

THE GLOBE AND MAIL

Doctor discovers one way to a patient's heart: Valve replacement without invasive surgery

Wed Dec 7 2011

VANCOUVER -- When a doctor told May Brown, at age 90, that her aortic valve was failing, the former Vancouver city councillor feared she was done for.

Open-heart surgery wasn't an option because of scar tissue left two decades earlier after radiation treatments for cancer of the esophagus, she said.

Ms. Brown, a dedicated outdoorswoman and Order of Canada honoree, began to tire easily and became short of breath. "I could see that I was going downhill," she said.

Fortunately, she was referred to John Webb, a cardiologist who recommended an alternative procedure to replace her deteriorating valve.

Pioneered by Dr. Webb at St. Paul's Hospital in Vancouver, the method involves inserting a collapsible valve on a catheter that is guided to the heart through an artery in the leg. Once the catheter reaches the aorta, a balloon expands the circular valve, pushing the old valve out of the way.

Ms. Brown underwent the procedure in October, 2010. By the second day she was on her feet, and within five days she was back at home and ready to start a walking routine. "After a month I was feeling very well," she said. "This was really like a new lease on life."

Dr. Webb developed the minimally invasive procedure in 2005. Since then, colleagues in more than 25 countries have performed a total of 50,000 aortic valve replacements using his technique.

In a 2010 editorial in the journal of the American Heart Association, Blase Carabello, vice-chair of medicine at Baylor College of Medicine in Houston, called the work by Dr. Webb and colleagues "one of the most exciting events in cardiology in the last 50 years."

The procedure, known as trans-catheter aortic valve implantation (TAVI), eliminates the need to open the chest, saw through the breastbone and put the patient on a heart-lung machine.

Compared with open-heart surgery, patients who undergo TAVI tend to recover faster, Dr. Webb said, adding the success rate among high-risk patients is more than 95 per cent.

"Almost everybody can have their valve done this way," he said.

The trans-arterial approach was the main innovation of the St. Paul's Hospital team, which built upon techniques developed elsewhere. There was no "aha" moment, Dr. Webb said. "It was an incremental thing."

The method allows Dr. Webb to replace aortic valves in up to four patients a day. The majority are not candidates for surgery because of previous procedures or advanced age, he said.

Aortic valves deteriorate with age. The tissue begins to stiffen, preventing the valve from opening fully. "It's a wear-and-tear thing," Dr. Webb explained.

The aortic valve has three triangular leaflets that fit together like the Mercedes Benz logo's three-pointed star. Dr. Webb uses a similarly shaped valve made of bovine tissue that is sewn to a circular metal mesh called a stent.

In its compact form, the stent has a diameter of seven millimetres, about the same as a milkshake straw. The stent is fitted behind a small balloon on a catheter that enters an artery through an incision in the patient's leg. Inside the body, the stent is pulled over the balloon to prepare for expansion at the aorta above the heart's left ventricle.

The cardiologist makes two smaller incisions in the patient's other leg to insert a tube to inject X-ray dye and a wire that sends electrical stimuli to pace the heart. While the patient is asleep, a small ultrasound probe is put down the throat and into the stomach to provide visuals as the cardiologist moves the new valve into place.

The balloon at the end of the catheter is filled with saltwater to expand the stent's metal frame until it fits snugly against the old valve, which is pressed against the walls at the base of the aorta. As the balloon is deflated, the leaflets of the artificial valve open and close with the blood flow.

A new biological valve should last 10 to 15 years, Dr. Webb said. "When they wear out, though, we can put another inside the first one."

TAVI has other uses as well. Cardiologists are following similar steps to replace pulmonary valves and artificial aortic valves that have failed after open-heart surgery. Recently, Dr. Webb replaced the valve of a man who'd had aortic valve surgery four times, thus preventing a fifth open-heart surgery. "That's kind of a big deal because the risk gets very high every time you redo heart surgery," Dr. Webb said.

Another patient, Jeremy Wilkins, had undergone a quintuple heart bypass a decade earlier when his aortic valve began to fail. Mr. Wilkins, who is 61 and HIV-positive, said his surgeon was concerned he might disturb two of the bypasses he had put in place years before.

Mr. Wilkins's case drew the attention of Dr. Webb, who replaced his aortic valve using TAVI in June, 2011, without interrupting the cocktail of medications Mr. Wilkins takes for HIV.

The psychological impact of TAVI was much less than that of open-heart surgery, said Mr. Wilkins, who went hiking in the Fraser Valley near Vancouver five days after his valve was replaced. "It feels kind of like science fiction has come to life."

So far in Canada, however, the procedure is available only to patients who are not good candidates for surgery.

TAVI may not be cost-effective for lower-risk patients, who tend to spend less time in the hospital, Dr. Webb explained. A standard surgical valve costs \$5,000, compared with \$22,000 for a trans-catheter valve. After factoring in recovery times and the cost of the device, he said, "I think [TAVI] is cheaper in high-risk patients but more expensive in lower-risk patients."

Health-care decisions will determine whether Canada goes the route of Germany, where a quarter of all aortic valves are replaced using the less invasive procedure, he said.

Nevertheless, Dr. Webb predicts that TAVI may become the gold-standard procedure for aortic valve replacement down the road.

"This is just better than surgery for many patients - not just the people who can't have surgery."

THE VALVE

The aortic valve has three triangular leaflets. Dr. Webb uses a similarly shaped valve made of bovine tissue.

TRANS-CATHETER AORTIC VALVE IMPLANTATION (TAVI)

The procedure, pioneered by Dr. John Webb at St. Paul's Hospital in Vancouver, eliminates the need to open the chest, saw through the breastbone and put the patient on a heart-lung machine.

1. Insertion / The stent is fitted behind a small balloon on a catheter that enters an artery through an incision in the patient's leg.
2. Pathway / Cardiologists use an ultrasound probe and x-ray dye to obtain real-time moving images of the patient's internal structures.
3. Placement / Once the catheter reaches the aortic valve, a small balloon expands the circular valve, forming a tight seal. As the balloon is deflated, the leaflets of the artificial valve begin to open and close with the blood flow.