

## **ERFAHRUNGSBERICHT**

**Großbritannien, London**  
**University College London Hospital**

**Famulatur**  
**Pädiatrie**

**03.02.2014 – 28.02.2014**

**Supervisor:** Dr. Ananth Shankar, Dr. Steven Daw

**Ward:** Children and young people's services

-T11 (under 12- year olds)

-T12 (13-18 year olds)

**Clinic:** Adolescent Neuro- Oncology, Adolescent Haematology

### **1.1 General information**

From Monday, February 3rd 2014, until Friday, February 28th 2014, I will perform a clinical attachment at the UCLH in the department of paediatric haematology- oncology. The first 2 weeks I will work together with Dr. Shankar, who cares for the oncological patients in the ward and in his clinic. The following 2 weeks Dr. Daw will supervise me. He is in charge of the haematological patients.

I will write a weekly report about my different experiences in the hospital, including what the new things are that I have learned what I find interesting or disturbing. At the end of my stay I will then be able to reflect on how this attachment has enlarged my knowledge and skills in this particular department, if I eventually managed to meet my expectations and what could have worked out better.

### **1.2 Expectations**

I have been planning to do most of my clinical traineeships abroad, because I like being away for a while and getting a different and much more differentiated view on things.

So I think one of my main goals in this attachment is very general: to be in a different country, work in a foreign hospital and get to know the way things work in a non-German hospital.

In addition to that I think that when being abroad, one will always face different and new situations that need to be handled and I think all those challenges will help me to grow, not only intellectually, but personally as well. Another very important aspect of being abroad is the fact that one is challenged to question everything that is so very normal at home. I am hoping to reveal some of these habits and form my own opinion about how things are done in England and in Germany.

I am mainly interested in paediatric/ adolescent haemato- oncology, so I am hoping that I will learn a lot about the different diseases that are treated at UCL in that department. But I wouldn't mind getting an insight in children with bone and brain tumors as well.

I have also just recently started my dissertation in the field of paediatrics haem-onc. So I think it would be great if I get a deeper insight in the different illnesses, their diagnosis and therapy. It would also be great if I would be able to accompany the doctors when they do a bone marrow transplantation/puncture and similar procedures that take place while the children are hospitalized.

Being involved in a small project would be really great and a fantastic opportunity to deepen my basic knowledge in a specific field. I fear though that if I am very involved in the project I would focus too much on one illness or one therapy only. Also I think since my knowledge of paediatrics and oncology is rather poor, being involved in a project would be too difficult of a task.

I would very much like to get an insight on the daily routine of a doctor at UCL, get to know patients and their history and be involved in examinations, meetings etc. so that at the end of my stay I will have a slight idea of the organization of the department, the patients and their way through the disease.

### **2. Week 1**

I have met several patients with very interesting history this week. Also I have attended some meetings with Dr. Shankar and I have accompanied other consultants as well. I have picked some very interesting cases and deepened my knowledge through research when I encountered something I didn't know before. In addition to that I have listed interesting facts and differences to Germany.

### **Week 2**

In my second week I have also met several patients and I went through their history together with Dr. Shankar. I have also attended some meetings and followed different consultants. I was able to detect some more differences between UK and Germany, but I also came across some things I already knew and put them in this report in order to remember them.

### **Week 3**

In my third week at UCLH I was with the Haematology team. I attended ward rounds, meetings and clinics.

### **Week 4**

In my last week I also attended the ward rounds, meetings and clinics. I spend a lot of time talking to a clinical nurse specialist, who gave me a great insight in their work and took a lot of time explaining ALL-treatment. I talked to 2 more patients with haematological diseases and discussed my final report with my supervisor.

## **3. Patients**

### Patient 1

L. is a 10 year old boy who was diagnosed with Osteosarcoma of left proximal Humerus and parts of the shoulder bones. In the summer of 2013 occurred a kick injury in his arm. After that he had pain in the left elbow. After complaining to his mother, she accredited his pain to the incidence. Nevertheless they had an ap image of the elbow done, which didn't show a fracture or any other abnormality. After a few days Luke started having pain in his left shoulder. They had an MRI done, which showed the tumor clearly. By the end of July a biopsy was done, which revealed he had an Osteosarcoma.

He underwent 3 cycles of Chemotherapy until he went to surgery: About half of the proximal Humerus was removed and parts of the shoulder as well. They were substituted with titanium.

After surgery Luke had more cycles of Chemotherapy and will get treatment until March 2014. He claims that sometimes the Chemo gives him shakes- he then gets an injection of Pethadine.

Concerning side effects Luke mentioned that he only had nausea during the 1st cycle which the clinical staff could control very well with medication. More side effects of the Chemotherapy were loss of weight, loss of appetite, hair fell off. His Chemotherapy is Mifamurtide. I had a long chat with Luke and he was very open to all of my questions. After I had taken record of all the medical history, I carefully started asking him questions about how the diagnosed had changed his life outside of the hospital.

Luke went to school during treatment and he tries to go as often as he can. He has good friends at school, but he has experienced that after being diagnosed, even more people started talking to him and everyone was being generally nice to him. The teachers had given year 5 and 6 a briefing and explained Luke's situation. Luke says he is happy they did that. He wears a hat to school and he likes wearing the hat. By the time now he even has so many hats to wear that he switches them very often. Once he is inside with friends, he takes it off. His friends and family are very supportive and instead of finding it annoying Luke finds this rather encouraging. I found this conversation very touching. I was having troubles to say words like "cancer", "hair falling off", "Chemotherapy" out loud and actually was a bit ashamed of that, whilst Luke talked about it in such a grown up way. That made me look a bit stupid, I felt.

### Patient 2

I saw a patient in clinic with a Glioblastoma multiforme stage 4. It was very impressive for me to see a patient like this. The patient was a young man who was sitting a wheelchair which was pushed by his mother. During the whole conversation, he didn't say a word. He once lifted up his thumb in order to let us know he was feeling okay. He couldn't hold up his head and he was only moving the right side of his body. Consultant Dr Stoneham had a long conversation with Mum about further treatment and how things were going. The mother appeared to me as very tough, caring and strong. I don't think I can fully imagine the situation she is in, having one child diagnosed with high grade GBM.

I had a conversation with Dr Stoneham after they had left. She said that she believes he has not only troubles with the efferent parts, but with the afferent parts as well. So he might not always understand what his mother or the doctor is saying to him. I found this very eye-opening. I have studied Glioblastomas already and I should have known that they are incurable, but I had forgotten about those details. I think now after seeing this patient, I have a face to that disease and I will be able to better remember what kind of an aggressive disease this is.

### Patient 3

Another patient I saw at clinic was a young girl with a Medulloblastoma, who presented herself with back pain. The pain was located in the region of the second surgery- the Medulloblastoma had spread along the spinal cord down to the lumbal region and had caused problems there. They resected parts of it, and now there was a small lump visible, probably filled with CSF. Dr Stoneham explained to better leave it alone and not manipulate it, since that could introduce infections.

### Patient 4

I saw this patient at Dr Shankar's clinic. He has a history of a lump in the inguinal region. It was removed and diagnosed as a Hodgkin Lymphoma. The only possible treatment for this patient was surgery. After the surgery he had a lump on the other side in the inguinal region. A biopsy showed that there was nothing suspicious. The patient came to clinic because he could feel a lump in his left armpit and was

worried. Dr Shankar asked him about an infection recently, cough, sore throat and if he has been working out a lot (because all of this can irritate the lymph nodes and they can swell in the course of an infection. None of this was the case. Dr Shankar then palpated the lymph nodes in the neck region, axillary and inguinal nodes. He could palpate a 1x1 cm big node in the left armpit with no sign of lymphoma. Also, Dr Shankar explained to me that it is very unlikely that this node is a Hodgkin Lymphoma, as they spread along the lymph nodes. Since the HL was in the inguinal region and the new one is in the axillary region, Dr Shankar said he is not worried it might be a HL. He told the boy to come back to check everything in 3 months.

#### Patient 5

We examined the cranial nerves of a young girl. The nerves up to the 6th were inconspicuous. The 7th, 9th, 11th and 12th cranial nerves showed abnormalities: her smile on the right side was attenuated, her Uvula moved to the left, her speech was slurred and food stayed in her mouth while eating. The lesion was in the region of medulla and pons. The following day Dr Shankar had a long conversation with the parents. He explained that their child clinically has a 7th, 8th, 9th, 11th cranial nerve pathology with difficulties in eating, swallowing, smiling. He told them that the tumor recurred not in only 1 place but in 3 at least. Her initial tumor was higher in the brain, but now she has problems that show the tumor has moved down her brain and her symptoms are likely to represent disease progression.

The procedure with this girl is as follows: no more steroids; they are not likely to be helpful and may worsen her increased appetite. Now we will only do symptom control -> the symptom-care-team is to be informed. The parents are very understanding and say they know that Dr Shankar and his team did their best and are now at the end of their possibilities. Dad wanted to know how much time his daughter will have to suffer, and Dr Shankar hesitated telling them an exact time frame, as it could happen very soon (the tumor is close to the breathing centre, so she may go away as she sleeps) or in a few weeks. It was very touching for me to witness that kind of conversation. Even though I had no emotional contact with either the patient or her parents, I felt a lot of sympathy for them. It must take a lot of practice for a doctor to undergo a conversation like this, and I think topics like that are not taught enough during the course of medical school. There should be more information and practice.

#### Patient 6

I saw a patient with a classical midbrain syndrome: ptosis on the left eye, the right eye turned lateral, she had a tremor of the right part of her body, her muscle power on the right side was reduced, her eyes couldn't look up to the maximum, vertical nystagmus left eye, Babinski sign was positive. She had a hydrocephalus and therefore a vp- shunt. The site on the abdomen was a bit painful, so we did a swab. The further procedure will be: more Dexamethasone against the shivers.

#### Patient 7

We examined a young man, 17 years old, who used to be a lifeguard. He came to see Dr Shankar in November 2013. He reported that since August 2013 he felt weaker, his mum overtook him in running and after a while he could not lift his right leg. The weakness continued to become worse he noticed changes of sensation on the right side and visual problems. A scan showed that there was a change but they were not sure what exactly it was. So they started to give him some steroids. After a while they were certain that the lesion was in the mid brain and a biopsy in October 2013 showed that it was a low grade pilocytic Astrocytoma.

As they started to wean the Steroids, he became weaker. They started Radiotherapy and got rid of the Steroids. Then he started to fall several times and had almost no function in his right hand.

He responded well to the treatment and gained more function in his right side of his body.

He now presents again with weakness in his right hand and difficulties walking. Dr Shankar assured him that he is certain that the tumor is not getting bigger. He explained that during Radiotherapy the tumor starts to die and blood vessels are damaged. That means they leak fluid. That fluid will surround the tumor, so in the scan it will be very difficult to distinguish the tumor from fluid. He also explained that the Steroids will keep the inflammation low and that he will therefore put him on steroids again. If he would not get steroids, his muscles will continue to become weaker. So Dr Shankar's suggestion was to start again with the steroids and then gradually stop them. He pointed out that the lesion is in the mid brain where all the fibres are coming together, so little damage will have a big impact.

He assured the patient that he will be on steroids for about 3-4 weeks and that the oedema in the brain will get better through it. His function in the right side of the body should come back as well then. Dr Shankar said that he will use Dexamethasone because it penetrates the brain well and can be reduced better. The patient says he does not like the steroids because they keep him up at night. Another Doctor explained that the timing of taking the steroids is very important and that he should try and take them in the morning. But she also pointed out that we all have steroids in our body and that they are being secreted during the day, so he taking the steroids might cause the steroids to accumulate.

Even though Dr Shankar said that he expects his symptoms to improve after the steroids, he also made clear that once the steroids are weaned, his symptoms may reverse, which would mean he would have to be on low dose steroids again. He showed the patient and his parents the scan, which showed clearly that the tumor was close to the 4th ventricle, which can cause obstruction. Once we think the tumor obstructs the ventricle, we will do a CT scan.

Examination showed that he has less power on the right side of his body, when walking he has difficulties to move his right leg forward properly. His right leg is held in extension and his right arm is flexed. He

also has a right side facial paresis. His face looks puffy. His head was partially shaved; he was in no obvious respiratory stress. He had difficulties looking lateral with both eyes. We would expect the plantar reflex to be positive. As a conclusion to all of the symptoms mentioned, we think he has a right side upper Moto neuron lesion, which is represented on the left side of the brain- so we think he has a tumor in the midbrain including a part of the pons.

#### Patient 8

History of A.A.

##### General History

A. stated that she had an infection about 4-5 months ago. She could feel a lump on the right side of her neck. She went to GP, who gave her Flucloxacillin. The lump was still there after 1 month and she started to feel worse: coughing, vomiting, back pain, temperature. She then went to the hospital Newham in January 2014. They examined her and said that she had a chest infection. They explained the enlarged lymph node with the fact that when you have an infection, your lymph nodes become bigger. They prescribed Amoxicillin. That actually helped her getting better, the coughing went away but the lump was still there. After the treatment she went back to GP, who did a blood test. It showed that she has low iron, but there were no signs of infection. Her cough and all the other symptoms came back. Her GP then made referral to paediatrics hospital. The appointment was not until April 2014. He gave her Flucloxacillin again. A. felt worse and worse every day. About 2 weeks ago she then went to A&E, who again said that she has a chest infection. 2 days later she noticed a lump/swelling in the middle of her neck, which she found very irritating and worrying. She started having problems swallowing. She went to Newham again and stayed there from Monday to Wednesday last week. He was admitted to UCLH on Wednesday last week. Since then, a lot of scans have been made. A CT-Scan showed enlarged lymph nodes in her chest and stomach. A TB-Test on her skin was negative, and also the blood test for TB was negative. The following tests have been made: x- ray, ultrasound, CT- scan, PET- scan, blood tests, Biopsy. A MRI is planned for Monday. Her lymph nodes in her stomach are about 4-5 cm big, and the scans have also showed enlarged nodes in her chest. Functional test have showed that her liver and kidney function are fine.

##### Specific History

The first lymph node that she could feel on her right side of her neck was painful at touch, but didn't hurt when she left it alone. During the treatment with antibiotics it got bigger. In the last 2-3 months she has noticed that the node on the right got bigger until it reached from her right ear to her upper clavicle. In January she noticed a second node on her left neck, which hurt less than the one on the right.

In terms of the specific characteristics of the node on the right she said that the skin over it has never been red or swollen, she could move it around in between her fingers under the skin and it felt quite hard. Her vegetative history had many findings:

She has had headaches since she could first feel the lump in her neck. She also felt dizzy. Sometimes that was so strong that she couldn't get up to get water or the mail from outside. The headaches were constantly existing during the day. Recently she only has headaches that last for about 5-10 minutes and then they disappear. She has difficulties swallowing once the middle part of her neck started to swell. That started on Saturday 1 week ago. She reported of having massive pain in her lung that prevented her from lying down. She said she felt like she was going to die. Since 4-5 months she has had a cough and brings up clear mucus. She vomited a few times in the week.

She could always feel her heart beat and she could feel it beating really fast. Also when she was at rest she could feel it beating fast. She has had no diarrhoea and had no problems passing water.

3 months ago she started having a fever. When it started, she only had it a few times. But since January she had a fever every single night. She has heavy night sweat, her clothes would always be soaked and she needed to change them. She still has a temperature now, which is usually 38 degrees. Yesterday it was up to 39 degrees. She lost weight, but could not really say how much. She realized it when she put her pants on and they would fall down. She also noticed that her feet were swollen. Her fingers hurt sometimes and are stiff. She did karate before, and could handle it in the beginning. But 2 weeks ago after practice she was very sore and felt really tired. No previous diseases, no previous operation.

She took iron tablets. No allergies. Both her father and mother have Diabetes. No other malignant diseases in her family, no lymphomas. She lives with her parents and her dad's mom and her little sister, 11. She goes to school and is attending year 9. She enjoys going to school, her favourite subjects is Science. She says it's hard going on and off of school, because she has had all those infections. Her parents want to keep her away from the school, but she usually likes to attend.

She is now waiting for the results of the biopsy, which will probably be done on Thursday.

Now she is taking Paracetamol and Codein twice a day. On the 20th of February she received the confirmed diagnosis of Classical Hodgkin Lymphoma stage 3B. She was sent off home on order to have her bracelets removed. She will be admitted to hospital again on Monday, 24th of February. The following procedures will be conducted: MRI MELT, Consent, ECHO, PICC. Since she is stage 3B, she will receive 6 months of treatment.

#### Patient 9

History of C.R.

## General History

C. is a 14 year old boy from Gibraltar who has a history of colds in October and November 2013. He states that he had one cold after another and he just would not get better. He was coughing and generally not feeling well. He was short of breath, but he did not have any temperature. He then went to GP, who gave him a drug against the cough. His symptoms did not improve whatsoever. His grandmother then took him to a private doctor. After examination the doctor thought that C had Asthma and gave him medication (inhaler). C's cough did not improve and he was still not feeling well. He consulted GP again on the 17th of January 2014, who sent him to hospital. An x-ray showed an infection in his lung, which is why he received antibiotics (Ceftriaxone and Clarithromycine). He stayed in hospital and another x-ray was done a week later: it showed a mass in his mediastinum. A CT scan from the 11th of February showed a 9 cm mass with compression of right main bronchus, small pleural effusion, small apical Pneumothorax and a widened mediastinum. C was sent to UCLH. He was admitted here on the 12th of February 2014. He has had several scans and examinations done: ultrasound, x-rays, CT- scan. A CT- guided biopsy showed a Non- Hodgkin Lymphoma. A chest drain was inserted as the pneumothorax was much larger than expected. On 19th February he started Chemotherapy.

## Specific History

When his symptoms started in October, he was only coughing. He did not bring anything up. Also he was short of breath. He had no temperature and no night sweats. He did not have any pain anywhere and did not notice any lumps. He had no difficulties swallowing and had no headache. The only time he has had a bit of a temperature was by the end of January. He has noticed fatigue since October, he was very tired during the day and did not have the motivation to get up and do anything. He also noticed a decreased appetite and therefore lost weight. Regarding pre-existing illnesses, he broke his arm, his left auricular finger and his left ankle. None of this was treated with surgery. No other pre-existing conditions known. Before his symptoms started he did not take any medications regularly. Once his symptoms started he received antibiotics against his supposed lung infection and an inhaler against his supposed Asthma. He does not have any allergies. He has never smoked, but his Dad used to smoke inside the house. He has now stopped smoking. His family history is negative in terms of Lymphoma, cancer or any other severe disease. He comes from Gibraltar where he lives together either with his father, his paternal grandparents or with his maternal grandmother. He usually switches houses every few days and lives mainly with his paternal grandparents. His mother suddenly passed away at the age of 35 years when he was 6 years old. Neither his grandparents nor him knew the real reason, but mentioned something about embolism. C has 1 older stepsister, who is 17 years old and one younger brother, 11 months. 1 sibling is due in August 2014. He is currently attending year 10 in Gibraltar. He enjoys going to school, his favorite subjects is carpentry, which is what he wants to go for after school. They have 11 years in total in Gibraltar. Once he is done with his treatment in 6 months he will be able to go back to Gibraltar. His school is informed about his diagnosis and his treatment. Once he is off treatment he will be able to go straight back to year 11, he will not have to repeat year 10. He is in touch with his friends and told them about his diagnosis. They were surprised and did not expect this to happen, but they are okay with it and support him. They are very much looking forward for him to come back to Gibraltar in the summer. C likes to play football with his friends after school. He says he has accepted the diagnosis and the following treatment. At the moment he feels fine and does not have any fear or worries.

His regular prescriptions include:

Allopurinol 300 mg  
Ranitidine 150 mg  
Prednisolone 60 mg  
Ondansetron 8 mg  
Domperidone 20 mg

For once only:

Furosemide 10 mg

As required:

Paracetamol 1 g  
Lorazepam 1-2 mg  
Oramorph 2-5 mg – 5 mg  
Salbutamol 2-10 puffs

Infusion:

0.9 % NaCl 1 litre  
0.9 % normal Saline + 5% Dextrose 1 litre

Protocol:

BNHL Guidelines  
Group B Reduction Phase COP 1  
Vincristine 1,9 mg  
Cyclophosphamide 580 mg  
Prednisolone 60 mg

Patient 10

Classical Hodgkin Lymphoma

The patient presented with enlarged lymph nodes in his neck, supraclavicular and mediastinal. This is a stage 2B HL. It is 2 because it is only on one side of the diaphragm but more than one area is affected. It is B because he had B-Symptoms (which consist of fever, night sweat, loss of weight). He started treatment in September 2013 with 4 cycles of Chemotherapy (Vincristine, Etoposide, Prednisolone and Doxorubicin). A PET- scan in February 2014 showed no signs of active nodes. Dr. Daw asked the patient the following questions: Pain? Signs of infection? Fever? Night sweat? Rashes? Itching? Swollen glands? The plan for the patient is to come and see Dr. Daw in clinic every 3 months. Another MRI will be done in 3 and 12 months as well as an x-ray. Once the patient is 6 months off treatment he will need vaccines.

#### Patient 11

Patient: Hodgkin Lymphoma

He presented with alcohol induced chest pain, which is a typical symptom for Hodgkin. He had no peripheral lymph nodes. An imaging showed a mediastinal mass. A biopsy was done here and showed a classical Hodgkin Lymphoma. A Staging was done, which showed he had no peripheral nodes, only the mass in his mediastinum. So he was Stage 1A and therefore received 2 cycles of Chemotherapy. After treatment a PET and MRI were both negative.

The patient was now about 4 months off treatment. He complained of having had a cold and feeling very exhausted after playing football.

The parents asked about the difference of MRI and PET scan. Dr. Daw explained it to them by saying that in the MRI you see the location of possible nodes and their size, but not their metabolic activity. In order to measure the activity of the tumor, the PET scan is done. This is the most accurate scan in predicting if the disease is still active or not. If it still active, the patient will receive radiation. The PET shows if the residual lumps are only necrotic tissue or if they are active cells. We don't do PET scans in follow up, because there are a lot of false-positive results (when someone has a cold, the lymph nodes become bigger and are active). The PET scan is instead very useful in order to decide if radiation is necessary or not. When the PET is clear, there is a 95% chance for the patient of being cured.

#### Patient 12

C. is a 12 year old girl who was transferred from Barnet. She has been feeling unwell since the summer 2013. She has had headaches and noticed a reduced physical activity. She also noticed easy bruising on bumps, but no petechial and no bleeding on brushing teeth. She presented to GP and had a blood test done in August 2013. She complained about dizziness and abdominal pain. She also had a reduced oral intake and therefore lost some weight. She denied fevers, mouth ulcers and skin rashes. Her menstruation has not started. She had a normal medical history. She received her 2nd dose of HPV in school. She does not have any allergies and was not on any previous medication. She has had 2 episodes of fainting and shaking last year. Concerning her family history, her grandparents have diabetes requiring insulin. Her mum has hypothyroidism and anaemia. They have 2 cats at home. Her parents are divorced and she has not much contact to her biological dad since the last 4 years. Her elder brother, 13 years old, is from the same dad, her younger brother from a different dad. The plan for C. is BMA and trephine biopsy. On Monday, 20th February 2014 she received the confirmed diagnosis of AML. She will be on ADE starting the 20th of February.

Her current medications are: Tazocin D3

Allopurinol

Septrin

Dexamethasone eye drops

Domperidone

Ondansetron

Cyclizine

Ensure Plus

Guideline

1. Induction- Chemotherapy: ADE

2. Consolidation Chemotherapy: 2 blocks of HD- Ara-C (Cytosine- Arabinoside)

#### Patient 13

G. is a 16 year old girl at the ward because of relapsed ALL. I started to talk to her firstly about her current symptoms, and after that we talked about when she was first diagnosed. G. had been feeling very tired in the last couple of weeks. She has also had some colds and continuously felt tired and weak. She noticed breathlessness when she was walking to school and after walking just small distances. On Monday, 17th February, she fainted. She did not actually lose consciousness, but her legs were really weak so that she collapsed. Her parents took her to A&E. They did a blood test, which did not show anything. She did not feel better, so she was admitted to UCLH on Wednesday, 19th February. She did not have a temperature and only a little cough without bringing anything up. She noticed that she felt really sleepy after school and was breathless from walking. Here, she had a bone marrow done on Thursday, 18th of February, which showed a relapse. She has started treatment on Monday, 24th February.

Before admission she did not have any headaches and no sickness. She did feel dizzy, which was also the reason of her fainting. She did not have any problems swallowing. She could feel palpitation of her

heartbeat and she could feel it really fast. She was breathless, but did not have any pain in her chest and lying down was okay for her as well. She did not have any fever, no night sweat and no weight loss. In terms of previous diseases, she had pneumonia in October 2009. She has not had any surgery. She was not on any medication before she was admitted. She is allergic to nuts. Concerning previous severe diseases in her family, her grandfather has arrhythmia, no other relevant diseases known. She lives together with her parents and her younger sister, 14 years old. She currently attends year 12 in high school and will finish after year 13 in the summer of 2015. I asked her about her symptoms before she was first diagnosed. She told me that she did not really have any symptoms. No fever, no night sweat, no weight loss, no indisposition. She was on a ski trip 1 week before she was diagnosed, which was in February 2010. She felt fine during the whole trip and did not notice any difference. She started feeling unwell on the plane back. When she arrived, she was really tired and worn out, she had a raced heartbeat and really sleepy. She has had pneumonia only a few months before that, which started out with a raced heartbeat and fatigue, so they thought it might be pneumonia again. They went to the hospital, where she had a bone marrow done. It showed ALL. She was on treatment for 2 years and 3 months. She was only on the ward for 4 weeks and had the rest of the treatment done in day care. That way she could go back to school quickly. She preferred to wear a wig to school. She said that she has good friends who supported her throughout the treatment. When I asked her about how she felt when she was first diagnosed, she said that she doesn't think she understood the whole gravity about the diagnosis, since she was only 12 when she was diagnosed. What was very hard for her was losing her hair. Other than that she tolerated treatment well. Now she is just kind of upset that she relapsed and has to be back in hospital. To me she seemed very stable. I had expected her to be a lot more upset and sad about her relapse, but she seemed to be dealing with it in a very grown up and sensible way.

Concerning her treatment, she is on the following drugs:

Mitoxantrone

IT- Methotrexate

Vincristine

Steroids

Asparaginase

4. Medication

Pethadine

It is an opioid and one of the strongest analgesics. It is an agonist on m- receptors, which means its effect is similar to the one of Morphine. One of few effects that distinguish it from Morphine is that it works better against postoperative shivering (which is probably the reason why Luke gets it when he starts shaking). It is metabolized in the kidney. Mifamurtide It is a drug against Osteosarcoma. It is indicated for the treatment of high grade, non- metastatic resectable Osteosarcoma. All of this was the case with Luke. Mifamurtide is a synthetic derivative of muramyl dipeptide (MDP). It is naturally part of the cell walls of Mycobacterium and is immune stimulatory. Mifamurtide binds to NOD2. This is a receptor in white blood cells, mostly in monocytes and macrophages. This NOD2 receptor recognizes muramyl dipeptide, which is part of the wall of bacteria. So when Mifamurtide binds to NOD2 on white blood cells, it simulates a bacterial infection and activates the white cells. The result of this is an increased production of TNF- $\alpha$ , IL-1, IL- 6, IL- 8, IL- 12 and other cytokines, as well as ICAM-1. The white cells are activated and start to attack the cancer cells.

Ondansetron

It is a Serotonine- 5 HT<sub>3</sub>- receptor antagonist used to prevent nausea and vomiting caused by cancer Chemotherapy, radiation therapy and surgery

Methotrexate

It is an analogon of folic acid (an antifolate drug). It acts by inhibiting the metabolism of folic acid. It is used for Chemotherapy, autoimmune disorders and abortion.

It can be orally administered or by injection. The most common adverse effects are: ulcerative stomatitis, low white blood cell count and thus predisposition to infection, nausea, abdominal pain, fatigue, fever, dizziness, acute pneumonitis.

Methotrexate competitively inhibits dihydrofolat reductase (DHFR). The DHFR hydrogenates folic acid to Dihydrofolic acid (DHF) and DHF to Tetrahydrofolic acid (THF). Those reactions activate the vitamin folic acid, which is indispensable for the synthesis of the nucleoside thymidine. That is needed for the DNA synthesis and purine base synthesis. Methotrexate therefore inhibits the synthesis of DNA, RNA, thymidylates and proteins.

Mtx acts during the DNA and RNA synthesis, so it is therefore cytotoxic during the S- phase of the cell cycle. That means it has a greater effect on rapidly dividing cells (malignant cells, but also gastrointestinal and oral mucosa, because they replicate their DNA more frequently).

Mtx is metabolized by intestinal bacteria to an inactive metabolite.

Temozolomide

It is used for the treatment of Glioblastoma multiforme. Temozolomide alkylates or methylates DNA on guanine residues. This damages the DNA and causes the death of the tumor cell. However, some tumor cells express a protein (O- alkylguanine DNA alkyltransferase), which is encoded in humans by the O-6-

methylguanine- DNA- methyltransferase (MGMT) gene. This protein enables the tumor cells to repair this type of DNA damage.

One of the very important characteristics of Temozolomide is that it is able to cross the blood- brain- barrier, which is why it is used against Glioblastoma multiforme.

Fludarabine

It is a chemotherapy drug used in the treatment of hematological malignancies (e.g. leukaemia, lymphomas). It is a purine analog and therefore interferes in DNA synthesis.

It can be given orally or IV. Being a purine analog, it inhibits the DNA synthesis by interfering with ribonucleotide reductase and DNA polymerase.

One of the side effects of Fludarabine are lymphopenia, which as a result can lead to opportunistic infections. Patients therefore are often treated with Cotrimoxazole in order to prevent an infection with Pneumocystis jirovecii pneumonia. Blood transfusion might become necessary, which can then lead to graft-vs.-host disease. It also causes anaemia, thrombocytopenia and neutropenia. That requires regular blood count monitoring and eventually blood or platelet transfusion or G-CSF injection to boost neutrophils count.

G-CSF injection

Granulocyte colony- stimulating factor is a glycoprotein that stimulates the bone marrow to produce granulocytes and stem cells. They will then be released into the blood stream. It also stimulates the survival, proliferation, differentiation and function of neutrophil precursors and mature neutrophils. The signal induction pathway G-CSF uses is JAK and Ras.

The biological function of G-CSF works as follows: G-CSF receptors are present on precursor cells in the bone marrow. When G-CSF stimulates the receptor, it initiates proliferation and differentiation into mature granulocytes.

G-CSF stimulates the production of granulocytes. It is used with cancer patients to accelerate recovery from chemotherapy, which will allow higher- intensity treatment regimes.

G-CSF is also used to increase the number of hematopoietic stem cells in the blood of the donor before collection by leukapheresis for the use in hematopoietic stem cell transplantation. Since I am working for a student organisation that aims to typecast young people in order to help patients with hematological diseases, this is a very interesting fact I just came across. I knew that something was given to make the cells in your bone marrow proliferate and be washed out into the peripheral blood stream, but I never really knew what exactly it was.

Cyclophosphamide

It is an alkylating agent which adds an alkyl group to DNA (to the guanine base). This interferes with DNA replication. It is used to treat cancers and autoimmune disorders. Since it is a prodrug, it is converted in the liver to active forms that have chemotherapeutic activity.

Vincristine (brand name Oncovir)

-vinca alkaloid

- mitotic inhibitor

-binds to tubulin dimers -> inhibits assembly of microtubule structures -> arresting in metaphase

Cyclophosphamide

-alkylating agent

-adds alkyl groups to DNA (to guanine base) -> interferes with DNA replication

Prednisolone

-synthetic glucocorticoid (derivate of cortisol)

-used to treat inflammatory and auto- immune conditions

ABVD

-chemotherapy regimen

-1st line treatment of HL

-consists of: Adriamycin (doxorubicin/ hydroxydacnorubicin: H in CHOP)

Bleomycin

Vinblastine

Dacarbazine (similar to procarbazine)

BEACOPP

-chemotherapy regimen for treatment of HL

-used for patients in stages > II or early (IA/ IB) with unfavourable risk factors

- consists of: Bleomycin

Etoposide

Adriamycin (Doxorubicin)

Cyclophosphamide

Oncovir (= Vincristine)

Procarbazine

Prednisolone

CHOP

-chemotherapy regimen used in treatment of NHL

-consists of: Cyclophosphamide (alkylating agent)

Hydroxydaunorubicin (doxorubicin/ adriamycin) (intercalating agent)



Oncovir (Vincristine): binds to tubulin -> prevents cells from duplicating  
Prednisolone: Corticosteroids

## 5. Meetings

### Radiotherapy Meeting

The meeting took place at the ward and was attended by consultants and radiotherapists. It takes place once a week. The team discussed every patient currently receiving radiotherapy at UCL and at GOSH and talked about problems that have occurred, changes in the program etc.

### Neuro- oncology Meeting with MDT

MDT stands for multidisciplinary team. That meeting took place at the grounds of Great Ormond Street Hospital (GOSH). University College London (UCL) and GOSH work very closely. Part of the multidisciplinary team were oncology consultants from both hospitals, surgeons and radiotherapists. We looked at every image of every patient currently receiving treatment at either UCL or GOSH. Usually there were previous images available, so that you could really see either improvement of the therapy or a relapse. That was very impressive to see.

Sometimes there was a discussion on whether to operate or not, and it was clear who of the surgeons and radiotherapists favoured which treatment.

To give an example: One patient was a new born girl with an infratentorial lesion. The question here was: can this child survive a surgery, yes or no? I did not quite understand the arguments, since the surgeon said it is resectable. But in conversation with Dr. Shankar after the meeting he explained to me that babies have a blood volume of about 500 ml, and adults have 5 l. A tumor of that size is very well supplied with blood. Taking this tumor out would mean too big of a loss of blood for the baby, and it will eventually die during the operation. At the end of the meeting, a research study was introduced: "Understanding decision making for children with high risk brain tumors: A prospective, longitudinal Study of Parents, Children and Clinicians to Provide Guidance for Clinical Consultations". The study was explained and the girl presenting it asked the attending consultants to give their approval for the study in order to support them during the course of it.

### Clinical safety Meeting

This meeting takes place once a month and is attended by nurses and consultants of ward T11 and T12. They are having a discussion about the problems that have happened at the ward. One nurse presents each case. The occurred incidence is described in detail and everyone attending the meeting can add more information. The group discusses about how this could have happened and what circumstances could have been in the way. Then the nurse explains what action was taken after the incidence. In a discussion the group tries to find a result for how to prevent those incidences and what steps there need to be taken and who is responsible for what part.

I will give some examples of the discussed cases:

- Incidence: Someone gave evening medication (Rifampicin). Following administration the person went to sign the drug chart and realized the dose had been given and signed 2 hours earlier.

Action taken: informed doctor, monitored patient closely and checked BNF for adverse effects

- Incidence: Levomepromazine was prescribed oral or IV -> patient fainted because it was applied in an inappropriate way

Goal for the doctors: Clearly indicate the route of administration

- MTX- level was taken with other blood at 12 am. No pad was found to send the blood. Labs could not process the blood -> results were delayed -> patient treatment would have been delayed

Anyone working on ward T11 or T12 can fill in a form online. It is anonymously, so no one will have to fear trouble. Furthermore this meeting is not taking place to blame someone, but to evaluate the problems and find a good solution for them.

I found this meeting very interesting and I think it's very useful. The atmosphere was also very positive, everyone could add something into the discussion, no one was angry. In total I had the feeling of this being very productive. But one thing remained unclear: what happens with the results that everyone comes up with at the end of each case? How are they presented to the rest of the staff? Is there another meeting for it?

### PTC TYA MDT Meeting

->Primary Treatment Centre Teenager and Young Adults Multidisciplinary Team

This meeting takes place once a week and contains psychological issues that arise during the hospitalization of a child, be it newly diagnosed, there for follow up or relapse.

The multidisciplinary team consists of consultants, nurses, psychologists, dieticians, social workers, teachers and occupational therapists.

The content of the discussion are written down: details of MDT discussion, agreed action/ allocation. On a Screen everyone can follow what is discussed and what the next steps are.

One very sad case was a boy who is newly diagnosed with Osteosarcoma in left tibia. Apparently he keeps having fights with his mum and she is struggling with the situation. A few days ago she had yelled at him, run out of the hospital leaving her son standing there with no keys and no other way to get home. Plus, he was on crutches and wasn't supposed to put weight onto his leg. The team discussed on

how to talk to the mother about it so that she understands the situation better and can then deal with it in an appropriate way, if the boy has a mobile phone just in case things like that happen again. Another case: A boy is diagnosed with Astrocytoma. He thinks "Oh everything will be fine", so the parents worry a lot about the question: what if something is NOT fine- how will they find out about it, since the boy is 18 years old?

#### Teaching

The teaching was about Neuroblastoma. I found it very interesting and effective, as I have come across at least 2 Neuroblastoma patients without knowing very much about it.

I will not summarize the presentation, but write down the things that I have learned from it and that I searched to find a bit more information about.

Neuroblastoma is a disease of the sympathetic nervous system, so it can basically occur anywhere along the spinal column, head-/ neck area, thoracic, abdominal and pelvic region and on all sympathetic trunks. Very often it is found in the adrenal gland.

Due to the various places it can occur, the symptoms the patients present themselves with vary as well and can be difficulty to breathe, abdominal pain, back pain etc. Raised blood pressure and diarrhea are also very common, due to the hormonal activity of the tumor.

Raccoon eyes are a sign of a retrobulbar Neuroblastoma.

When it comes to the diagnostic, a few things are very important:

-MIBG scan (Metaiodobenzylguanidine): this is a nuclear imaging test that uses the radiopharmaceutical MIBG to help locate and diagnose the tumor. It examines the sympathetic nervous system. The neuroblastoma cells take up MIBG and this is shown on the image.

-bone marrow aspirate: When there is the suspicion of a neuroblastoma, a bone marrow aspiration is essential. It gives us information about whether the bone marrow is infiltrated with neuroblastoma cells or not. Very important about the bone marrow aspiration is that it has to be done on more than one place (compared with leukaemia- diagnostic), so 2 aspirations on the posterior spinal crest and 2 on the anterior.

-Urine: it is tested for metabolites of catecholamines. The tumor produces catecholamines and they are being secreted in the kidney and broken down to homovanillic acid (HVA) and Vanillicmandelic acid (VMA).

-bloods: there are several markers for this tumor: LDH, HVA, VMA, Noradrenalin, Dopamin, Ferritin

The sequence of treatment includes many steps:

1. Induction: the patient receives 5 drugs every 10 days. The drugs are: Vincristin, Carboplatin, Cisplatin, Cyclophosphamide, Etoposide
2. Assessment: can the patient undergo surgery yes or no?
3. Harvest the stem cells from the patient
4. High dose Chemotherapy
5. Rescue the patient with own stem cells
6. Immunotherapy with IL-2

You give the patient antigen GD2. Neuroblastoma cells express GD2 on their surface. When the antigen GD2 binds to the receptor, it induces apoptosis in the Neuroblastoma cells.

By the end of treatment you also give cis- retinoic acid: this will allow the Neuroblastoma cells to differentiate. The differentiated cells are easier to treat than the undifferentiated ones, so that way the treatment has better effects.

#### Radiotherapy Meeting

We discussed a patient with choroid plexus carcinoma. An image showed an increased size of the ventricle and also a midline shift. Nevertheless, there is no evidence to call it a tumor. The team had a discussion whether or not to do surgery on the patient or not. The arguments were: -The neutrophiles are too low (1.5), we should wait for them to go up, because the infection risk is too high

-Do the surgery, because the neutrophile count in the circulating blood varies depending of your activity. So waiting would make no sense. In addition for that, we might wait 2 weeks for them to go up and they might not come up very much.

Another patient was diagnosed with a Prolactinom- a tumor that secretes prolactin. A way to work against this tumor and reach a reduction in growth and less compression is using dopamine- antagonists.

#### Psychosocial Meeting

We discussed a girl, L., who is newly diagnosed B cell ALL.

She had 1-3 months of symptoms. Her white count was > 100. She initially went to her GP because of dizziness. He thought she had a reflux and prescribed some antacids. Her situation got worse and she had breathing difficulties. She also noticed a rash. She went to the GP again and he said that he could only concentrate on one thing at a time, so he agreed to the blood test but didn't look at the rash. When the nurse drew her blood, she showed the rash to the nurse, who told her to see a different GP, who fully examined her. As soon as her blood results were through, he sent her to hospital as emergency. She has also had PV bleeding continuously for the previous 3 months.

The question that was raised in the team was: how could the GP have missed this? Different arguments were thrown in, such as that the GP probably sees ALL once in a few years and therefore is not used to dealing with it.

Another problem in that case was discussed: L. doesn't like to have much information, whereas her sister, going to biomedical science in college, wants to know every detail. The team made clear that definitely people cope with things differently, but there might be a time where L. really does not want to hear it but her sister does. L. says it's okay if her sister knows more than her. When the family is around, L. doesn't really talk about her problems. So the team thought that her sister might need some extra support, as she is taking every bit of information in. We need to be careful that the sister doesn't take L. over.

#### BTAP- Meeting

The meetings takes place 1th a month and is held at Macmillan Cancer Centre. Theme of the discussion are all patients with bone tumors.

Attending staff were: surgeons, orthopaedical surgeons, radiologists, consultants, histopathologists, nurse specialists and the medical oncologist professor.

Every patient is presented and the specific issue is discussed with the team. Usually one person presents the case, previous treatments and responding to it. Then images are shown of the disease, usually in comparison with previous images. The radiologist then comments on the image and explains the progress/relapse in the disease. In some cases resection pictures are shown as well as histology. The team then discusses about the current question and what to do first, second etc. For example if a patient should become Chemotherapy first and then have his surgery or vice versa.

#### Haematology Meeting at Macmillan Cancer Centre

It takes places every Thursday in the office on the 3rd floor. Attendants are consultants, clinical nurse specialists, registrars from the ward and from day care. All the patients who come in to day care on that day are discussed, as well as all the patients who come in the following week. After that the consultants go through the patients who come to their clinic on that day. Then there is a separate discussion about the patients who are diagnosed with AML and are in Maintenance. They check their bloods (Hb, WBC, neutrophiles, platelets) and if the counts are still appropriate for the dose of drugs they receive. If the neutrophiles are below 0.5 and the platelets below 50 the treatment will be stopped until the counts have recovered. If the

neutrophiles are between 0.5 and 0.75 and the platelets between 50 and 75, the treatment will be reduced to 50%.

## 6. Specials

By the end of the week I attended Macmillan Cancer Centre in order to watch bone- marrow punctures. I saw 2, which were both undertaken in young Leukaemia patients at the end of treatment. The patients were in general anaesthesia. First, the area of the puncture (Spina iliaca posterior superior) was disinfected, then a sterile cover was placed on top of it. First, the doctor performed the local anaesthesia under the skin and on the periods. Then she used a big needle and moved it into the bone under constant rotation. She then aspirated bone marrow and put one small drop on about 25 glass plates and filled 3-4 small bottles. She spread out the drops on the glass plates in order for them to be nice and flat. Then she used another needle and moved it inside the bone again for the trephine. That was put in a small case with fluids in it. The skin was cleaned and a plaster was put on it.

The third patient who I wanted to see was a 19 year old girl newly diagnosed with ALL. She had a 2 months history of headaches and general malaise, night sweat and a sore throat. She went to the GP who saw punctuated dermatorrhagia and sent her to the hospital. She was now supposed to undergo a bone- marrow puncture in order to verify the suspected diagnosis. Her Hb upon arrival at the hospital was 4.6, and another test shortly before the planned intervention was 3.2, which is probably due to dilution. They took the blood from the canula, through which the patient had received fluids previously. So they drew blood again, hoping it was at about 6-7. The anaesthetist explained to the patient that the Hb has to reach a certain level before she can undergo the puncture. The patient will be under general anaesthesia, where generally the oxygenation is not very good. If the Hb is already very low the puncture would be too high of a risk. Unfortunately the Hb was only 5.5, so the patient was sent back to the ward in order to receive 2 packs of blood transfusion and she was put on the emergency list.

It was very hard to watch all this, because the patient was very needlephobic and the medical staff was struggling even convincing her to be poked again. Also, the girl was very pale due to the low Hb. It was also very difficult to watch the parents. It was obvious that everything was very new to them and that they were very worried.

I am hoping to see the patient again during my stay, as she was admitted to T12.

On the ward are a lot of GFR- tests. They are necessary because a lot of the patients receive Methotrexate. This needs to be cleared by a certain time, so the Methotrexate clearing is measured. In order for the Methotrexate to be cleared properly, the kidney has to function right. So they do the GFR- Test. It can be either done with a canula or a butterfly. First you check where the PICC line is and you inject the radioactive marker on the other side. First you inject the needle, aspirate blood, inject sodiumchloride to make sure the needle is correctly positioned in the vein. Then you slowly inject the marker (it's irritating to the vein, so it's very important you inject it slowly). When you have injected about half of the marker, inject more sodiumchloride and then more of the marker. Then you inject sodiumchloride into the injection with the marker, in order to make sure that everything that is attached

on the wall will be injected. Then you inject the mixture of sodium chloride and marker. You measure the clearance of the marker after 2, 3, and 4 hours.

## 7. What I have learned

-Chemotherapy- Clearance ONLY in liver -> problem when liver dysfunction. Dr. Stoneham told me a story about a girl with liver failure through Chemotherapy. Her Proteins were going down and her ammonia was going up. She was sent to hospice to die. They removed her from all her treatment, and this must have been just about enough for the liver to recover, so now she is walking around going shopping. The disease isn't gone of course, but it is kind of a miracle.

- follow up for Leukaemia patients: relapse can only be seen through symptoms, NOT the blood! Kids with Leukaemia might even have normal blood count. Taking of a blood sample in follow up is a waste of time, money, personnel etc. Patients in relapse have the symptoms they had when they were diagnosed.

-Mucositis and similar side effects are a good indicator ONLY in Osteosarcoma that Methotrexate is working very good against the tumor.

-In order to palpate the spleen, have the patient roll on the right side – when the spleen is enlarged it moves to the front part of the abdomen, and if the patient lies on the right side, the spleen is palpable very good.

-when testing the peripheral vision: be at eye level with the patient! Otherwise you will achieve a better result in the upper quadrants when your own head is higher than the patient's one.

-Methotrexate is metabolized in the kidney. When a patient receives Methotrexate, the clearance of it must be measured regularly. When the kidney function is low, you can still apply Methotrexate, but in a lower dose.

-DNR: do not resuscitate

This is a legal order written either in the hospital or on a legal form to respect the wishes of a patient not to undergo CPR or advanced cardiac life support. A DNR does not affect any treatment other than that which would require intubation or CPR. Patients who are DNR can continue to get chemotherapy, antibiotics, dialysis, or any other appropriate treatments.

-Methotrexate is excreted in the kidney. The carboxypeptidase breaks down MTX. In the course of treatment there is a possibility that a patient develops a MTX toxicity, which eventually leads to kidney failure. In that case the patient receives Carboxypeptidase because his body can not break MTX down.

-Usage of steroids during RT/CT: RT and CT cause inflammation, edema, erythema etc. Steroids naturally inhibit inflammation and work against it. That is why steroids are usually used during this kind of treatment. But Dr. Shankar has told me that he does not like to give Steroids during treatment. The reason for that is as follows: During CT the blood brain barrier is broken. Due to swelling and edema the tight junctions, which are the most essential part of the blood brain barrier, will loosen and a gap will develop. This is used for the drugs to enter the brain. So during treatment we favour the edema in the brain. Giving Steroids would mean the edema will be reduced and eventually vanish, the blood brain barrier will be closed again and the CT will not operate. That is the reason why the doctors are trying to give as little Steroids as possible.

Purpuric rash

There are several reasons why a patient might have purpuric rash:

-low platelet count

-medication (Chemotherapy)

- consumption (DIC)

- infections (meningitis)

-vasculitis

Methotrexate therapy

Methotrexate causes kidney damage because it crystallises in the tubuli and obstructs them. So when patients are on MTX it is very important that the patients receive lots of fluid to flush the kidney. This is the reason the patients receive Hyperhydration therapy. They also receive Sodiumbicarbonate IV in order for the urine to become alkaline. This inhibits the crystallisation of MTX in the tubuli. The urine pH is held at around 8.

On the protocol that demonstrates the in- and output there is usually seen less urine output during the night. That is due to the fact that ADH is being secreted, which reduces the urine output. It induces aquaporine to be built in the very distal part of the tubuli. As a result of that, water is being resorbed.

Chemotherapy and Estrogens

Chemotherapy causes platelet drop. The patients have therefore a higher bleeding risk. As a result of this we give the patient estrogens to prevent the menstrual cycle so that the patient has less risk to develop haemorrhagia or bleeding.

The ovarian cycle consists of the follicular phase, ovulation and luteal phase. The cycle is controlled by the endocrine system. There are 2 situations where estrogene is playing an important role.

Firstly, FSH stimulates ovarian follicles. Giving a patient estrogens will reduce the secretion of FSH, which therefore will suppress ovulation.

Secondly, in mid- cycle there is a LH- peak, which causes the release of the ovum/egg of the dominant follicle. The remains of this follicle become corpus luteum, which secretes high amounts of progesterone

(which can be transformed to estrogens). In the case of no implantation, the corpus luteum will involute. That results in massive drop in levels of both progesterone and estrogens. That starts the menstruation.

In Radiotherapy oxygen radicals occur. They are important to kill the tumor cells. When a patient receives radiotherapy we sometimes give blood. The reason for this is as follows: Oxygen is carried in haemoglobin. During radiotherapy the Hb usually drops. This is counterproductive, because the patient needs the oxygen in order for the oxygen radicals to emerge. So we give the patients blood in order to have enough Hb to carry the oxygen. That way there can be more oxygen radicals to fight the tumor. We saw a patient on high dose Morphine, but her pupils were dilated (usually under Morphine the pupils would be constricted). The reason for this is the fact that she receives GD2- antibodies for immunotherapy. GD2 is expressed by the Neuroblastoma cells, but also on nerve cells. That causes dilatation.

Vincristine causes peripheral neuropathy. This is why every time before you give Vincristine you have to do an assessment. It includes the following questions/examinations: Constipation? Jaw pain? Foot drop? Functional difficulties? Test of power and reflexes.

Drug combination for Hodgkin's Lymphoma: Vincristine, Etoposide, Prednisolone, Doxorubicin.

The definition for the number of cycles a person receives when diagnosed with HL is as follows:

Stage 1A, 2A: 2 cycles

Stage 1B, 2B, 3A: 4 cycles

Stage 3B, 4A, 4B: 6 cycles

When patients have extranodal diseases, there is an extra -e at the Staging (e.g. 2Ae). Extranodal means that the tumor grows outside the lymphatic system (chest, bone, lung).

Chemotherapy causes death of tumor cells. The cells are broken down and all the electrolytes are released in the blood. That usually causes an increase in potassium and phosphate and a reduction in calcium. Due to that we usually check the patients' blood 3 times a day to check of the electrolytes go up very high. If they do (tumor lysis), we give them fluids in order to dilute the blood.

-The chances for a HL to come back are 5-10 %. If it comes back, it is most likely to come back in the first year the patient is off treatment.

- Patients off treatment from HL get vaccines. They must be a minimum of 6 months off treatment before he can receive the vaccines.

-The goal in ALL- treatment is to keep the neutrophils below 1.5.

-Procarbazine can cause infertility.

Radiotherapy can cause hypothyreosis.

-When I am being asked about differential diagnosis, I should always have the following concept in mind:

It can be either congenital or acquired.

When acquired, it could be: Trauma

Infection- bacterial (TB) or viral (EBV, HIV)

Neoplasm- Hodgkin's, Non- Hodgkin's

Vascular

Autoimmune- SLE, RA

This concept applies to any question about differential diagnosis and is not limited to paediatric haematology.

-OEPA includes the following drugs: Vincristine, Etoposide, Prednisolone, Doxorubicin.

Treatment ALL/AML

Regimen A: 1-10 years and WBC < 50

Regimen B: >10 years

Regimen C: if child had suspicious cytogenetics

-the intensity of the treatment increases from A to C

-the treatment for boys is usually half a year longer than for girls (girls 2.5 years, boys 3 years)

1. Induction

Asparaginase

IT- Methotrexate

Vincristin

Doxorubicin

Mercaptopurin and Steroids (by the end of induction)

2. Consolidation

Cyclophosphamide

Cytarabine

IT- MTX

3. Maintenance

-Some of the side effects of Asparaginase is bleeding or clotting. Asparaginase is given twice during induction. We want to wait for the Asparaginase to be fully cleared before a patient receives a line, which is why we give it after day 28 of treatment.

-MRD means minimal residual disease. It stands for a small number of leukaemic cells that remain in the patient during treatment or when the patient is off treatment and in remission. It is the major cause of relapse in cancer and leukaemia. It is divided in high risk MRD and low risk MRD. 28 days after the start

of treatment we expect the patient to be in remission. We test them for MRD and depending on their count, they might fall under a new regimen.

-GvHD is firstly seen on hands and feet.

-CNS prophylaxis and treatment in children:

A lumbar puncture should be performed at the time of diagnosis in all children. CNS disease is defined by presence of  $>5 \times 10^6$  /L leukaemic blasts in a CSF cytospin preparation.

- Fragmin is given when a patient has a clotting from Asparaginase. We don't give Heparin, because Heparin only prevents clotting, but does not actually get rid of the clot, whereas Fragmin does.

ALL- Treatment

-Once a patient is diagnosed, they receive hyperhydration and Allopurinol. They usually get it in their local hospital already. The reason for that is as follows: Cancer cells have 4\* more phosphate, more nucleic acids and more potassium than normal cells. The nucleic acids are converted to uric acids, which is converted to urate. This can develop into crystals and precipitate in the kidney. Also, tumor lysis can already start prior to treatment, which can cause kidney failure. So it is very important to protect the kidney prior and during treatment.

That is why we give hyperhydration (to dilute the blood from the tumor lysis) and Allopurinol/Rasburicase. In difficult cases we give Rasburicase. The reason for that is the fact that Allopurinol prevents the formation of urate acid crystals, but cannot actually get rid of the crystals. Rasburicase can dissolve them.

-blasts can start to spontaneously burst- tumor lysis before we have even started the treatment. A patient then has a massive risk of hyperkalaemia. Which is why it is very dangerous to give them potassium, even if it is going down.

-The patients on T12 are stratified according to risk. On T12 all patients are in Regimen B, simply because of their age. Regimen B is for patients in between the age of 1-10.

We always do MRD- tests on day 28. This test can detect very low levels of leukaemia cells. The result of the MRD is as follows:

$<0.005\%$  blasts: low risk (that patient will continue in Regimen B)

$>0.005\%$  blasts: risk (that patient will then switch to Regimen C)

When a patient is classified as risk, they will have another MRD at week 40:

If that shows that they did not respond, they will be taken off the protocol and will be in relapse-treatment.

If that shows that they responded, they will continue the treatment.

-If for some reason the MRD does not show any results, the patient will have a bone marrow:  $>25\%$  blasts: slow responder -> they will switch to Regimen C

$<25\%$  blasts: they will stay in Regimen B

-Patients will receive lumbar punctures and IT- Methotrexate weekly to see if they have CNS. All patients receive that on day 1, 8,15 and 28 (in induction). In Maintenance they will receive it every 3 months.

Order of treatment

1. Induction
2. Consolidation
3. Interim Maintenance
4. Intensification
5. Maintenance

Induction

-duration: 4-5 weeks

-Regimen A: Steroids (Dexamethasone)

Asparaginase

Vincristine

Mercaptopurine (starting in week 5 and continuing throughout the next block)

-Regimen B: Steroids

Asparaginase

Vincristin

Donorubicin

2. Consolidation

-Regimen B: Mercaptopurine

Cyclophosphamide

Cytarabine

IT- Methotrexate

-The treatment in Regimen B is 6 weeks.

-Regimen C: Mercaptopurine

Cyclophosphamide

Cytarabine

IT- Methotrexate

Vincristine

Asparaginase

-the treatment in Regimen C is 10-11 weeks long.

### 3. Interim- Maintenance

-Regimen B can be on 2 different protocols:

\*Basic Interim- Maintenance: Mercaptopurine

MTX oral

Vincristine

IT- MTX

\*Protocol M: high dose MTX

-Regimen C can be on 2 different protocols:

\*Protocol M

\*escalated Capizzi: high dose MTX, starting with 50 mg/m<sup>2</sup>, going up by 50 mg/m<sup>2</sup> up to 300 mg/m<sup>2</sup>

-The problem in the escalated protocol is that there can be heavy toxicity side effects (eg mucositis). So the dose has to be admitted every time. When a patient has too many toxicity side effects we can't go up in the escalation but we give them the dose they previously had.

### 4. Intensification

-it lasts for about 10 weeks

-included drugs are: Doxorubicin

Vincristine

### 5. Maintenance

-The patients are on the following drugs: Mercaptopurine

Methotrexate

Vincristine

-The goal in maintenance is the suppression of counts. We want the neutrophils to be between 0.75 < n < 1.5 and the platelets between 75 < p < 150. Research has shown that if the counts are below or above the mentioned count, the patient is of higher risk of infection and relapse. That's why the goal in maintenance is to keep the counts in this range.

-The dosage is only based on the patient's counts and the chemotherapy will be adjusted accordingly. We always start with 75mg/m<sup>2</sup> dose Mercaptopurine and 20 mg/m<sup>2</sup> Methotrexate and change the dosage then according to the counts.

-Every block is count- dependent: at the start of each block we check the bloods. We want the neutrophils to be > 0.75 and the platelets to be > 75. We check the bloods weekly, and if they don't come up after each block, we wait for 1-2 weeks for the counts to come up.

-the start date of the Interim- Maintenance is important: 2 years after the first day of Interim- Maintenance girls finish treatment, and 3 years after the start day of Interim- Maintenance boys finish treatment. So the treatment for girls is usually 2 years and 3 months and for boys it's 3 years and 3 months.

### Hodgkin Lymphoma treatment

-The first step in the treatment is the staging, which is determined through a biopsy and bone marrow. This is called risk- stratified treatment

-According to their risks, the patients are categorized into 3 different groups: Treatment group (TG) 1, TG 2, TG 3. The higher the treatment group, the more intense the treatment.

-All the treatment groups start out with 2 cycles of OEPA (Vincristin, Etoposid, Prednison, Adriamycin)

-That follows an early response assessment with PET scan and MRI. This is called response- adapted treatment. We look how well the patient has responded to treatment.

-Based on the results of the scan is the decision if whether or not the patient has to undergo radiotherapy. If the scan shows an adequate response, the patient will not receive radiotherapy; if the scan shows an inadequate response, the patient will receive radiotherapy.

-TG1: 2 cycles OEPA -> PET -> adequate response -> no RT

-> inadequate response -> RT

-1/3 of the patients who receive RT will suffer from long term side effects

-TG 2: 2 cycles of OEPA -> PET -> 2 cycles of COPDAC -> adequate response -> no RT

-> inadequate response -> RT

-1/2 of the patients receiving RT will suffer from long term side effects

-TG 3: 2 cycles OEPA -> PET -> 4 cycles COPDAC -> adequate response -> no RT

-> inadequate response -> RT

-2/3 of the patients receiving RT will suffer from long term side effects

-The side effects of the treatment against Hodgkin's is mostly only caused by Radiotherapy. Therefore the goal of treatment will always be to try and minimize the usage of Radiotherapy.

### Differences Hodgkin's vs. Non- Hodgkin's

-Hodgkin's grow rather slowly, they grow around things and patients usually have a long history of symptoms. Non- Hodgkin's have a short history, they grow quickly and they compress blood vessels etc.

-HL does not lead to tumor lysis. The treatment in the beginning will just be adequate drinking and Allopurinol. In NHL patients have a high risk of tumor lysis -> accurate surveillance of their urine output, oxygen saturation, heart rate etc is a MUST.

-Treatment of NHL: Cyclophosphamide, Vincristine, Prednison and after a while high dose Methotrexate and Doxorubicin.

- The treatment in against NHL is stronger, but patients will never need radiotherapy. Instead, they get high dose IT- MTX
- The cure rate in ALL, HL and NHL is about 90%, in AML about 60%.
- ALL is a disease of children
- AML is a disease of adults
- HL is a bimodal disease. Teenagers and adults of 20 years of age and older people over 60 are affected most.
- NHL is starts to be seen in 10-20 years old and then the prevalence is stable.

## 8. Differences

One major difference of doctors in Germany and the UK is the dress code: At UCL all the doctors are dressed in their normal clothes, which I find very irritating. I am not used to it at all, because in Germany everyone is dressed only in white (except for the surgeons, they wear green). And in Germany they wear white coats, here they don't. As an answer to my question, Dr. Shankar said it's because of the infection risk: at home you wash your clothes; in the hospital you wear the hospital clothes usually more than once. It makes sense to me, but I wonder if infections really are less spread only because doctors wear their clothes only once. Another interesting fact is that in Germany doctors are often seen as the "God in white", which is sometimes interpreted in a bad way. I wonder how doctors in the UK are seen, not wearing just white. Are they equally accepted in society (because being dressed all in white does distinguish the profession "doctor" from other professions)? Also, in Germany the white coat is kind of a sign of identification and through that the doctors can separate them from sisters. How do patients and parents make that difference, when it's not obvious?

Curtains around the bed: we don't have them in Germany. I don't actually know why not, because they make a lot of sense to me. Now that I think about it, in Germany sometimes there are 3 patients in one room, and when one patient is being observed (which usually means taking parts of the clothes off), the other patients are still in the room and can see what is going on. I think the curtains are very good to protect a patient's privacy. We should have them in Germany too.

Disposable tourniquet: apparently less infections, but more waste?

Patients have a wrist band that informs every one about: identity, allergies, current medication. We have the wrist bands as well, but they only show the name and date of birth. I think it is very good to have the wrist band with all that other information on, because it will probably lower the risk of patients becoming mixed up or getting the wrong Chemotherapy.

Nurses and Doctors work very closely together here. I have witnessed handovers with doctors and nurses together- that would never happen in a German hospital, as there usually is a big rivalry between these 2 groups. I have the feeling here they work much more together than against each other and are a much better team than in Germany. I think that doctors here pay nurses more respect and value their work more.

There are so many different departments working on the ward: doctors, nurses, pharmacists, physiotherapists, teachers, occupational therapists, psychologists, dieticians, cleaning staff, staff to deliver the food, staff to accompany patients to radiotherapy...

I am not sure if this is only because it's a paed-onc ward or if all other wards are so well equipped with personnel. I was very surprised seeing so many different people on the ward and every day I see someone new. I think that's a very good concept. In Germany, we have psychologists and teachers etc. as well, but I think they only come to the ward when they are being asked to come for a specific patient. Here I have the feeling that personnel is always there. Which is great, because it removes some tasks from people who are not really responsible to do certain things, so that they can concentrate on their own work. In Germany for instance the nurses deliver the food to the patients on some wards, make their bed etc. That puts more work on the nurses shoulders and they are more stressed.

I wonder if that kind of personnel is working on every ward or if it is only because this is paed-onk.

-Medical students in the UK don't draw blood etc. during their studies because they are not insured. They only learn it once they have finished their studies and are on their way to become a consultant. I find this really strange, because in Germany we learn how to draw blood after the first 2 years of our medical education and we keep training it during various clinical internships etc., which I find very useful. We are insured for it as long as it happens during the semester. In our semester breaks when we do clinical internship we are not insured, but we still do it then. I think it is very good in order to practice it during your studies and have someone watch over you. In Germany, once we have finished our studies people expect us to have enough practice in all invasive procedures to actually be able to do them on our own.

The student fees here are about 9.000 £ for 1 year! The students take out a big loan and once they are done with their studies they pay it back for the rest of their lives. That is a huge amount of money compared to our 360 € that we pay in Hessen.

In GB a death certificate can only be signed by the doctor who saw a patient shortly before the death and after it, no other doctor is allowed to sign it. I don't really know how it works in Germany, but I haven't heard of any kind of rule like that and I don't find clear information when I research it.



SHO's are allowed to file an application for x-rays. In Germany only a person who has performed extra training is allowed to do that.

On the ward the nurses are responsible for certain patients (1 nurse, 5 patients). They know everything about their patients, they prepare their drugs and the doctors have always a specific person to ask if they have any questions. If the designated nurse is not available, the other nurses still try to be informed about all patients. In Germany we do not have that concept where one nurse is designated for a few specific patients, but all nurses cover the whole ward. I think it makes a lot of sense to do it the way they do it here, because it will probably cause less confusion. Also, if one nurse is only responsible for a few patients, she will really know all the details about them. I also think it's a good way for giving nurses the responsibilities. A negative aspect might be that if that specific nurse is not available, the other nurses won't really know what is going on.

Bleep vs. phone: We have phones in Germany, which I find a lot better than the bleeps. I think with bleeps there is more work involved than with a phone- you check the number of the bleep, have to interrupt your work, find a phone, dial the number. With a phone, you either answer if you have time, or call back once you have finished your work.

## 9. Vocabulary/Abbreviations

-CSF: cerebral spinal fluid

-extravasation: leakage of a fluid out of its container. In the case of malignant cancer metastasis it refers to cancer cells exiting the capillaries and entering organs

-LP: lumbar puncture

-CSF: cerebral spinal fluid

-BMA: bone marrow aspiration

-pn: peripheral nutrition

-DIPG: diffuse intrinsic pontine glioma

-ng tube: nasogastric tube

-DNR: do not resuscitate

-VP- Shunt: ventriculoperitoneal shunt

-ATRT: atypical teratoid rhabdoid tumor

-DNET: dysembryoblastic neuroepithelial tumor

-PNET: primitive neuroektoderm tumor

-shingles: Herpes zoster

## 10. Recapitulation

### Blood-Brain- Barrier

The blood brain barrier is a physiological barrier between the circulating blood and the brain extracellular fluid in the central nervous system. It functions in order to maintain the homeostasis in the brain and to separate it from the one in the blood. The essential part of the blood brain barrier is endothelial cells along the capillaries, which are connected via tight junctions.

The blood brain barrier protects the brain from circulating pathogens or toxins. It is a highly selective filter which provides the brain with its essential nutrients and cleans it from metabolic products.

The filter works in a passive and an active way as follows: endothelial cells restrict the diffusion of microscopic objects (bacteria) and large hydrophilic molecules into the cerebrospinal fluid, but they allow the diffusion of small hydrophobic molecules (oxygen, carbon dioxide, hormones). The cells of the barrier actively transport metabolic products (glucose, specific proteins) across the barrier.

Parts of the barrier are also a thick basement membrane and astrocytes end feet.

### Babinski

The Babinski reflex is a pathological reflex which occurs when the pyramidal tract has a disturbance. It is only physiological in infants.

The physiological plantar reflex works as follows: sweeping the sole with a blunt object causes a downward response of the hallux (flexion). An upward response (extension) of the hallux is called Babinski response or Babinski sign. Its presence is an indicator for diseases of the spinal cord and brain in adults

The lateral side of the sole of the foot is rubbed with a blunt object from the heel to the toes.

The Babinski sign can indicate upper motoneuron lesion causing damage to the corticospinal tract.

### Bloods

white blood count: 4-10 \*1000/ mikroliter

platelets: 150-400 \*1000/mikroliter

Asthma treatment

1. b2- Agonists, eg Salbutamol

2. low dose inhaled steroids, eg. beclomethasone BD

3. >5 yrs: long acting b2- agonist, eg Salmeterol

<5 yrs/ >5 yrs: leukotriene receptor antagonist, eg. Montelukast

4. high dose inhaled steroids

5. po Prednisolone + refer to respiratory specialist

## **11. Diseases**

ALPS: autoimmune lymphoproliferative syndrome is a form of lymphoproliferative disorder. It affects lymphocytes apoptosis.

It is a rare genetic disorder of abnormal lymphocyte survival caused by defective Fas mediated apoptosis. After an infection the immune system usually downregulates itself by inducing Fas expression on activated B- and T- lymphocytes and Fas ligand on activated T- lymphocytes. Fas and Fas ligand the interact and induce the caspase cascade, which leads to cell apoptosis. Patients with ALPS have a defect in this apoptotic pathway, which leads to chronic non- malignant lymphoproliferative diseases.

They have an increased risk for developing Hodgkin's Lymphoma, but it is very rare.

They can have different symptoms: bowel symptoms, joint pain, arthritis, enlarged lymph nodes in the neck etc.

They usually undergo a splenectomy and then receive lifelong Penicillin because they are at such a high risk of infection.

## **12. Reflective Summary**

### Supervision

My supervisor for the first 2 weeks was Dr. Shankar.

When we first met he asked me about my expectations for this attachment, previous clinical exposure, theoretical knowledge etc. Having this in mind we discussed the way this clinical attachment would be most beneficial for me and decided that I join the ward round, attend the meetings, clinics, teaching and join doctors in day care. Since I had been new to everyone, he usually introduced me to everyone in the room/on the ward if possible and asked the member of staff to introduce themselves to me. That way everyone knew who I was, what my position is and who my supervisor is. I found this very pleasant and I am thankful Dr. Shankar put so much effort in introducing me to other people. I felt as if the staff members then respected me more than when I introduced myself to them. Being a complete stranger to every person and the environment on the ward, I think it was very helpful to have had Dr. Shankar to take care of that part in the beginning. Dr Shankar always told me in the mornings about what is going to happen on that day and what the schedule for me would look like. He told me where and when to either meet him or another person, if he couldn't be there. If he could not attend a meeting or the ward, he would usually speak directly to a member of staff when I was with him, introduce us and ask the person if I could shadow them at that time. I found this very helpful, since I was new and did not know anyone. Once Dr. Shankar had talked to the people, it was usually no problem for them to supervise me. I then felt a lot more comfortable meeting the person after Dr. Shankar had spoken to them than if I had to go and ask them myself and did not know the person before. In my first days we usually met at 250 Euston Road and went to where we needed to go from there. That was very helpful, since I didn't know where everything was in the beginning. After a while when I was comfortable with the hospital and the rooms, I met Dr. Shankar at the place of the meeting. We discussed my report as soon as possible, so either on that Friday of the week or the following Monday. Dr. Shankar replied to my emails right away, which was very helpful. In my last 2 weeks I was with Dr. Daw in the haematology team. The supervision of Dr. Daw was not as close as with Dr. Shankar. It was a bit irritating to me in the beginning, because I was used to something different. But it meant that I had to take care of things on my own and work my way through this, which in the end probably had helped me as well. When Dr. Daw and I first met he asked me about my expectations and told me about what I could do and see as long as I am here in order to get a broad overview about how things are done here and what haematological diseases are most common. I then worked my way through it and tried to get as much out of this last 2 weeks as possible. I talked to patients with ALL, AML, HL and NHL and wrote a full history about them. I shadowed a clinical nurse specialist on the ward and on meetings, I went to clinics with Dr. Daw and shadowed a Registrar on Day Care. I then went through the history and also the treatment of HL in detail with Dr. Daw in my second week, which was really helpful. We also talked about the differences that I have noticed and what I have learned so far.

### **Organisation**

In general I think this attachment was very well organized. I was in regular email contact with both of my supervisors before I came about starting date, content of the attachment etc. The only real problem occurred when Mrs. Apps has told me that apparently I hadn't sent in the documents, whereas I did send them 4 weeks earlier. It gave me a big shock, since I thought I would not be able to attend that attachment due to a mistake I did not make. We sorted it all out though in the end.

On the ward things were generally good as well, nevertheless I think a few things could have been done better. Sometimes I had the impression as if no one really felt responsible for me when one of my supervisors was not around. I know the ward is very busy and the work needs to be completed, but sometimes I was literally running after consultants/ registrars, because they wouldn't tell me where they

were going and what was going on. Usually on consultant ward round there was no time to ask questions about the patient, because they went in and out so fast and then discussed things very quickly in passing. So the consultant ward round in my last 2 weeks was not very useful for me at all. Sometimes I was even asked to chase the patient's drug chart or the like, which meant I did not even catch what they were saying in the patient's room.

Apart from that I really liked the way I was working here. I think it is very useful to go to all those meetings, attend the ward round, go to clinics, talk to patients, discuss patients with the supervisor, look at scans and discuss them, talk to nurses and follow them around, look up medication and write it down etc. It was useful to do all those things, like talk to the patients and write this report. But I think the most useful thing for me was the discussion with my supervisor or other doctors about a topic I knew a little bit about and could then deepen my knowledge through theirs or when I had a certain question about something I have heard or come across. But again, the discussion was usually only of value for me if whoever I talked to had a little bit of time to explain the issue.

### **Suggestions**

For the future I suggest several things:

- The supervisor should choose a few people on the ward and in day care, ask them if it is okay if a student follows them around and make sure that person knows that the student will ask questions and would like to learn something, so also tell the person to be willing to spare some minutes for explanation!
- Especially the consultant on the ward round should integrate the student more in the conversation between the doctors and should make sure the student doesn't feel left out but learns something. A student should not feel bad asking a question during ward round, and a student should expect a proper answer. Being a consultant, one could expect that he/she is able to finish the ward round in time to go meetings etc., but also to arrange time wisely in a way that students take something home for the day.
- The student should be introduced to patients in clinic and the consultant should not sit turning the back to the student, but integrate everyone on the room so that everyone is participating. The consultant should give the student a rough history of the patient and also discuss the most important things with the student once the patient has left
- Instead of telling the student what you expect from them, maybe have a sheet prepared with useful things they could do, but don't have to do, and names of people and their bleep/telephone number they could join and talk to if they think it's interesting and be of any significance for their further medical career. Also, a schedule would probably be helpful as well, where all the important/relevant meetings, ward rounds, clinics, teachings etc. are listed with date and time just to have an overview and to know what's going on, in order to then choose. I felt a bit under pressure writing this report, seeing all those patients and shadowing all those people. Sometimes this led to me sitting in the office/in day care during my lunch break and beyond writing everything down instead of either having a break or seeing patients. I just did not want to work on it during the evening, because I tried to spare that time for either studying for my exams at home or seeing the city.

### **What I have learned**

All the things that were new to me are listed separately in this report. Like I said previously it was very useful to acquire those things in dialogue with a person and sometimes with a patient also.

What I will take back to Germany/What I have learned for the future

- Question white coats
- Appreciate the work of the nurses and try to work more closely with them
- Find out if we have MDT's and if not, find out why and try to find doctors to introduce them
- Get rid of those hierarchies and treat everyone equally (this includes encouraging colleagues to treat everyone equally)
- Appreciate the fact that students in Germany are trained better in terms of practical experience during the course of their studies
- Question the fact that we don't have any curtains
- Appreciate our low tuition fees
- Look for scholarships
- Hope that my experience will carry me through my dissertation in paed- haem- onc, which will probably take about 2.5 years to finish
- Take my gained motivation in haematology back to Germany and motivate my fellow students in the team for further success in finding stem cell donors and be able to encourage potential stem cell donors better now that I have seen an actual person behind the disease
- Always accept a challenge, no matter how huge or insignificantly small it might appear. Any challenge will help you grow in many ways.
- Always try and find a healthy balance between work and fun.
- Study, and especially think, outside of the box! Don't just learn something by heart from the books, but always have the broader concept in mind and from that acquire your knowledge and make logical conclusions.

-Once you leave the lecture room, you are responsible for your further medical education. So make sure you make the most of your time and see, do, hear, feel what you think is most beneficial for your personal and educational progress. Don't let anyone or anything stop you or get in your way. If you want something, get it. If you do something, do it.