ELECTIVE (SSC5c) REPORT (1200 words)

A report that addresses the above four objectives should be written below. Your Elective supervisor will assess this.

1. Identify and understand disease processes locally and how this compares to the UK?

Ischemic cardiovascular disease remains the leading cause of death worldwide, in western nations cardiovascular disease causes over 7 million deaths annually. Cardiac surgery represents a key treatment modality for the whole range of cardiovascular diseases, including valvular disorders, ischemic disease, congenital cardiac defects and treatment of heart failure using devices or transplant. The etiology of ischemic cardiovascular disease is similar worldwide, namely atherosclerosis of coronary vessels resulting in impaired flow to the myocardium and ensuing failure of the muscle. A number of conditions predispose to cardiovascular disease, namely diabetes, hypertension, hyperlipidemia and obesity - all of these conditions are common in both NYC and East London, and represent key focuses of public health campaigns to improve cardiovascular health.

New York Presbyterian Hospital is a large academic medical center that offers a wide variety of cardiac procedures, including interventional cardiology, electrophysiology and cardiac surgery. The cardiac surgery service carries out the full spectrum of cardiac surgical procedures, and performs over 1800 open heart surgeries annually. Compared to the London Chest, this is huge with only around 1000 procedures performed annually. During my four weeks with the service, I was exposed to a huge variety of cases. Typically, four to five operating rooms were conducting two operations each per day – meaning that there was plenty of volume for me to observe a wide range of procedures.

Typically the patients treated at NYPH are some of the sickest in New York State. As such, many of these patients have come to NYPH as a last resort – and this often entailed reoperations. The re-operation seems to be the nemesis of the cardiothoracic surgeon – mortality climbs rapidly as you have more procedures requiring sternotomies. One particular case, with a fourth time re-operative patient who required the replacement of a mechanical mitral valve demonstrated this to me. The distortion of anatomy was incredible; even in my inexperienced eyes, with the right atrium adhered to the posterior surface of the sternum. The operation took over five hours and resulted in significant bleeding, but achieved significantly improved function of the valve, and hopefully the patient will notice improved symptoms after recovering from the operation. The combination of sick patients and high volume also gave me the opportunity to witness some emergencies, notably a patient in cardiac arrest placed on emergency central veno-arterial extracorporeal membrane oxygenation (VA ECMO) to enable the interventional cardiology team to continue to pass stents across the patient's stenosed left main coronary artery.

The variety of surgeries performed was really amazing, I was expecting to see a variety of different coronary artery bypass grafts, and some valve replacements. I never thought I would be seeing placement of ventricular assist devices, extracorporeal membrane oxygenation, minimally invasive valve replacements and heart transplants. During my time at NYPH I scrubbed on over 20 operations, and the great variety of cases, world leading surgeons and patient residents ensured that I had a fantastic time.

2. How does the healthcare system differ from that of the UK?

The medical systems in the US and the United Kingdom are vastly different. The National Health Service obviously provides what is referred to as "socialised medicine" – i.e. it is not insurance or privately based as it is in the US. This led to some fascinating conversations around the provision and quality of care in the respective systems, and a number of cases highlighted this difference acutely. A patient with Marfan's disease who had an aortic root dilatation underwent a "David Procedure", where the diseased portion of the aorta that is dilated is replaced, while sparing the aortic valve. She had previously decided to not have the procedure due to the vast cost, but after her mother and brother sadly died after their own dilated aortas ruptured, she decided to go ahead. In the UK, this problem would not exist, as there is no economic element to decisions made. However, the provision of care, in terms of staffing levels and equipment availability seemed superior to what I've seen in UK operating theatres, with most patients in private rooms and equipment always available and ready to use.

A further difference between the UK and US healthcare systems is the presence of Physician Assistants (PA's), who are central to practice in the US, but do not exist in the UK. These are mid-level practitioners who carry out much of the "floor" work (on the wards) and looking after patients in the pre and post-operative periods. In the cardiac surgery service, the PA's are vital in assisting the residents opening the chest, cannulating in preparation for bypass and closing the chest, while also operating independently to take vein grafts for coronary artery bypass grafting (CABG). I understand that there is a pilot scheme, and some mid level practitioners in the UK at present, and in the US they are indispensible members of a close-knit team.

The final major difference in the US is the training structure. A number of residents at NYPH are on a new training scheme, this program effectively recruits direct from medical school and enables residents to complete within six years – though they often go on to do fellowships at other institutions to complete their training. While this is a significantly shorter time of training than in the UK, the residents seem to be in the hospital for long periods of time, obviously in CT surgery the care of the patient comes first, and requires the presence of the surgeon. The on-call structure is one on-call every four days, and residents do not get zero days after a night shift. In the UK, this wouldn't be possible with current European Working Time Directives, which prevent excessive working hours.

Each resident has one weekend off per month and during their training time, residents seem to spend 95% of their time in theatre operating, with no real time in clinics and with limited time on the wards or intensive care unit. In contrast, NHS registrars often spend a day or two per week in clinic and on the wards, operating two or three days per week. Residents are expected to develop their surgical skills during residency, and the competence of the residents I observed here was quite unbelievable, especially those who were only PGY-4, where in the UK they might be just starting to get time in theatre, these residents were happy cannulating alone.

3. Outline an interesting case encountered during your placement

The most exciting case I scrubbed on was an orthotopic heart transplant (OHT) conducted one evening for a patient with a dilated cardiomyopathy of unknown etiology. The patient was in his late 40s and had been waiting for transplant for around one year. Following a standard midline sternotomy, the patient was cannulated and placed on bypass. Once it was confirmed that the aircraft carrying the donor heart had safely landed, the attending and resident explanted the recipient's native heart, leaving enough native vessel to allow successful anastomoses with the donor heart. It was at this point, as the heart was removed, that the attending handed me the heart and started a master class in cardiac anatomy. First pointing out the continuity between the aortic and mitral valves, the relative distance between the tricuspid and pulmonary valves, and the various landmarks of the heart. To hold a warm heart and to have such incredible exposure to the anatomy, up close and personal, was an amazing experience. It also highlighted just how lucky I was to be involved in such a life changing procedure – we had certainly reached the point of no return if anything happened to the team transporting the heart back to the hospital from the airport. Luckily, all went well and the anastomoses were completed within 4 hours and 10 minutes of the initial cross clamping of the donor heart – just outside the target time of 4 hours.

Heart transplant is probably the most invasive surgical procedure that it is possible to do. The removal of the central organ system within the body and to observe such an amazing, lifesaving procedure was a real privilege. During my time at NYPH a number of transplants took place, during the 24 hours following the OHT that I observed, a further heart, kidney and two lungs were successfully transplanted into recipients. In addition to these fortunate patients, there were a number of cases during my time there who were awaiting transplant.

Patients awaiting transplant, or those who are not eligible for transplant may be offered a number of life prolonging therapies. These include implantable ventricular assist devices, which shunt blood away from the ventricle to reduce the work of the heart and maintain cardiac output. One of the attendings, Dr. Naka, is currently leading a large randomized study comparing the two most commonly used versions from NYPH. For shorter-term solutions, patients may be offered external ventricular assist devices (VADs) and ECMO. The transplant patient I saw had not previously been on

any of these therapies, which made the operation less technically demanding. Often patients who have been on VADs represent a highly complex distortion of anatomy and many adhesions, leading to difficult dissection and significant blood loss. Observing such a range of life changing interventions on a daily basis was inspiring, and to be able to take part in a heart transplant was the highlight of my time at NYPH.

4. How did technical skills improve during your time on placement?

During my time at NYPH my technical skills improved rapidly, including subcuticular suturing, tying of chest drains, pacing wires and general basic surgical skills. In addition to practicing these skills, I observed a wide range of techniques, including the use of pericardial pledgets for hemostasis, minimally invasive aortic valve and mitral valve replacements, and large aortic work including a thoraco-abdominal aortic aneurysm repair and an emergency repair of a type A aortic dissection. My improved abilities will help me further develop skills as I move through foundation year and into my specialist training.