Part I: Overview of Cardiothoracic Surgery

Description of Specialty, Common condition, types of patients
Welcome to Cardiothoracic Surgery! Cardiothoracic Surgery is an exciting surgical residency. As a cardiothoracic surgeon you will be taking care of patients from a wide range of ages, diseases and conditions. Within the specialty you can choose to focus on Cardiac Surgery; these patients commonly suffer from coronary artery disease, myocardial infarction, congestive heart failure, arrhythmia, valve disease, and aortic disease. You could also choose to focus on Thoracic Surgery and treat people with malignant chest diseases such as lung, esophageal, pleural, chest wall and mediastinal cancer. There are also benign chest diseases such as complex airway disorders, achalasia, diaphragmatic hernias and gastro-esophageal reflux disease. Cardiothoracic surgery is a field combining surgical management, multi-disciplinary collaboration with other specialists, and exciting opportunities for research and innovation.

Practice Models
Practice models for cardiothoracic surgery includes hospital or medical center employment; academic centers and private practice.

Career trajectories: academics, clinical, research, teaching, etc.
The prospects for the field are bright. Cardiac surgery is one of the most innovative fields in medicine, with increasing efforts to address heart failure (such as ventricular assist devices), a devastating disease affecting millions of Americans. Endovascular valve repair and aortic aneurysm repair are rapidly evolving techniques and cardiac surgeons will remain an integral part of this technology. The use of minimally invasive techniques, including robotic surgery, is expanding; the demand for surgeons facile in these techniques continues to grow. Adult congenital heart surgery is also on the rise as the first generations of pediatric patients are now older and require the attention of highly trained adult congenital surgeons.

Thoracic surgery, perhaps more than any other discipline, has seen the largest penetration of minimally invasive technology with robotics, video assisted, and endoscopic technology breaching every aspect of care. The now clearly defined role of lung cancer screening will also increase the volume of disease requiring evaluation and treatment by thoracic surgeons.
Cardiothoracic surgeons can also enjoy fruitful research careers, even in basic science research.

Residency: Length, typical curriculum
Currently, there are three types of cardiothoracic surgery training programs:
1. Independent Programs (also known as the Traditional Fellowship Pathway — 5 years of general surgery, plus 2-3 years of cardiothoracic surgery residency)
2. Joint Thoracic/General Surgery Track (also known as the Fast-track or Accelerated Pathway — 4 years of general surgery, plus 3 years of cardiothoracic surgery residency), all completed at one institution.
3. Integrated Pathway (also known as I-6 — 6 years of cardiothoracic surgery residency). Some I-6 programs will require an additional 2 years for research, so end up being 8 year programs.

The application process, curriculum, and board certification for each of these pathways varies significantly.

● Traditional Pathway (5 Years General Surgery, plus 2-3 Years Cardiothoracic Surgery)
Medical students apply to and complete a general surgery residency program (5 clinical years), consisting of clinical rotations through the various surgical disciplines. During the fourth general surgery clinical training year, residents apply for a residency position in cardiothoracic surgery. Clinical training in cardiothoracic surgery varies between 2 and 3 years in length. Following successful completion of training, residents are able to apply for certification by both the American Board of Surgery and the American Board of Thoracic Surgery. The ACGME website provides a listing of traditional thoracic surgery residency programs: Visit https://apps.acgme.org/ads/public/ for more information.

● Fast-track Pathway (4 Years General Surgery, 3 Years Cardiothoracic Surgery)
Medical students apply to one of the participating general surgery residency programs offering a fast-track pathway. Residents interested in fast-track programs generally apply after their second year of general surgery residency. Mayo Clinic currently has the only official 4/3 fast track pathway. This program has its own ERAS ID and applicants can apply during 4th year of medical school. At other programs are informal fast track pathways, and students apply into the general surgery program. In these programs, the application process is informal, involving discussions between the general surgery and cardiothoracic surgery program directors. For a given institution’s fast-track program, only general surgery residents from the same institution are eligible. Residents who complete this track are eligible for board certification by both the American Board of Surgery (after General Surgery Training) and the American Board of Thoracic Surgery. Residents continue having exposure to the different fields of surgery before deciding on cardiothoracic surgery (conversely, programs can assess residents’ performance in general surgery). In this way, residents maintain the experience of the general surgery chief resident year. Contact ACGME at https://apps.acgme.org/ads/public/ for a listing of 4/3 programs.

● Integrated Pathway (6-8 Years Cardiothoracic Surgery)
Medical students apply directly to an integrated cardiothoracic surgery residency program, similar to standard applications for other residency programs. The overarching objective of this training program is to provide a more comprehensive and rational total immersion in the diagnosis and management of all
aspects of cardiovascular and thoracic diseases through multidisciplinary training, including rotations in interventional radiology, interventional cardiology, endovascular surgery, oncology, and pulmonary disease. Upon completion of an integrated residency, residents are eligible to sit for American Board of Thoracic Surgery certification, but not for the American Board of Surgery certification. Visit https://apps.acgme.org/ads/public/ for a listing of integrated thoracic surgery residency programs.

CT surgery residency programs are accredited by the Accreditation Council for Graduate Medical Education (ACGME) and all programs must provide their trainees with an adequate educational environment to meet the requirements set forth by the American Board of Thoracic Surgery (ABTS). In terms of fulfilling requirements, there are no differences between 2- and 3-year programs. Of course, there is variation among all programs. The case volume and the mix of complex and basic cases will vary from program to program. In addition, some programs will have a clear clinical focus such as aortic, transplant or oncology that will differentiate a program irrespective of the duration of training. The availability of clinical research, simulation, and other elements of training also varies.

In general, there is no real advantage of one program over another. However, personal issues and program variability will influence one’s selection. For example, an applicant’s desire to pursue additional training after his/her CT surgery residency (e.g., congenital, aortic, etc.) might lead him/her to select a 2-year program. Alternatively, an applicant may feel a stronger training curriculum (e.g., case volume, clinical focus on transplants, etc.) is the deciding factor rather than the training duration.

● Am I at a disadvantage applying after a general surgery residency rather than doing an I-6 program?

Excellent training programs are available and will remain available. The specialty will not handicap itself by turning away a quality applicant only because they arrived at the decision to pursue CT surgery later in their training. We recognize many trainees simply were never exposed to CT surgery during medical school and therefore could not make an informed decision. Our profession recognizes individuals who remain committed and grow during their general surgery residency will need to have exposure and access to the specialty. One advantage of doing a traditional residency (general surgery followed by a 2- or 3-year cardiothoracic surgery residency) is the ability to be certified by the American Board of Surgery (ABS).

*The paragraphs marked with an asterisk above are cited from the Thoracic Surgery Directors Association (TSDA) site. Visit https://www.tsda.org/the-tsda/tsra/
Fellowships offered after residency
Further Fellowship training is offered in certain high volume centers, after the completion of the general CT training, for Surgeons who wish to practice sub-specialized discipline such as Congenital Cardiac Surgery, Aortic Surgery, Mitral Valve Surgery or Transplant Surgery (lung and heart). Fellowships last between 6 months to 2 years, depending on the sub-specialty.

Part II: Life as a Cardiothoracic Surgeon

Demographics
The disease processes which call upon the skill of a cardiothoracic surgeon are predominantly found in older individuals. Atherosclerotic coronary artery disease (CAD), valvular disorders, and neoplastic disorders are all primarily afflictions of the elderly. However, a wide variety of disorders in this discipline, such as aortic disease, lung or heart transplants, and benign chest diseases, have a younger patient population.

Earnings Potential
A cardiovascular surgeon's salary exceeds the general surgeon's wage. The average cardiothoracic surgeon's salary in the United States is $458,476 as of January 16, 2019, but the range typically falls between $367,533 and $574,685. Salary ranges can vary widely depending on many important factors: education, certifications, additional skills, and the number of years you have spent in your profession. The salaries of cardiothoracic surgeons are increasing faster than any other specialty, according to the American Medical Group Association’s 2018 Compensation and Productivity Survey.

Lifestyle
As well as performing surgery, cardiothoracic surgeons are involved in the treatment, management and follow up of many different conditions within their specialty. Before surgery you will meet with patients and their families to discuss and explain procedures and offer reassurance. Monitoring patients in intensive care after surgery is a vital part of your work.

Although most of thoracic surgery is elective, cardiothoracic surgeons are often needed for on call and out of hours work during evenings and weekends. The demand for on calls can be substantial and is often higher than the requirement within other surgical specialties. The number of on calls nights and weekends will depend on the hospital you work in, and the number of other cardiothoracic surgeons, who will share the call schedule in your facility.

Many students love cardiothoracic surgery but do not want to go through the demanding long residency. If you really like it, just do it. Do not make a decision based on the dread of a few hard training years, and deny yourself doing what you really like to do for the next 30.
Academic Medicine
If you work in an academic center, you will be expected to perform research, publish, and present your results at conferences. Most surgeons are also involved in teaching students and residents.

Part III: Applying in Cardiothoracic Surgery

How Competitive is CT surgery?
CT Surgery is becoming more competitive. In 2018, there were 72 certified traditional CT surgery programs in the US, and 96% of the certified positions were filled. Out of 112 applicants, 81% matched to a program, and 19% did not match to any other program. Sixty six percent of the matched applicants were US graduates. For I-6 programs, there were approximately 38 positions, with over 150 applicants.

Planning the post-clerkship and senior years:

Clinical Rotations
In order to prepare yourself and have better chances at matching into cardiothoracic surgery, make sure to have surgical and critical care electives. Despite your surgical inclination, you will also have to excel at your internal medicine clerkship.

Sub-Internships
Sub internships are an important way to get experience and knowledge in cardiothoracic surgery together with cardiac and pulmonary physiology. It is recommended to take a sub internship in either cardiac or thoracic surgery so to acquaint yourself with the patient population, disease process and patient care. It is also important to have a basic understanding of the cardiac and pulmonary physiology, so a sub internship in cardiac or thoracic surgical ICU can be very beneficial for you, and help you have some experience in treating complicated cardiothoracic postoperative patients. Some programs prefer you do at least one of your sub internships with them, in order for them to get to know you better.

Away electives
Away elective can be tricky. A great performance may make you a preferred candidate, but anything less may actually put you at a disadvantage. An away elective might help demonstrate your commitment to the field. Some thoracic surgery programs will actually prefer it if you do at least one elective in their institution, to be able to assess your performance, and get to know you personally. You can also make connections with well-respected CT surgeons both for networking and for a letter of recommendation. While on your away elective, make sure to meet with the residency program director and the chief of thoracic surgery, to discuss your application and interest in the field of cardiothoracic surgery. Try to meet with as many of the faculty members and residents, and remember; put your best effort forward, you have a limited time to impress them.

A great performance in an away elective can compensate for a less competitive application. Another way to establish familiarity and good reputation for yourself if you are interested in a specific
program is to take your research block in that institution. You will have more time to make an impression and establish personal connections with the faculty.

Other Recommended Electives
Electives outside cardiothoracic surgery can help you get a broader understanding of this field and give you some experience in other important aspects of managing a thoracic patient. Electives in chest radiology, ECHO, interventional cardiology, medical and radiation oncology, surgical ICU and thoracic anesthesia, can be helpful, and provide you with an understanding of the multidisciplinary approach involved in patient care in this field.

Research
Cardiothoracic Surgery is a competitive field and many of the prestigious and highly selective programs will expect an applicant to have some research experience. This can be in any field and can be lab experience, medical education, public health research, clinical trials or outcome research.

National Meetings
It can be helpful for your application, if you have an opportunity to present in a national CT surgery meeting. This can be very hard to achieve as a medical student, so by no means is this a requirement. Attendance only in a national meeting is also very helpful, and demonstrates your enthusiasm and interest.

There two most important annual national meetings are held by the American Association for Thoracic Surgery (AATS), and the Society of Thoracic Surgeons (STS). Another important surgical meeting is held annually by the American College of Surgery (ACS), which hosts posters, workshops and oral presentation from all surgical fields and disciplines. Other than the academic accomplishment of presenting in an important national meeting, you can use the opportunity to participate in these meetings for networking, and to introduce yourself to leading cardiothoracic surgeons and program directors from different institutes.

Part IV: Assessing your Competitiveness

What Criteria do Programs Consider?
There are many factors considered in inviting an applicant for an interview. According to the NRMP, there were 117 applicants for a cardiothoracic surgery residency in 2017 (in all pathways), and 54% received an in depth review. The factors considered most important by CT surgery programs were letters of recommendation, personal statement and the commitment to the specialty. Second in importance were the Step 1 grades, the Dean’s letter and leadership qualities.

1. Grades and your DSA
In order to apply to Thoracic surgery you will need DSA in Medicine and Surgery. If possible, try to complete your medicine sub-internship and surgery electives by July of your senior year. This will give
the department committee enough time to complete course grades and summative comments for your Departmental Summary Assessment (DSA).

2. USMLE Board Scores
As mentioned above, step 1 score is important and is valued in all the CT surgery programs as a good screening tool to evaluate academic strength. According to the NRMP data about the 2018 match, 70% of the programs required a target score of 230 and above. If you had a failed attempt at step 1, but passed eventually, fear not. Seventy five percent of programs will still consider you a worthy candidate. Some programs will use step 2 CK scores as another screening tool to measure your academic achievement.

3. Research Experience and Publications
Research experience can be very helpful, and will strengthen your application. Some of the I-6 programs have mandatory extra 1-2 years dedicated to research, and research experience is valuable for these programs.

4. Extracurricular Activities
Thoracic surgery programs prefer to have well rounded and mature residents. Hobbies and outside interests may help prevent burn out, and reflect good time management skill. Don’t forget to add your interests or achievements in areas other than medicine to your ERAS application.

5. Other Factors
Recent HMS students note letters of recommendation, demonstrated interest and commitment to the specialty (through research or advanced study), and a strong personal statement outlining commitment to CT surgery have been valuable in their experience of the match.

Getting an Interview: Attributes Residency PD’s Consider in Granting Interviews

The personal statement is probably the most important first tool the program director screens for worthy candidates. Remember, the faculty members want to get to know you, and the first impression is your personal statement. Start your personal statement the same way you introduce yourself to a new colleague.

You want the first opening paragraph to be a concise introduction of who you are.
The purpose of the personal statement is to indicate you have what the program needs; abilities, skills, enthusiasm, dedication, and maturity. It should demonstrate you are indeed a good fit for the program.
Letters of recommendation:

You will need 3 letters of recommendation. It is preferable to have at least 2 recommendation letters from surgeons within the specialty to which you are applying. Cardiothoracic surgery is a small specialty, and surgeons tend to rely on recommendations from people they know. A general surgery letter is also an option, as is a physician whom you worked with on a research or quality improvement project and
can attest to your character, maturity, dedication and abilities.

**How many programs should you apply to?**
As a medical student who is interested in going directly to CT surgery, you can apply to the I-6 programs. If you are not sure, or prefer the 4/3 or 5/2 pathways, you will apply to general surgery first, and your CT surgery application will be done at a later stage of your residency. There are 72 traditional CT surgery fellowship programs in the US, but only 26 of them offer an I-6 pathway. Each I-6 program accepts 1-2 residents each year. We advise you to apply to as many I-6 programs you can, realizing it can be a financial burden. If you are interested in a certain program, we recommend applying both to the cardiothoracic I-6 and the general surgery residencies in that institution. This will increase your chances of matching at that specific program, because if you fail to get accepted as an I-6 resident, you can then re-apply through the 4/3 or 5/2 pathways, having the advantage of being a general surgery resident in the same institution.

Some programs with both I-6 and general surgery programs will allow a student to apply to both, whereas some will not and will not interview you for general surgery if you apply to their I-6 program. You should discuss the best strategy for you as an individual with both recent graduates (current residents) and your faculty specialty advisor. Need to talk to people who have applied already to figure out this info for the specific programs they plan on dual applying.

**Common questions you may be asked – CT surgery:**

- Tell us about yourself
- Tell us about why you want to be a cardiothoracic surgeon
- Where do you see yourself in 10 years?
- Why are you interested in our program?
- Tell us about the most difficult decision you’ve ever made.
- Tell us how you would make a good team member
- As a chief resident, how would you deal with a junior resident who is not doing his fair share
- What are your hobbies
- Tell us about your research interests / projects
- What are your strengths/ weaknesses
- Tell us about how you dealt with a big mistake / bad decision you made.
- Tell us about a time you saw a mistake being made by others, and what you did about it.
- Tell us about a difficult personal or professional experience, and how you coped with it.
- What makes you the best candidate for this program?
- Have you ever deal seen a death of a patient? If so how did you deal with it?
- How do you study best: are you a tactile / visual/ auditory learner?
- You might be asked “What questions do you have for us?” Be prepared with questions about the specific program you are interviewing with. This will indicate you are interested and thoughtful (ask about the number and variety of cases they perform, assess teaching commitment from the faculty, discuss research opportunities)
Communication with Programs: NRMP Code of Conduct for Applicants and Programs
After completing your interview, be sure to send thank you letters to the program director and the chief of the cardiothoracic surgery division. You can indicate in your letter your interest in their program, and if true, you may indicate the program is at the top of your match list. Do not tell more than one program it is your first choice- program directors speak with one another and you do not want a reputation for dishonesty. After you have completed all your interviews, rank your preferred programs. Do not rank programs you would not be willing to go to. Matching through the NRMP constitutes a binding agreement.

Advocating for Interviews
The CT surgery I-6 programs usually invite the top 15-20 candidates for an interview, depending on how many positions they offer. If you do not get an interview offer with a desired program you may communicate with the residency program director yourself or ask your advisor to contact the program director; this is not always successful.