remains to be reunited."

More than 100 victims were identified by matching the DNA in remains to that in personal effects retrieved from victims' homes or from blood samples provided by family members. The raw data were downloaded to the RCMP's central forensic laboratory in Ottawa.

"I'm amazed at how well the families are thinking about this in view of the hardship they are suffering," says RCMP research scientist Ron Fourney. "We had an instance where a [victim] had been scheduled for surgery and had banked his own blood, and the [family] went back and got a sample. There's nothing better. It's like getting the person's DNA handed to you."

1370 DNA samples processed

Fourney, head of DNA methods and the DNA database at the forensic lab, was in charge of the DNA-typing task force formed because of Swissair 111. By late November he has written 107 identification reports and was trying to put names to the last 10 or so victims with the help of a human population geneticist and statistician.

Fourney says 1370 samples have been processed and all 228 profiles have been completed (one victim was identified visually). He says scientists even succeeded in identifying all the children on board, including a set of identical twins and a set of fraternal twins. "Entire families were lost," he says. "Regardless of how good we are, the siblings are all going to be [genetically] related somehow to the parents in the same manner, so we can't really distinguish 1 child from the other.

Communicate with empathy

"What we've had to do in every instance is go back and get baby soothers, sweaters, items that belong to the child that have the genetic blueprint. We've been able to link that back and say, well, not only were Mom and Dad lost and these were the 3 kids, but this is each kid."

At times, Fourney has found the extent of the tragedy difficult to bear. "The fact that you see so many young children and young adults [just] starting off their professional careers, it's a loss that's going to affect many people — family relations, loved ones."

In Halifax, John Butt can't recall an experience that has affected him so profoundly. He has made headlines for the compassion he showed to victims' families and for his public expressions of sympathy. He has received phone calls, personal letters, prayers, even gifts. "The [outpouring of] emotion has done me a lot of good."

"When you are a doctor, it's a 2-way street," he says. "The laying on of hands in medicine is more than a metaphor, it's a truism. The intimacy of that doesn't necessarily mean just physical [touch]. It also has to mean communicating with empathy."

A follow-up article on the psychological impact of this crash will appear in the next issue of CMAJ.

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