How Emotions Change the Shape of Our Hearts
by ted.com

No other organ, perhaps no other object in human life, is as imbued with metaphor and meaning as the human heart. Over the course of history, the heart has been a symbol of our emotional lives. It was considered by many to be the seat of the soul, the repository of the emotions. The very word "emotion" stems in part from the French verb "émouvoir," meaning "to stir up." And perhaps it's only logical that emotions would be linked to an organ characterized by its agitated movement.

But what is this link? Is it real or purely metaphorical? As a heart specialist, I am here today to tell you that this link is very real. Emotions, you will learn, can and do have a direct physical effect on the human heart.

But before we get into this, let's talk a bit about the metaphorical heart. The symbolism of the emotional heart endures even today. If we ask people which image they most associate with love, there's no question that the Valentine heart would be the top on the list. The heart shape, called a cardioid, is common in nature. It's found in the leaves, flowers and seeds of many plants, including silphium, which was used for birth control in the Middle Ages and perhaps is the reason why the heart became associated with sex and romantic love.

Whatever the reason, hearts began to appear in paintings of lovers in the 13th century. Over time, the pictures came to be colored red, the color of blood, a symbol of passion. In the Roman Catholic Church, the heart shape became known as the Sacred Heart of Jesus. Adorned with thorns and emitting ethereal light, it became an insignia of monastic love. This association between the heart and love has withstood modernity. When Barney Clark, a retired dentist with end-stage heart failure, received the first permanent artificial heart in Utah in 1982, his wife of 39 years reportedly asked the doctors, "Will he still be able to love me?"

Today, we know that the heart is not the source of love or the other emotions, per se; the ancients were mistaken. And yet, more and more, we have come to understand that the connection between the heart and the emotions is a highly intimate one. The heart may not originate our feelings, but it is highly responsive to them. In a sense, a record of our emotional life is written on our hearts. Fear and grief, for example, can cause profound cardiac injury. The nerves that control unconscious processes such as the heartbeat can sense distress and trigger a maladaptive fight-or-flight response that triggers blood vessels to constrict, the heart to gallop and blood pressure to rise, resulting in damage. In other words, it is increasingly clear that our hearts are extraordinarily sensitive to our emotional system, to the metaphorical heart, if you will.
There is a heart disorder first recognized about two decades ago called "takotsubo cardiomyopathy," or "the broken heart syndrome," in which the heart acutely weakens in response to intense stress or grief, such as after a romantic breakup or the death of a loved one. As these pictures show, the grieving heart in the middle looks very different than the normal heart on the left. It appears stunned and frequently balloons into the distinctive shape of a takotsubo, shown on the right, a Japanese pot with a wide base and a narrow neck. We don’t know exactly why this happens, and the syndrome usually resolves within a few weeks. However, in the acute period, it can cause heart failure, life-threatening arrhythmias, even death.

For example, the husband of an elderly patient of mine had died recently. She was sad, of course, but accepting. Maybe even a bit relieved. It had been a very long illness; he had had dementia. But a week after the funeral, she looked at his picture and became tearful. And then she developed chest pain, and with it, came shortness of breath, distended neck veins, a sweaty brow, a noticeable panting as she was sitting up in a chair -- all signs of heart failure. She was admitted to the hospital, where an ultrasound confirmed what we already suspected: her heart had weakened to less than half its normal capacity and had ballooned into the distinctive shape of a takotsubo. But no other tests were amiss, no sign of clogged arteries anywhere. Two weeks later, her emotional state had returned to normal and so, an ultrasound confirmed, had her heart.

Takotsubo cardiomyopathy has been linked to many stressful situations, including public speaking --

(Laughter)

(Applause)

domestic disputes, gambling losses, even a surprise birthday party.

(Laughter)

It’s even been associated with widespread social upheaval, such as after a natural disaster. For example, in 2004, a massive earthquake devastated a district on the largest island in Japan. More than 60 people were killed, and thousands were injured. On the heels of this catastrophe, researchers found that the incidents of takotsubo cardiomyopathy increased twenty-four-fold in the district one month after the earthquake, compared to a similar period the year before. The residences of these cases closely correlated with the intensity of the tremor. In almost every case, patients lived near the epicenter.

Interestingly, takotsubo cardiomyopathy has been seen after a happy event, too, but the heart appears to react differently, ballooning in the midportion, for example, and not at the apex. Why different emotional precipitants would result in different cardiac changes remains a mystery. But today, perhaps as an ode to our ancient philosophers, we can say that even if emotions are not contained inside our hearts, the emotional heart overlaps its biological counterpart, in surprising and mysterious ways.

Heart syndromes, including sudden death, have long been reported in individuals experiencing intense emotional disturbance or turmoil in their metaphorical hearts. In 1942, the Harvard physiologist Walter Cannon published a paper called "Voodoo Death," in which he described cases of death from fright in people who believed they had been cursed, such as by a witch doctor or as a consequence of

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eating taboo fruit. In many cases, the victim, all hope lost, dropped dead on the spot. What these cases had in common was the victim's absolute belief that there was an external force that could cause their demise, and against which they were powerless to fight. This perceived lack of control, Cannon postulated, resulted in an unmitigated physiological response, in which blood vessels constricted to such a degree that blood volume acutely dropped, blood pressure plummeted, the heart acutely weakened, and massive organ damage resulted from a lack of transported oxygen.

Cannon believed that voodoo deaths were limited to indigenous or "primitive" people. But over the years, these types of deaths have been shown to occur in all manner of modern people, too. Today, death by grief has been seen in spouses and in siblings. Broken hearts are literally and figuratively deadly.

These associations hold true even for animals. In a fascinating study in 1980 published in the journal "Science," researchers fed caged rabbits a high-cholesterol diet to study its effect on cardiovascular disease. Surprisingly, they found that some rabbits developed a lot more disease than others, but they couldn't explain why. The rabbits had very similar diet, environment and genetic makeup. They thought it might have something to do with how frequently the technician interacted with the rabbits. So they repeated the study, dividing the rabbits into two groups. Both groups were fed a high-cholesterol diet. But in one group, the rabbits were removed from their cages, held, petted, talked to, played with, and in the other group, the rabbits remained in their cages and were left alone. At one year, on autopsy, the researchers found that the rabbits in the first group, that received human interaction, had 60 percent less aortic disease than rabbits in the other group, despite having similar cholesterol levels, blood pressure and heart rate.

Today, the care of the heart has become less the province of philosophers, who dwell upon the heart’s metaphorical meanings, and more the domain of doctors like me, wielding technologies that even a century ago, because of the heart’s exalted status in human culture, were considered taboo. In the process, the heart has been transformed from an almost supernatural object imbued with metaphor and meaning into a machine that can be manipulated and controlled. But this is the key point: these manipulations, we now understand, must be complemented by attention to the emotional life that the heart, for thousands of years, was believed to contain.

Consider, for example, the Lifestyle Heart Trial, published in the British journal "The Lancet" in 1990. Forty-eight patients with moderate or severe coronary disease were randomly assigned to usual care or an intensive lifestyle that included a low-fat vegetarian diet, moderate aerobic exercise, group psychosocial support and stress management advice. The researchers found that the lifestyle patients had a nearly five percent reduction in coronary plaque. Control patients, on the other hand, had five percent more coronary plaque at one year and 28 percent more at five years. They also had nearly double the rate of cardiac events, like heart attacks, coronary bypass surgery and cardiac-related deaths.

Now, here’s an interesting fact: some patients in the control group adopted diet and exercise plans that were nearly as intense as those in the intensive lifestyle group. Their heart disease still progressed. Diet and exercise alone were not enough to facilitate coronary disease regression. At both one- and five-year follow-ups, stress management was more strongly correlated with reversal of coronary disease than exercise was.

No doubt, this and similar studies are small, and, of course, correlation does not prove causation. It’s certainly possible that stress leads to unhealthy habits, and
that's the real reason for the increased cardiovascular risk. But as with the association of smoking and lung cancer, when so many studies show the same thing, and when there are mechanisms to explain a causal relationship, it seems capricious to deny that one probably exists. What many doctors have concluded is what I, too, have learned in my nearly two decades as a heart specialist: the emotional heart intersects with its biological counterpart in surprising and mysterious ways.

And yet, medicine today continues to conceptualize the heart as a machine. This conceptualization has had great benefits. Cardiology, my field, is undoubtedly one of the greatest scientific success stories of the past 100 years. Stents, pacemakers, defibrillators, coronary bypass surgery, heart transplants -- all these things were developed or invented after World War II.

However, it's possible that we are approaching the limits of what scientific medicine can do to combat heart disease. Indeed, the rate of decline of cardiovascular mortality has slowed significantly in the past decade. We will need to shift to a new paradigm to continue to make the kind of progress to which we have become accustomed. In this paradigm, psychosocial factors will need to be front and center in how we think about heart problems.

This is going to be an uphill battle, and it remains a domain that is largely unexplored. The American Heart Association still does not list emotional stress as a key modifiable risk factor for heart disease, perhaps in part because blood cholesterol is so much easier to lower than emotional and social disruption.

There is a better way, perhaps, if we recognize that when we say "a broken heart," we are indeed sometimes talking about a real broken heart. We must, must pay more attention to the power and importance of the emotions in taking care of our hearts.

Emotional stress, I have learned, is often a matter of life and death.

Thank you.