

北海道大學附設醫院放射線治療科見習心得

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從大五開始，在台北榮總的各科見習，偶爾從老師、學長姐、病人的口中提到放射治療。我總是依稀記得大四區段課程中上過的幾堂放射治療課程，但除此之外，我對放射腫瘤科的業務了解不多。出於好奇，當獲得北海道大學姊妹校交換資格，我選擇在放射線治療科見習一個月。

就結果論，被放射線治療科當成半個住院醫師訓練了一個月後，發現自己對放腫非常有興趣，於是寫信給北榮的教學部把大六的自選課程改成「重粒子及放射腫瘤部」。未來也認真考慮成為放射腫瘤科醫師。我在北海道實習的內容，大約可以分成以下幾個部分：

一、見習日常：超乎想像的充實

日本的放射線治療科目前似乎缺人，主治醫師跟資深住院醫師每周有一到兩天到區域或地區醫院支援放療。日本有很多放療機器，但是醫師人數不足。有些醫院甚至沒有放腫住院醫師的容額上限，只要申請上就幾乎保證有主治缺。作為極少數在放腫見習的醫學生，又是多年來第一位國際學生，科裡的主治醫師跟住院醫師除了拿我當練習英文口說的對象之外，也非常重視我的學習。

我注意到排班表上多了一個欄位：「Chen 桑教學負責人」，於是每天上午跟下午都有一位醫師 Teaching。實習期間，每天從早上 9 點到下午 4 點幾乎都處在忙碌狀態，除了每天會設計一到兩個放療計畫，其中也會穿插著門診教學、治療室教學、病房教學、研究會議、病房會議，每天的下午 4-5 點是 routine 的 case conference。我當天做的治療計畫也會在這時候接受科主任跟其他醫師的審視。

二、設計放療計畫：共參與設計 19 例，其中 7 例被掛名為「計畫擔當醫」。

起初，我被教導如何操作 Pinnacle 跟 Eclipse 的設計軟體，然後被分配到的工作是 contour 特定器官，例如 prostate。之後就漸漸被提升難度，例如在 MRI fusion 之下 contour pancreatic cancer 或是 HCC 的 GTV。在確認我從 CT 上能正確辨認解剖構造後，我被分派了幾個 Breast cancer PMRT 的 case，為了找出 GTV, CTV, PTV 的範圍，必須查詢 JASTRO 的 guideline。我雖然不會日文，但是看圖還有漢字大概可以瞭解意思。

實習的第二周，田口醫師認為時機成熟，就給我一個挑戰：SBRT of Rt Lung Adenocarcinoma。之前的住院醫師做出來的計畫 Conformity Index = 0.73，田口醫師希望我能做出 CI > 0.75 的計畫，於是我必須優化各式條件跟參數。因為腫瘤靠近縱膈，所以我用了 7 的 beam 從不同角度設法避開心臟，為了平衡熱區必須調整每一個 beam 的 EDW 角度跟 weight。為了讓放射線劑量更加集中，我又微調了每一個 beam 的 MLC 大小，又將 ROI 的劑量從 40Gy 提升至 48Gy。最後這個 plan 的 CI = 0.86，且 PTV > 95% over 40Gy，在 case conference 獲得其他醫師的認可，計畫被採用於病人放療。我最後也從攝影機看見 Truebeam 如何精準得執行我的 SBRT 計畫。

實在想不到，第一位被我治療的病人既不是內科的 UTI，也不是值班時的 ACLS，而是我在日本當 subintern 時幫病人 SBRT。這位病人也成為我面試北榮 PGY 時報告的 case。在未來的見習時間，簡單的 case 老師們就會放給我做，等我完成後再進行調整跟指導，例如 PMRT of the breast, prostate cancer RT 等等；較難的 case 老師們就會在旁邊指導以及跟我講解 guideline 還有放療概念。

三、門診教學與住診教學：聽不懂日文，仍收穫滿滿。

考慮到語言不通的問題，我比較多時間在做放療計畫，比較少跟門診以及查房，但還是有。在小泉醫師的頭頸癌放療門診，我學到 radiation induced dermatitis grading 的方法，若大於 grade 3 就要暫停放療。我分別看到一位 grade 2 以及 grade 1 的病人。在西岡醫師的 CNS 放療門診，我觀察老師如何跟病人做放療前準備的衛教。個案是一位術後兩周的 GBM 病人，參加了腫瘤疫苗的臨床試驗

計畫。病人是當地的眼科診所開業醫。我們都被他術後兩周的復原速度所驚訝，病人快步走進診間，對答如流。我從同意書的漢字聽老師逐條仔細的跟病人解說放療的目的跟副作用，最後看病人在充分理解各方面資訊後簽下同意書，我期許自己未來能做到完整的醫病溝通以及告知後同意。

我也跟了一次青山英史教授的查房，雖然醫療問題都在先前跟住院醫師解決了，但教授還是很關心病人的疼痛跟生活起居，他甚至讓我觸診一位頭頸癌病人下顎的腫塊。

四、Lecture and Research

青山英史教授用兩個小時的時間跟我仔細地說明放療的基本概念，我們甚至拿手機一起算了很多 EQD2。我也因此更加了解 hyperfractionation 以及 hypofractionation 對組織以及放療計畫的影響。小泉醫師也跟我講解了 palliative RT 的作用，以及帶回幾個需要 emergency RT 的 case，我了解到腫瘤急症中的 spinal cord compression 以及 SVC syndrome 需要在 24 小時內接受放療。

研究的部分，我的 clinical supervisor 打浪雄介醫師，讓我參與他研究的一部分，研究的內容是分析做過 SBRT of liver HCC 的病人，MRI FLIS score 跟 overall survival 之間的關係。因此我花了一整天看了數十位病人的 MRI 然後給予 FLIS score。

五、實地參觀：陽子線(質子束)治療、RTRT、RALS。

當初選擇放射線治療科交換實習的原因之一，是因為北海道大學附設醫院的放腫是該院全國排名最頂尖的科，據說有全日本排名前三至前五的水平。森崇醫師非常驕傲地帶我參觀陽子線治療中心。意外的發現是質子束的加速器竟然是 HITACHI 做的，然後治療中心內有 Bragg's Peak 為主題的藝術創作。我也觀看了 RTRT 的過程，是如何透過動態追蹤 gold markers，在目標進入靶心時才精準照射。最後，專長是婦科放療的木下醫師，讓我觀察了 RALS 的全過程，從導管置入，到子宮頸癌的放療計畫，最後看三根導管中的核種，在子宮頸內停留電腦根據當下放射線強度計算出的時間。

六、國際交流：

我在放射線治療科的研究會議中，花了半小時報告台灣的醫學教育，以及台灣的醫療環境現況。最意外的收穫是在會議中認識了從廈門來北到大學攻讀博士的放腫醫師，他也跟我分享了許多他在中國大陸做的 BNCT 研究，也感嘆中國的醫療水準實在不及台、日。青山英史教授也藉機在會議中分享世界各國放腫學會的合作，我才知道青山教授是今年 TASTRO x JASTRO 的 chair。由於我的分享讓科內的醫師對台灣以及對我有更深的興趣，加上鳳梨酥外交讓台灣糕點在科內大受好評，科主任在實習結束前在居酒屋為我辦了送別會。

七、結語：

從過去對放療的陌生，到 2023/10 在英國倫敦 St. Bartholomew's Hospital 的腫瘤醫學部開始認識放射腫瘤(我在這間醫院主要在腫瘤內科見習)，再到 2023/11 全心投入並且享受放腫的實習，我實在沒想過自己會在見習的過程中對特定科別產生如此的興趣。我目前非常期待 2024/03 到北榮放腫實習。或許這個見習過程就是在彼此學習與交流，我能感受到放射線治療科的醫師們在一個月當中英文口說有進步，經過他們用心的教學與鼓勵，我也找到了未來行醫努力的方向。

八、附件：由於上文以概述為主，細節可參閱以下附件。

附件一：在北海道大學放射線治療科見習的合影

附件二：我設計的 Lung cancer SBRT case

附件三：北海道大學病歷系統輸出的資料，內涵所有我掛名參與的治療計劃設計

附件四：投稿於北海道大學國際學生雜誌的實習心得

附件五：實習日記

附件一：在北海道大學放射線治療科見習的合影

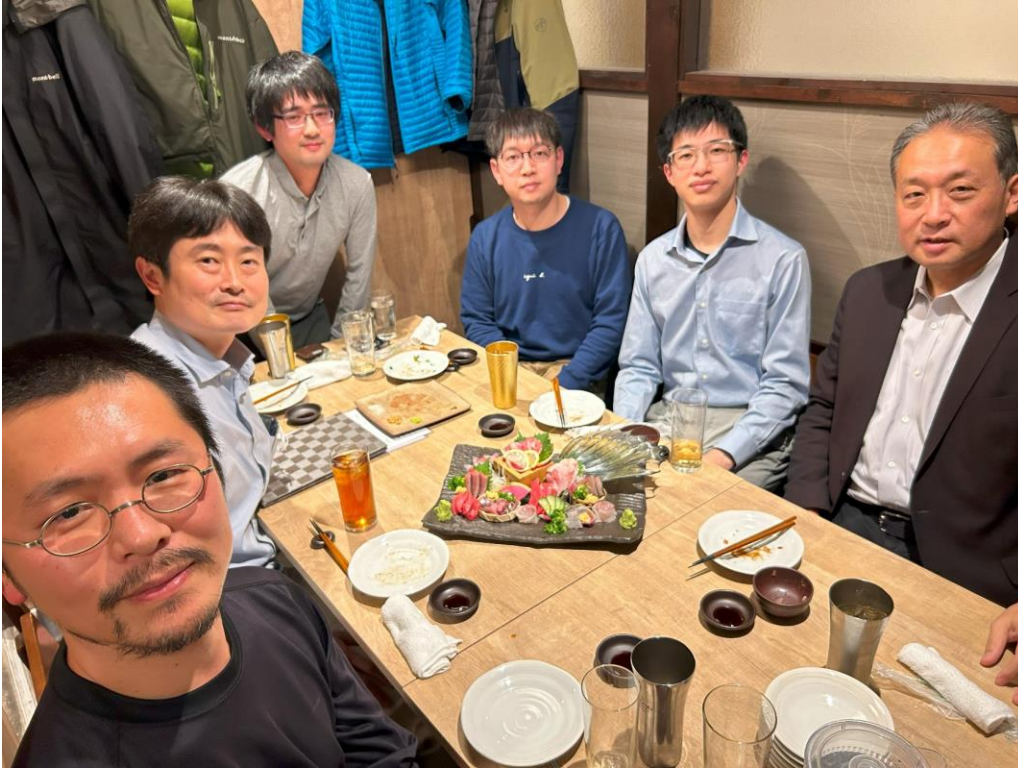


我(右五)與放射線治療科的醫師於陽子線治療中心合影



我(左二)與北海道大學醫學院院長(右一)及國際關係部長(左一)合影

附件一：在北海道大學放射線治療科見習的合影



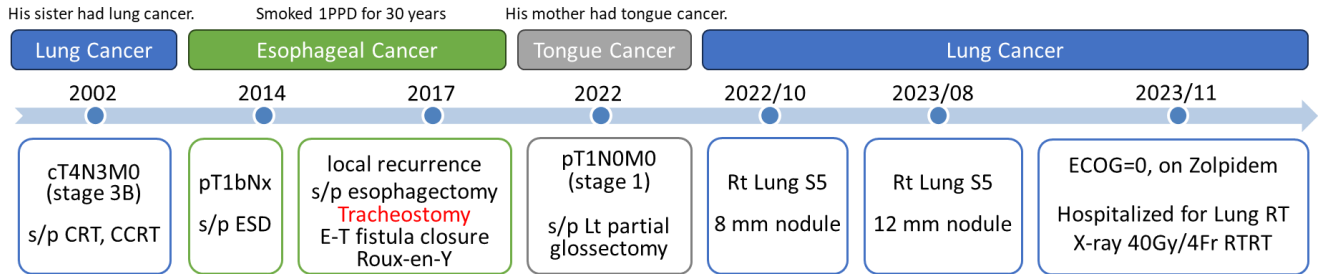
送別會與森醫師、橋本教授、打浪醫師、高橋醫師、我、青山教授(左至右)合影



北海道大學雪景

個案簡介

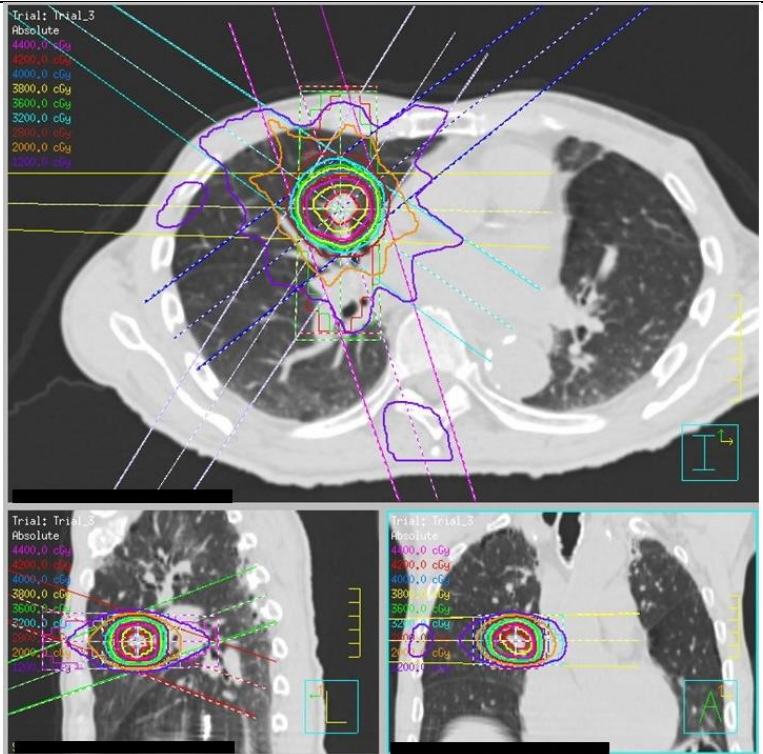
- This is a 78-year-old male with history of stroke, hoarseness (Lt recurrent laryngeal n. injury), tracheostomy, and **triple cancers** as follows:



- He was **ECOG=0** (non-restricted daily activity), and currently under Zolpidem 5 mg 2# HS.
- Social History: Retired mechanic, social drinking, **heavy smoker (1PPD for 30 years)**
- Family History: **Lung cancer (sister)**, Tongue cancer (mother).
- Medical Insurance: 50K~1.4M JPY per instance, up to 6 instances per year.
- This time, the patient was admitted for RML lung cancer RTRT.**

治療方針

- SBRT with RTRT.**
3 gold markers were implanted.
- Initial plan:
Proton beam therapy 70Gy/10Fr
but the patient refused due to the 1.6 million JPY copayment.
- Final plan:
X-ray RTRT 40Gy/4Fr
PTV: 95.61% > Max dose (> 0.95)
Conformity Index = 0.86 (> 0.75)
Heart, Lung, Spinal cord doses within limits.



結論與心得

- 這位病人的放療計畫是我在北海道大學附設醫院見習時設計的，計畫經過放射線治療科的老師核可後被實際用於治療病人。
- 肺部腫瘤會隨病人呼吸移動，即時追蹤 gold marker 可增加照射精準度。
- 放療讓無法開刀的病人有治癒肺癌的機會，但病人的經濟能力會影響治療決策。

附件三：北海道大學病歷系統輸出的資料

Case no.	年齢	性別	予約名	指導医	計画担当1	計画担当2	計画担当3	計画担当4
1	77	男性	Merkel's 細胞腫腋窩 LN 転移 [1A]	青山 英史	Chen さん	藤井 裕里	宮崎 智彦	木下 留美子
2	87	男性	口腔癌 QUAD [1C]	青山 英史	Chen	高橋 周平	安田 耕一	小泉 富基
3	79	男性	肺 RTRT [1A]	青山 英史	小林 圭太	Chen	宮崎 智彦	田口 大志
4	69	男性	L5 転移 [2A]	青山 英史	(学) Chen	小泉 富基		
5	76	男性	直腸再照射 [2A]	青山 英史	(学) Chen	小泉 富基		
6	68	男性	食道再照射 [2A]	青山 英史	Chen	宮崎 智彦	高橋 周平	
7	54	女性	左温存乳房 [1A]	青山 英史	小泉 富基	(学) Chen	西岡 健太郎	
8	76	男性	全脳照射 [2A]	青山 英史	(学) Chen	西岡 健太郎		
9	74	男性	直腸術前 RNAC02 [1A]	青山 英史	宮崎 智彦	田口 大志	Chen	
10	73	女性	左大腿軟部肉腫 [1A]	青山 英史	Chen	田口 大志	檜垣 朔	打浪 雄介

Case no.	疾患部位	組織	部位	照射部位
1	C77.3 LN: Lymph nodes of axilla	8000/3 Tumor, malignant, NOS	C77.3 LN: Lymph nodes of axilla	所属 LN
2	C03.1 下齦肉:Lower gum	8070/3 Squamous cell carcinoma, NOS	C03.1 下齦肉:Lower gum	原発
3	C34.9 肺:Lung, NOS	8231/3 Carcinoma simplex	C34.9 肺:Lung, NOS	原発
4	C34.9 肺:Lung, NOS	8140/3 Adenocarcinoma, NOS	C41.9 骨 関節:Bone, NOS	遠隔転移
5	C20.9 直腸:Rectum, NOS	8140/3 Adenocarcinoma, NOS	C20.9 直腸:Rectum, NOS	原発+LN
6	C15.9 食道:Esophagus, NOS	8070/3 Squamous cell carcinoma, NOS	C15.9 食道:Esophagus, NOS	原発
7	C50.9 乳房:Breast, NOS	8140/3 Adenocarcinoma, NOS	C50.9 乳房:Breast, NOS	原発
8	C34.9 肺:Lung, NOS	8041/3 Small cell carcinoma, NOS	C71.9 脳:Brain, NOS	遠隔転移
9	C20.9 直腸:Rectum, NOS	8140/3 Adenocarcinoma, NOS	C20.9 直腸:Rectum, NOS	原発+LN
10	C76.5 下肢:Lower limb, NOS	8800/3 Sarcoma, NOS	C76.5 下肢:Lower limb, NOS	原発

Case no.	治療装置	計画装置	放射線質	放射線質 2	照射方法	動体追跡	固定方法	計画方法
1	01Varian iX	Pinnacle(日立)	4X(4MV X 線)	10X(10MV X 線)	固定照射	Not used	Other	CT
2	02Varian iX	Pinnacle(日立)	6X(6MV X 線)	10X(10MV X 線)	固定照射	Not used	Shell	CT
3	03Varian TrueBeam3319	Pinnacle(日立)	6XFFF(6MV X 線 FFF)		体幹部定 位照射	Not used	Vacuum Cushion	4DCT
4	02Varian iX	Pinnacle(日立)	10X(10MV X 線)		固定照射	Not used	Free	CT
5	01Varian iX	Eclipse(Varian)	4X(4MV X 線)	10X(10MV X 線)	固定照射	Not used	Free	CT
6	01Varian iX	Eclipse(Varian)	10X(10MV X 線)		固定照射	Not used	Free	Free
7	01Varian iX	Pinnacle(日立)	4X(4MV X 線)	10X(10MV X 線)	固定照射	Not used	Posirest	CT
8	01Varian iX	Eclipse(Varian)	10X(10MV X 線)		固定照射	Not used	Shell	CT
9	01Varian iX	Pinnacle(日立)	10X(10MV X 線)		固定照射	Not used	Free	CT
10	PROBEAT	VQA	陽子線		陽子線	Not used	Vacuum Cushion	CT+MRI

Case no.	照射開始日	照射終了日	Dose(Gy)	Fr	累積線量(Gy)	累積回数	最終照射日	ステータス	入外区分
1	11/29/2023	1/5/2024	50	25				未開始	入院
2	11/15/2023	11/16/2023	7	2	7	2	11/16/2023	完了	入院
3	11/20/2023	11/24/2023	40	4	40	4	11/24/2023	完了	入院
4	11/20/2023	11/27/2023	20	5	20	5	11/27/2023	完了	入院
5	11/30/2023	12/7/2023	18	6				未開始	入院
6	11/30/2023		20	10				未開始	入院
7	11/22/2023	12/27/2023	50	25	10	5	11/29/2023	治療中	外来
8	11/22/2023	12/12/2023	35	14	12.5	5	11/29/2023	治療中	入院
9	11/17/2023	12/22/2023	45	25	14.4	8	11/29/2023	治療中	外来
10	12/13/2023		70	28				未開始	入院

The First Patient I Ever Treated.

By Kuan-Yuan Chen

“Blasting X-rays at tumors had become my passion.” This is how I felt after four weeks of clinical elective placement in the Department of Therapeutic Radiology at Hokkaido University Hospital.

I am very thankful to all the staff from the Department of Therapeutic Radiology for treating me kindly and patiently explaining the knowledge, guidelines, and details of radiotherapy in English. Learning from doctors with diverse specialties, I gained invaluable experiences in lectures, ward rounds, case conferences, outpatient clinics, research meetings, touring the proton beam facility, witnessing the RALS procedure, and most engagingly – treatment planning.

Initially, I learned how to use the treatment planning software and contour organs on CT images. Then, I started learning how to configure photon beams and fine-tune the MLCs, angles, weights, and wedges to optimize the treatment plan. One day, after contouring for SBRT lung cancer treatment and arranging the beams, my Sensei chose my plan to treat the patient because it met all the requirements. I will always remember how the plan was presented at the case conference with my name credited as the “plan designer.” Later, I observed the patient undergoing SBRT from the surveillance camera, witnessing how each parameter I adjusted was actualized in treatment. This was the first time in my life that I treated a patient for his illness.

Throughout the month, I dedicated hours daily to treatment planning, mentored by different doctors, and planned for 3D CRT, SBRT, and even proton beam therapy. I really enjoy tracing the patient’s anatomy and identifying the GTV with image fusion techniques, while considering the best beam angles and wedging for effectively targeting tumors.

In addition to clinical and research work, I had numerous opportunities for cultural exchanges. I deepened my understanding of Japanese culture, healthcare policies, and the day-to-day life of a radiation oncologist in Japan. Also, I gave a presentation about medical education in Taiwan, which led to some discussions comparing medical education and policies between Taiwan and Japan.

I am extremely grateful for this month-long experience and extend my heartfelt thanks to everyone who made my exchange possible, especially Professor Aoyama and Dr. Uchinami, who cared a lot about my studies and helped me to make the most out of my elective program in the Department of Therapeutic Radiology.

Hokkaido University Department of Therapeutic Radiology Clinical Elective Diary

November 6, 2023

Morning Session: Treatment Planning

- 75M with prostate cancer. Planned for proton beam therapy with SpaceOAR hydrogel spacer and gold markers inserted. Contouring of the prostate was done using Pinnacle software.

Case Conference Discussions

- 89M with dysphagia due to esophageal cancer, good ADL. Scheduled for RT because of an enlarged LN around the esophagus noted in a CT scan.
 - Patient with fallopian tube cancer, showing metastasis. Scheduled for abdominal irradiation.
 - Patient with left temporal lobe GBM. The patient suffers from claustrophobia, requiring sedation for MRI scans, which raises concerns about tolerating the plastic mask during radiotherapy.
-

November 7, 2023

Morning Session with Dr. Taguchi: Treatment Planning

- 64F with Hashimoto's thyroiditis and left breast cancer with LN metastasis. Post-chemotherapy, the treatment plan focuses on protecting the carotid sheath and irradiating axillary LN and the chest wall.

Observation of Real-time Radiotherapy

- 83M with RCC undergoing RTRT.

Ward Round with Dr. Kobayashi and Professor Aoyama

- Palpation of a patient with a left mandible mass.

MDD Conference: Head and Neck Cancer

- 54F with left upper gingiva sarcoma, cT4aN0M0. Post-tumor excision, with suspected metastasis to the right oral cavity. Awaiting biopsy results and considering RT.
- Patient with left parotid gland tumor, likely secretory carcinoma, referred by an ENT specialist. Suggesting adjuvant RT with chemotherapy due to residual tumor and facial nerve preservation during surgery.

Evening Conference

- Patient with cardiac poorly differentiated pleomorphic sarcoma.
 - 78M with left urothelial papillary carcinoma.
 - 75M with double cancer (RCC post-resection and pancreatic cancer post-surgery and salvage chemotherapy). Recent discovery of metastasis; discussion on potential RCC origin and indication for SBRT.
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November 8, 2023

Morning Research Meeting with Dr. Uchinami

- **Discussion 1:** NSCLC patients treated with and without Durvalumab. Results show no significant difference in OS and PFS, despite differing clinical experiences. Noted that PD-L1 expression doesn't affect OS, but no data on PD-L1 expression was collected during the study.
- **Discussion 2:** Correlation between radiation-induced lymphopenia and overall survival in NSCLC patients. Clinical significance is noted, along with the impact of age and overall survival. NADIR (lowest point) during treatment was discussed.

Observation with Dr. Mori: Radiotherapy Sessions

- HCC patient on Linac, receiving SBRT with TRT. Noted that patients with hepatocellular carcinoma larger than 5 cm are indicated for proton beam therapy, the treatment is 66Gy/10Fr.
- Prostate cancer patient receiving SBRT on Linac.
- 9F with germinoma. The radiologist reported a swollen pituitary stalk, loss of posterior pituitary signal, initially suspected psychological DI, later diagnosed as central DI. The patient is on desmopressin, with normal AFP and beta-HCG levels. Received three courses of CARE chemotherapy (carboplatin and etoposide) and underwent whole ventricular irradiation, receiving 23.4Gy/13Fr.

Lecture on Radiotherapy Basics by Professor Aoyama

Afternoon Conference: Case Discussions

- Patient with hypopharyngeal cancer undergoing IMRT with a focus on sparing the parotid gland (< 30 Gy on average) and protecting the spinal cord.
 - Patient with skull base meningioma treated with proton beam therapy.
 - SCLC patient undergoing prophylactic brain irradiation.
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November 9, 2023

Morning Observation: Remote Afterloading System (RALS) Brachytherapy

- 77F with cervical cancer. Previously underwent 44 Gy in 22 fractions of total pelvic irradiation. RALS procedure using iridium isotopes (replaced four times a year) involving three catheters with 3, 3, and 6 planned stops respectively. The procedure included insertion of the catheter under C-arm guidance, CT confirmation, treatment planning, C-arm usage again, and then treatment.

Treatment Planning for Thymoma

- **Task:** Contouring the aorta, pulmonary trunk, and the CTV. Proton beam therapy planning involves contouring on non-CE-CT, fusion with CE-CT, and PET-CT.

Afternoon Conference: Case Discussions

- Patient with SVC and right ventricle sarcoma, s/p proton beam therapy.
- Patient with invasive thymoma, AChR (+) but without MG, planned for proton beam therapy.

November 10, 2023

Morning Session with Dr. Uchinami: FLIS Score Research

- **Task:** Investigated FLIS score correlation in contrast MRI of liver and survival outcomes in HCC patients for SBRT, related to liver function. Analyzed FLIS score in 60 patients, examined its relation to Child-Pugh score.

Treatment Planning with Dr. Hitori: Esophageal SCC

- 89M, esophageal SCC. Treatment: 66Gy/33Fr.

Afternoon Conference: Case Discussions

- Parotid gland cancer, post-op proton beam therapy on positive margin. Dose: 66Gy/33Fr.
 - Breast cancer, adjuvant PMRT. Dose: 12Gy/6Fr.
 - 10+ years esophageal cancer post-surgery, 2 oligometastasis. Curative SBRT for both lesions.
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November 13, 2023

Treatment Planning:

- **SCC of Right Lower Gum:** 88M, s/p tumor resection & relapse, bleeding gum ulcer, s/p cervical LN resection. Plan: Palliative RT, 14Gy/4Fr BID. Focus on avoiding left parotid gland and face, sparing lips.
- **HCC:** s/p surgery and TACE, with recurrence.

Case Conference Discussions:

- **SRT for Bone Metastasis:** Left iliac bone metastasis. (30Gy/5Fr)
 - **Prostate Cancer:** Undergoing proton beam therapy. (63Gy/21Fr)
 - **SCC of Left Tongue:** s/p surgery and cervical LN resection, metastasis. Post-adjuvant chemo recurrence. IMRT 60Gy/30Fr, cervical LN boost 10Gy/5Fr.
 - **Metastatic Lung Cancer:** Positive cervical LN biopsy, history of interstitial pneumonia.
 - **Invasive Ductal Carcinoma (Breast, Tubular Forming Type):** Surgical wound boost 12Gy.
 - **Esophageal Cancer with Multiple Metastases:** Bone, liver, thymus metastasis, on nivolumab and paclitaxel. SINS for patient evaluation.
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November 14, 2023

Treatment Planning:

- **Lung Cancer SBRT (Dr. Taguchi):** Focus on Conformity Index >0.75, steeper gradient in PTV, larger dose in ROI, adjustments for MLC, avoiding opposing rays.
- **74M Rectal Cancer (Dr. Miyazaki):** Low-level with suspected LN metastasis. Plan: Sacral and posterior pelvic wall irradiation (45Gy/25Fr), rectal tumor boost, sparing external iliac vessels.

Case Conference Discussions:

- **SBRT Lung Cancer (79M):** Approved treatment plan.
 - **Left Temporal Lobe Glioblastoma:** Highly invasive, requiring large CTV.
 - **Postop Proton Beam for Nasal Cavity Melanoma:** Protect optic nerve and chiasm, increased dose for positive margin (30Gy/5Fr).
 - **Double Cancer Patient:** Left renal sarcoma s/p resection, sternum relapse; pancreatic head cancer s/p resection.
 - **1-Year-Old Male ATRT Tumor:** WHO grade 4 malignancy, relapsed mass effect on MRI.
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November 15, 2023

Morning Session: Outpatient Conference (Proton Beam Therapy Meeting Room)

- **Discussion Topics:** COVID-19 weekend policy, information sharing among medical teams, discussing elderly patients with dementia.

Treatment Planning:

- **47F Cervical & Breast Cancer:** History of cervical cancer, current breast cancer (ER+, PR+, HER2-, Ki-67: 9.7%). Plan: s/p surgery, boost RT with electron beam, dummy plan creation, electron beam planning by medical physicists.
- **62M Male Breast Cancer:** Rare case. Plan: Right breast photon beam therapy, post-operative lymphedema considerations, wedge use for dose distribution, high and low energy beam combination.

Afternoon Case Conference:

- **Sarcoma of Left Calf:** Proton beam therapy.
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November 16, 2023

Morning Session: Treatment Planning (Dr. Uchinami)

- **86M Pancreatic Cancer:** s/p ERCP stent, MI s/p PCI, kidney removal for cancer, DM, hypertension, dyslipidemia, CKD. CT: Small intestine adhesion to peritoneum.

Lecture on Palliative and Emergency Radiotherapy (Dr. Koizumi)

- **Urgent RT Conditions:** Spinal cord compression leading to paralysis, SVC syndrome causing facial swelling.

Afternoon Case Conference:

- **Cardiac Poorly Differentiated Pleomorphic Sarcoma:** Positive surgical margin.
 - **15F with Left Ear Keloid:** Electron beam therapy (20Gy/4Fr, 6 MeV).
 - **41M with Multiple AVMs:** Post-intervention, suboptimal outcome.
 - **77M HCC:** Considering RT, tumor bordering stomach. Challenges with proton beam, potential for TACE/Y90 radioembolization, and spacer placement.
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November 17, 2023

Morning Session: Radiotherapy Clinic (Dr. Koizumi)

- **Learning Point:** Radiation-induced dermatitis grading with atlas, treatment pause for grade ≥ 3 .
- **Patient Cases:**
 - **64M Dermatitis Grade 2:** Buccal cancer, Undergoing 60Gy/30Fr.
 - **??F Dermatitis Grade 1:** On TPN for anorexia, pain, loss of taste; side effects of cisplatin.

Afternoon Session: Treatment Planning (Dr. Koizumi)

- **64M Lung Adenocarcinoma:** Pleurodesis, spinal metastasis. GTV: L5; CTV: L4, L5, S1. Symptom: Left thigh numbness. Plan: Photon beam therapy (20Gy/5Fr), 3 beams protocol with 60-degree EDW at 120 and 240 degrees (20% weight), and 180 degrees beam (40% weight).

Afternoon Case Conference:

- **HCC for RTRT:** Reimplantation of 2 fallen gold markers needed.
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November 20, 2023

Morning Session: Planning for Pancreatic Cancer, Offline Adaptive Treatment

- **Procedure:** Check last treatment, adjust as needed.
- **Challenges:** Patient history of laparotomy complicates large colon tracing, small bowel adherence to peritoneum, small bowel dilation.
- **Approach:** Use MRI and CT fusion images to define tumor border.

Afternoon Case Conference:

- **SBRT for Colon Cancer with Liver Metastases:** Discuss treatment planning.
 - **Interesting Cases:** Left CPA schwannoma patient, Merkel cell carcinoma patient.
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November 21, 2023

Morning Session: Treatment Planning

- **CNS Radiation Oncology (Dr. Nishioka): 66M SCLC Brain Metastases:** Whole brain irradiation, 38Gy/14Fr.
- **Breast Cancer (HER2 Positive):** Tangential irradiation. Review JASTRO guidelines, discuss with doctor.

Afternoon Conference: Case Discussions

- **Prostate Cancer with Bone Metastases:** PSMA-PET using Ga-68-PSMA-11.
 - **Spindle Cell Carcinoma of Left Thigh:** Case and treatment planning discussion.
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November 24, 2023

Morning Session: Head and Neck Clinic (Dr. Koizumi)

- **Maxillary Sinus Cancer Patient:** Cisplatin injection into tumor arterial supply by IVR doctor.
- **72F Malignant Melanoma:** Left nasal cavity melanoma. Plan: 45Gy/10Fr, radiotherapy Mon/Wed/Fri, hospitalization.
- **82F Recurrent Tongue Cancer:** Radiotherapy June-August, now recurrence.

Outpatient Department Clinic in CNS (Dr. Nishioka)

- **43M Astrocytoma Patient:** WHO grade 4, IDH mutant, s/p left frontal lobe surgery. In CELLM-001 tumor vaccine trial. RT with plastic mask preparation. Discussed adverse events including radiation dermatitis, headache, fatigue, otitis media, bone marrow suppression, cataracts, retinal/optic nerve injury, brain atrophy, necrosis, secondary cancer. Postop recovery: remarkable recovery in IADL tasks in 14 days. RT Plan: Photon IMRT, 50Gy/25Fr, plus 10Gy/5Fr boost.
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November 27, 2023

Morning Session: Treatment Planning for Merkel's Cell Carcinoma

- **74F with Merkel's Cell Carcinoma:** Metastasized to left axilla, s/p resection.
 - **Planning Activities:**
 - Contour L1-L3 axillary lymph nodes, three-beam arrangement.
 - Lung: <10% receives >20Gy.
 - PTV Coverage: 98% > Total dose
 - Consultation with Dr. Miyazaki.
 - **Anatomical Considerations:**
 - Humeral head: Not spared due to PTV proximity.
 - Back scapular muscles: Received 60Gy, acceptable as muscles are radio-resistant.
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November 28, 2023

Morning Session: Treatment Planning

- **74F Spindle Cell Carcinoma of Left Thigh:** Proton beam therapy, 60Gy/30Fr.

Afternoon Session: Treatment Planning

- **Metastatic Colon Cancer:** Palliative treatment, 18Gy/6Fr.
 - **Japanese Health Insurance for Proton Beam Therapy:** Coverage for HCC, pancreatic cancer, intrahepatic cholangiocarcinoma, prostate cancer, head and neck cancer.
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November 29, 2023

Morning Session: Treatment Planning (Dr. Takahashi)

- **74F Mesothelioma Patient:** Lesser curvature gastric lymph node metastasis. Palliative RT, 30Gy/15Fr. Plan revised due to beam affecting contralateral arm.

Discussion with Dr. Koizumi: Colon Cancer Treatment

- **Case:** Palliative treatment for colon cancer, Sacral metastasis.
 - Plan: 18Gy/6Fr
 - Consideration: Debate over using 3 beams vs. 4 beams, balancing bowel preservation and hotspot coverage.
 - Decision: Opted for 3 beams, focusing on GTV and margin.

Lecture and Case Discussion with Dr. Nishioka

- **Topics:**
 - Whole brain vs. whole ventricle vs. whole spinal cord irradiation.
 - Proton beam therapy: Benefits in sparing organs, equal dose distribution, especially important in pediatric growth and adult bone marrow preservation.
 - IMRT in proton beam therapy: Importance for a gradual transition between fields to avoid spinal cord damage.
 - Tomotherapy: Equal dose distribution to the spinal cord.
 - Challenges: Pediatric glioma patients needing sedation for RT and MRI; pediatric patients with Down syndrome and germinoma, difficulty in persuading for RT.

End of Clinical Elective

- Exported all treatment plans to a flash drive with encryption.
- Farewell: Concluding the elective at Hokkaido University Department of Therapeutic Radiology.