YEDİTEPE UNIVERSITY
FACULTY OF MEDICINE

SCHOOL OF MEDICINE
INDIANA UNIVERSITY

OBSERVER MEDICAL STUDENT REPORT

INDIANA UNIVERSITY HEALTH HOSPITAL–
DIVISION OF TRANSPLANT SURGERY

JULY 12 - AUGUST 9 2019

STUDENT:
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This work consists of my experiences in inpatient and outpatient clinics, patient rounds, surgeries and meetings, new knowledge I acquired by observing and researching in an academic institute, the Division of Transplant Surgery at Indiana University School of Medicine. It also includes social activities I participated in Indianapolis, IN, Chicago, IL and New York City, NY.

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Indiana University Health

Transplant

Indianapolis, IN, September 4, 2019

Prof. Sina Ercan
Dean, School of Medicine,
Yeditepe University

Re: Ali Yenigun

Dear Prof. Ercan

I am writing you regarding the medical student, Ali Yenigun. As you may already know, he was seconded to me at the Department of Surgery, Indiana University for his elective clerkship in transplant surgery.

Ali showed great enthusiasm and successfully completed his observership period. He is a very knowledgeable student with great ambition to medicine and especially to surgery. He is very respectful to his peers, colleagues, and other people (patients, family members and other personnel of the hospital).

He joined several organ procurement operations under my observation. He successfully scrubbed in more than 10 organ procurements (liver, kidney, and pancreas) where he observed and participated. He was able to scrub in a liver transplantation operation as well. He also observed several general surgery cases, as he documented in his report.

In our daily rounds and daily patient management, he was able to observe emergent patient management, such as patient intubation for acute respiratory failure, central line placement for G.I bleeding and vasopressor support, dialysis line insertion for CVVH, mechanical and chemical cardioversion for atrial and ventricular fibrillation, etc. in the Transplant Intensive Care Unit.

I believe the 4-week period was very helpful and educative to Ali and I personally enjoyed working with him. His Medical Observership Program Report will extensively show all details of what he daily participated.

Please do not hesitate to contact me if you need more information about his observership period at Indiana University.

Yours truly,

Burcin

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Assistant Professor of Surgery
Director, Transplant Research and Xenotransplantation Research Lab
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July 12th – Friday + July 13th – Saturday:

Surgical experience – Procurement and liver transplant:

It was only supposed to be the day I arrived, trying to get used to the time zone differences and sit back. As a surprise turnout of events, there were organs available for procurement in a neighbor state. We went to Dayton, Ohio at 1 am. After we arrived at the hospital there, along with my fellow observer student, Emir Arman, who joined from Yıldırım Bayezit University in Ankara, we got scrubbed in and got into the surgery room. It wasn't the first time I scrubbed, but it was definitely an experience to remember, as it was my initial experience with organ transplantation that procured an entire organ from a cadaver to a living person; the transplant surgery I had the chance to see before procured a single lobe from a living donor. There was a brief moment of silence for the deceased person initially, then the operation started. Dr. Ekser let us help him with basic procedures during the operation, such as suctioning blood and other bodily fluids or simply holding the organs to let him operate on the cadaver easier. At the end of the operation the liver was procured for a patient back in IU Health and the kidneys were taken out for educational purposes along with some lymph nodes. When we were back to IU Health very early in the morning, the liver was transplanted into a male patient. He had micronodular cirrhosis due to high amount of alcohol consumption, therefore when the abdomen was incised, the small size of the liver was very striking.

Figure 1: Emir and I before we board the plane to Dayton, OH for procurement

Transplant screening tests:

I overheard two of the staff giving each other information regarding infectious agents the deceased patient had. I went on to find information needed to match donors and protect the recipient's safety before the transplant surgery. These are the important variables:

- Blood type: Matching of A, B, AB or O blood types between the donor and the recipient is essential. Rh is not a key factor here and it isn't compulsory to match Rh antigens.

- Human leukocyte antigen: These are antigens found on many cells of the body but mostly on the white blood cells. 8-10 serotypes scanned before the procedure to match the donor's tissue with the recipient's. The higher number of matching HLA's, the more likely the recipient's immune system will tolerate the incoming organ, and the closer the relative is to the recipient, the more HLA's are likely to match.

- Crossmatch: Blood from both the donor and the recipient are drawn, and then they are mixed to see if the recipient's blood gives any immune reaction to the donor's

blood. If the crossmatch is positive, the recipient has synthesized antibodies against the donor and the transplant cannot take place. If the crossmatch is negative, the operation can be performed.

- Serology: Serology tests are performed to detect any communicable diseases, such as HBV, HCV, HIV, CMV, EBV, syphilis (*Treponema pallidum*), HTLV and WNV (West Nile Virus).

July 15th – Monday:

Clinical experience:

Figure 2: Dr. Mihaylov and the team rounding

It was my first day at the hospital. I arrived early in the morning. The day started with rounding with Dr. Mihaylov (the transplant surgery attending), Dr. Soma (the transplant fellow), Dr. Yujin (surgery resident), nurse practitioners and the dieticians. I had been on some patient rounds before, but this was the most detailed, thorough and definitely the longest I had ever been on. All the patients were transplant patients but some of the cases were interesting either due to pre-existing conditions of the patients or complications after the surgeries.

One of the patients was sickle cell anemic. Due to his condition, his liver functions deteriorated over the years and he had liver failure. His skin color was also paler than it should have normally been and his fingernails were clubbing. He went into sickle cell crisis after he underwent liver transplant. He was in much pain, refused to eat, lost weight and therefore nasogastric tube was placed. He was treated with analgesics, IV fluid and blood transfusion. After seeing this patient, I decided to research the relationship between sickle cell disease (SCD) and liver dysfunction.

Sickle cell hepatopathy:

The liver can be affected by the complications of the SCD itself and/or its treatment. In SCD, the normal shapes of the erythrocytes are lost and form into a morphology resembling a sickle. The membranes of the faulty erythrocytes are prone to breaking down when entering narrow blood vessels, making them unable to transport oxygen to the cells. The abnormal shape of the erythrocytes can also clog the blood vessels and impede with the oxygen flow to the tissues and organs. Liver is one of the major organs affected by this disease as it is very rich in vasculature due to its function. Another risk factor for hepatic diseases in SCD patients is its treatment. SCD often receive blood transfusions. Such procedures place the patients at risk for viral hepatitis, iron overload, and development of pigment gallstones, all of which may contribute to the development of liver disease.

Hydroxyurea is the drug of choice in SCD patients. It was first developed as an anti-cancer drug due to its myelosuppressive properties, that inhibit the enzyme ribonucleotide reductase and consequently stop cell proliferation at the S phase of mitosis. The property of the drug that is important in SCD is its ability to increase HbF, the type of hemoglobin that has higher affinity for oxygen, and induction of vasodilation.

July 16th – Tuesday:

Clinical experience:

Today had more action than yesterday. I started to get to know the physicians and other healthcare workers. I also started to get a hang on the abbreviations and medical jargon. As a brief example, the term "prn", which comes from Latin "pro re nata", is used to describe a drug that can be given to the patient as required without having to consult to the physician.

Also, today, I went to my first pediatric liver meeting, where Dr. Kubal and Dr. Mangus talked about incoming pediatric liver cases and their diagnoses. One of the children was said to have been diagnosed with Hepatopulmonary syndrome. I had heard of this syndrome before, but the pathophysiology had never been made clear to me, so I decided to make a quick research about it.

Hepatopulmonary syndrome:

The syndrome basically results from the formation of intrapulmonary AV dilations in patients with chronic liver diseases. While the mechanism is not very well known, the theory is the overproduction or under-clearance of vasodilators in the blood stream causes such formations. The vascular dilations cause overperfusion relative to ventilation, leading to hypoxemia, particularly because patients have an increased cardiac output resulting from systemic vasodilation. The patients most usually show signs of dyspnea and sometimes even have more characteristic findings, such as spider angiomas.

The liver selection committee meeting:

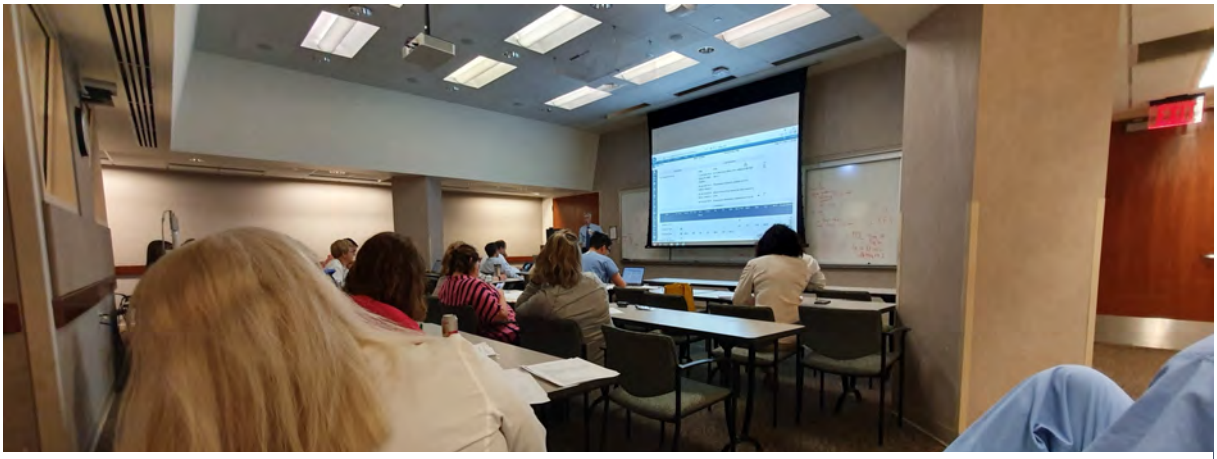

Figure 3: Liver meeting

Apart from the pediatric liver meeting, there was also the liver selection committee meeting with all the physicians presenting their cases to their fellow physicians. It was around 2.5 hours long. Some cases were presented for informing the others about any updates regarding patients, a few cases were new, and in some cases, the presenting physician asked

for the opinions of the others on what steps to take. There was this one particular case that really captured my attention due to its nature of being multi-disciplinary and including an ethical decision. A bipolar patient was diagnosed idiopathic hepatitis that required liver transplant. On top of his psychiatric condition, because of his background of alcohol and drug abuse, the physicians were unable to decide whether to proceed with the transplant or not, keeping in mind of a probable tendency to abuse any substance that may be harmful to the liver in episodes of mania or depression.

July 17th – Wednesday:

Morbidity and Mortality meeting:

Today started with the M&M (morbidity and mortality) meeting at the Emerson Hall. We saw five presentations about the procedures residents and their physicians performed. One of the presentations in particular was of more importance to me because of a malpractice that included wrong entrance through the abdominal wall and subsequent breach into retroperitoneum Knowing the layers of the abdominal wall is of upmost importance in general surgery, as this surgical branch incontrovertibly incises through the abdominal wall every single surgery. Because it was 3 years ago when I last memorized these layers, I am going to re-familiarize to the structures below.

Clinical experience:

The day at the hospital started with Emir and I checking on two of the patients as per nurse physician Morgan's request. We asked the patients how they were, if they were in pain, if they had any existing or recently-developed problems. We also checked the bags of the tubes they were connected to and palpated the abdomen as a routine check. The bowel movements and urinary output were also among routine checks.

The day continued with rounding with Dr. Mihaylov and the team. There were no new patients. None of the patients' condition deteriorated and everyone seemed to stable and on the right track.

Layers of the abdominal wall:

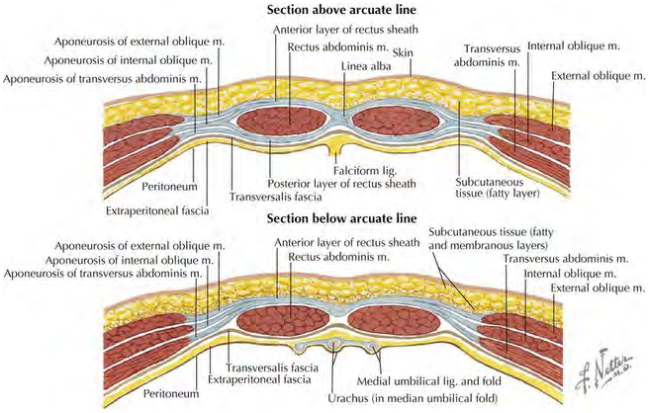

Figure 4: Layers of the abdominal wall

One thing to be very cautious about while incising the abdominal wall is being aware of the location that is being operated on relative to the level of the arcuate line. The arcuate line is right in the middle of the distance between the umbilicus and the pubic crest. If the linea alba can be viewed, the level is above the arcuate line.

Prograf; its mechanism of action, major adverse effects and the way to increase its efficacy:

Prograf is one of the major immunosuppressive drugs used in organ transplant. Its active ingredient is tacrolimus. By forming a complex by binding to FKBP12, it inhibits

calcineurin phosphatase and T-cell activation. It has similar effects to those of cyclosporine, but has lower incidence of systemic findings, such as hypertension, hyperlipidemia, skin changes, gum hyperplasia, hirsutism and higher incidences of post-transplantation diabetes mellitus and neurotoxicity. Cardiac diastolic dysfunction is also a possible adverse effect.

The importance of knowing the adverse effects of tacrolimus came in handy at a patient's room two days ago. The patient was dyspneic and was trying to use all of his accessory respiratory muscles to catch his breath. He was consequently intubated. It was later understood by looking at his chest CT, the problem wasn't lung-related. After the echocardiogram, it was found out that as a result Prograf usage, the patient had diastolic dysfunction. The drug was eventually switched with cyclosporine to minimize the adverse effects on the heart as much as possible.

In some cases, it may be necessary to increase the efficacy of Prograf. To do so, ketoconazole can be co-administered. The mechanism behind the magnification of the effects is that ketoconazole inhibits the enzyme CYP450, which is crucial in the metabolism of tacrolimus. When CYP450 is inhibited, the metabolism of tacrolimus is delayed, which increases the availability of the drug, leading the way to more successful immunosuppression.

July 18th – Thursday:

Clinical experience:

Today started with our visiting of four patients with Emir. Events overnight were asked as per usual. Nothing was out of the ordinary for three of the patients, but the fourth patient, who was a young female with history of rejections, had some issues. Later on, the usual rounding started with Dr. Ekser and the team. The young female patient was having severe pain on her surgical scar that was located on her epigastric area, which impeded with her ability to walk. After checking the CT, Dr. Ekser decided rejection was not among the differential diagnoses.

One of the patients, a middle-aged male, had a large swelling on his right cheek, close to the mandible. The patient said that the swelling appeared overnight and said it was too painful to touch. ENT specialist was called for consult and it was ruled out from the purulent flow from his parotid that the patient had parotitis. Antibiotics were started right away.

Figure 5: Dr. Ekser and Dr. Soma at Riley Children's Hospital

After the rounding was over, Dr. Ekser, Dr. Soma, Emir and I went over to Riley Children's Hospital to visit two pediatric patients. Both had liver insufficiencies, one of which

was due to biliary atresia and the other one due to gastroschisis. It was a quick visit from which we came back just a few minutes later.

When we were back in IU Health, Dr. Ekser and I went to the SOPA clinic (surgery outpatient). A patient, middle-aged female came to the clinic for her routine check with a right upper quadrant pain. Lab tests revealed increased AST and ALT levels and increased lymphocyte counts. Dr. Ekser asked for bile duct USG and viral serology tests to rule out the underlying cause of the patient's concern. According to the results of these two procedures, ERCP and liver biopsy could be asked later. Rejection was one of the possibilities. Another middle-aged female patient, who had been out of the inpatient ward for about a month was in the hospital for her routine check too. Her tests revealed that she had no problems at all.

Milan criteria:

During our observation in the surgery, I remembered that the Milan criteria were used to decide if a patient with HCC was fit for transplant. Because I was unable to list the criteria, I decided to make a quick search on the internet to refresh my mind.

- Single tumor with diameter ≤5 cm
- Up to 3 tumors each with diameter ≤3 cm
- No extrahepatic involvement
- No major vessel involvement

A breach in any of the criteria makes the patient unsuitable for a liver transplant.

Surgical experience #1 – Liver transplant:

In the afternoon, Emir and I went to a liver transplant surgery in the operation room. The male patient was is need of the transplant due to hepatocellular carcinoma and hepatitis B infection. Dr. Mangus was removing the cirrhotic liver, while Dr. Mihaylov was preparing the liver that was procured. After the removal of the cirrhotic liver, we were allowed to touch and observe the liver. The difference in consistencies between the livers was just remarkable.

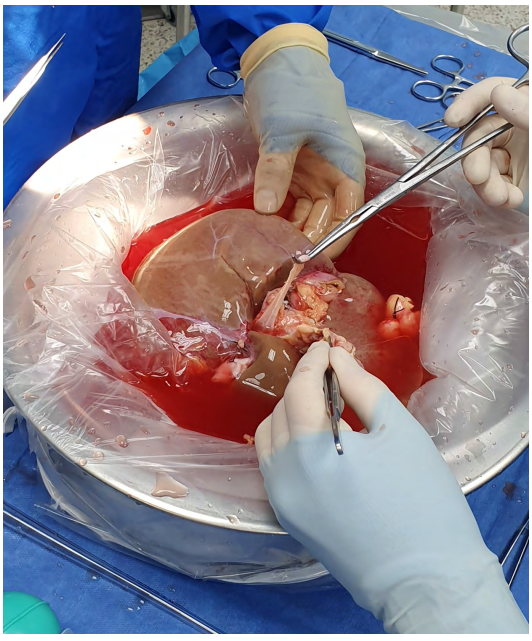

Figure 6: Healthy liver from the donor

Figure 7: Cirrhotic liver from the transplant patient

Surgical experience #2 – Multiple organ procurement:

A few hours after the first surgery, we were notified that there was procurement at Eskenazi Hospital. Emir and I went to the OR and we were welcomed by a large crowd. The body was of a young adult female and the organs to be procured were the lungs, heart, liver and the kidneys. The lungs went to Ohio, the heart went to Kansas, the liver stayed at IU Health and the kidneys were to be used for research purposes. The procurement was successful without any damages to any of the organs. However, the transplant team faced a roadblock during the surgery: the lungs had been allocated to a recipient before the procurement started, but because the receiving hospital dropped the organ request, the organ had to be re-allocated to a new recipient. After the match was found, the heart, the lungs, the liver and the kidneys were procured in order. After the liver was collected, it was transferred directly to IU Health Hospital for transplant.

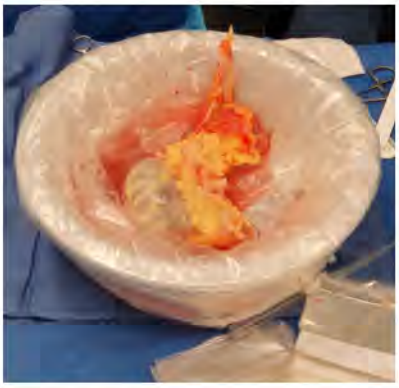

Figure 8: The heart

Figure 9: The kidney

Figure 10: The lungs

Figure 11: The procurement

July 19th – Friday:

Surgical experience – Liver transplant:

It was the first hours of the day when the previous procurement was over, and the liver transplant was scheduled. Dr. Ekser was the surgeon to perform the transplant. As a routine procedure, the liver had to be cleaned and cleared from all the unnecessary tissues, such as diaphragm and fat attached to it on the back table. To help Dr. Ekser, I scrubbed in. He gave me a short anatomy lesson while we were prepping the liver. We identified the lobes of the liver, the ligaments, the hepatic duct and the vessels going in and out of the liver. The vasculature anatomy that I had repeated a few days ago came in handy, as I didn't feel in the dark while observing the liver. It took us about an hour until the liver was ready to be transplanted. During the transplantation, Dr. Ekser used the 'piggyback technique'. He later explained us the technique, as well as importance of specific steps of the operation, such as 'partial clamping' in the morning. The surgery took a total of four hours and it was very successful. Not only was it a very educating experience, but also a memorable one too! I've had the chance to scrub in just a few times before coming to Indianapolis, but none of my responsibilities in any of my previous experiences was as important as prepping an organ for transplant, for which I am thankful to Dr. Ekser.

Figure 12: Me helping Dr. Ekser on the back bench

Clinical experience:

Today began with the patient rounds with Dr. Mihaylov and the team. All the existing patients were either doing better than they did before or remained stable. The transplant patient Dr. Ekser and I saw in the SOPA clinic yesterday was the new addition to the inpatient clinic today. After her far-from-ideal lab results yesterday, Dr. Ekser had ordered USG. Because it was decided that there was nothing wrong with her hepatic duct based on the USG, new tests were in order. Two of the patients in the clinic today were due to be released.

After rounding, Dr. Ekser gave Emir and I a small lecture about some techniques used in the surgery. They were types of anastomoses and piggyback technique.

Types of anastomoses:

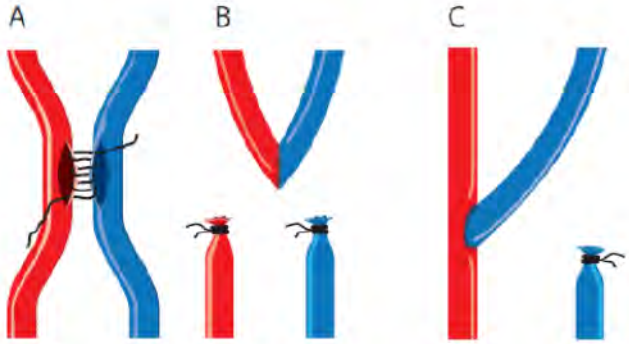

Figure 13

A. Side-to-side
   e.g.: a segment of the bowel is removed and the both ends of the remaining portions of the bowel are anastomosed
B. End-to-end
   e.g.: used in anastomosing the vessels of the liver in transplant
C. End-to-side
   e.g.: used in connecting the small bowel of the donor to the recipient's to prevent any narrowing that may be possible if any other technique is used, and thus keeping the peristaltic outflow of the GI tract as unobstructed as possible

Piggyback technique:

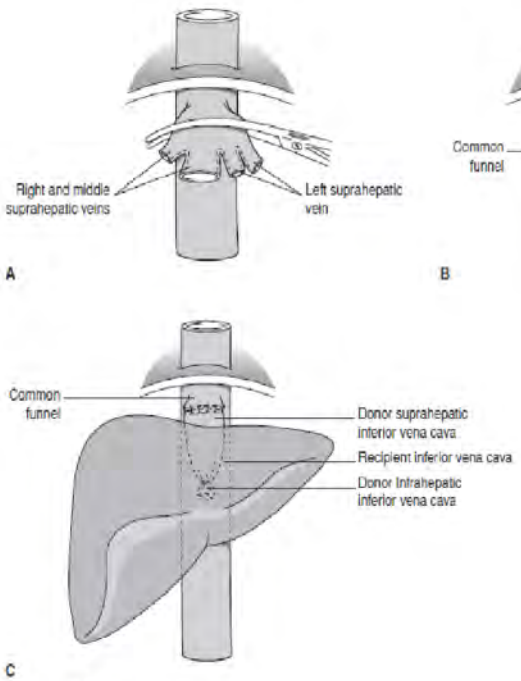

Figure 14

Piggyback liver transplantation is an alternative technique which leaves the recipient's IVC in place and eliminates the need for veno-venous bypass. It basically allows the removal of liver without removing the portion of the IVC. The conventional hepatectomy technique requires clamping of both portal flow from the viscera and vena cava flow from the lower body, whereas piggyback requires clamping of portal flow only. It should be noted that this technique is not used in patients with hepatocellular carcinoma due to theoretical increased risk of a positive vena cava margin and the potential for metastatic spread of tumor in the native vena cava or through the hepatic veins.

July 22nd – Monday:

Clinical experience:

Today started with checking up on some of the patients before the rounding with Dr. Yujin. We asked the patients the regular questions and enquiries specific to their conditions. After our quick tour of check-ups, the rounding started. It is Dr. Ekser's week to do the patient rounds, so he leaded us. Most of the patients were doing fine. Some of them were even scheduled to leave the hospital for home. The patient who underwent transplant last week was doing very well and it looked like he's going to bounce back very quickly. After the rounding was over, we headed to Riley Children's Hospital to check up on the only pediatric transplant patient that was left there. Her liver function tests were fine. She had CMV infection that was detected in her blood, and before she could leave the hospital, she had to be administered her antiviral drugs, namely acyclovir.

Because it is Monday, the patients who have undergone transplantations came to the SOPA clinic. I was with Dr. Mangus and Nurse Practitioner Lindy. One of the patients came for her last outpatient checkup, and it was very amazing, as well as emotional to see the happiness on her face.

Sickle cell disease and Parvovirus B19:

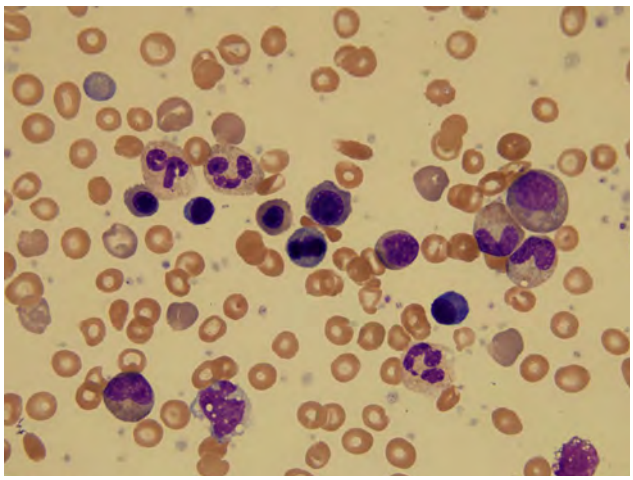

Figure 15: Parvovirus infected blood cells of a sickle cell disease patient

Parvovirus B19 is a small, non-enveloped DNA virus. It exclusively favors erythroid progenitor cells in bone marrow and blood as hosts. By the mechanisms of induction of apoptosis or arresting the cell cycle, erythropoiesis is ceased temporarily for 7-10 days. It causes self-limiting subclinical erythroid aplasia and followed by rash and arthralgia in patients with competent immune systems. In the immunosuppressed, however, the course of the infection follows a path of a marked decrease of hemoglobin values and anemia, which is life-threatening. The reason why the effects of parvovirus B19 is very explicit in sickle cell disease patients lies under the balances in hemostasis. Normal red blood cells have a lifespan of 120 days. In SCD, that duration is shortened to around 15 days.

Because the SCD patients have a lower ratio of healthy hemoglobin, they are unable to carry oxygen to their tissues effectively, which may require them to have blood transfusions at some points in their lives. Arrest of erythropoiesis due to parvovirus B19 infection, especially in SCD, on which the patients rely heavily on sustained RBC turnover, decreases the ratio of the healthy hemoglobin even further, magnifying the effects of the infection. The result is life-threatening anemia.

July 23rd – Tuesday:

Clinical experience:

Things at the hospital has been relatively calm today. We started with visiting some of the patients with Dr. Yujin and Emir. Nothing was out of the ordinary. Almost all the patients were doing better. After our brief tour of checking up on the patients, the rounding with Dr. Ekser and the team started. A patient discharged a few days ago came back with a complaint of chest pain and dyspnea. We found out later that she wasn't eating as much as she should have and therefore, she was having some problems with her GI system, which may have complicated into the chest she was complaining about. This was a prime example of the importance of listening to the advices the healthcare professionals give to the patients. The physicians and the nurses can treat a person as much as their knowledge and skills enable them to do so. Without an effort from the patient, the treatment is mostly useless and the road to well-being can be cut short easily. The same thing counted for another patient in the inpatient clinic today, which a male patient was not doing his daily exercises of walking around the corridor to gain strength and to improve his GI motility. Other than these two incompliant patients, everything seemed to be in order.

The liver selection committee meeting:

Today I attended my second liver selection committee meeting. It was much shorter than the one in previous week because of a smaller number of cases to be discussed. One of the main topics that was spoken about in today's meeting was (previously or currently) alcoholic patients with diagnoses requiring liver transplants. Except for a few, almost all the patients have had a history of excessive alcohol consumption, leading them to cirrhosis. The reason why it was a big issue today was due to the length of sobriety requirement being open to discussion. Previously, 6 months of sobriety was required in order to put the patient's name on the transplant list, while there have been some exceptions made, considering the fact that some patients' conditions requiring urgent transplant for survival or because of compliant and positive nature of the patients. Because of the debatable nature of this issue, no consensus has been reached on the alcoholic cirrhotic patients regarding proceeding with transplants.

MELD scoring:

$$MELD = 3.78\times\ln[\text{serum bilirubin (mg/dL)}] + 11.2\times\ln[INR] + 9.57\times\ln[\text{serum creatinine (mg/dL)}] + 6.43$$

For candidates with initial MELD score greater than 11, the score has to be recalculated using the following formula:

$$MELD = MELD_{(i)} + 1.32*(137-Na) - [0.033*MELD_{(i)}*(137-Na)]$$

It is used to evaluate the mortality rate in 90 days in end-stage liver disease or chronic liver disease patients. It is also used for the allocation of liver transplants, prioritizing patients in more severe conditions based on the acquired score.

- 40 or more -71.3% observed mortality
- 30–39 - 52.6% observed mortality
- 20–29 - 19.6% observed mortality
- 10–19 - 6.0% observed mortality
- <9 - 1.9% observed mortality

The scores have to be calculated:

- every week if >25
- every month if 19-25
- every 3 months if 11-18

Primary sclerosing cholangitis – Ulcerative colitis (PSC-UC):

Primary sclerosing cholangitis (PSC) is a chronic liver disease characterized by progressive cholestasis with inflammation and fibrosis of the both intrahepatic and extrahepatic bile ducts. While the etiology cannot be properly explained, PSC is believed to be due to autoimmunity. The course of PSC may lead to cirrhosis, portal hypertension and end stage liver disease. While they may seem unrelated, PSC is strongly associated with ulcerative colitis. They may also be complicated with development of cholangiocarcinoma.

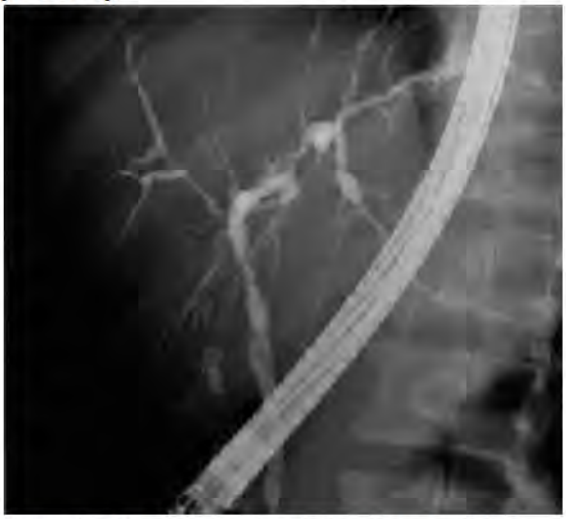

Figure 16: Primary sclerosing cholangitis on radiologic imaging

July 24th – Wednesday:

Morbidity and Mortality meeting:

Today started with the M&M meeting at the Emerson Hall at 7 am. There were fewer presentations than the last week, which may have been due to the length of the presentations and time constraints. One topic that really caught my attention was about a malignancy in the colon. Cancers of the colon are symptomatic based on the location they arise from. While typical findings of the colon cancer may include lack of fecal output, hematochezia, melena, pain, near-syncope and etc., depending on whether the neoplasm is on the right, transverse, left or sigmoid colon, the patient may have all or some of these findings. The case yesterday, was about a malignancy in the right colon. Because the stool doesn't form into solid consistency until it reaches the left colon, the patient was not experiencing any lack of bowel output. Instead, he was having abdominal pains and near-syncope. The lesson to be learned is keeping a long list of differential diagnoses in order to not cross out the actual problem.

Figure 17: Morbidity and Mortality Meeting

One thing the watching and enquiring physicians pointed out at the meeting yesterday was the importance of not saying a physician can do nothing differently if he or she were to do the operation again. As a physician on the way, I am always made aware of the fact that

there can always be a better way of doing things, whether it be for saving a patient's life or improving the quality of life of the patient after an operation.

Medical Student Summer Research Program poster presentations:

After the M&M meeting, the annual poster presentations started at the Van Nuys Building. This is where the medical students present the research projects they did with their mentors. There were two sessions; one in the morning and the other in the afternoon. Around 200 projects were presented in total. 20 of them are going to be selected by a panel of judges to present their projects in front of a crowd on an upcoming day. Dr. Ekser had two student who were presenting their 3D organ bioprinting project for kidneys and liver. Not only did we walk and view the posters with Dr. Ekser, he also gave us thorough insight on properly preparing a research poster and presenting it. It was a nice organization that I have never had a chance to neither experience, nor participate before.

Figure 18: Dr. Ekser, Emir and I in Van Nuys Science Building

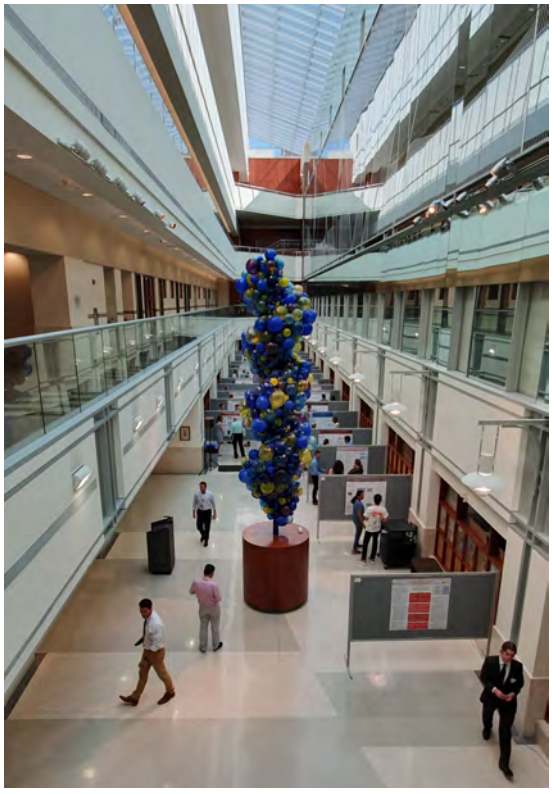

Figure 19: Research project posters

Surgical experience #1 – Kidney transplant:

Today I had the chance to see my first kidney transplantation. The main surgeon was Dr. Goggins, who told us that he was performing his 2200th kidney transplant! He greeted us kindly and he was instantly open to answer any questions we had. The kidney was from a living donor in the OR next to the one recipient was in. The patient had autosomal dominant polycystic kidney syndrome. The *left* kidney was procured from the recipient and WAS planted to the *right* side of the recipient. The operation went very smoothly. The urine output was already nearing a liter since the kidney was planted until the end of the operation. Dr. Goggins calls them "happy kidneys". I saw the patient in the clinic the next day and he seemed like he was already doing fine.

Figure 20: Dr. Goggins and us after a successful kidney transplantation

Figure 21: The polycystic kidney

Surgical experience #2 – Whipple operation:

We had already spent a large portion of our day at the kidney transplantation. After the operation ended, Emir and I went over to Simon Cancer Center to watch the Whipple operation Dr. Nakeeb was conducting. When we arrived there, Dr. Nakeeb was very close to closing up the patient. However, we were able to see the end result of the operation with the gall bladder, the bile duct, the head of the pancreas and the first part of the duodenum removed from the patient. Because we missed most of the operation, we asked Dr. Nakeeb about a possible operation in the near future, and he gladly accepted us to come and join him any time.

July 25th – Thursday:

Clinical experience:

Before the rounding started, we checked up on the patients with Dr. Yujin, as usual. One of the patients was febrile, and another one was having pain on the location where the chest tube was connected. A few hours later, we had some troubles with the chest tube because it came out of the patient; the reason why remains unclear. The rest of the patients were doing fine. In fact, so fine that some of them were scheduled to be discharged. The one thing that was different today was I was allowed to ask the events overnight to a patient. I was very excited at first, but Dr. Yujin and Emir helped me by reviewing the things to ask before we entered the room and the patient was so understanding and so cooperative that I was able to handle the task. Overall, I can say it went pretty well, but I took some mental notes of things that I can improve until next time I speak to a patient.

Later we had the SOPA outpatient clinic. I went with Dr. Ekser to check on the patients who have had liver transplants. Patients seemed fine and none of them were having rejections. The registered nurse, however, did feel the need to underline the importance of sticking to the diet to the patients in order to get healthy again, especially after we learned that one of the patients wasn't consuming enough proteins, while another patient was straight up drinking sodas.

Surgical experience – Liver procurement and transplant:

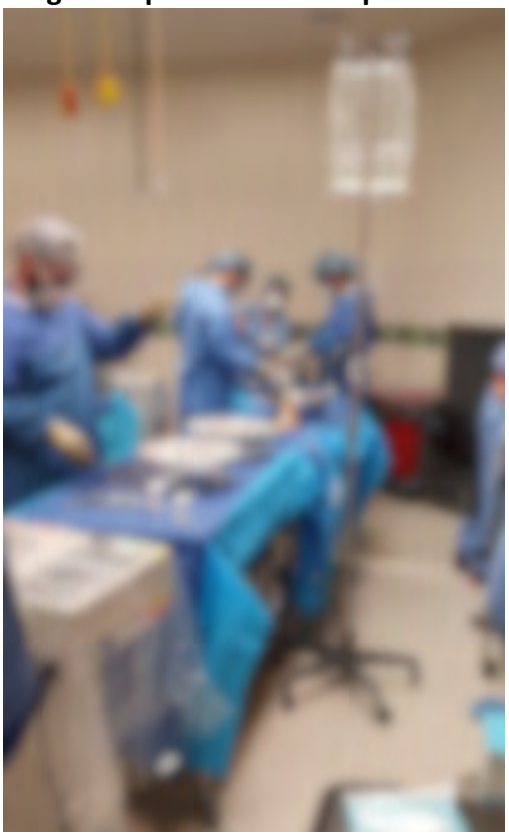

Figure 22: Organs being prepared for transport

For the second day in a row, I saw a transplant operation. For procurement, we didn't have to board a private jet this time. We went to Community North Hospital, which is a half-hour-drive from the IU. The donor was a middle-aged male who passed away from a heart attack due to coronary atherosclerosis. The lungs, liver and the kidneys were to be procured. Dr. Mihaylov and Tobias (the organ perfusionist) were there to operate on the donor. In addition to the surgeons, Dr. Mihaylov let me and McKenzie scrub in, for which I am thankful for. I was asked to incise the abdomen using the bowie. Dr. Mihaylov briefly showed me how to use the device and listed me the things to be cautious about, especially not perforating the bowel. I was a bit anxious at first, tried to get a tight grip on the bowie and attempted my best at not having a shaky hand. After a few seconds, my anxiety was gone, and I was using the bowie without any difficulties. We opened up the donor, exposed the abdominal organs and ready to operate on the inside. Then it was McKenzie's turn to use the bowie to liberate some parts of the bowel from the mesentery and the peritoneum. Along the procedure, Dr. Mihaylov was giving us small anatomy lectures. We reviewed some of the vasculature, ligaments, parts of the organs and etc. After some vessels were blocked and organs were liberated from the ligaments, it was time to procure the organs. McKenzie and I scrubbed out and gave Dr. Mihaylov and Dr. Tobias their spaces. Liver was procured first, then the kidneys and lastly the lungs. After the organs were packaged and they were put in the cold boxes, Emir scrubbed in to close the patient up.

When we came back to IU, the surgery had already started. The recipient had non-alcoholic steatohepatitis (NASH) and she needed a transplant Dr. Mangus was removing the sick liver from the female recipient, while Dr. Mihaylov was benching with an assistant. We didn't get to scrub in this time because it was already crowded inside the OR. However, it was still a privilege to be in that OR, observing one of the most complicated surgeries a human can go through.

July 26th – Friday:

Clinical experience:

The rounding started very early today as Dr. Ekser had to be somewhere else. There were two new additions to the inpatient clinic; one of them had a transplant yesterday in the morning and the other patient was the one, who we procured the organ late in the evening for. We rapidly checked up on the rest of the patients and Dr. Ekser left. After that, the NP Lindy took the matter in her hands and we continued rounding with her. One of the patients, who had a GJ tube implanted a few days ago was in so much pain. The sickle cell patient was febrile a few days ago, and we were relieved that his body temperature and his white cell

counts returned to normal levels. He was having pain due to the NG tube swelling up his throat, but because we were not confident that he would eat adequate amounts of food, we decided that the tube should stay over the weekend.

Surgical experience – Liver transplant:

Dr. Mihaylov and Emir had flown to Fort Wayne for two organ procurements. Liver from one of the procurements was brought to IU for transplantation. Dr. Mangus and Dr. Soma were the surgeons of the operation. During the operation, Dr. Mangus asked me to pull up steps just behind him and thoroughly explained steps of the procedure. This was the closest I had been so far in terms of also being able to see the anastomotic parts of the procedure, as liver is so confined into the abdomen, it is otherwise hard to see things without coming up real close to the operation table.

CMV and its importance in transplant patients:

Cytomegalovirus (CMV) is among the viruses that a patient is always serologically tested for before a transplant surgery. It is normally a ubiquitous virus that infects 60-100% of the population. In most immunocompetent patients, the course of the infection is latent, where the virus persists in myeloid lineage cells, but may also present as an unspecified febrile, flu-like or mononucleosis-like syndrome. In rare cases, the infection presents as a systemic syndrome, affecting many organs.

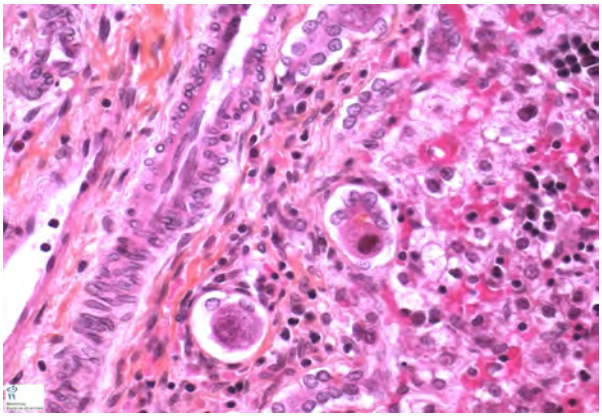

Figure 23: CMV hepatitis

The disease caused by post-transplant CMV occurs due to transmission from the transplanted organ, due to reactivation of latent infection, or after a primary infection in seronegative transplant patients. The clinical picture of a viral syndrome in a transplant host is characterized by fever, malaise, leukopenia, thrombocytopenia, elevated liver function tests. Upper GI tract manifestations like pain are also common. Lower GI manifestations are indicative of lower GI involvement of the CMV and is relatively uncommon. Respiratory symptoms are indicative of a severe disease. Hepatitis, meningoencephalitis, pancreatitis and myocarditis are rare complications of the virus.

July 29th – Monday:

Clinical experience:

The day started pretty hectic. We were told that there had been new admissions over the weekend, so the patient list was very crowded. Dr. Mihaylov was in charge of the patient rounds and we started with the ICU, as always. One patient, whose transplant was last week had altered mental status. She was confused the entire time and wasn't able to answer our questions. One other patient in the ICU, who had undergone transplant a long time ago was also very confused. A foreign patient, who had suffered from HBV, HCV and HCC, whose blood tests were optimal, said she wasn't in a good mood and she was constantly feeling thirsty. In the normal inpatient clinic, the patient who had parotitis finally recovered. Another patient was discharged, because she had no problems with her new liver. The rest, however, were not

doing totally fine. A male patient, who managed to recover quickly and consistently over the days I have been in the hospital suddenly started having a very severe RUQ pain. Contrast CT was ordered to rule out mesenteric ischemia. Another male patient, who has been in pain for the last seven days was not only still feeling pain, but also, he was bleeding from a point in the GI tract that had not been diagnosed yet, for which gastroduodenoscopy was ordered.

Monday means SOPA outpatient clinic at IU Transplant, so we headed down to the outpatient clinic with Dr. Mihaylov and NP Morgan. Emir went with Dr. Mihaylov, whereas I was with NP Morgan. On the contrary to the 4th floor patients, all of the patients that I saw were doing fine. The patient, whom doctors feared may had been having rejection was doing better and her liver enzymes were returning back to normal ranges after her high-dose steroid therapy. The other patients' statuses were unremarkable.

Surgical experience – Laparotomy exploratory gastrojejunostomy and pyloroplasty:

Because the rounding and the SOPA clinic took around 3 hours to complete, we were late to the surgery and only caught the last part of the surgery. Dr. Mangus had a non-transplant laparotomy exploratory gastrojejunostomy and pyloroplasty surgery planned for the day. Dr. Soma and Dr. Yujin were assisting him.

The female patient had had a surgery, in which they connected the esophagus to the jejunum, bypassing the stomach, which was suffering from gastroparesis, altogether. It was told to me that she had been doing fine for some time, but she later developed dumping syndrome. She hadn't been getting enough nutrients digested and she had been mostly diarrheic. In order to treat the dumping syndrome, as well as compensating for the gastroparesis, Dr. Mangus admitted her to the hospital for a new surgery.

Her previously disconnected esophagus was reconnected to the fundus of the stomach. The pylorus was reformed and widened to be connected to the jejunum. A GJ tube was installed to act as a valve, in case the contents of the stomach were too much, and they would not proceed to the bowel due to gastroparesis.

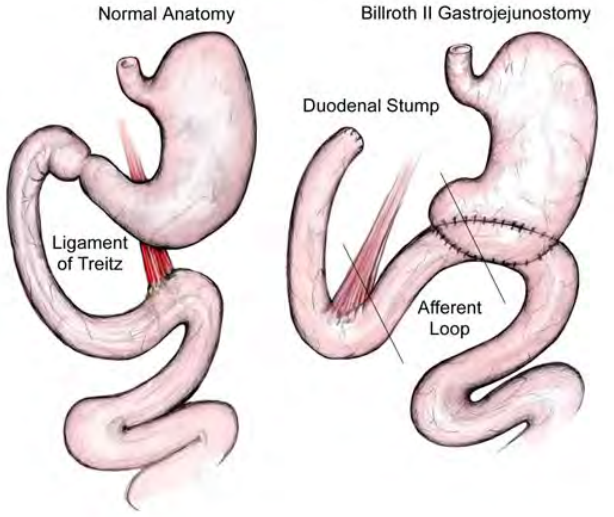

Figure 24: Gastrojejunostomy

Dumping syndrome:

Dumping syndrome is a condition in which stomach contents get emptied into the small intestine before they are completely digested. It usually happens after a gastric bypass surgery. There are two types of dumping syndrome: early and late types. In the early type, large amounts of food from the stomach move into the duodenum faster than usual. With this movement, a mixture of fluid of stomach acid and partially digested food gets emptied into the small intestine. This type is more symptomatic of nausea, diarrhea and bloating. In the late type, large amounts of glucose from the ingested food and drinks move into the small intestine, where excessive amounts of sugar cause rapid increase and subsequent immediate insulin release causes rapid decrease in blood sugar, which results more in hypoglycemic symptoms.

July 30th – Tuesday:

Clinical experience:

Figure 25: Fascia closure operation

The day started quite ordinarily with rounding with Dr. Mihaylov leading the team. We had a new admission overnight due to liver transplant, which increased the patient count to a staggering 19! More patients mean longer patient rounds and more patient issues to deal with. Most patients in the ICU were stable. One of the patients, an elderly female was suffering from catheter-caused UTI. An elderly man, who underwent liver transplantation was continuing to have altered mental status.

The most interesting case of the day belonged to the intestinal transplant patient. When he was sent to radiology for CT yesterday, instead of a highly suspected vascular accident, he was observed to have large amount of ascites in his abdomen and a very distended bladder. Few hours later, the nurses reported to Dr. Yujin that he *urinated* 7 liters of pinkish, frothy fluid through the catheter. While the situation confused the physicians, it was found out later by the urologists that the patient's bladder wall actually had a defect and the chylous ascites diffused through that defect into the bladder and out of the body through the catheter. As the patient excreted the whole ascites, his urine color and consistency returned to normal. The pain he had been having eventually subsided. The formation of the chylous fluid was linked to the fact that the patient had only recently undergone the intestinal transplant, and that his GALT was taking its time to reach balance. It was decided to put the patient on NPO and give IV fluids to compensate for any liquids that he might have lost.

Surgical experience – Fascia closure:

Figure 26: Dr. Mihaylov, Emir and I after the fascia closure

The only surgery of the day was a basic fascial closure procedure. We went down to the OR to see that Dr. Mihaylov and Dr. Soma had already started the procedure. The patient had undergone liver transplantation on the weekend. His fascia was left open due to high risk of post-operative bleeding.

3D bioprinting laboratory:

Dr. Işıdan agreed to take us to the 3D bioprinting lab, where they research if 3D printing can be utilized for producing organ tissues. The research assistant Lester concisely explained us the intricate process of bioprinting.

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Figure 27: The 3D bioprinter

Figure 28: Lester, Emir, Dr. Işıdan and I

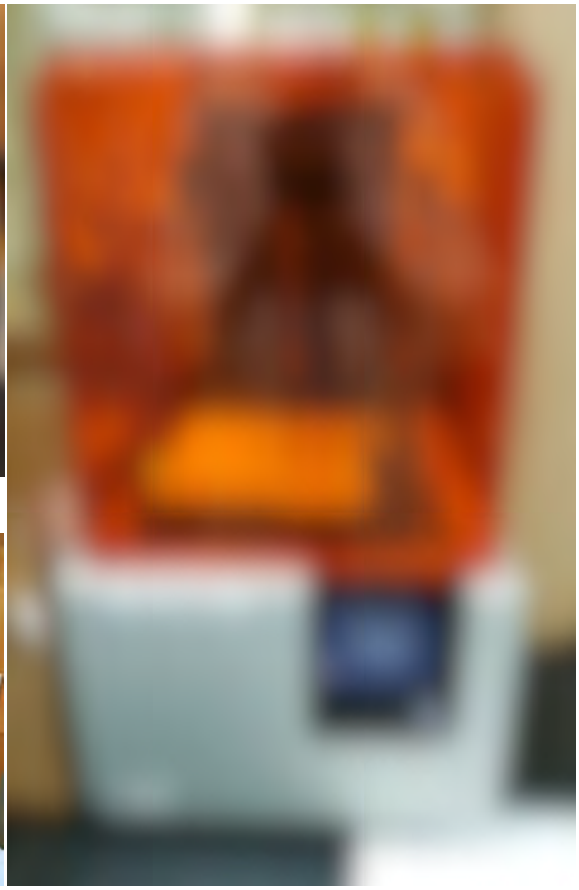


Figure 29: The 3D printer

The liver selection committee meeting:

Tuesdays are crowded with meetings. The most important one to me is the liver selection committee meeting. Almost all transplant surgeons, hepatologists, dieticians, pharmacists and social workers were there to discuss the potential transplant candidates. As usual, the cases of some patients were up for debate due to the etiology of the liver failure, their psychological or social histories. Most patients had alcohol related etiologies, which the committee debated about whether strict rules should be continued to be enforced on them or make exceptions to some of them. While this has been the hot topic for the last three weeks, some physicians expressed their concerns about too many exceptions having been made recently and they suggested that the rules should cover all the candidates without yielding any more omissions.

There were some cases that I found to be interesting. Regardless of having seen such a case in the clinic, primary sclerosing cholangitis with ulcerative colitis caught my attention. The patient was diagnosed after consulting with symptoms of abdominal pain, fever, fatigue, etc. Another interesting case was of a patient having cirrhotic liver due to alpha-1-antitrypsin deficiency. Alpha-1-antitrypsin is a protein the liver produces to protect tissues from the agents the cells of immune system secrete, mainly the lung and the liver tissue. In the case of AAT deficiency, the patient can suffer from pulmonary problems, like COPD, or find himself/herself in higher risk of developing cirrhosis or HCC. The patient that was discussed about in the committee had developed cirrhosis due to AAT deficiency and was granted a place on liver transplant list.

One other patient that took a big portion of the committee was a potential psychiatric patient in need of liver transplant. He was described as an extremely noncompliant patient that never followed the dialysis schedule and was told to be very hostile towards healthcare workers on times he showed up to the dialysis center. He was giving discrepant statements to different physicians regarding following the schedule. It was decided that he could actually be suffering from a non-diagnosed personality disorder and that he was unfit for transplant.

July 31th – Wednesday:

Figure 30: A resident presenting his case at the Morbidity and Mortality meeting

Morbidity and Mortality meeting:

7 am at the Emerson Hall: a typical Wednesday gathering for the general surgeons, physicians, residents, interns and medical students. There didn't seem to be as many cases as there were in the previous weeks, but they were more interesting. We arrived at the hall just before a case of a man, diagnosed with Dengue fever was presented. The case was of a Burmese man, coming back from travelling to Thailand. He was found to be febrile and fatigued. His blood tests revealed extremely high levels of AST and ALT and quickly decreasing levels of Hb. He was hemorrhagic. He was later diagnosed with Dengue fever and his status was rapidly deteriorating to acute liver failure.

Another interesting case that was presented at the M&M was of a male patient with rapidly decreasing Hb levels. Days before he was deteriorating, he had underwent thoracentesis. Looking at the Hb levels, it was ruled out that the patient was hemorrhaging from a blood vessel. The surgeons took the patient to the OR, opened his abdomen and couldn't visibly find any leaking blood vessels, nor could they see blood building up in the abdominal cavity. Because even after the surgeons checked the integrity of the arteries and veins and the patient's status wasn't improving, the surgeons decided to incise open the abdomen again. It was later realized that the right hepatic vein was punctured during thoracentesis and the reason why they didn't have a visual of the vein was due to the resident covering the vein with his hand while trying to maneuver the liver to view the other blood vessels.

Surgical experience – Whipple operation:

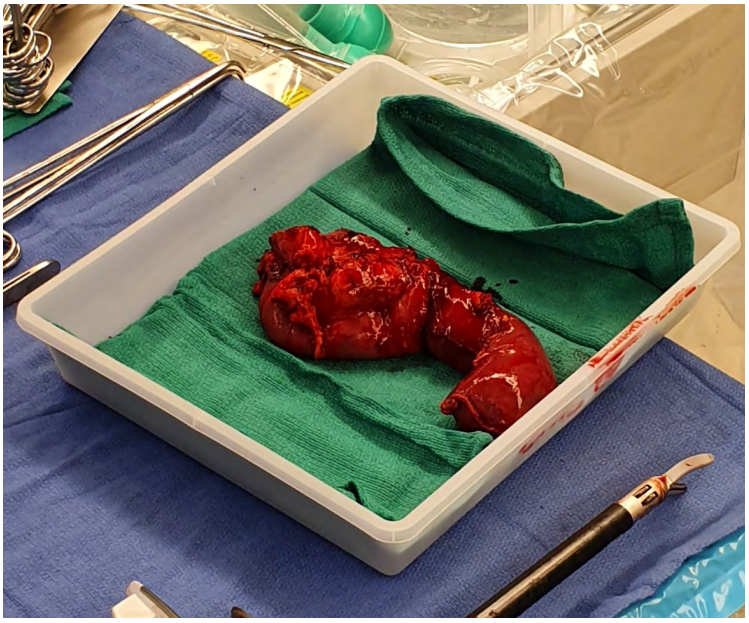


Figure 31: Resected duodenum, pancreatic head and uncinate and ampullary tumor

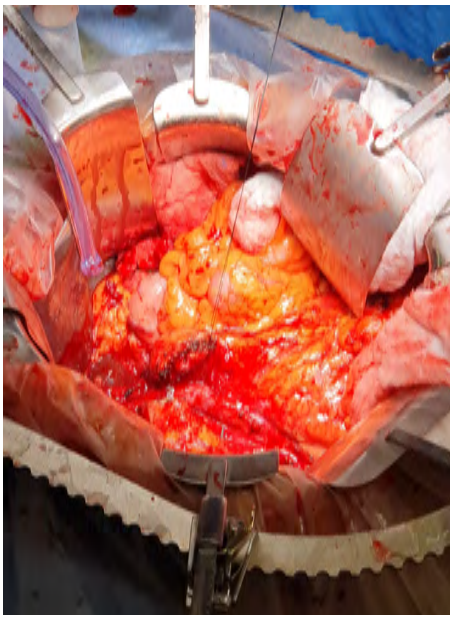


Figure 32: Dr. Nakeeb connecting the remaining pancreas to the duodenum

Today was the only day that we didn't participate in the patient rounds in the morning. In order to seize the opportunity of observing a Whipple operation, we headed straight to the Simon Cancer Center, downstairs to the OR 8. Dr. Nakeeb was the surgeon and he was going to perform the operation with the resident. He kindly greeted us and allowed us into the OR.

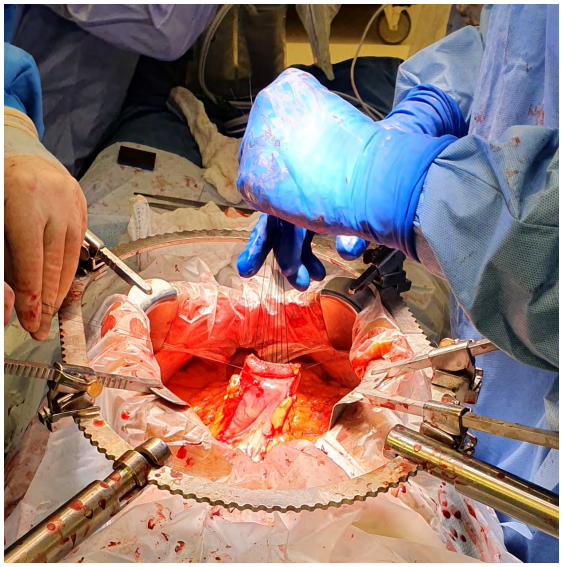


Figure 33: Pylorus being connected to the small intestine

The patient was a middle-aged, male patient, who was diagnosed with ampullary tumor. As a standard procedure in such cases, Whipple operation was scheduled to be performed. His gall bladder, uncinate and head of the pancreas and much of the duodenum were resected, along with the tumor. After removal of these structures, the pylorus and the bile duct were connected to the small intestine and the remaining parts of the pancreas was connected to the 4th part of the duodenum. Even though I had been told before, that the Whipple operation takes around 5-6 hours, Dr. Nakeeb managed to finish it in only 2.5 hours! He was friendly, verbal and very explanatory the entire operation and made sure that we were able to see all the steps of the procedure.

Dengue fever:

Dengue fever is caused by any of the dengue viruses 1, 2, 3, 4, transmitted by either mosquitos or vertical transmission. It is most commonly seen in Central Africa, South America, Eastern Asia and some Pacific countries. Typically characterized by common symptoms like fever, aches, rashes, nausea and vomiting. In 5% of the cases severe dengue may develop, which is further characterized by hematemesis, hematochezia, abdominal tenderness, organ failure, of which liver is the most common, and death. Hepatic manifestations are either a result of direct viral toxicity or dysregulated immunologic injury in response to the virus.

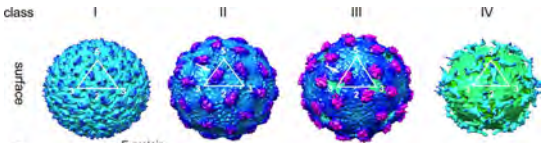


Figure 34: Serotypes and structures of dengue viruses

Emir's last day:

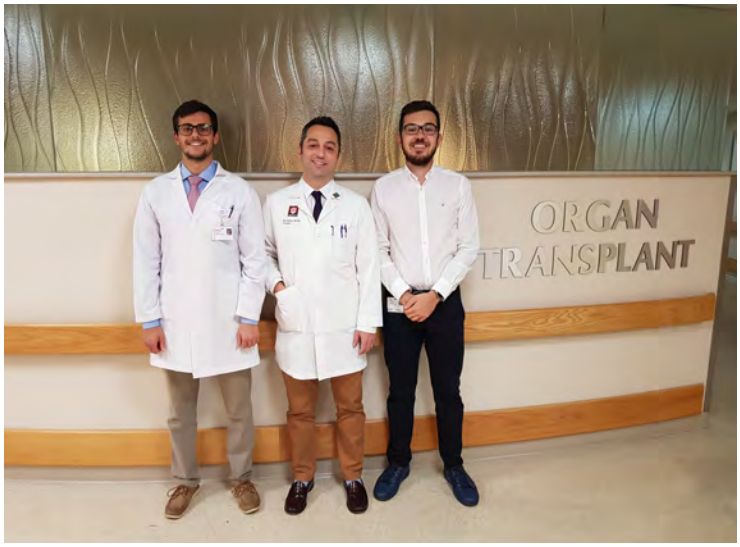


Figure 35: Emir, Dr. Ekser and I at the entrance of the organ transplant floor

Today was Emir's last day. Since the day we met at a barbeque, the first time we flew to procurement together and every morning and evening, he gave me many reasons to thank him, as my fellow colleague, for him helping me around, showing and teaching me basic knowledge about things that I didn't know before. It was a pleasure to have him by my side for the last three weeks.

August 1st – Thursday:

Along with the departure of Emir, the resident Dr. Soma, intern Dr. Yujin and the fellow medical students rotated to different specialties due to the beginning of the new month. This meant that introductions were in order. Dr. Sonal replaced Dr. Yujin and Dr. Aaron Kaviani replaced Dr. Daiki Soma.

Clinical experience:

Dr. Kubal was the surgeon in charge of the patient rounds this week. Along with him was the usual rest of the team of NPs, nurses, dieticians and pharmacists. Two of the patients who have been in the hospital for some time were continuing to have altered mental statuses. The patient in the ICU who suffered from UTI was now suffering from a bacterial infection in her lungs. A long-time patient in the clinic was still in pain due to hematoma that accumulated on the site where he tore his trapezius. Two patients were scheduled for discharge. The rest of the patients were stable.

After we were done rounding in the inpatient clinic, NP Lindy and I went down to the SOPA. I saw a lot of familiar patients coming for their regular visits as I have gotten to know them either from post-op on the 4th floor or from their previous outpatient checkup sessions. None of the patients were suffering from major problems. No cases of rejection were come across. A few patients expressed pain on a site on their abdomens, which were easily manageable with painkillers and weren't due to any serious etiology. The only extra-ordinary case at the SOPA was the non-healing wound of a patient who was discharged the week before. Half of his wound had healed, but the other half not only didn't close up on its own, but it also was acting as a fistula to the outside for the ascites accumulating in the abdominal cavity. It was deemed that the wound needed surgical intervention and the patient had to be discharged for only a short amount of period.

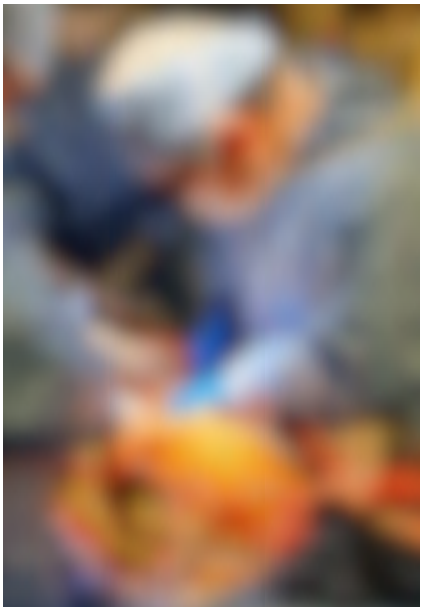


Figure 36: Organs being procured

Surgical experience #1 – DCD organ procurement

Today I had to chance to experience a DCD organ procurement for the first time. The formalities differed so much from a standard organ procurement from the deceased. The surgeons left the OR to stay out until the donor expired. The donor was kept intubated until the family arrived to say their goodbyes. After around 15 minutes, we were informed that the donor expired, and the procurement was ok to proceed with. The surgeons very quickly scrubbed and immediately excised the body. The kidneys and the liver were to be procured. Dr. Mihaylov, Dr. Soma and Dr. Aaron procured all the necessary organs very quickly; they were placed in cold containers and we rushed back to IU Health.

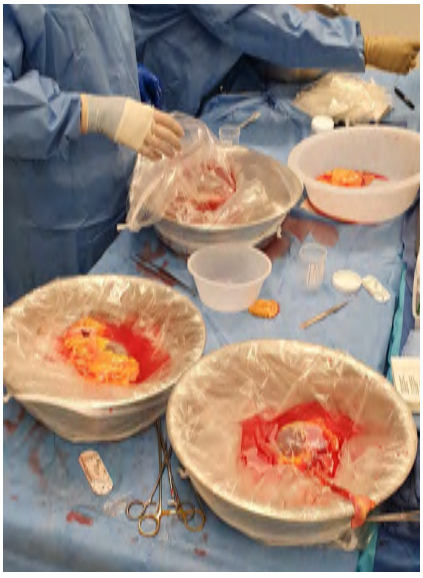


Figure 37: Procured organs being prepped

Surgical experience #2 – Liver transplant

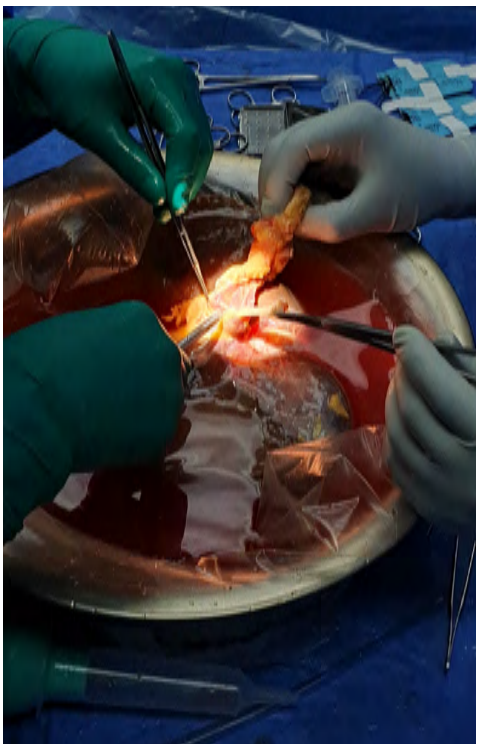


Figure 38: Liver being prepared r for transplant

When we went to the OR 15 in IU, we found out that the surgery was delayed for at least 1.5 hours. Before the procurement was performed, Dr. Mihaylov went to the outpatient area to check on the patient. He found out that he was suffering from severe cellulitis on his both legs and they were enlarged and very warm. He was found unfit to undergo the surgery and a new recipient was called to the hospital. Because everything happened in the last minute, it took some time before all the paperwork was filled, the lab tests were performed, and the patient was prepared for the surgery. When the patient arrived, the surgery started right away. Dr. Soma and Dr. Aaron prepared the liver on the back bench. Dr. Kubal and Dr. Mihaylov were the main surgeons, but Dr. Soma assisted them, and Dr. Aaron helped and mostly observed as it was his first liver transplant surgery. Because I have had the chance to see the operation a few times now, I was mostly interested in the anesthesia part of the surgery this time. Dr. Bye and the anesthesia resident Dr. Jake were very explanatory about the work they were doing. They let me know about the steps they were taking the entire surgery and they even helped clear my mind of some questions I have had before.

August 2nd – Friday:

Clinical experience:

Dr. Kubal and the team were rounding again. On the contrary to the earlier days of the week, the inpatient clinic was relatively calm. Most of the patients were stable. So stable in fact, four patients were planned to be discharged. The patient with the hematoma located on the site where he had a trapezius tear was still in pain. The other patient who had a defective bladder wall, who excreted 7L of fluid from his urethra was back on track to recovery and he was doing just fine. One of the confused patients in the ICU was seen walking in the halls, which was a great development! On the other hand, a long-time patient who was charged yesterday was going to be brought back to the hospital due to tachypnea, hypertension and a heart rate of 220!

Thymoglobulin (anti-thymocyte globulin):

Thymoglobulin is one of the first-line immunosuppressive drugs used after transplant surgeries. They are used in conjunct with other immunosuppressive drugs, such as calcineurin inhibitors. While its mechanism of action is not completely understood, the primary action of the thymoglobulin is induction T cell depletion by complement-dependent cell lysis, as well as activation of antibody-mediated cytotoxicity. Lymphocyte depletion after IV administration of thymoglobulin occurs rapidly. Recovery of the T cells after cessation of the treatment occurs gradually and levels up to 50% of the initial counts have been observed in patients.

There are adverse effects associated with the use of thymoglobulin. While some these adverse effects are caused by obvious consequent immunosuppression, there are other side effects that can be observed with the administration of this drug.

- Chills
- Leukopenia
- Headache
- Abdominal pain
- Hypertension
- Nausea
- Tachypnea
- Hyperkalemia
- Hypotension
- Rash
- Sweating
- Malaise

A lot of patients in the inpatient clinic and especially in the transplant ICU (TICU) have been having reactions to thymoglobulin. The ones I have seen reacted to the drug were mostly suffering from pain, nausea, tachypnea and blood pressure-related symptoms. In my first week, a patient in the TICU suffered from the nauseous effect of the drug and had consequent aspirational pneumonia due to vomiting. Another patient, who is currently in the TICU has had problems with her blood pressure.

Atrial fibrillation:

Atrial fibrillation is the most common type of cardiac arrythmia. It is the irregular and asynchronous contraction of the atria in the heart. When that happens, they pump blood into the ventricles out of coordination with their own contraction rhythm. The cause of AFib is the paroxysmal sources of electrical signals that arise from spots in the atria, on top of the innate pacemaker, the AV node. The paroxysmal sources may be due to congenital abnormalities or may arise after damage to the heart's structure, which may be caused by heart attack, CAD, abnormal heart valves, hypertension, heart surgery, hyperthyroidism, etc. It is possible that AFib leads to stroke or heart failure. Stroke can be seen after AFib because as the atria lose their ability to effectively pump blood forward, blood dams in the atrial cavity, which is also called stasis, and this leads to formation of blood clots. If these clots embolize to the brain this will cause stroke. Heart failure is another possible complication as AFib can weaken the heart and lead to HF.

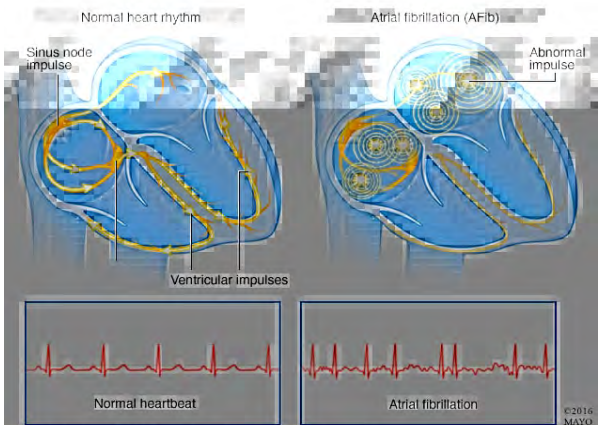


Figure 39: Normal heart rhythm vs AFib

August 5th – Monday:

Clinical experience:

A new week means a change in the rounding surgeon. This week, Dr. Mangus is that surgeon. He had his own way of doing things. We all met in the physician work room. He gathered all the information he needed from the inputs from the NPs, dieticians, pharmacists and nurses. He entered the input to the system before visiting the patients and when he was done, we started walking around the floor and saw the patients.

The patients in the TICU weren't necessarily doing well today. One of the patients was hypercapnic and needed to be intubated again. His chest x-ray revealed fluid infiltrations. US

and echocardiogram were ordered. A female patient in the TICU, who we admitted last week was having acid-base imbalance. No signs of infiltration in the lungs or any kind of infection were found. It was initially thought that she was fluid overloaded but further tests indicated that she was actually dry due to fluid not staying in the blood vessels. Albumin was administered. A patient in the TICU was transplanted just last night. He had both a very enlarged liver and PCKD. His peritoneum was not sewed due to his kidney transplantation being scheduled for tomorrow. The patients outside the TICU were doing just a bit better. The patient's lab tests, who received his liver from a DCD procurement, was indicative of *Clostridium difficile* infection. His WBC count was 14k and he was diarrheic. Another unfortunate patient, who was planned to be discharged today interestingly dislocated his posterior tibiotalar joint and fractured his lateral malleolus while he was in the bathroom, just with his own body weight; he didn't fall or hit somewhere. It was a big setback on his way to recovery.

In the afternoon, there were 2 admissions to the inpatient clinic. Both of the patients came down from the outpatient clinic that happened in the morning. The female patient was back due to pain on her incision site and elevated liver function tests. She informed us that she felt nauseous whenever she ate something. The male patient was back due to increased creatinine and INR levels. When he was going to bed, we also found out about an abscess on his lower back. Dr. Sonal drained most of the abscess and took specimen for culture.

Clostridium difficile:

Although not too ubiquitous in the general population, *C. difficile* is an important infection in the hospital environment. It burrows itself in the human intestine and usually causes active infection after antibiotic treatment. This otherwise nosocomial infection, which is of utmost importance on the transplant floor. Patients are immunocompromised and are commonly on antibiotic treatment, which creates a perfect environment for the bacteria to spread and infect. The course of infection can be either mild or severe. In the mild type, watery diarrhea and abdominal cramping can be the only symptoms. In more severe types, the symptoms can range from tachycardia, fever, dysentery, dehydration, weight loss, increased WBC count, all the way to kidney failure. Depending on the severity of the infection, drugs used in treatment can be vancomycin (125mg), fidaxomicin (200mg) or metronidazole (500mg).

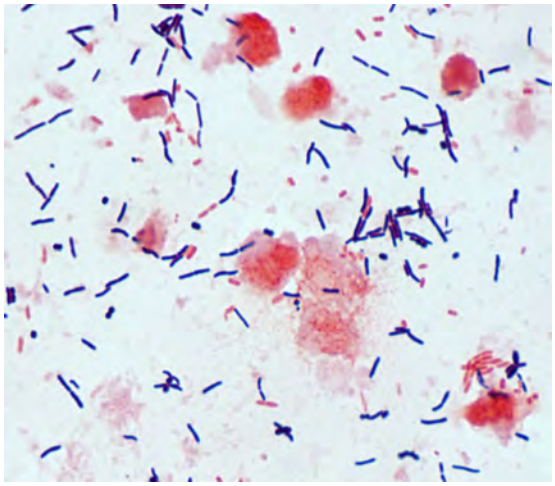


Figure 40: Clostridium difficile under microscope

August 6th – Tuesday:

Clinical experience:

It was Dr. Mangus's turn to lead the patient rounds again. We all met at the physician work room as usual and then visited each patient. The female patient, who underwent transplantation was doing a bit better today. Even though her pCO2 levels were higher the upper limit, because it showed a trend of decreasing on the last couple of days she was

extubated. The male patient who had liver transplant on the weekend was scheduled to return to the OR for, this time, a kidney transplant and fascia closure. Another patient in the ICU was having trouble controlling his breathing. He was dyspneic; therefore, he was connected to a CPAP machine to facilitate breathing. The patient, who was re-admitted to the hospital due to severe pain and nausea the day before was not doing very fine. Her level of pain had increased compared to yesterday and her blood tests revealed increasing WBC counts without any other signs of infection. LFTs were also elevated but showed a decreasing trend. The patient who excreted ascites last week was doing much better. His cystogram verified the integrity of his bladder wall. He was overall eating better, started exercising and didn't inform of any pain. He was being kept with catheter on to eliminate any stress the urine collection in the bladder may exert. Finally, after much deliberation with multiple disciplines, the physicians and the patient himself, the SCD patient was discharged. He was very uneager to be let go from the extended care services of the hospital due to his pain, but there was nothing the professionals could do at that point. Even though it is believed that the contrary will happen, the patient should regulate his eating to match the daily caloric intake and do basic exercises to gain muscle. Cooperation between healthcare professionals and the patient is key.

Surgical experience – Liver left lobe resection:

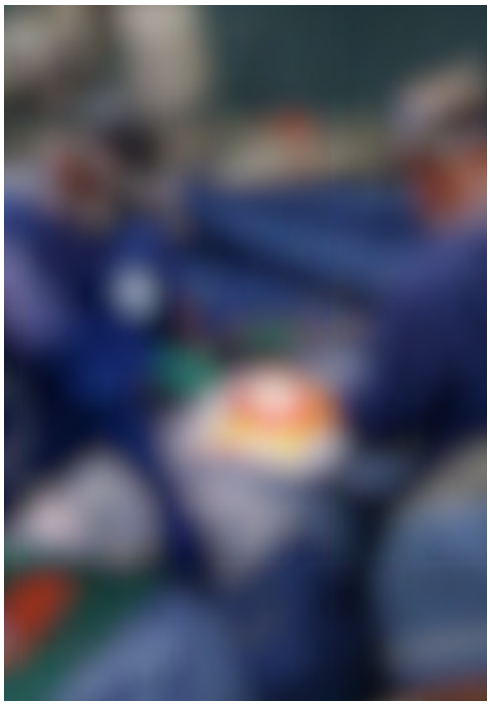


Figure 41: The enormous HCC mass on the left lobe of the liver

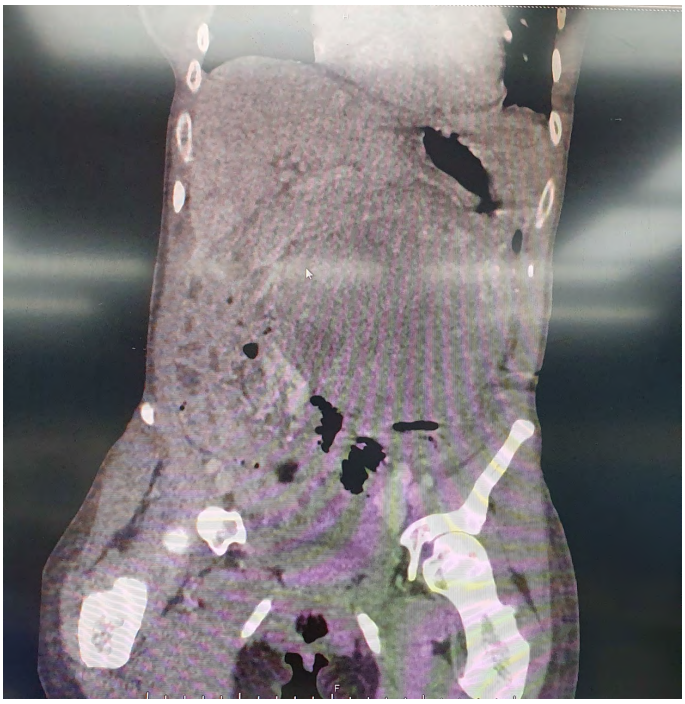


Figure 42: Abdominal CT revealing a 15 cm tumor in the liver

The only operation I was able to attend today was that of a 36-year-old female patient. She was going to undergo left lobe hepatectomy due to a 15 cm mass of HCC. After she was sedated on the OR table and as her abdomen was being sterilized for the operation, it was conspicuous that she was malnourished. I later learned that even though she had appetite, she was unable to eat anything properly in the last 2 months as oral intake of any nutrition gave her severe abdominal pain.

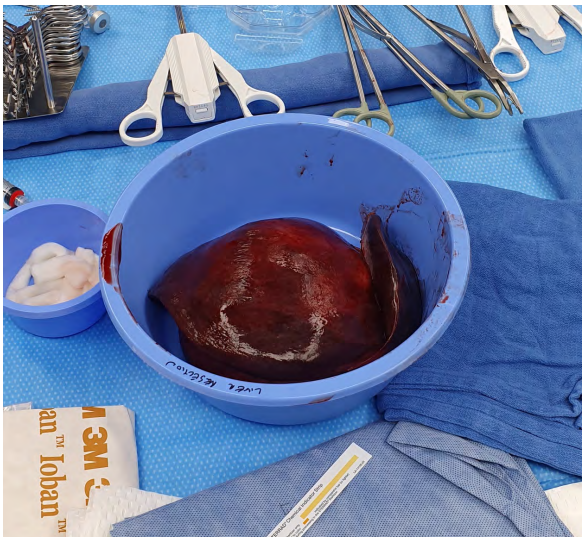


Figure 43: The resected left lobe

Dr. Kubal was the main surgeon of the operation and Dr. Aaron and Dr. Soma assisted him. They started by exposing the liver to the outside by incising the abdomen. Because the liver had grown enormously, the abdomen failed to contain it and as soon as the abdominal layers were incised the liver protruded outside by itself. Dr. Kubal first examined the lobe of the liver where the HCC was present. Then he started clamping the vasculature going to and arising from the left lobe. He cut the ligaments that kept the left liver in place, and finally, slowly but very carefully, resected the left lobe. To cover the exposed parenchyma on the left side of the right lobe, he covered it with "floseal", a liquid that induces platelet activation and fibrin clot formation. The operation was completed successfully. A part of the excised tumor was sent to the pathology lab, while the rest went to New York. The patient was taken to the ICU.

Abernethy malformation:

Abernethy malformation is a rare vascular anomaly of the splanchnic venous system. There are 3 types: 1a, 1b and 2. Epidemiologically, type I predominantly occurs in females, whereas there is a greater male dominance in type II malformation.

Type 1 shunts are defined by the congenital absence of the portal vein, where the portal blood is diverted into systemic veins – IVC, renal veins or iliac veins.

- Type 1a: Superior mesenteric vein and splenic vein drain into a systemic vein separately.
- Type 2b: Superior mesenteric vein and splenic vein converge into a single extrahepatic portal vein that drains into a systemic vein.

Type 2 shunts are defined by a hypoplastic portal vein with a communicating branch that connects it to the IVC.

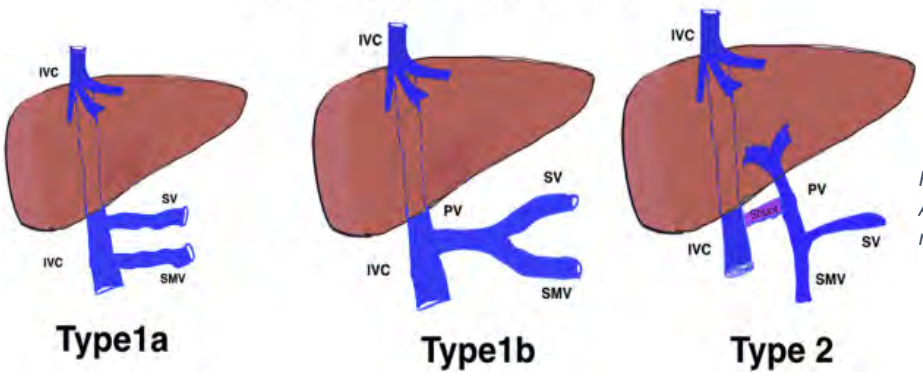


Figure 44: Subtypes of Abernethy malformation

August 7th – Wednesday:

Morbidity and Mortality meeting:

I attended my last M&M meeting of my time in IU Health. It started promptly at 7 am. Because I was around 5 minutes late, I missed most of the first presentation and wasn't able to follow completely. The next and only remaining presentation of the meeting was about explorative laparotomy. The mentioned patient had a history of MM and amyloidosis and subsequent bone marrow transplant. GJ tube was placed to facilitate feeding. After the tube was removed the following day, the patient had pneumoperitoneum. His arterial blood gas (ABG), the pH went down to 7.11 and he had a base deficit of -7, indicating metabolic acidosis. Explorative laparotomy was performed on the patient to exactly locate a perforation in the GI tract.

Clinical experience:

Dr. Mangus and the team gathered in the physician work room for the patient round. We went over the patient statuses, events overnight and matters requiring immediate attention with him. We started with discussing the hepatectomy patient from the previous day, the patient whose left lobe was completely removed due to HCC. Her LFTs were finally returning to normal levels. She stated that she was already feeling better. Her BMI was still very low though, and it was especially lower after the weight she lost after the removal of a huge tumor. It looked like she would be out of the TICU in a couple of days. The other female patient in the TICU was not necessarily doing any better. In fact, she had to reintubated due to her inability to breathe without any accessory equipment. On top of that, her bilirubin levels continued to increase, and her sodium levels showed a steep upward curve. We were informed by the nurses that she was often delirious and sometimes showed signs of an absent seizure-like state. An MRI was ordered to rule out any lesions in the brain. The last patient in the TICU was the patient who had had liver transplant over the weekend and kidney transplant yesterday. He was doing fine and there weren't any considerable updates. The long-term male patient in the inpatient clinic was having a hard time to get any better. The hematoma that was found on his back not only persisted to show its presence, but also it enlarged into the thoracic cavity and caused the collapse of the right lung, consequently leading to left mediastinal shift. Dr. Mangus asked why thoracentesis wasn't performed on the patient, but we were told that the other disciplines were anxious of the consequences. It was finally decided that thoracentesis will be scheduled, although we weren't sure when. Finally, the results for the male patient who broke his right ankle while going to the bathroom came in. We were afraid that a pathological cause or early osteoporosis was the etiology of the fracture. It turned out to be a deformation in the ankle and the knee and we were told that there was nothing to worry about in terms of a serious etiology.

Surgical experience:

Another hepatectomy operation was scheduled after the one that happened the previous day, but it differed from the previous one in many ways. This time it was a partial, right lobe, segments 6 and 7 hepatectomy. Also, this time the neoplastic lesion was not primary, but it was secondary from metastatic colon cancer. The patient had a history of colon, lung and prostate cancer. The surgeons of this surgery were Dr. Kubal and Dr. Kaviani. Again, one of the differences in this surgery from the previous one was the amount of procedures to be

followed. None of the blood vessels had to be clamped, as doing so would impede with vasculature and oxygenation of the remaining segments in the right lobe. The resection of the segments also took a very long time as Dr. Kubal was very careful about not damaging the remaining parenchyma. After the segments were removed, the exposed parenchyma was covered with "floseal", the peritoneum was sutured, and the abdomen was closed.

Figure 45: Resected segments 6 and 7

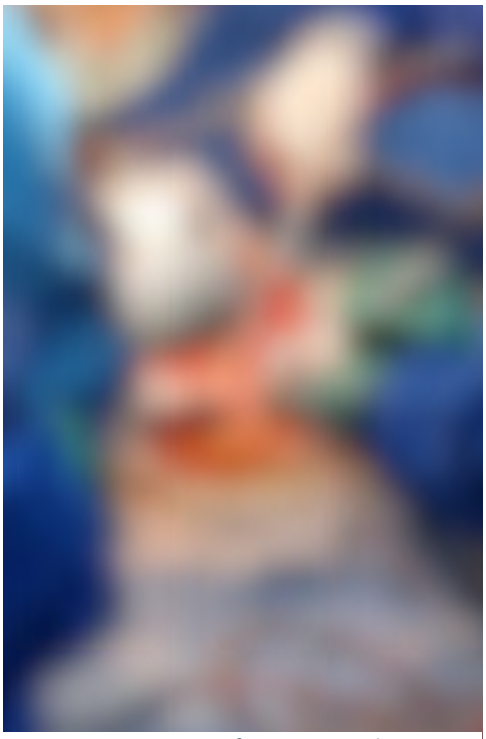


Figure 46: Surgeons performing partial hepatectomy

Metabolic and respiratory acidosis and alkalosis:

When approaching to acid and base disorders in the blood, the pH is the parameter that is used. With that, the two cardinal ions to check are CO_2 and $HCO3^-$. Changes in the CO_2 levels indicate the etiology of the problem is respiratory related, whereas changes in the$HCO3^-$ levels are indicative of metabolic problems. Any minute changes in the arterial pH are immediately compensated by body's responses. The lungs respond by changing the rate of respiration, thereby controlling CO_2 saturation, while kidneys respond by changing the amount of excreted $HCO3^-$. Base deficit basically means there is an inadequate amount of base in the blood to compensate for acidosis, whereas base excess means there is too much of base in the blood, driving the patient to alkalosis.

Ions	Increased levels	Decreased levels
CO_2	Respiratory acidosis	Respiratory alkalosis
$HCO3^-$	Metabolic alkalosis	Metabolic acidosis

August 8th – Thursday:

Clinical experience:

8 am sharp in the physician work room. Dr. Mangus, NP Lindy and the rest of the team met again for rounding. The female patient in the TICU, who has been having problems with

her respiration was scheduled for tracheostomy to prevent further long-term vocal cord damage. This problem also drove up her CO2 levels in the blood, which triggered compensatory metabolic alkalosis. On top of that, her bilirubin levels continued to show an increasing trend to a point where she had to be scheduled for endoscopic retrograde cholangiopancreatography (ERCP) to locate any obstructions in the biliary tract. The patient who had liver and kidney transplantation got a vocal cord injury subsequent to intubation. ENT consult was requested. They confirmed the injury, but they requested further consultation from neurology due to his tongue deviation. Neurology diagnosed the patient with hypoglossal nerve injury. MRI was ordered to assess further injuries. Other than his vocal and tongue problems, both grafts were functioning properly, and the patient was found fit to be transferred out of the TICU. The patient who underwent partial liver resection yesterday was doing fine. He was occasionally feeling nauseous, which directed the team to order NG tube. Other than that, all his other lab tests were ideal in that stage. Another patient, who was re-admitted two days ago due to high levels of creatinine was scheduled for discharge tomorrow. It was found out that he actually didn't have a kidney dysfunction, but instead he was severely dehydrated in spite of him having claimed he was taking in enough fluids. His feeds and electrolytes were balanced by the dieticians and it was decided he no longer needed to be in the hospital. The female patient who underwent left lobe hepatectomy was still in the ICU. Although she was feeling okay, she refused to eat anything. She was anorexic before she came to the hospital and that disorder seemed to persist. Dieticians were going to make a plan to reverse that.

After we were done rounding, I went down to the outpatient clinic. I was with Dr. Ekser this time. I got to see two patients today. One of patients was discharged two days ago following her re-admission due to pain on her wound and increased LFTs. She came back today with pain and redness around the wound. She was afebrile. Upon examination, Dr. Ekser found pus under the wound. He removed one of the staples and drained that pus. It is expected that she won't be in as much pain as before. The other patient came to the outpatient clinic one week after his wound was revised. He was doing fine, and the wound started healing nicely. Dr. Ekser even let me remove some of the staples. I had seen Dr. Yujin and Emir removing staples before and it had looked fairly easy, but I was never given the chance. It turned out to be pretty basic and straightforward.

August 9th – Friday

Figure 47: The beginning of patient rounds in the physician work room

Clinical experience:

Dr. Mangus, the team and I met at the physician work room for the rounding on my last day of the hospital. The female patient in the TICU went to get ERCP yesterday due to constantly increasing bilirubin levels. ERCP was inconclusive for any abnormalities. She was scheduled for tracheostomy today. A problem was seen on her chest x-ray: butterfly appearance was apparent. She was going to be given furosemide for only a day to relieve her from the fluid accumulation in her lungs. A long-time patient in the hospital was reported to have tachycardia and ST elevation yesterday. Cardiologic consult referred to this problem to hypercalcemia. While the reason behind this increase is not completely clear, it was thought that it may be due to vitamin D supplement he is being administered for deficiency. Tests will be followed. The male partial hepatectomy patient was doing better today. He was in pain and feeling nauseous yesterday. After passing stool and getting medication for his nausea, he started to feel considerably better. The female left lobe hepatectomy patient was continuing to have GI problems. Not only was she still not consuming as needed, but her abdominal x-ray revealed abnormally dilated bowels and gas not being passed. She was also having problems with urine excretion. It was reported that she hadn't urinated for a long period of time previous day. She was empirically given 500 mL bolus, and she only excreted 300 mL urine with very dark consistency. A female patient in the TICU, who has had two rejections to date was suffering from severe headache. She was administered hydromorphone to ease the pain, but she stated that that wasn't really helpful. She pointed her occipital and parietal areas as the areas where she felt the pain the most, which got me thinking if it was hypertension related. I checked her BP and it was 125/83. When I asked Darby, the pharmacist what her baseline BP was and what medications she was on, I learned that her normal BP was around 90's and she was being given norepinephrine and Benadryl. It was decided that she would be off the pressors and a CT will be taken to rule out any other possible severe etiology. There were several patients whose creatinine and electrolyte levels increased. I was told that it was more indicative of dehydration rather than anything serious or excess electrolyte intake. Finally, three patients on the floor were scheduled to be discharged today.

And that concluded my last rounding with the transplant team in this hospital.

Farewell to the transplant team:

After a month of early awakenings, pre-roundings with the interns, main roundings with the team, outpatient clinics, scheduled surgeries, non-scheduled surgeries, procurements that seemed to come out of nowhere, plane rides, car rides and many other experiences that I can and cannot count, it was finally time to say "Goodbye" to the transplant team. I asked the members of the team to be taken photos with to keep the memories fresh after I leave the hospital, and they kindly accepted. I expressed my gratefulness to each and every one of them and told them what their kindness, acceptance and willingness to teach during the time I was at the hospital meant to me.

I turned my scrubs in, put my regular clothes on, stepped out of the main entrance and took one last look at the hospital. And just like that, my month at IU Health was over.

Figure 48: Dr. Kaviani, Dr. Sonal, NP Lindy and I

Figure 49: Dr. Ekser and I

CITIES TRAVELLED

INDIANAPOLIS

After dinner with Mutlu and Arman families

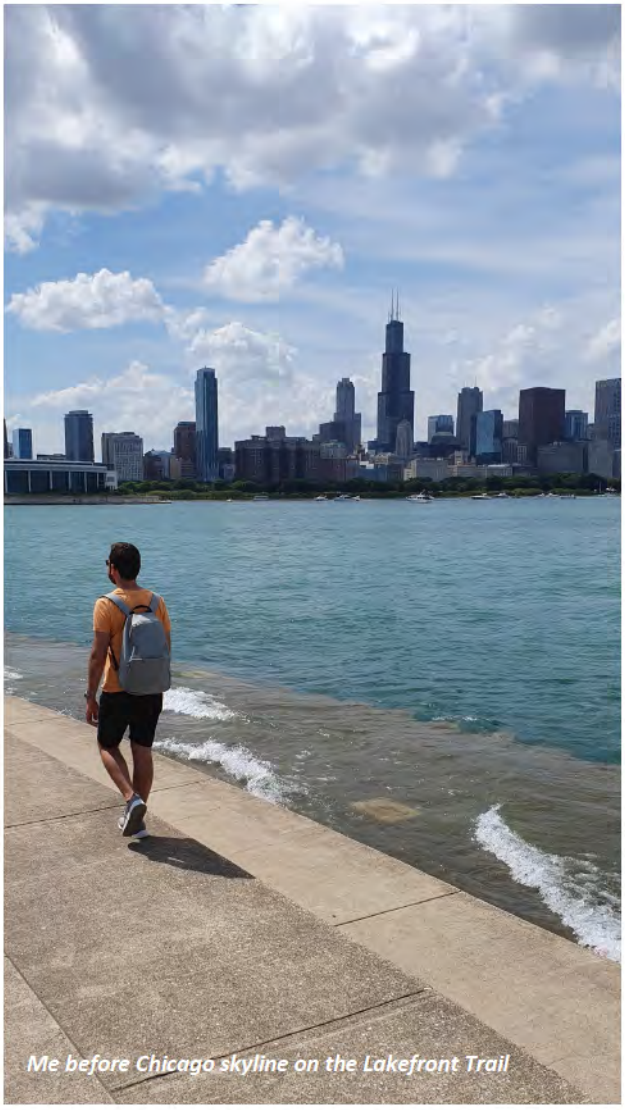
At Downtown Indianapolis

Emre, Emir and I kayaking at Turkey Run State Park

By the Indiana Central Canal

The house I stayed at in my first 20 days in Indianapolis

CHICAGO



Me before Chicago skyline on the Lakefront Trail

Millenium Park

Emre, Emir and I eating at Lou Malnati's Pizzeria

Chicago skyline from the top floor of 875 North Michigan Ave

NEW YORK CITY

Times Square


South pool on the site where the South Tower of the World Trade Center once stood


One World Trade Center


The view of Statue of Liberty from Battery Park


The Vessel at the Hudson Yards

On the Brooklyn Bridge

The view of Empire State Building from Broadway/East 21st St

Brooklyn and Brooklyn Bridge seen from Eastern Manhattan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