Future heart valve repair

Without opening the chest

The ability of heart surgeons to open up your chest, stop your heart, and repair or replace a heart valve that isn't working properly is a miracle of modern medicine. This time-tested procedure is generally very safe and almost always results in an effective and durable fix.

Still, even under the best of circumstances, open-heart surgery puts major stress on the body — particularly from large chest incisions and from being on a bypass machine that keeps your blood flowing when your heart is stopped. Recovery usually requires several days in the hospital, and it may take six to eight weeks before you start feeling normal again.

Finding new techniques

That's why numerous companies and research institutions — including Mayo Clinic — are working to develop new technologies and techniques to repair or replace heart valves. These can generally be done through small incisions in the chest and without stopping the heart — or by accessing the heart through blood vessels, with no chest incisions at all.

Most of these technologies are in the research phase and aren't ready for widespread use. However, what follows is a glimpse into the future at technologies that may one day funda-
mentally transform heart valve repair and replacement.

With each heartbeat, the four valves in your heart open and close in a coordinated manner to ensure that blood flows in one direction. From the right side of your heart, the tricuspid and pulmonary valves help direct blood to the lungs to get oxygen. On the left side of the heart, the mitral and aortic valves help direct oxygen-rich blood throughout your body.

Valve disorders can result in inefficient blood flow, causing the heart to continually work harder than it should. With more-severe heart valve disorders, this can lead to irreversible heart failure.

The two main problems that can develop with heart valves are:

- **Narrowing (stenosis)** — Any heart valve can become stiffened or narrowed from scarring or calcification, limiting blood flow.
- **Backward leaking (regurgitation or insufficiency)** — When valve flaps (leaflet) don’t close tightly, blood may leak backward in the wrong direction.

Although stenosis and regurgitation can be problems with any heart valve, the two most common problems found in people are stenosis of the aortic valve and regurgitation occurring in the mitral valve.

### Fixing aortic stenosis

The standard procedure for fixing aortic stenosis is open-heart surgery to remove the damaged valve and replace it with an artificial one. However, a new device — a collapsible artificial heart valve that’s surrounded by an expandable wire mesh (stent) — is allowing doctors to replace an aortic valve without stopping the heart and with only small incisions.

Placing this device first involves positioning a slender tube (catheter) near the aortic valve. The catheter can be inserted into a large artery in the groin and guided to the aortic valve — or it can be inserted through a small incision into the chest and up through the bottom of the heart. Once the catheter is in place, the folded artificial valve is carefully positioned inside the aortic valve and expanded, pushing the natural valve leaflets aside and locking the artificial valve in place.

Mayo Clinic is participating in a randomized study comparing outcomes in people who have an artificial heart valve placed using either catheter-based techniques or standard open-heart surgery. Results of this study, and any long-term results aren’t known, but Mayo experts are excited by the new technology.

Although technical challenges remain, the placement procedure appears to be safe and continues to be refined. It eliminates the need for open-heart surgery, but also leaves that possibility open for the future. When successfully placed, the artificial valves are highly effective. In fact, they allow for better blood flow than do other artificial valves because they create a wider opening.

In addition to aortic valves, pulmonary valves can also be replaced using catheter-based techniques. However, mitral and tricuspid valves have a much different anatomy, and development of a potential device that can be placed without open-heart surgery is still a long way off.

### Mitral valve repairs

Mitral valve regurgitation is often addressed by repairing the faulty valve. Repair options vary, but they usually involve open-heart surgery. However, mitral valve repair can be done using robotic technology. This requires a few punctures and one small incision in the chest, in addition to heart bypass. In the experience of Mayo Clinic surgeons, results of these procedures have been good and recovery times have been significantly shortened.

Several procedures and devices are under investigation to make mitral valve repairs without opening the chest and stopping the heart.

One such device is the mitral valve clip. In many cases of mitral regurgitation, one of the two valve leaflets is floppy and flailing, while the other remains healthy. A mitral valve clip is used to staple the two leaflets together at their midpoint. Thus, the healthy valve leaflet supports the flailing side, with blood flowing through the two holes on each side of the clip.

Placement of these clips can be done using catheter-based techniques, but it’s a challenging procedure that isn’t as controllable or predictable as are other options. An early trial of the device showed the placement procedure to be safe, but rates of recurring regurgitation were higher when compared with other
repair techniques. A larger trial is under way to further assess the viability of mitral valve clips.

Another procedure involves replacing tendon cords (chordae tendineae) that help the mitral valve to function. When these tendons become loose or broken, the valve leaflet they connect to becomes floppy, allowing regurgitation. Chordae tendineae can be replaced or fixed with open-heart surgery, but getting the artificial tendon cord length just right is difficult because the heart isn’t beating.

A device invented at Mayo Clinic may change that. Through a fairly small incision in the chest, the slender device can be poked through the open tip of the heart. The device grabs the edge of the floppy leaflet, attaches a suture string and is then removed, along with the string end. The string is then tightened, and echocardiography shows when the string is optimally taut to stop regurgitation.

There are plans to begin a European trial of the device this summer. A United States trial would be needed after that.

A third approach to fixing mitral regurgitation is to tighten up the ring of tissue (annulus) that supports the circumference of the valve leaflets. Tightening the annulus can push together separated leaflets, allowing them to close more snugly.

Several devices under development seek to take advantage of the fact that a large vein (the coronary sinus) runs parallel to the mitral valve annulus. One device, developed in part at Mayo Clinic, is a metal arc with anchors at each end that can be placed in the coronary sinus using a catheter. The arc envelops the mitral valve and can squeeze the valve together somewhat.

Additional devices have been developed that work under the same concept, but with a different design. Overall, these devices are not as well developed and have considerably more limitations than do mitral valve clips or the chordae tendineae repair device.

**Game changers**

In the foreseeable future, open-heart surgery to fix severe valve problems will remain the predominant form of treatment. However, the trend toward less invasive procedures will continue to advance, and it’s possible that select technologies will become true alternatives to open-heart surgery.

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**Health tips**

**Avoid biking mishaps**

If bicycling is something you enjoy, make sure you’re doing it safely. The American Academy of Orthopaedic Surgeons recommends that you:

■ **Always wear a bike helmet** — Helmet protection is always critical, but normal changes that occur in the aging brain make it more susceptible to life-threatening injuries from sudden head trauma. Check to see that your helmet is approved by the Consumer Product Safety Commission (CPSC). Your helmet should fit snugly and comfortably, without obstructing your vision. Typically, helmet shelf life is about five years, after which it should be replaced. A helmet worn during a serious fall should be replaced.

■ **Ride a bike that’s fitted to you** — The size of the frame, handlebar style and placement and seat height all are important factors in a good fit. Bike shops can help measure you for a proper fit. Be familiar with how the brakes and gear systems work and the response they produce when engaged.

■ **Wear suitable clothing** — Bright-colored clothes are best. Avoid loose clothing that might catch in gears or wheels. Pant leg clips may be helpful. And protect your feet by wearing closed-toe shoes that don’t easily slip off the pedals.

■ **Avoid pitfalls** — Loose gravel and uneven or slippery surfaces are best avoided. Ride during the day, not at night.
Optimism and health

Shift from the dark side

Did you know that your outlook on life can impact your health and quality of life?

There’s an ever-expanding body of research examining how your outlook may relate to various aspects of health, feelings of well-being, quality of life and even longevity.

Consider the evidence

Studies have found that people with an optimistic outlook have an overall positive sense of well being and are less prone to depression.

Since 1994, researchers have examined results from the Women’s Health Initiative, a study involving nearly 100,000 women age 50 and over. Among recent findings, women who have an optimistic outlook lived healthier and longer lives compared with pessimistic women.

During eight years of follow-up, optimists were 30 percent less likely to die of heart disease and 14 percent less likely to die of any cause as compared with pessimists.

Another study, published in 2004, looked at longevity among more than 900 older adults. Those with an optimistic outlook lived healthier and longer lives compared with pessimistic women.

During eight years of follow-up, optimists were 30 percent less likely to die of heart disease and 14 percent less likely to die of any cause compared with pessimists.

Another main track of end-of-life care is the life-enriching or palliative care approach, which can include hospice care. This approach treats dying as an expected process and seeks neither to hasten nor postpone death. It puts the emphasis on comfort and care, quality of life, pain relief, attention to emotional and spiritual needs, and spending as much time as possible with family and friends.

A key event in transitioning from a life-prolonging approach to a palliative care approach is coming to terms with the fact that you or a loved one will pass away. If you can do that, the following ideas may be able to simultaneously increase your level of comfort and dignity, and reduce the cost of end-of-life care:

■ Look your doctor in the eye and assure him or her that you’ve accepted the fact that you’re dying. Explain that your preference is to enjoy your remaining time as best as you can, rather than to aggressively seek an unlikely cure.

■ Remember the golden rule of testing, which is to always ask your doctor: “What will be done with the answer?” Will the answer make a difference in your care, or will it reveal information that isn’t likely to be acted on.

■ With any procedure, ask your doctor: “What are the chances of it making me better, making me no better or no worse, or making me worse due to complications?” If you’re making choices for a loved one, ask yourself — and your loved one’s doctors — whether the treatment is prolonging life or prolonging suffering.

End-of-life care — Decisions with dignity

Talking about death is uncomfortable for many people. Moreover, it may seem tacky or even morally offensive to talk of your — or your loved one’s — final days from a financial perspective.

But it’s a fact that everyone dies, and end-of-life care is likely to be one of the most expensive periods of health care in your life.

In many cases, what makes financial sense with end-of-life care also is what makes sense in terms of living out your final days in a dignified and comfortable manner, with as much quality time as possible with family and friends. The end-of-life time frame generally begins when it’s no longer possible to cure or stop the progression of a disease such as cancer or heart failure. This point may begin a year or more before death, or later.

One option for end-of-life care is the “life-prolonging” approach. This involves aggressive treatment in hope of prolonging life, even though a cure is highly unlikely. It may include aggressive therapies, surgery, hospitalizations, feeding tubes and mechanical ventilation. Due to legal and societal factors, many doctors work best in this mode, as they are concerned that they will be faulted if they don’t do everything possible to prolong life.

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had about a 30 percent greater chance of dying than did those who were the most optimistic, least anxious and least depressed.

Similar results were reported in an earlier Mayo Clinic study that involved more than 800 people and had a follow-up period of 30 years. Those who had a pessimistic thinking style had a 19 percent increase in risk of death when compared with their optimistic counterparts.

As for quality of life, optimists reported having fewer health problems and fewer difficulties with work or daily routines, and they were generally happier, calmer and more peaceful. In addition, they experienced less pain, had more energy and reported greater ease in social activities.

Changing negative self-talk

While studies suggest a positive attitude is associated with a longer and healthier life, changing one’s thinking pattern can be challenging — but it is possible.

One important step is to identify negative self-talk. In order to change, it’s helpful to understand the problem. Conversations you have with others are part of everyday life, and often you can easily remember what others said to you.

But often, below the external conversation there’s an ongoing stream of self-talk and thoughts that run through your mind. If your stream includes negative self-talk, start challenging it. For instance, your friend says, “This is a great dessert.” If you’re pessimistic, you may think, “I over cooked the dessert. I’m a horrible cook.”

Psychologists have identified some common negative thought patterns you may encounter:

- **Polarizing** — You think in terms of things being all or nothing, good or bad, and there’s no middle ground. You either succeeded or totally failed.

- **Filtering** — You minimize or even filter out positive aspects and focus only on whatever might be negative. You may even find yourself magnifying the negative.

- **Catastrophizing** — You always anticipate and believe the worst.

- **Personalizing** — When something bad occurs, you assume you’re the problem and blame yourself.

- **Shift your perspective**

One’s general attitude in life is likely attributable to a combination of nature and nurture — family genes combined with upbringing and ongoing life experiences that help frame your unique perspective.

If you tend to be on the pessimistic side, can you adjust your attitude? For some, self-help strategies may work. For others, treatment from someone trained to apply the principles and tools of positive psychology may be needed.

Remember — change is possible once you become aware of ways in which your current viewpoint influences how you think and feel. Here are some steps you can take:

- **Refocus your perspective** — Everyone has ups and downs. Just because something goes wrong, doesn’t mean you’re doomed to fail. Refocus when your thinking is clouded by negative thoughts.

- **Look for the good in life** — Try this in situations you might normally write off as being a lost cause. For instance, if you lose all of your garden tomato plants to blight, look at it as an opportunity to learn more about gardening from tomato growers at your local farmers market.

- **Be grateful and savor good times** — Take stock of what you have to be grateful for. Gratitude can help you shift the focus to what’s good in your life. Cherish the times when all is well — those memories can be invaluable when times are rough.

- **Look for pleasure in small things** — Find simple pleasure in everyday things, like walking your dog, sitting on the deck with a glass of iced tea, reading a good book, or just sitting and talking with a friend.

- **Practice random kindness** — Reaching beyond yourself to treat friends and even strangers with unexpected kindness not only enriches them, but it also can help you feel better.

- **Reconsider your pessimism of others** — Constantly thinking or talking in a pessimistic or critical way won’t fix the problem, and it can dampen your mood and the moods of those around you. Reduce the frequency with which you discuss the issues that irritate you. Or, try challenging yourself to look for the positive aspect in things you dislike.

- **Building strength, personal strengths, not just human weaknesses**

- **Refocus when your thinking is clouded by negative thoughts**

- **Personalizing** — What about gardening from tomato growers at your local farmers market.

- **Positive psychology**

The practice of psychology generally is associated with helping people who have a mental health disorder such as depression, anxiety or substance abuse. But can psychology actually make people happier?

Those in the emerging field of positive psychology say that psychology should be concerned with:

- **Personal strengths, not just human weaknesses**

- **Building strength, resiliency and a feeling of fulfillment, not just repairing damage**

- **Identifying and nurturing talents, not just healing disease**

Positive psychology focuses on people’s strengths and virtues and how individuals can build upon these attributes in their lives.

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**Inner ear inflammation**

**Riding out a spin cycle**

You’ve never felt worse — sudden severe dizziness, relentless nausea and vomiting. Could this be from a condition caused by a virus? Yes, but with signs and symptoms this severe, a medical evaluation is warranted to look for other causes, especially if problems continue.

Labyrinthitis (lab-uh-rin-THI-tis) is the term used to describe inflammation of the inner ear, which most frequently is caused by a viral infection that can result in these signs and symptoms. The problem may crop up for different reasons. Although it often goes away on its own after a few weeks, a doctor can evaluate labyrinthitis in case medication is required to help treat the problem.

**Inner ear workings**

The fluid-filled, snail-shaped cochlea (KOK-le-uh), which is located in your inner ear, is the most sophisticated component of your hearing. It’s responsible for translating incoming sound waves into nerve impulses to the brain.

Attached to the cochlea is the inner ear vestibular system, which influences your sense of balance and eye movement and is contained in a bony labyrinth. Its three semicircular tubes are also filled with fluid and have tiny hair cells that pick up any fluid movement to help keep you aware of where your head is in relation to the ground.

Inflammation of the cochlea and vestibular system is called labyrinthitis. Sometimes, the inflammation affects only the vestibular nerve, which conveys information about head movement from the inner ear to the brain. If this is the case, it’s called vestibular neuronitis.

**Spin master**

The causes of labyrinthitis and vestibular neuronitis vary. The inflammation usually affects only one ear and comes on the heels of a viral upper respiratory illness or from a nearby bacterial infection. It may also occur due to bacterial meningitis, head trauma or sometimes for no apparent reason.

The signs and symptoms of labyrinthitis may include:

- A sudden, intense spinning sensation (vertigo) that may last several days, possibly affecting your ability to sit, stand or walk. For some, balance is permanently affected.
- Nausea and vomiting.
- Periods of uncontrolled, back-and-forth eye movements, called nystagmus (nis-TAG-mus).
- Hearing loss, and possibly a total, permanent loss of hearing in the affected ear.
- Ringing or buzzing in the ears, called tinnitus (TIN-i-tus).

If the problem is limited to vestibular neuronitis alone, the signs and symptoms are similar except there’s no hearing loss or tinnitus.

**What can be done**

Check with your doctor if you experience symptoms related to a possible inner ear inflammation. Bacterial and viral infections have similar symptoms, but treatments are very different.

If your doctor determines labyrinthitis is due to a bacterial infection, antibiotics likely will be prescribed. If it’s viral and you’re diagnosed within 72 hours of your first symptoms, you may be given antiviral drugs. If there’s no evidence of infection, you may be given steroids to help reduce inflammation.

You may also be given drugs to help relieve dizziness and nausea. Dehydration from severe vomiting may result in a brief hospitalization. To minimize dizziness, you may find it helpful to sit still and avoid sudden changes of position.

Recovery times vary from several days to several months. Typically, symptoms of labyrinthitis are quite intense for the first few days and then gradually improve over a few weeks. Some lingering feelings of imbalance with quick movements often last several weeks.

When treated promptly, many inner ear infections cause no permanent damage. However, some may encounter partial or total loss of hearing that could be permanent. Others may encounter some persistent dizziness. In rare circumstances, even with prompt and appropriate treatment, there can be permanent damage.
Bell’s palsy

Regaining facial function

Am I having a stroke? That was your first thought upon waking. Half of your face felt strange, and when you looked in a mirror, it seemed to be drooping. No matter how hard you tried, half of your mouth wouldn’t smile and one eye wouldn’t close.

Anytime half of your face seems to abruptly weaken or go limp, it’s important to quickly get to the emergency department. You may indeed be having a stroke. But if your face is the only part of your body affected, there’s a good chance that you may have Bell’s palsy.

The partial or complete paralysis caused by Bell’s palsy typically goes away on its own within weeks or months. Still, prompt treatment can up the odds of full recovery.

Nerve compression

The nerve that controls your facial muscles passes through a narrow corridor of bone on its way to the face. If the nerve becomes inflamed or swollen, it can become compressed, irritated and injured in this corridor, resulting in Bell’s palsy.

Bell’s palsy can occur in anyone, but the risk rises until about age 40, and then begins to decline. In addition, Bell’s palsy occurs disproportionately in people who have certain viral infections — such as cold sores or upper respiratory infections — and in those who have Lyme disease or diabetes.

Damage to the nerve can lead to a diverse range of problems that begin fairly abruptly and usually reach their maximum level within one to three days. Signs and symptoms include:

- Loss of muscle function that can range from mild weakness to total paralysis, occurring on one side of the face. The majority of those with Bell’s palsy don’t experience total paralysis.
- A dry, irritated eye with tears dripping from the corner. This occurs because you can’t close the eyelid on the affected side.
- Pain around the ear or jaw area, a ringing in your ears, or sensitivity to noise.
- Headache.
- Loss of taste or a decrease in saliva production.

Shades of gray

There’s no test that can confirm a diagnosis of Bell’s palsy. The diagnostic process involves eliminating other conditions that can cause similar facial paralysis. These include stroke, tumors, inner ear infections, multiple sclerosis, and certain autoimmune diseases or shingles that may affect the nerves of your face. In addition, Lyme disease can cause Bell’s palsy, and it can involve both sides of the face.

Many subtle differences — such as gradual rather than abrupt onset, paralysis of both sides of the face, a lack of weakness or paralysis of the forehead of the affected side — may suggest some problem other than Bell’s palsy.

If your doctor suspects something other than Bell’s palsy, certain tests or imaging scans may be performed. In addition, people with Bell’s palsy may be tested for conditions that may have previously gone undetected, such as Lyme disease or diabetes.

While you wait

For most, symptoms of Bell’s palsy begin to improve within a few weeks. Complete recovery may take three to six months, or even longer in severe cases. About 85 percent of those with Bell’s palsy will experience full recovery of nerve function, even without treatment. The 15 percent of people who don’t fully recover are almost always those who experience total paralysis.

Your doctor may prescribe a course of oral corticosteroids in an attempt to reduce inflammation around the facial nerve. This increases the number of people who fully recover and may help shorten the duration of recovery.

Antiviral drugs have also been studied as a potential means of improving recovery. There’s some controversy as to whether these are of benefit, but Mayo Clinic doctors say they may be of benefit if given within the first 72 hours of when symptoms begin.

Surgery rarely needed

In very rare cases, facial nerve decompression may be done to surgically widen the bony opening that the facial nerve passes through.

Some who don’t experience a complete recovery may benefit from surgical procedures to lift a drooping eyebrow or corner of the mouth. Injections of botulinum toxin (Botox) to temporarily paralyze certain muscles on the nonparalyzed side of the face may help make your face appear more symmetrical.

The nerve that controls your facial muscles passes through a narrow corridor of bone on its way to the face. If the nerve becomes inflamed or swollen it can become compressed, irritated and injured in this corridor, resulting in Bell's palsy.
Second opinion

Questions and our answers

Q: I’m taking an antidepressant, and I’m concerned that when my doctor instructs me to quit taking it I’ll go through withdrawal. Can this happen? What can I expect?

A: It can happen, but when withdrawal symptoms occur, they’re usually — but not always — mild and can often be reduced or avoided by tapering off the medication. It’s estimated that withdrawal symptoms can occur in about 10 to 20 percent of people who abruptly stop antidepressant therapy after taking it for longer than six weeks. In addition, it’s more likely to occur with antidepressant medications that are more quickly metabolized, such as paroxetine (Paxil) and venlafaxine (Effexor). Withdrawal is less of a problem with longer-acting drugs such as fluoxetine (Prozac).

Symptoms of withdrawal usually occur within days of drug discontinuation. They may include flu-like signs and symptoms such as fatigue, aches, diarrhea and nausea, insomnia, a dizzy or off-balance feeling, sensations of electric shocks, anxiety, or agitation. It’s thought that more-severe symptoms may be related to factors other than withdrawal, such as a re-emergence of depression. More typically, if depression does recur, it returns gradually and takes many weeks to develop.

If your doctor feels that stopping your antidepressant drug is in your best interest, be sure to develop with your doctor a plan for tapering off. Keep an open dialogue with your doctor regarding your signs and symptoms. Sometimes people mistake the physical symptoms of antidepressant withdrawal with a return of depression, and this can lead to unnecessary worry. Still, depression can recur, in which case your doctor may recommend resuming antidepressant therapy.

Q: My sister’s husband was recently in the hospital for heatstroke and very nearly died. What can be done to avoid or at least recognize heatstroke before it’s too late for help?

A: Normally, your skin, blood vessels and perspiration level adjust to the heat. But if you’re exposed to high temperatures and humidity for too long, these natural cooling systems may fail. The result may be a heat-related illness, such as heat cramps, heat exhaustion or heatstroke, which is a medical emergency. Use these precautions:

- **Take it slow** — If you’re used to exercising indoors or in cooler weather, take it easy.
- **Drink plenty of fluids** — Your ability to sweat and cool down depends on adequate rehydration. Drink plenty of water while you’re working out, even if you’re not thirsty. But avoid caffeine and alcohol, which promote fluid loss.
- **Dress appropriately** — Lightweight, loose clothing promotes sweat evaporation and cooling.
- **Avoid midday sun** — Plan activities in the morning or evening, when it’s likely to be cooler.

When you’re exercising in the heat, be on the lookout for heat-related illness. Signs and symptoms include weakness, headache, dizziness, muscle cramps, nausea or vomiting, and a rapid heartbeat.

If you suspect a heat-related illness, stop the activity and get out of the heat. Drink water and wet and fan your skin. If you don’t feel better in 30 minutes, contact your doctor. If you develop a fever higher than 102° F or become faint or confused, seek immediate medical help.

Some people are more prone to heat-related illness. Those at greatest risk are children up to age 4, adults 65 and older, people who are overweight, those with chronic disorders — such as heart disease or diabetes — and people who take certain drugs, such as diuretics and antihistamines. If you do experience a heat-related illness, you will be more susceptible to heat for a few days, so be even more cautious.

Have a question or comment?
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Check out Mayo Clinic Health Solution’s Web site, at www.MayoClinic.com

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