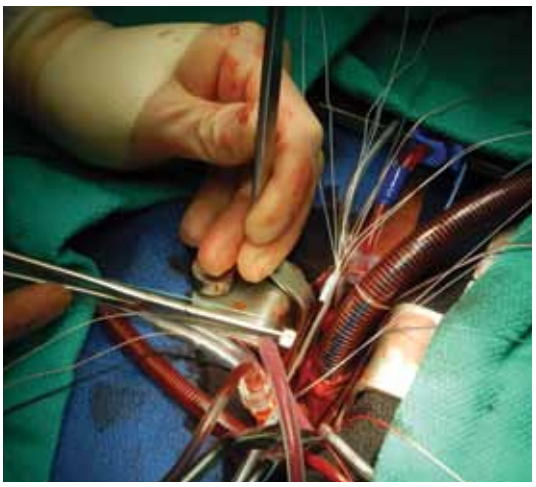
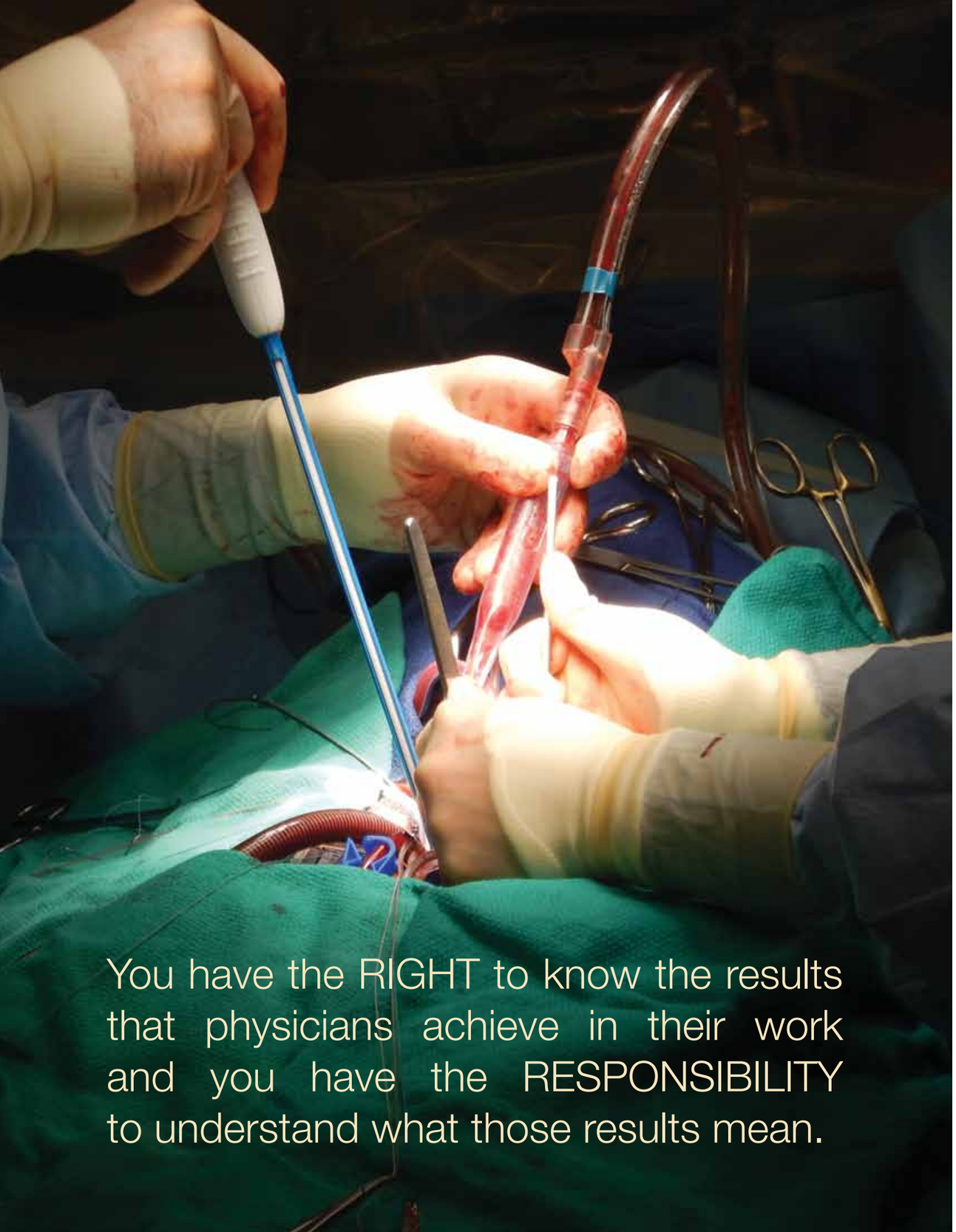


ADULT CARDIAC

SURGERY RESULTS • 2015

CONTENTS

Before presenting our new results, we thought you might enjoy understanding a bit about what it means to acquire experience in the operating room. When we perform a case, our staff gives us a dictation card that contains some of the important data that we use to dictate the operative notes. Since I began in practice, I have saved my cards. As you can see, they mount up over the years!



Welcome to the 2016 edition of our *Results*. We have been making our outcomes available on our website, **pccvs.com** and in brochures like this one for many years. We believe that patients and families who are confronting the necessity of a cardiac operation need to know both the average results obtained in the United States and the specific results of the surgical team they are visiting. National results come from a large database of the Society of Thoracic Surgeons that has compiled the results of United States surgeons for many years. This database is so large that it can "risk adjust" outcomes to account for the variety of complicating factors that effect the outcomes of procedures such as age, diabetes, and many other conditions. Individual surgeons and surgical groups collect their outcomes and contribute them to the STS database. We have always wanted patients to understand this information so they can make informed choices about their illness.

This edition of our *Results* contains three types of information; as in the past, it has recent National results and results our group achieved in over 6500 patients and over 8500 procedures. In this new edition, however, I have added my personal results for the past three years, 2012 through 2014. This includes over 1000 procedures I performed in 735 patients. I hope you will be comforted to know that our techniques have provided increasingly good results in the past as our techniques and technology have improved, and we are still working on making them better.

There are two reasons why we focused on my personal results in this edition of our results. First, I have been in practice over 30 years, and many have relied on my capacity to achieve excellent results. I wanted everyone to see my most recent outcomes. Secondly, our group controls cardiac surgery in six Bay Area hospitals, and that has made summarizing results for all of our surgeons in all of our hospitals a difficult problem for information technology. So we decided to start with me.

We have organized these outcomes so you can acquire an overview of what we do, followed by a more in depth look at some of the more common operations we perform. If you have questions, you can find information on our website, or you can ask them when you visit.

I have also put together some brief videos on YouTube that are generic discussions of some of the common problems in cardiac surgery. You can find them by typing “Vincent Gaudiani” into the YouTube search. Don’t hesitate to call our office if you need additional information. Contact information is listed on page 39. Good luck!

We collected our data in the standard format prescribed by our national organization, the Society of Thoracic Surgeons (STS). The STS has data on more than two million cardiac procedures performed in the United States and has used this data to establish national benchmarks.

Pacific Coast Cardiac & Vascular Surgeons
www.pccvs.com

IMPORTANT POINTS

1 Our results show that we perform an unusually broad and complex range of cases and achieve excellent results.

2 It is a mistake to rank like batting averages, the results obtained in various hospitals because results vary from year to year. In general, cardiac operations are competently performed throughout our nation. We present our results because we are proud of what we have done and because you have the right to know.

3 We are skeptical of groups who do not submit their results for scrutiny or who present only percentages. Look for actual numbers of cases. We are also skeptical of selected cases being presented. We present all of our cases for review. Some groups have not allocated resources to collect results while others argue that their cases are so difficult that they cannot be compared to any standard. However, the STS has developed statistical methods to adjust for the difficulty of cases. This adjustment at least partially compensates for the degree of difficulty of challenging cases. A surgeon should be sufficiently talented to achieve weighted results close to the standard.

VARIETY AND VOLUME

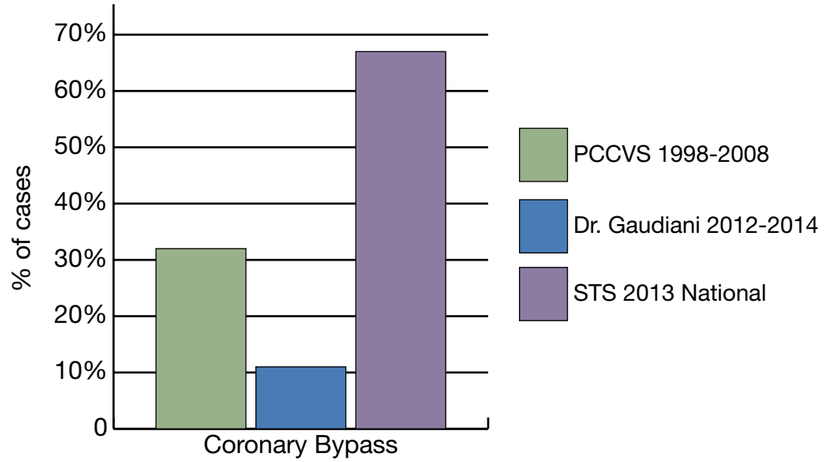
The graphs on the next page compare the types of cases performed for three groups:

- The average US practice
- Our practice 1998–2008
- Dr. Gaudiani's practice 2012–2014

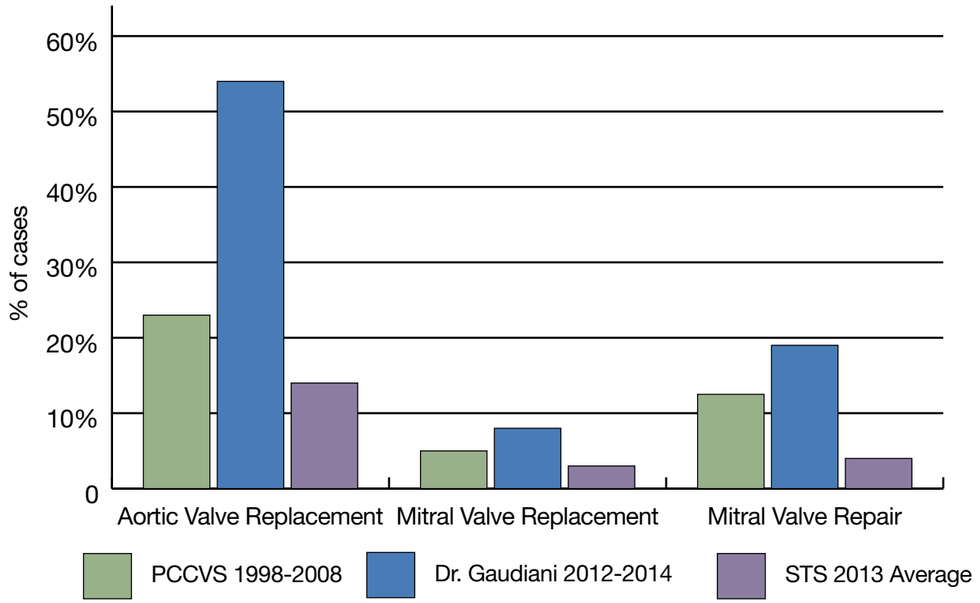
As you will see, we continue to perform fewer coronary bypass cases and more valve repairs and replacements.

We perform a much higher volume and percentage of valve operations than the national average.

MAJOR SINGLE OPERATIVE CATEGORIES VS. AVERAGE NATIONAL PRACTICE (CABG)



MAJOR SINGLE OPERATIVE CATEGORIES VS. AVERAGE NATIONAL PRACTICE (VALVES)



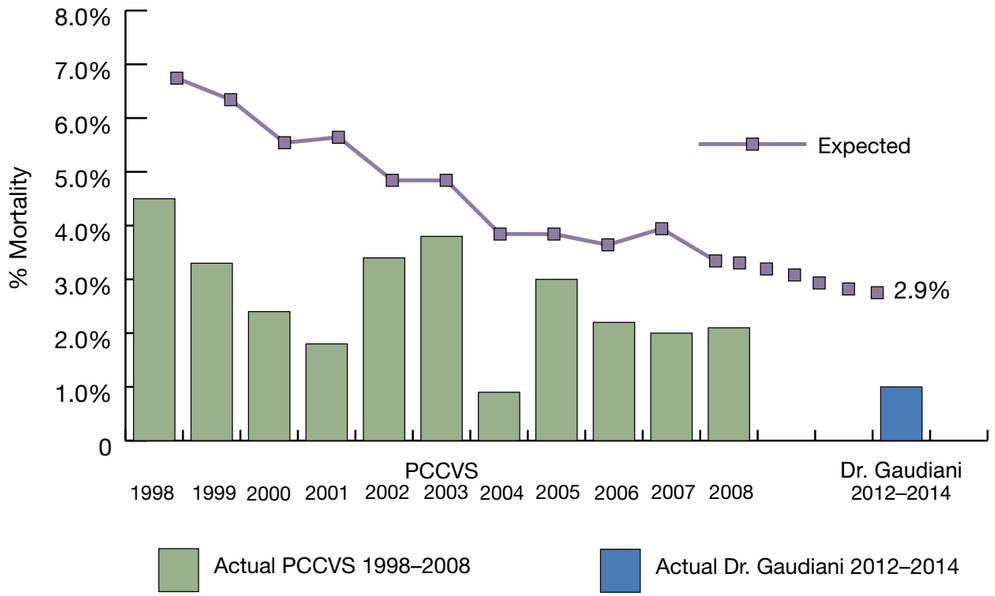
QUALITY MEASURES

OUR PRACTICE COMPARED TO THE STS DATABASE

The huge STS Database allows us to "risk adjust" our results. Risk adjustment allows us to compare our actual % mortality (shown as bar graphs) with the "expected" mortality (shown as line graphs) given the risk factors in our patients. We always strive to "beat" the predictions—that is to have a lower actual mortality rate than predicted by computer models. You can see that we continue to outperform the expected mortality.

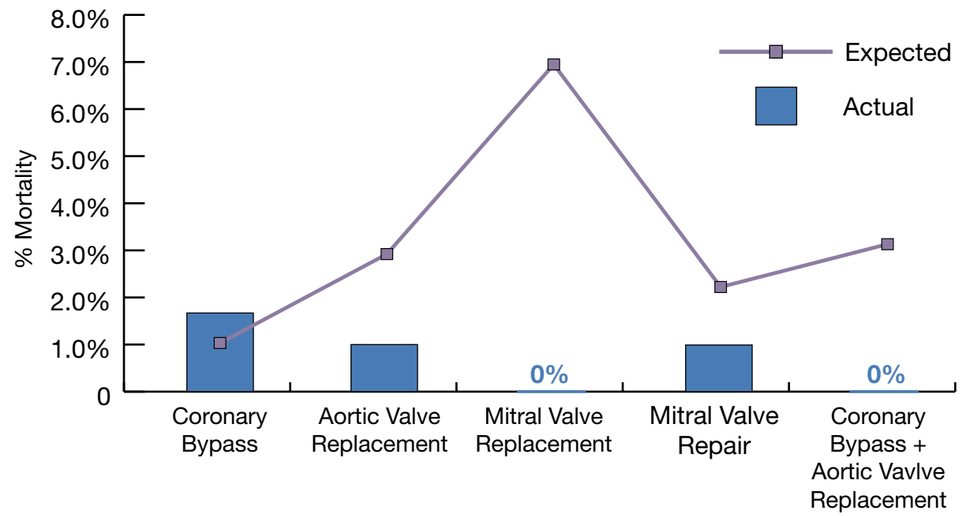
Our risk-adjusted mortality is lower than the STS Database averages for all major categories of cases.

ACTUAL VS. EXPECTED MORTALITY—MAJOR ISOLATED CASES: THEN AND NOW



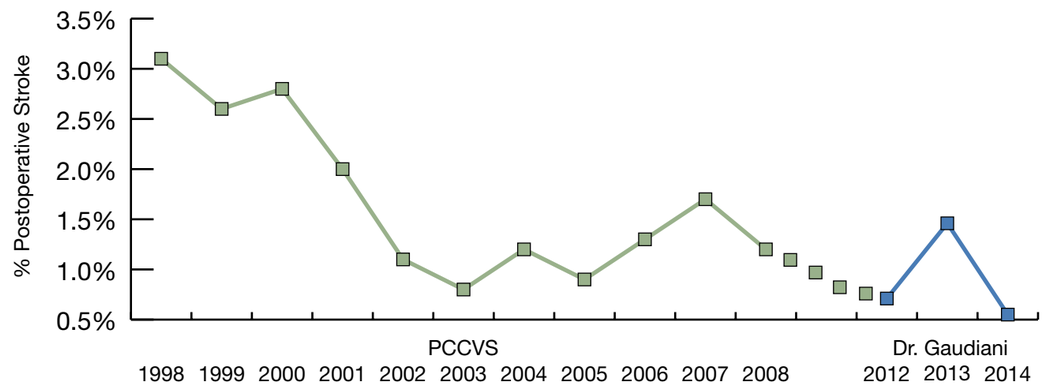
Actual mortality is generally lower than the statistically "expected" mortality for patients we operate on.

DR. GAUDIANI 2012–2014 MAJOR ISOLATED CASES: ACTUAL VS. EXPECTED MORTALITY



Stroke rates continue to decline despite our complex case mix.

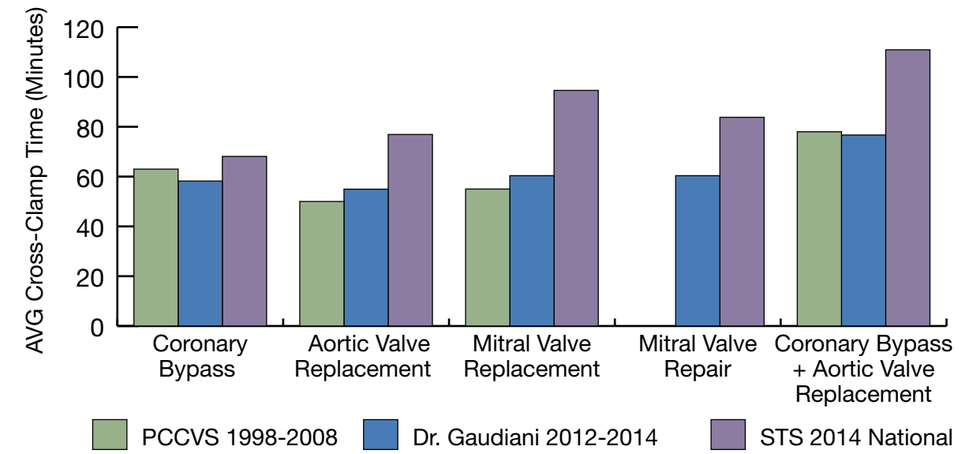
ALL CASES—POST OPERATIVE STROKE: THEN AND NOW



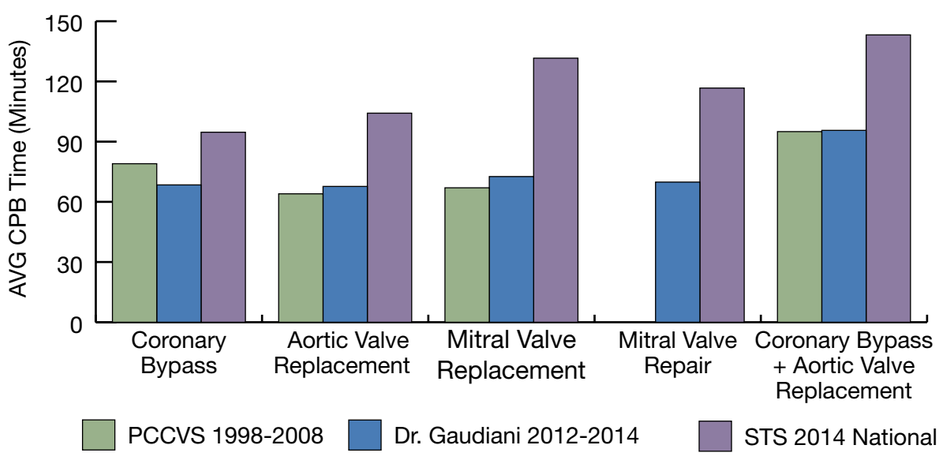
Our operating times are shorter than the national average.

Our cross-clamp and perfusion times are shorter, our mortality rates are lower, and our stroke rates are lower than national averages in all major categories of operations, and they are lower than predicted given our patient population.

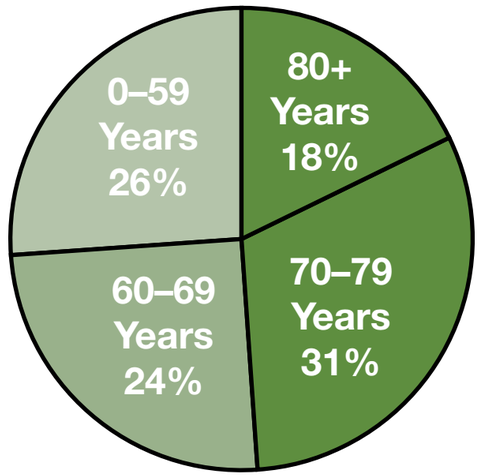
AVERAGE CROSS-CLAMP TIME VS. NATIONAL: THEN AND NOW



AVERAGE CARDIOPULMONARY BYPASS TIME VS. NATIONAL: THEN AND NOW

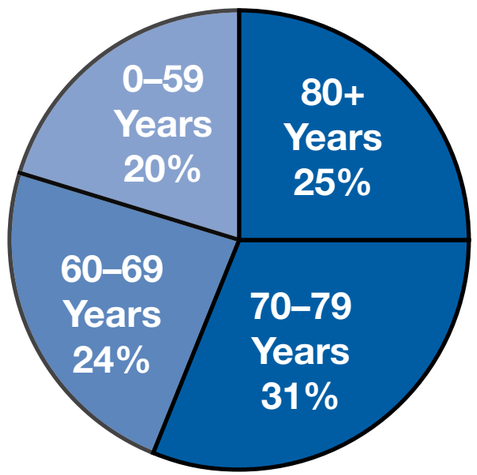


POPULATION DEMOGRAPHICS



ALL CASES—AGE DISTRIBUTION (PCCVS 1998–2010)

In 1998-2010, **49%** of our patients were 70 years or older.

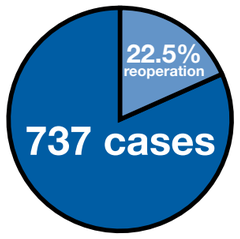


ALL CASES—AGE DISTRIBUTION (2012–2014)

In 2012-2014, **56%** of our patients were 70 years or older.

POPULATION DEMOGRAPHICS

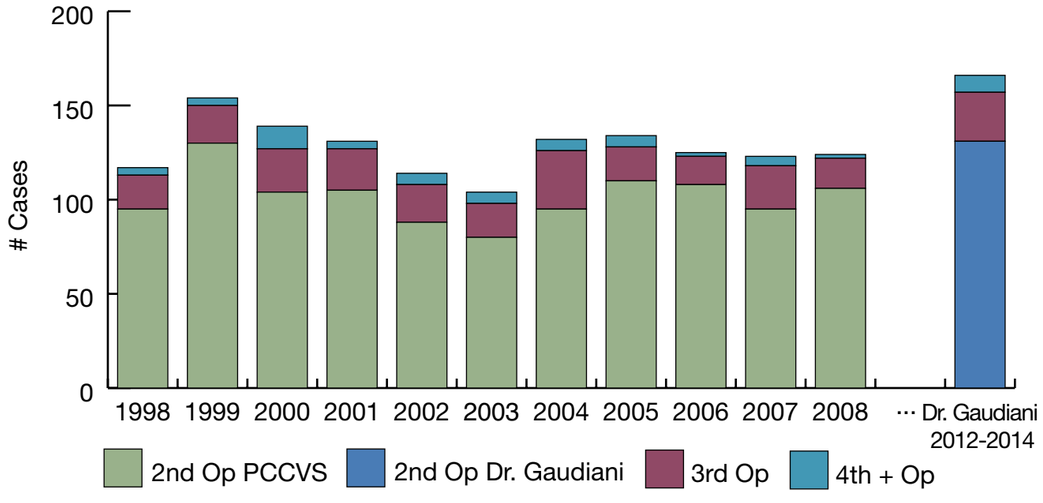
Nearly a quarter of all Dr. Gaudiani's cases from 2012-2014 are reoperations.



Patients who have had previous cardiac operations in their medical history may present a special challenge when they need another cardiac operation, often years after the first one. This is called "reoperation." Cardiologists select our practice to perform these reoperations at about three times the national average. 8% of patients in the STS National Database have undergone previous cardiac operation, over 20% of Dr. Gaudiani's operations are performed on patients who have had a previous cardiac operation.

We perform far more reoperations than the national average.

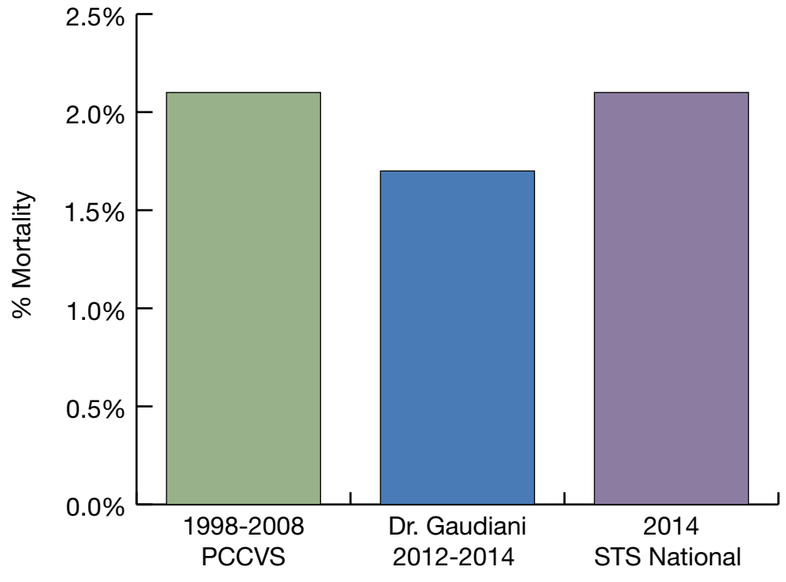
ALL CASES—PATIENTS WITH PREVIOUS CARDIAC SURGERY: THEN AND NOW



CORONARY BYPASS

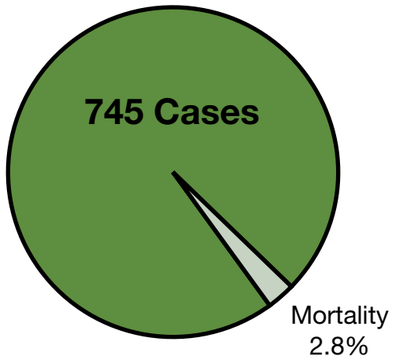
We continue to obtain good results performing coronary bypass.

ISOLATED CORONARY BYPASS MORTALITY RATE: THEN AND NOW



CORONARY BYPASS

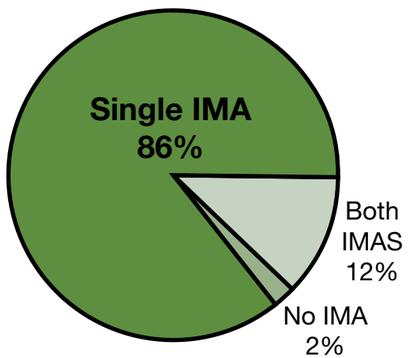
Mortality among diabetics is now similar to that of non-diabetics.



ISOLATED CORONARY BYPASS
FOR DIABETICS

Historically, diabetics have had a higher mortality rate after coronary bypass than non-diabetics. We have eliminated this difference by instituting careful perioperative routines that control blood sugar and reduce complications that diabetics typically experience after operation.

Virtually all of our coronary bypass patients receive an internal mammary artery graft.



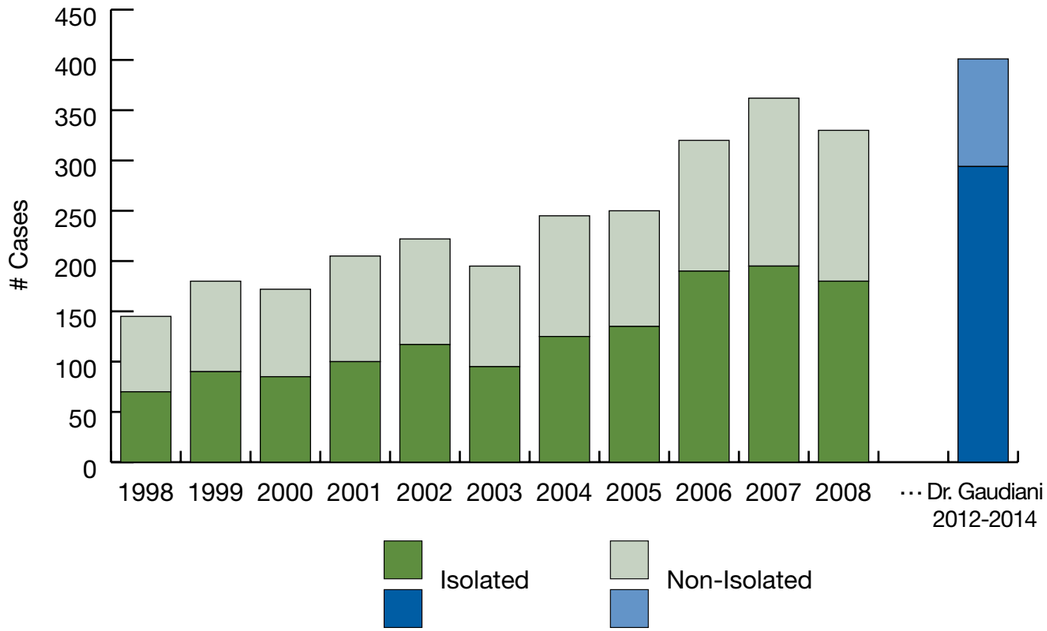
ISOLATED CORONARY BYPASS
FIRST OPERATION, NON-EMERGENT:
INTERNAL MAMMARY ARTERY (IMA) USE

The internal mammary artery (IMA) makes an excellent bypass graft that generally lasts longer than vein bypass grafts and confers a survival advantage. We use an IMA graft in 98% of eligible cases.

AORTIC VALVE

We performed 2532 aortic valve replacements (AVRs) from 1998-2008. Dr. Gaudiani, performed an additional 401 in just 3 years, 2012–2014.

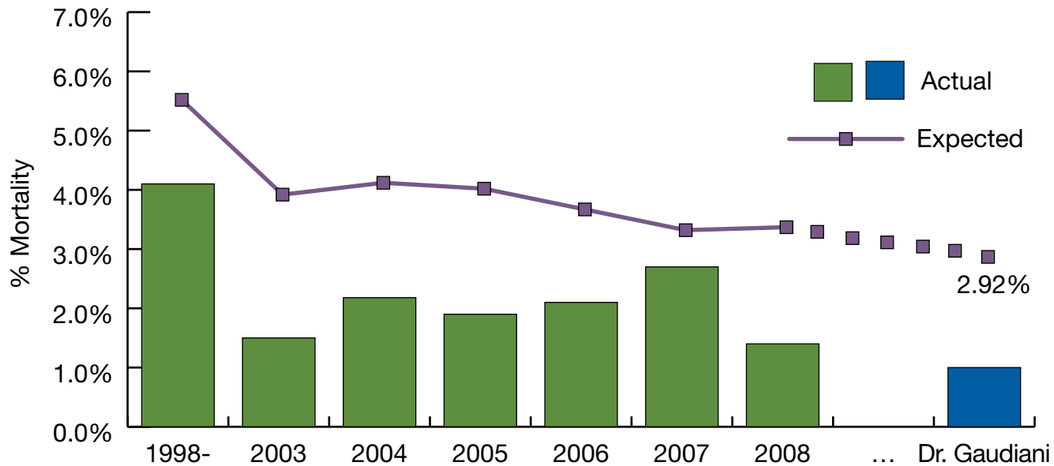
ALL AORTIC VALVE REPLACEMENT—VOLUME OF CASES: THEN AND NOW



AORTIC VALVE

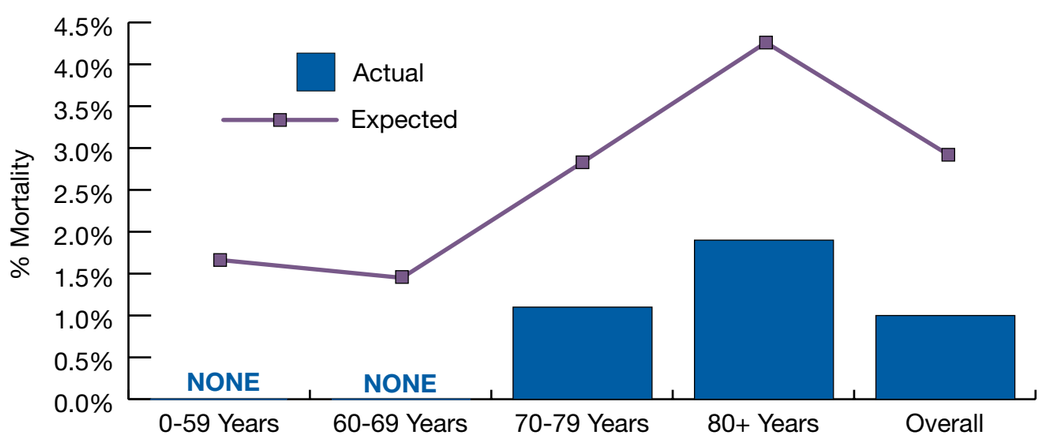
From 2004–2008, we had the lowest operative mortality in the STS registry. It is even lower now.

ISOLATED AORTIC VALVE REPLACEMENT MORTALITY: THEN AND NOW



Even in older patients, aortic valve mortality remains low.

ISOLATED AORTIC VALVE REPLACEMENT: MORTALITY BY AGE (2012–2014)



AORTIC VALVE

Two types of valves are widely used. Tissue valves are biologic: the valve material is derived from cow or pig. Because they are made from tissue like our own, they usually do not require anticoagulation, but they do eventually wear out and require re-replacement. Mechanical valves will last a lifetime, but do require anticoagulation.

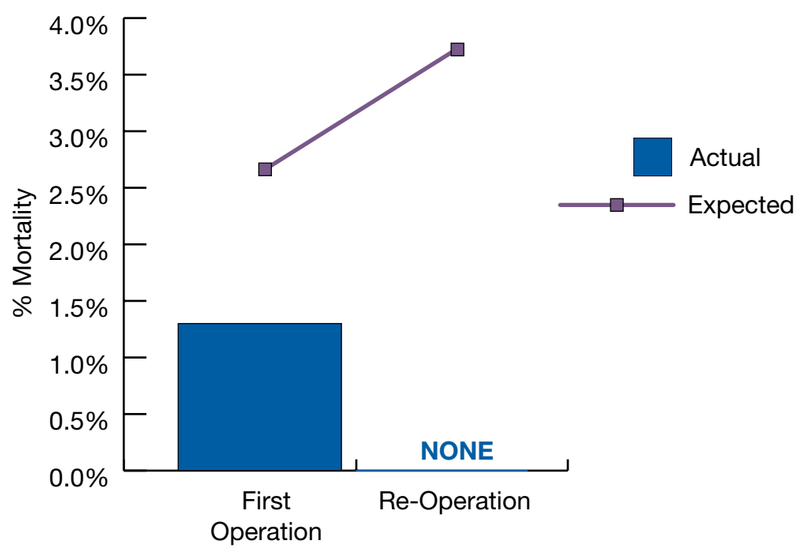
BIOLOGICAL VALVE

MECHANICAL VALVE

When we must reoperate on patients whose valves have worn out or deteriorated the mortality is very low.

As noted, some patients need aortic valve replacement but have had a previous cardiac operation. Although these “reoperations” are considered more difficult, our results have been excellent.

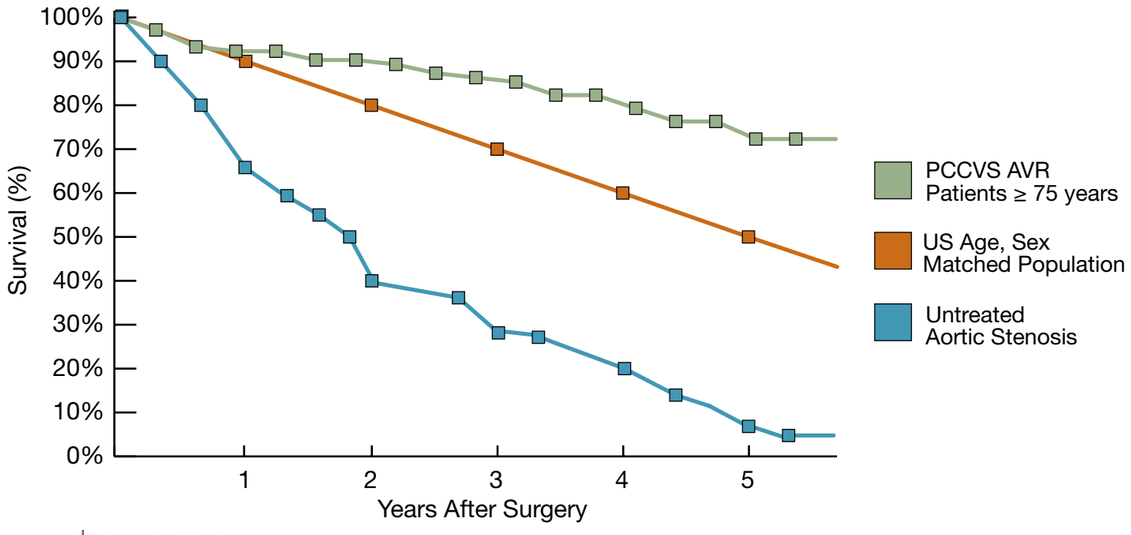
ISOLATED AORTIC VALVE REPLACEMENT MORTALITY (2012–2014)



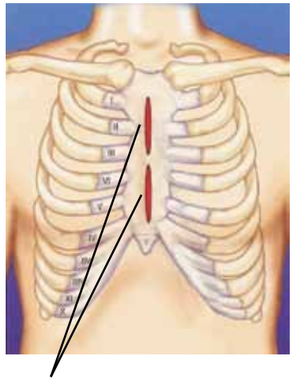
Do older patients live longer after aortic valve replacement?

We have now had the opportunity to study some of the longer-term effects of aortic valve replacement, particularly in elderly patients. We evaluated the long-term survival of 371 patients ages 75 and over whom we operated from 2004–2008. We compared their long-term survival to an age and sex matched group from the general US population. To our surprise, we found that the long-term survival of our operated patients with aortic stenosis is significantly better than their peers in the general population. This is because patients who have isolated aortic stenosis are evaluated and chosen for operation if they are reasonable candidates who are free of coronary disease or cancer—otherwise they would not have been selected. The importance of this outcome is that elderly patients who come for isolated aortic valve replacement can expect a substantial chance for five-year survival and therefore need a durable and well-performed operation. You might also notice that the graph includes operative mortality so that all patients who are operated are included, not just post-operative survivors.

ISOLATED AVR AGE 75+ LONG-TERM SURVIVAL VS. US AGE, GENDER MATCHED POPULATION 2004–2008 (N=371 PATIENTS)



MINIMALLY INVASIVE AORTIC OPERATIONS



Limited Sternotomy
(Upper and Lower)

In 1997, we began performing a variety of operations through limited incisions, including aortic and mitral valve procedures. Aortic valve operations can be performed through either an upper or lower mini-sternotomy. These incisions are about as long as an index finger. The upper mini-sternotomy is often the easiest to perform, but we prefer the lower mini-sternotomy in women to achieve a better cosmetic result.

We have performed well over 2000 aortic valve replacements through small incisions. This technique is now our standard of care. Our data shows that we are able to perform the operation just as quickly and as well through small incisions as we do through large incisions. We now reserve the large incision for patients who are morbidly obese or unusually ill. In the majority of cases, nearly 90% of our isolated aortic valve population, the small-incision approach works as well and has high patient acceptance.

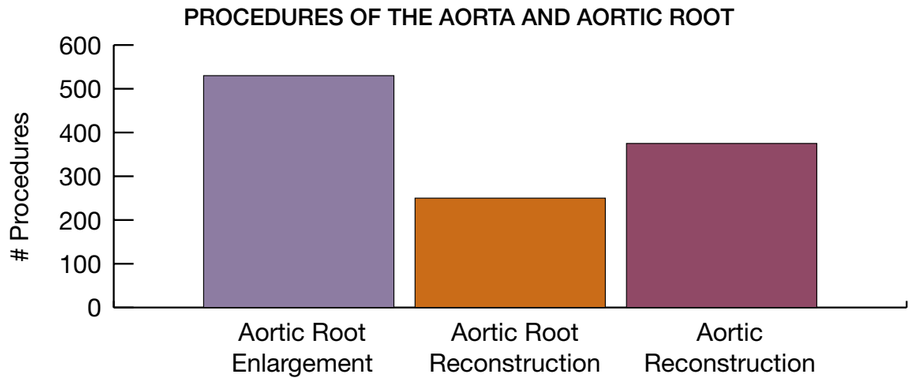
Most AVRs (>80%) are minimally invasive and:
Show no increase in mortality
Show no increase in stroke rate
Have similar cross-clamp and pump times as standard operations

AORTIC ROOT AND THORACIC AORTIC OPERATIONS

We performed more than 1165 procedures involving the aortic root and thoracic aorta during an eleven-year period.

We believe that patients who need aortic valve replacement should receive a prosthetic valve large enough to permit the heart to work easily at rest and through moderate exercise. Experimental work has shown that patients require approximately 0.85cm^2 of valve area per m^2 of body surface area. To achieve this, we must enlarge the left ventricular outflow tract with a patch in about 20–30% of our patients. We have now performed more than 500 such operations. Our results are published in *The Annals of Thoracic Surgery.*[1]

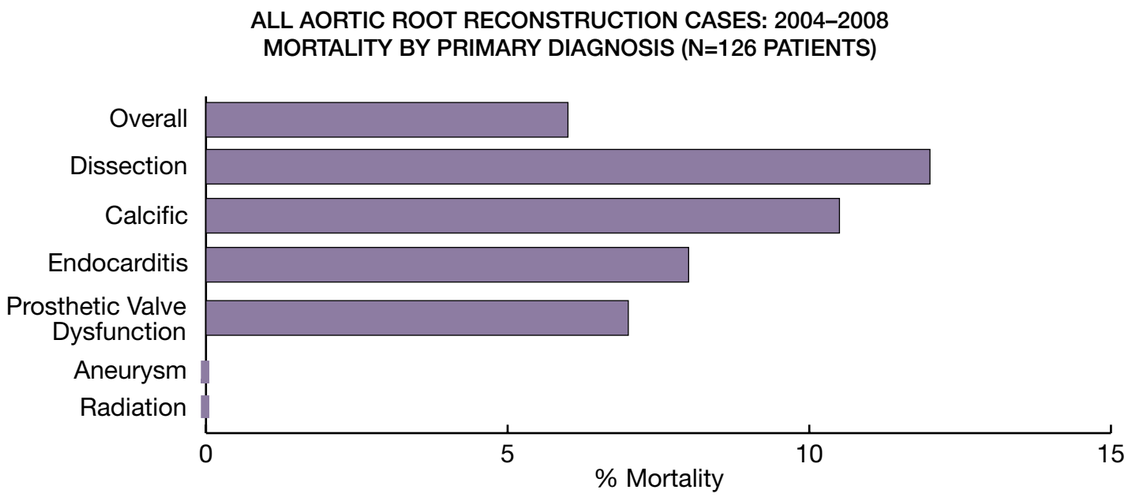
We also have occasion to completely replace the ascending aorta, particularly in those with bicuspid aortic valves who have ascending aortic enlargement. We recognize that the abnormal bicuspid valve is often accompanied by an abnormal ascending aorta, and in our hands the replacement of the ascending aorta has not proven to add mortality to the operation.



1 Castro LJ, Arcidi JM Jr, Fisher AL, Gaudiani VA. Routine enlargement of the small aortic root: a preventive strategy to minimize mismatch. *The Annals of Thoracic Surgery*. 2002 Jul;74(1):31-6.

We performed 532 aortic root enlargements, 262 aortic root reconstructions, and 371 reconstructions of the ascending, arch, and thoracic aorta.

Some patients require not only replacement of the aortic valve and the segment of the aorta above the valve, but they require replacement of the entire structure that involves their root. The aortic root includes the origin of the coronary arteries, as well as the valve and the aorta just above the valve. This is aortic root reconstruction. We use these procedures only in patients with particularly complicated problems and we will enumerate them in the following chart. These procedures are more complicated and are riskier than normal aortic valve replacement.



Although the overall mortality rate for aortic valve replacement rarely exceeds 2.5-3%, the average mortality rate for aortic root reconstruction is about 7% as you can see above. This is because the diagnostic categories in which we perform aortic root reconstruction are complex entities and they include: 1) type A dissection of the aorta, 2) severely calcified aortic root, 3) infections of the aortic root, 4) failed previous operations. Fortunately, patients with aortic aneurysms who require aortic root reconstruction have had outstanding outcomes in our hands.

MITRAL VALVE

We are pleased to report that we had the best performance for mitral valve replacement operative mortality in the national STS Database 2004–2009.

In the past eleven years, we have performed nearly 2000 mitral valve operations and in general, they are divided into two groups. The first group is those patients whose valves cannot be repaired because they are too deranged. These patients require mitral replacement. Another large group is those patients who require mitral valve repair. Even these groups have subgroups with very different outcomes, as you will learn when you read this section.

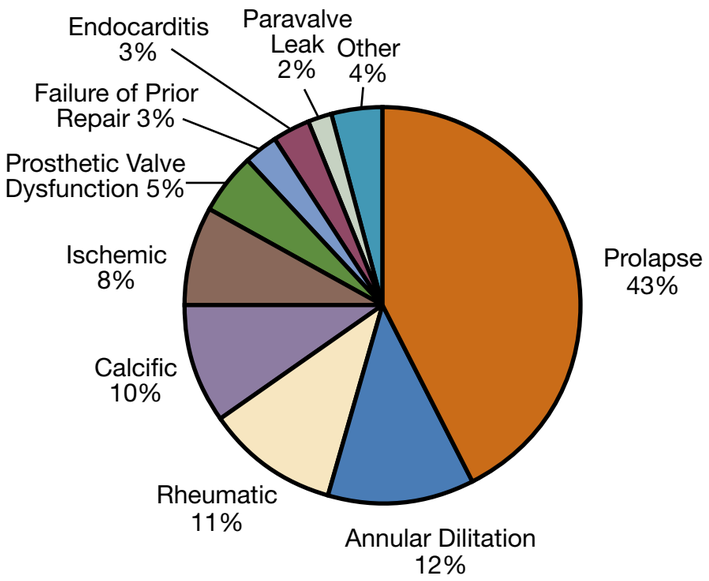
As you look through the ensuing graphs, you will notice that the largest category of mitral operation is repair for mitral valve prolapse. You can see the other numerous diagnostic categories that are present. If you have one of these diagnoses, please do not hesitate to ask for specific information about it when you meet with us.

You can also see that the mortality rate for mitral valve operations is vastly different by diagnosis. For example, the mortality for prolapse is very low. In fact, for isolated mitral valve prolapse we have had no operative deaths in patients under the age of 80 in the past five years.

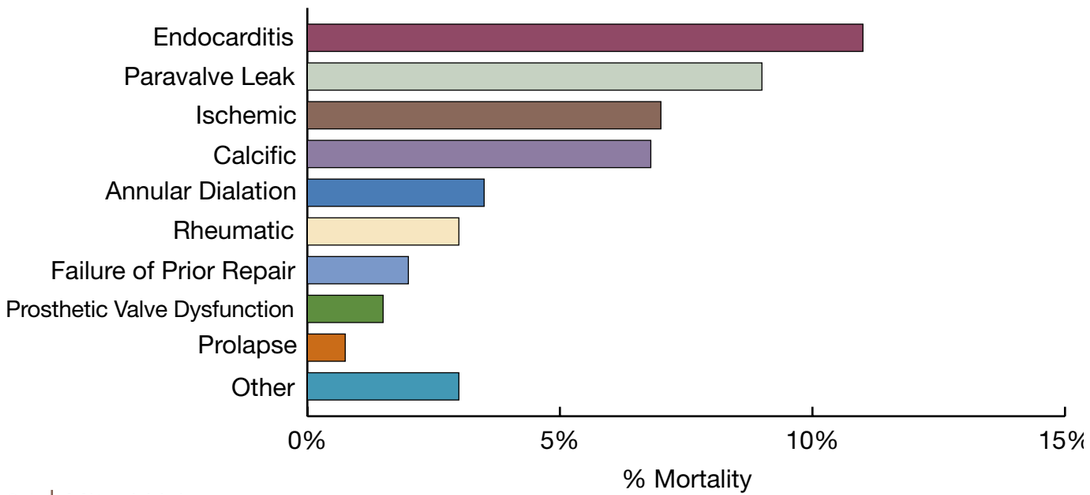
MITRAL VALVE

Mitral valve diagnoses are quite diverse and mortality associated with them varies widely.

ALL MITRAL VALVE CASES: % VOLUME BY PRIMARY DIAGNOSIS



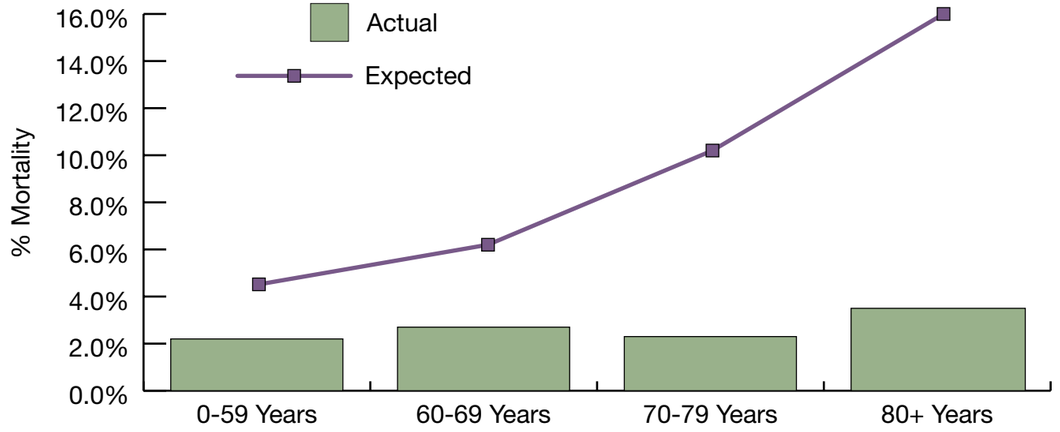
ALL MITRAL VALVE CASES: MORTALITY BY PRIMARY DIAGNOSIS



MITRAL VALVE

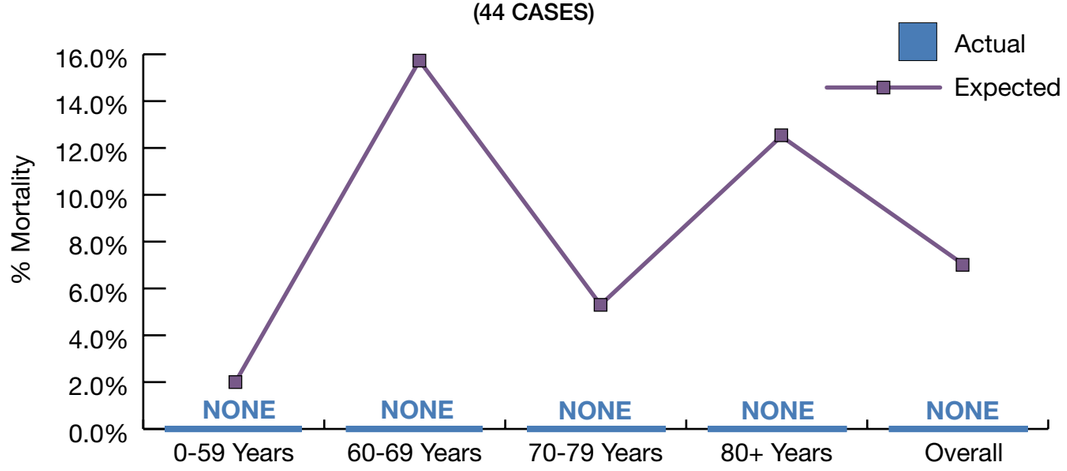
Our MVR operative mortality ranked the best in the US from 2004–2008.

ISOLATED MITRAL VALVE REPLACEMENT MORTALITY: PCCVS 1998–2008



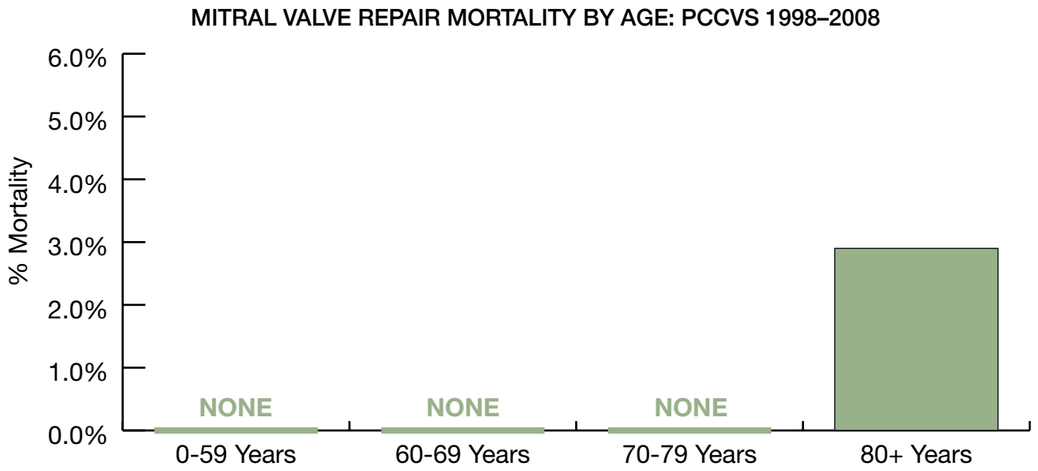
Dr. Gaudiani's MVR operative mortality was **0%** in 2012–2014 for all ages.

ISOLATED MITRAL VALVE REPLACEMENT MORTALITY: DR. GAUDIANI 2012–2014 (44 CASES)

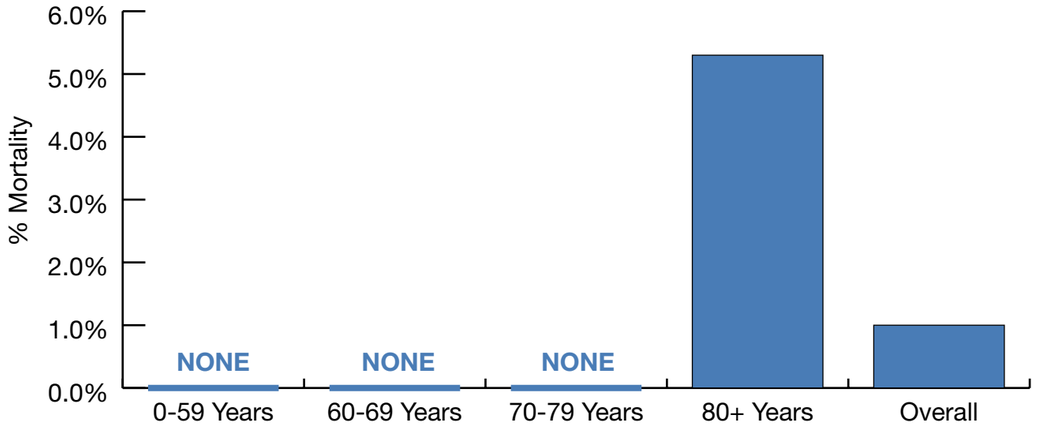


MITRAL VALVE

Mortality for mitral valve prolapse from 1998–2008 represents no deaths in 447 patients under age 80.



From 2012–2014, mortality represents one patient age 90.



MITRAL VALVE

We now have longer-term follow-up data on patients who underwent mitral valve repair.

From 2004–2008, we performed 449 mitral valve repairs for prolapse (with and without other procedures).

- There were no operative deaths.
- We contacted 199 consecutive isolated mitral valve repair patients and found that there were no deaths at an average of 2.26 years after operation.
- 97% did not require any further therapy for their mitral valve problem.
- We are confident that anatomic mitral valve repair is a robust operation.

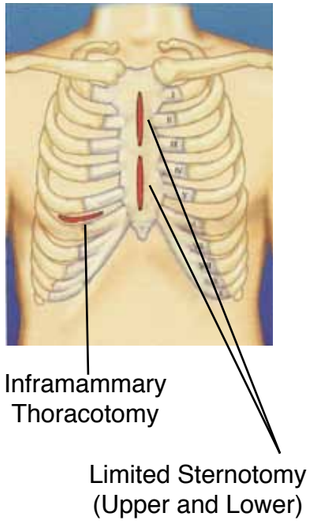
MINIMALLY INVASIVE MITRAL OPERATIONS

Although the outcomes are similar, patients prefer the cosmetics of small-incision surgery.

We perform isolated mitral valve repair through small-incision in more than 90% of cases.

As with aortic valve patients, we have gradually learned to perform small-incision mitral valve operations. Our experience in nearly 600 cases shows that cross-clamp, perfusion, and operation times are not statistically different whether we use a large or small incision. We reserve the complete median sternotomy for a few patients with difficult anatomy.

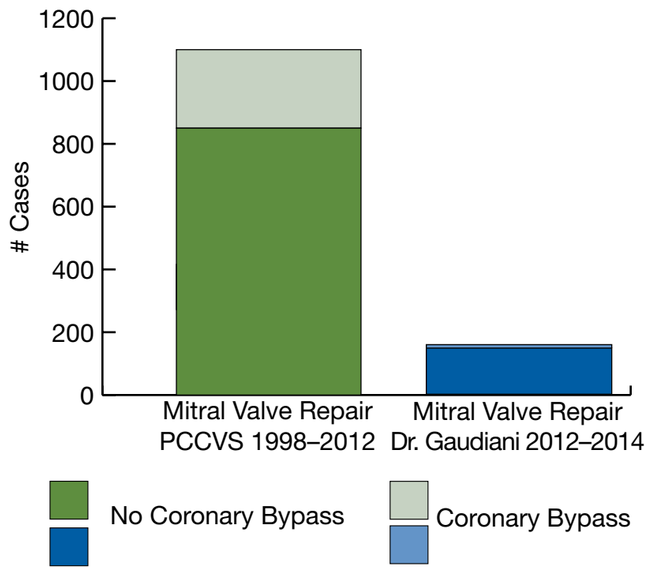
In women we prefer right inframammary thoracotomy as it provides the best cosmetic result. In most men we use the upper mini-sternotomy because access is somewhat easier and the cosmetic implications are less important.



MITRAL VALVE OPERATIONS WITH CORONARY BYPASS

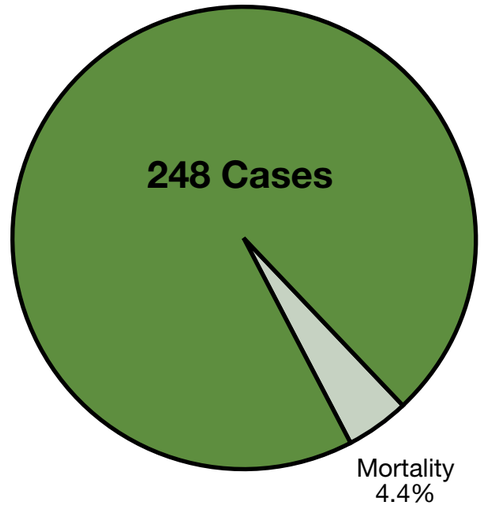
Among both the mitral valve repair and replacement populations, many patients require adjunctive coronary bypass.

ALL MITRAL VALVE CASES: CONCOMITANT CORONARY BYPASS VOLUME

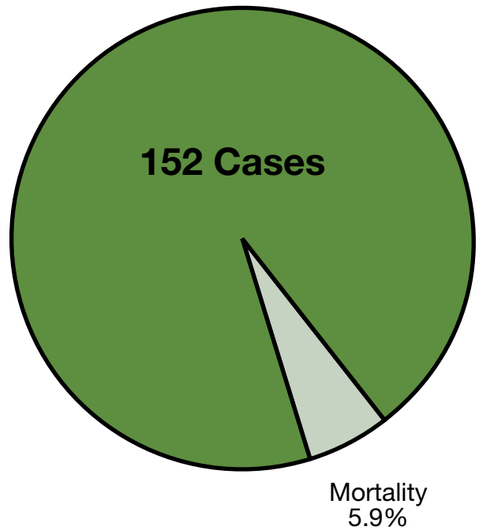


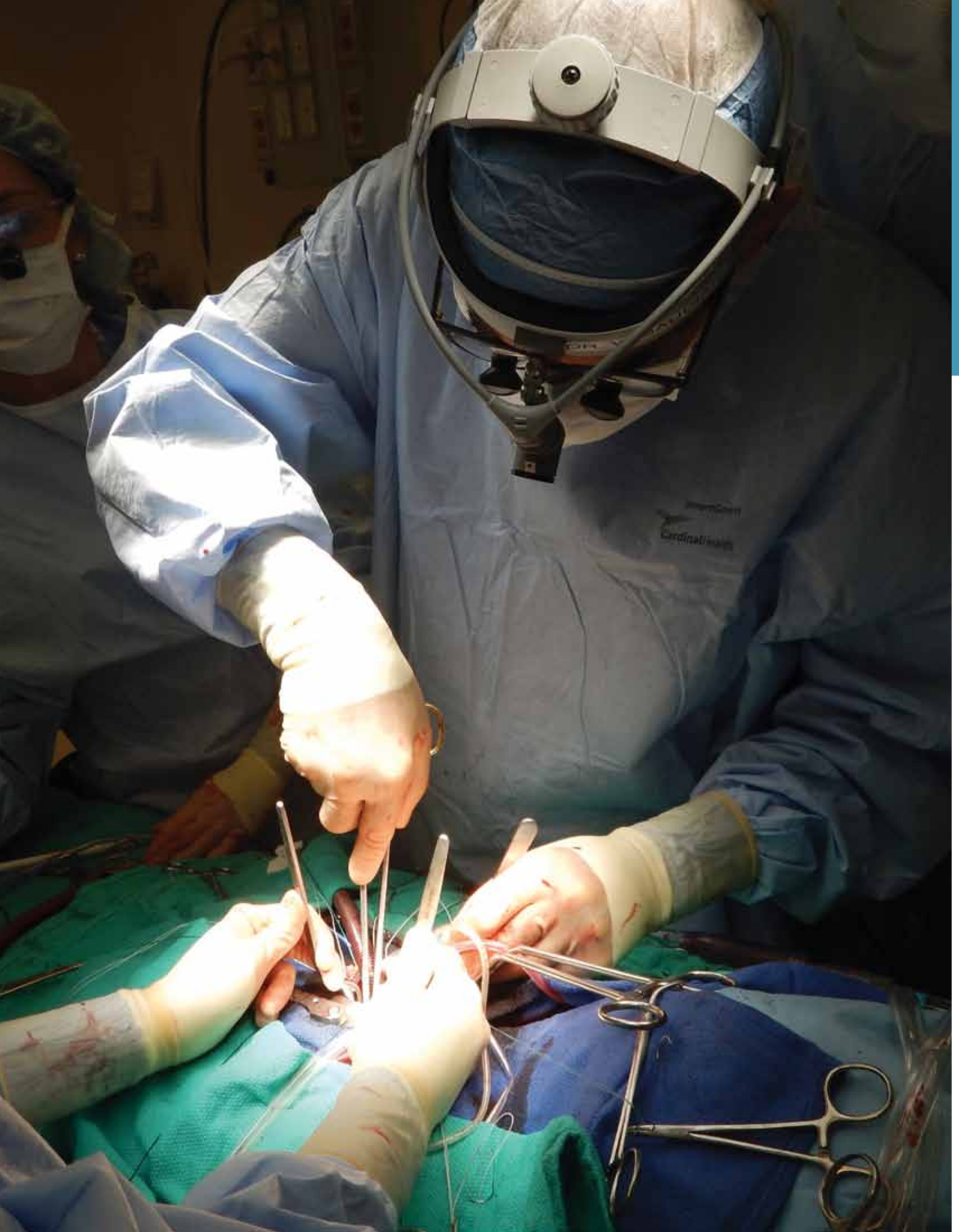
As is true for isolated mitral valve repair versus replacement, mortality is higher for combined mitral valve replacement with CAB than it is for mitral valve repair with CAB.

ALL MITRAL VALVE REPAIR + CORONARY BYPASS



ALL MITRAL VALVE REPLACEMENT + CORONARY BYPASS

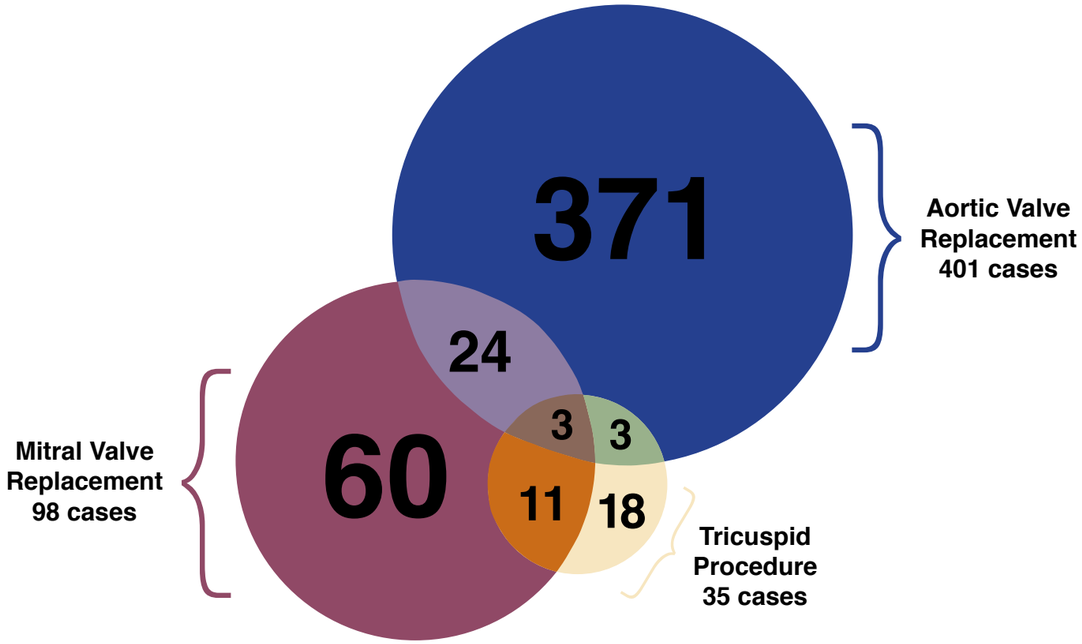




COMPLEX VALVE

The following Venn Diagrams illustrate the world of valve surgery. Each shows that Dr. Gaudiani performed 401 aortic valve operations from 2012–2014. The first diagram (below) shows that Dr. Gaudiani performed 98 mitral valve replacements and 35 tricuspid valve operations. The overlaps show patients who required more than a single valve replacement.

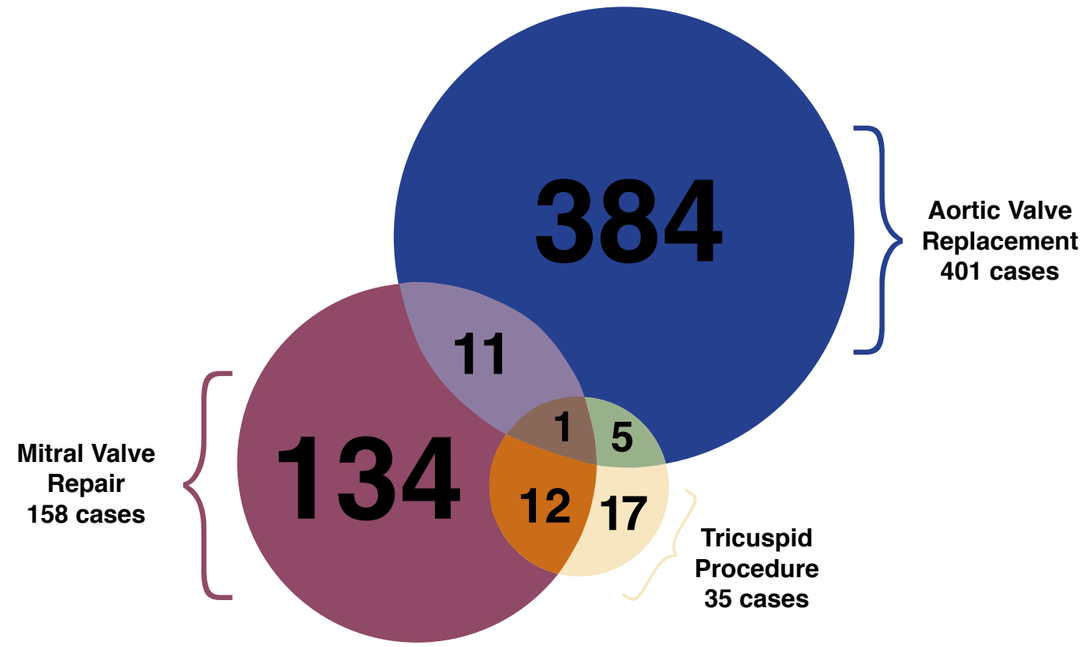
VALVE OPERATIONS WITH MITRAL VALVE REPLACEMENT (2012–2014)

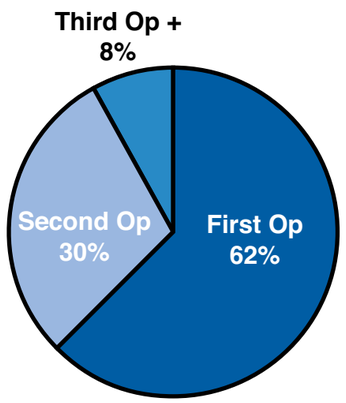


COMPLEX VALVE

The Venn Diagram below shows a similar breakdown with those who had mitral valve **repair** rather than replacement.

VALVE OPERATIONS WITH MITRAL VALVE REPAIR (2012–2014)





MULITIPLE VALVES: INCIDENCE OF PREVIOUS OPERATIONS (2012–2014)

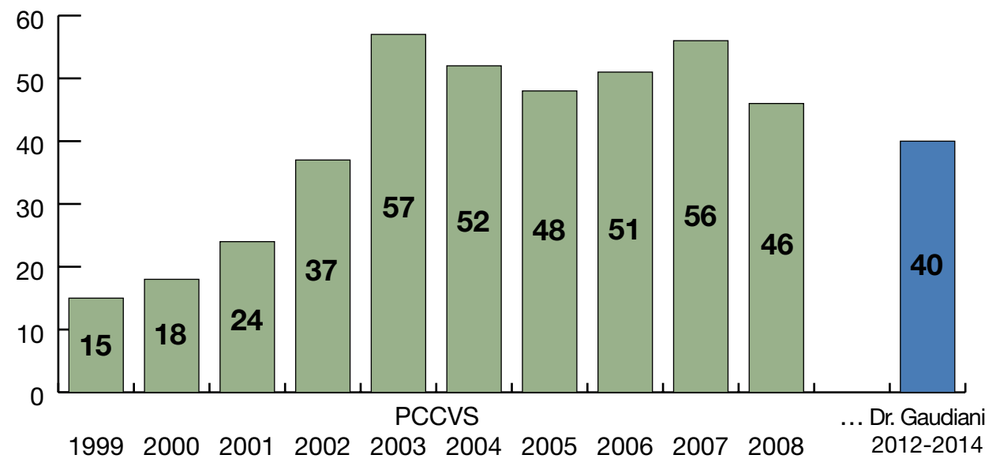
Those who need multiple valve operations have often had more than one procedure. Over 30% of our multiple valve patients are reoperations.

THE MAZE ATRIAL FIBRILLATION

We have performed more than 700 Maze procedures since 1999.

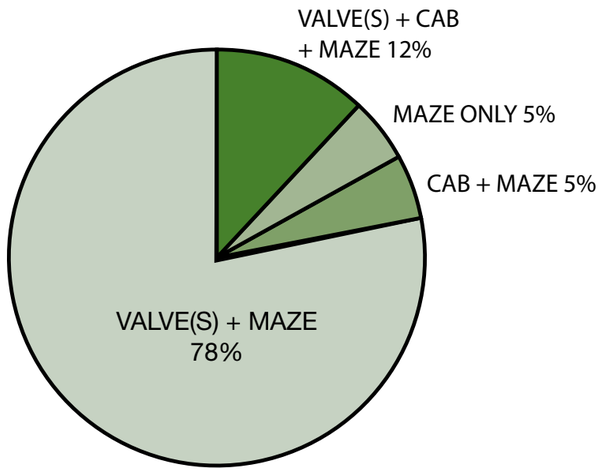
The Maze operation for atrial fibrillation is one of the interesting developments in cardiac surgery in the past fifteen years. The operation was established in 1993, and we began performing it in 1997. We still perform the standard “cut-and-sew” Maze on patients with valvular heart disease because we believe it provides the best results. About 80% of these will remain free of atrial fibrillation.

MAZE PROCEDURE: CASE VOLUME

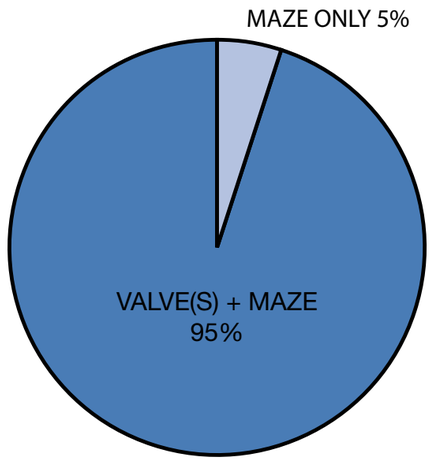


THE MAZE
ATRIAL FIBRILLATION

If you have atrial fibrillation you are best advised to have a thorough discussion with us or with your cardiologist. Each case is a bit different and the details are very important in deciding what to do.



**MAZE PROCEDURE:
MAJOR OPERATIVE CATEGORIES
(PCCVS 1998–2008)**



**MAZE PROCEDURE:
MAJOR OPERATIVE CATEGORIES
(DR. GAUDIANI 2012–2014)**

The Maze is most commonly part of a more complex valve operation. Most patients are improved by the Maze operation, but it is far from perfect. However, it does offer what we believe is the most likely way to avoid long-term atrial fibrillation.

ABOUT US

Our cardiovascular surgery group operates in 6 hospitals in the Bay Area. You will find a list of those hospitals and the surgeons who work with us. As mentioned, we began operating over 30 years ago in one hospital and gradually acquired and are still acquiring the skill set that drives us today. About 10 years ago, two ideas became clear: first, small private practices would have increasing difficulty managing the growing complexity of the business part of medicine; and second, we realized that we could build effective and safe cardiac surgery centers in many hospitals with enough focus and training.

We enjoy practicing in the private setting, without the red tape and confusion that large institutions generate, but of course, we wanted to achieve the best outcomes possible. Therefore we were fortunate to partner with the Palo Alto Medical Clinic, a Sutter affiliate, that has a long and excellent history of providing physicians with effective business leadership. The Clinic helped us to organize the infrastructure in our hospitals. They provide us with an excellent staff of physician assistants, nurses, and administrators to keep us organized. This also freed us to develop and build mindful surgery units in each of these hospitals and to see patients as individuals with individual needs. Our hospitals have offered us the opportunity to bring our skill set closer to patients, reducing their travel and expense. As you can see from this bulletin, we are achieving excellent outcomes, and if you are facing a cardiac surgical problem, don't hesitate to call or email any one of us.

My own story is one of unusual good fortune. I graduated in English from Harvard, but ended up at Case Western Reserve Medical School and promptly fell in love with surgery. I still am. After 9 years of residency, I realized that I did not want to work in a large bureaucracy, and so I went into practice with a skilled surgeon and legendary entrepreneur, Tom Fogarty. I was able to develop substantial technical skills and a way of practicing that I still enjoy. I have now performed about 11,000 cardiac operations, but there is no such thing as flawless in this craft, and I am still learning. Of course we all inevitably find our fate, but only the most fortunate find the fate that optimizes their talents. I count myself in that group.

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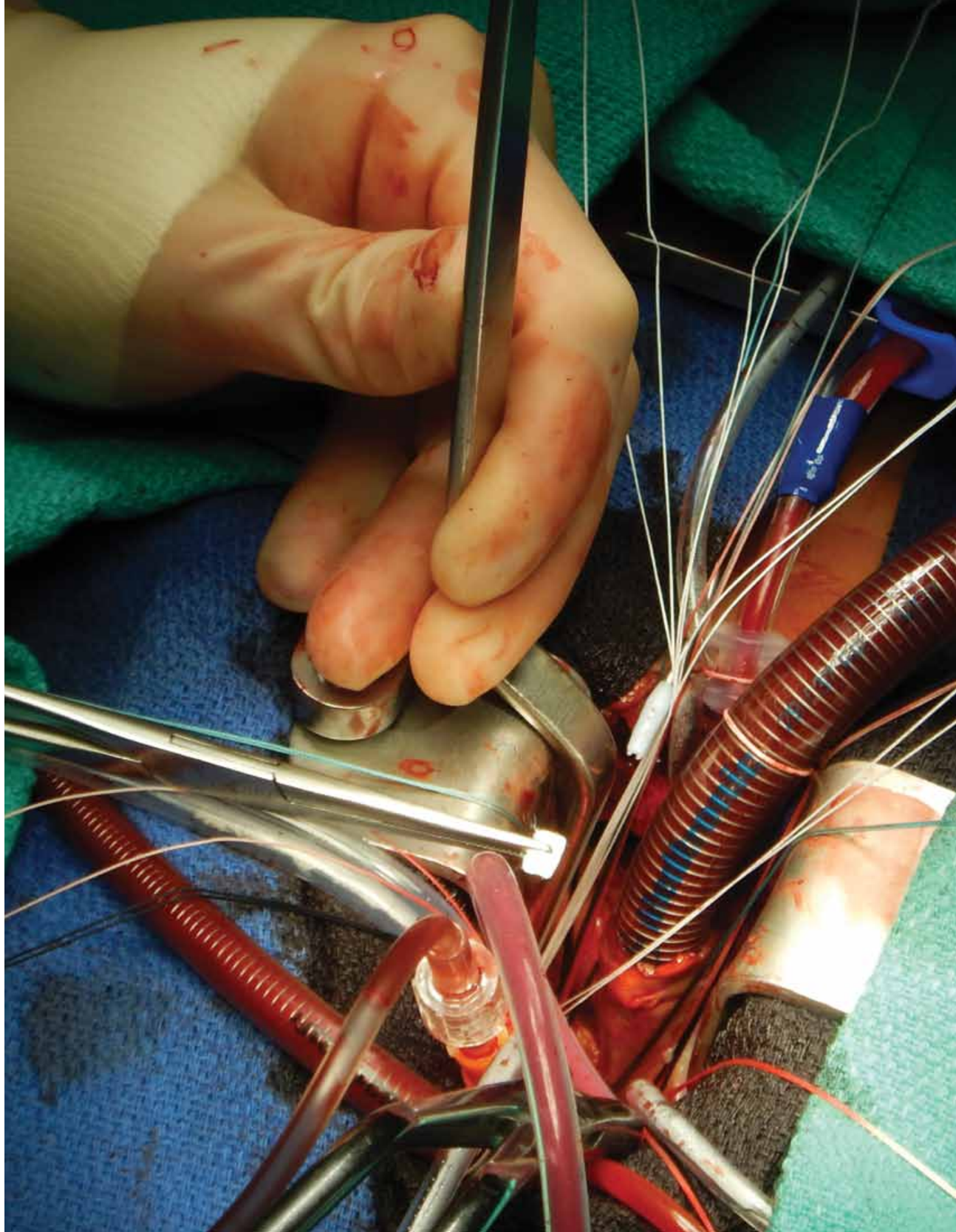

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