Management of Implantable Cardiac Defibrillators during I-131 Administration

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Background: The Radiation Physics department (RPD) at ICHNT administers approximately 52 I-131 cancer treatments annually. An increasing number of patients have implantable devices such as pacemakers, Implantable Cardiac Defibrillators (ICD) or Continuous Glucose Monitoring Devices, information on the management of these devices for patients undergoing I-131 treatment is limited. This case study looks at the steps that have been implemented locally to manage ICDs.

Processes: A member of the physics team attends all I-131 clinic appointments to assess radiation protection or other issues that might arise during treatment. Here patients with implantable devices are identified and where possible information on type of device and department that manages it is determined.

During one of these appointments a patient implanted with an ICD (Boston Scientific Momentum EL ICD D120) for dilated cardiomyopathy and ventricular arrhythmias managed by BHNT was identified. They were prescribed 3.7GBq of I-131 for the treatment of thyroid cancer. The ICD manufacture information stated there was no "safe level" of radiation exposure and that tests should be carried out after each exposure to radiation.

The Radiotherapy Board [1] recommends that doses to ICDs be kept to less than 0.5Gy. To assess the dose to the ICD from the 3.7GBq administered activity, the heart was used as a proxy. The calculation performed used methodology and assumptions from Barrington et al [2], and assumed that the heart was 10cm from the thyroid. The calculated dose to the heart/ICD was 0.2Gy lower than the Radiotherapy Board limit.

The cardiac physiology department at Bart's Health NHS Trust was contacted to assess the risks to the patient and to determine a monitoring plan. The risks from radiation damage could be temporary or permanent device malfunction, resulting in delivery of inappropriate ICD therapy, failure to deliver ICD therapy when needed or resetting of patient specific programming to default settings. The management strategy advised was to utilise remote monitoring using a wireless bedside transmitter to regularly monitor the device function whilst reducing the need for face-to face checks. The transmitter could be brought to the ward and used at home where manual an automatic device reviews could be monitored for abnormal device behaviour. Manual transmissions were requested on day 1, 8 and 15 of the treatment period. Daily automatic reviews were also performed when the patient came into close proximity to the transmitter (within 3m). Automatic reviews would notify the follow up centre of potential issues if present. During the treatment period 4 manual transmission were reviewed with no abnormalities and normal device function seen. No automatic 'early warning alert' notifications occurred.

Radiation protection advice on when it would be safe to perform in-person assessments of the ICD was communicated to BHNT. It was agreed that the ICHNT's RPD should be contacted if any malfunction was detected while the patient was an inpatient at ICHNT, and the patient should be contacted directly following discharge.

Lessons Learned: Working closely with the cardiac physiology department helped the understanding of the risks involved and to determine a plan to manage them. It helped reassure the patient and staff that the ICD was being monitored and reduce levels of anxiety for the patient. Remote device monitoring can support device management during radioiodine treatments.

Best Practice: The steps implemented here closely match those for patients undergoing external beam radiotherapy. Identifying the device, estimating the risks and contacting the cardiac physiology department for monitoring throughout treatment.

Conclusion: Patients with implantable devices can still receive radioiodine treatment as long as the risks are managed, early identification of patients with implantable devices is key.

References

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Setup and Evolution of Patient Dosimetry for Lu-177 Dotatate Peptide Receptor Radionuclide Therapy (PRRT)

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Background: IRMER Regulation 12 covers the optimisation of patient exposures including the planning and assessment of individual patient doses for therapy with unsealed sources. Lu-177 Dotatate Peptide Receptor Radionuclide Therapy (PRRT) for Neuroendocrine tumours (NET) has been used at the Queen Elizabeth Hospital Birmingham (QEHB) since 2012. In line with Regulation 12, dosimetry methodology was established to review doses to organs at risk (OAR) for individual patients. Over the last decade, dosimetry practices have evolved to reflect changes in patient funding, service demands, scanner technology, dosimetry software and the desire to obtain dose-response curves for this therapy. This case study illustrates the evolution of dosimetry at QEHB for Lu-177 Dotatate PRRT over the last ten years.

Processes: All imaging times are times post-injection.

Year	Planar	SPECT/CT	Calibration method	Dosimetry method	Volumes of interest
2013	Wholebody (WB) scans at 30min, 24h, 4d, 7d	Not performed	Patient vial residue	Spreadsheet	Kidneys, spleen
2014	WB scans at 30min, 24h, 4d, 7d	SPECT/CT at 24h	Patient vial residue	Spreadsheet	Kidneys, spleen
2016/17	1 x WB at 4h for restriction calculation only	SPECT/CT at 4h; SPECT only at 24h, 4d, 7d	Hermes SUV SPECT®	Hermes Dosimetry (HIRD OLINDA)	Kidneys, spleen
2019/20	1 x WB at 4h for restriction calculation only	SPECT/CT at 4h; SPECT only at 24h, 4d, 7d	Hermes SUV SPECT®	Hermes Voxel Dosimetry (VD)	Kidneys, spleen
2021 to present	1 x WB at 4h for restriction calculation only	SPECT/CT at 4h; SPECT only at 24h, 4d, 7d	Hermes SUV SPECT®	Hermes VD: Multi-time point (MTP) and single-time point (STP) using effective half-life & Hänscheid methods	Kidneys, NETs

Lessons Learned: Calibration of imaging systems to provide quantitative SPECT/CT has standardised and sped up the dosimetry process. Dosimetry results are different at each treatment cycle, however, service pressures have constrained dosimetry to cycle 1 only. Multiplying cycle 1 absorbed doses by the number of cycles is highly likely to overestimate true doses. Voxel-based dosimetry is more accurate than MIRD due to patient-specific Monte Carlo simulations. STP dosimetry should only be used once MTP dosimetry is established and understood.

Best Practice: Dosimetry is essential for the future optimisation of Lu-177 Dotatate PRRT. Dose-response curves are required for NETs and OARs to tailor patient treatments and improve response to therapy. A MTP voxel-based dosimetry service has been established for Lu-177 PRRT and can be expanded to included Lu-177 PSMA in future. STP dosimetry could be utilised on cycles 2-4 of treatment to improve overall dose estimates.

***Conclusion*:** The last decade of experience implementing dosimetry for PRRT at QEHB has shown that performing camera-specific calibrations can aid dosimetry processes. MTP voxel-based dosimetry is considered the gold standard for cycle 1 tumour and OAR dose evaluation. STP dosimetry should not be implemented until the setup of MTP dosimetry has been achieved locally, however it may be useful for future treatment cycles due to lesser imaging and analysis burdens.

Experience of using Whole Body Planar Dosimetry for Lu177 Dotatate therapies

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Background

Lu177 dotatate is used for the treatment of neuroendocrine tumours (NETs) and meningiomas, with co-infusion of amino acids for renal protection. At University Hospitals Plymouth NHS Trust, we have treated NET patients with Lu177 dotatate since January 2021. Patients receive a course of four treatments of 7400 MBq, ten weeks apart, with dosimetry performed at first treatment for all patients. In accordance with the EANM Dosimetry Guidelines [1], the kidneys are considered as the organ most at risk from non-target radiation dose. Kidney dosimetry is performed to inform the clinical team on the risk of kidney damage, so that reductions to administered activities for subsequent therapies can be considered.

Processes

Sequential SPECT/CT imaging is the preferred option for Lu177 dosimetry, but practical considerations in our department prohibit this. Instead, a series of whole body (WB) planar images are acquired at known scan speeds using MEGP collimators, from immediately post-infusion up to 7 days. The Lu177 vial and residue are measured in a calibrator with traceable calibration, and activity remaining in waste (e.g. infusion lines) is assessed with a contamination monitor with calculated conversion factor. Scans are imported into the Hermes OLINDA application and kidney doses are calculated by multiple operators using regions of interest (ROIs). Due to the difficulty of drawing ROIs with overlapping tissue, dosimetry is performed by multiple operators (up to four). Where one kidney is significantly overlaid by tumour, the other kidney alone is used, with options in OLINDA to double the calculated dose. Due to resource limitations, Lu177 treatments were suspended for a period in 2022. We therefore have two cohorts of patients with analysed dosimetry (12 patients in total to date).

Lessons Learned

For the patients in these cohorts, we have demonstrated that the inter-operator variation in calculated doses is largely due to subjectivity in drawing ROIs on planar images. We have investigated the effect on calculated doses of a partial WB scan for patients unable to bear the full scan time, and have harmonised scan speeds for scans at different time points to eliminate errors in calculations. We have investigated the effect of one ROI v. two for kidneys with overlying tumours, and have performed follow up dosimetry for subsequent therapies. Because of the greater staff dose from performing earlier scans, we have also investigated the effect on calculated doses of dropping the scan performed immediately after administration.

Best Practice

Once dosimetry has been completed by all operators, a report is produced and issued to the prescribing clinician for review between treatments 2 and 3. It includes the range and variation of calculated kidney doses, WB retention curve and QC features. A process map has been produced: actions depend on the range and variation in calculated doses, and other risk factors, with an upper threshold kidney dose of 23 Gy projected over the course of four treatments [1].

Conclusion

Our work has highlighted the limitations of a dosimetry system based on WB planar scans, while demonstrating that information of clinical value can be obtained with this method. We have explored complications arising from clinical scenarios within our cohort and have set up a system for assessing and reviewing doses.

[1] EANM dosimetry committee recommendations for dosimetry of 177Lu-labelled somatostatin-receptor- and PSMA-targeting ligands, Gleisner et al., European Journal of Nuclear Medicine and Molecular Imaging (2022) 49:1778–1809

Title of Study: After the PRRT, what happens when your visitors don't leave? Lu-177 patients with complex clinical needs and unplanned hospital admissions.

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Background. As utilisation of Lu-177 for molecular radiotherapy (MRT) in the UK increases (whether for PRRT or start-up of PSMA services) the number of patients who could potentially be admitted to hospital following clinical complications similarly increases. Additionally, with rationalisation of MRT services these unplanned admissions could happen in a different hospital to where the administration occurred. This work details radiation protection implications for 3 distinct case studies where Lu-177 MRT patients were admitted to our hospital as inpatients – whether planned or unintentionally via the Emergency Department (ED).

Methods.

Case Study 1: A 70 year old male patient with chronic renal failure (requiring regular haemodialysis) and significant diarrhoea was admitted as an inpatient to an Oncology ward following administration of 3891 MBq Lu-177 dotatate to treat a metastatic small bowel neuroendocrine tumour (NET). Dialysis was performed 1, 2 & 5 days post administration before the patient was discharged from hospital for subsequent haemodialysis in the community setting.

Case Study 2: A 55 year old male patient with adrenal NET was admitted to the ED 26 hours post administration of 7488 MBq Lu-177 dotatate, due to clinical concern over his erratic vital signs following overnight vomiting episodes.

Case Study 3: A 62 year old male patient with metastatic abdominal paraganglioma NET was admitted to the ED 24 hours post administration of 7346 MBq Lu-177 dotatate with acute abdominal pain.

Results.

Case Study 1: Radiation protection training was delivered to both Oncology and Dialysis ward staff caring for the patient. Dose rate measured at 1 m distance from the patient post administration was 25 µSv/hour, reducing to 16/12 µSv/hour after the first/second dialysis respectively. Lu-177 activity in the retained dialysis tubing was 1130/230 kBq after the first/second dialysis respectively, whilst Lu-177 activity in the waste bags and bed linen was 430/30 kBq after the first/second dialysis respectively. The patient remained an inpatient for 6 days and the maximum staff dose recorded by electronic personal dosimeter (EPD) was 40 µSv by a Dialysis ward nurse.

Case Study 2: Dose rate at 1m distance immediately prior to transfer to the ED was 7 µSv/hour (down from 35 µSv/hour immediately post administration). A significant volume of solid radioactive waste was generated (from disposable urine bottles/vomit bowls, with maximum activity 700 kBq) over the 9 day inpatient stay. Maximum EPD dose recorded by nursing staff was 2 µSv.

Case Study 3: Paramedic staff, initially apprehensive of transferring the patient between hospital sites, recorded an EPD dose of 5 µSv during the 30 minute journey. During his 48 hour inpatient stay the patient was able to use the toilet unassisted. The maximum EPD dose recorded by nursing staff was 6 µSv and the Lu-177 activity in the retained sharps bin was estimated as 0.2 kBq.

Discussion. Comprehensive radiation risk assessment is essential for safe MRT patient management. Each of these patients, although treated with the same radiopharmaceutical, brought different, distinct radiation protection challenges – whether due to the potential for significant staff skin dose from inadvertent contamination whilst handling bodily excreta, generation / disposal of solid radioactive waste or the management of staff anxiety when dealing with unfamiliar risks.

Conclusion. Clear, inclusive communication with multidisciplinary staff groups is essential for minimising occupational exposure as well as ensuring regulatory compliance, without compromising the care of this patient cohort with complex clinical needs.

Paediatric I-131 mIBG: lessons learnt over the first 10 fractions

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Background. The SMaRT unit is based at Glasgow's Royal Hospital for Children, and since March 2022 has been carrying out I-131 NaI (sodium iodide) ablations for thyroid cancer and I-131 mIBG (meta-iodobenzylguanidine) therapies for paediatric neuroblastoma, the focus of this case study. Neuroblastoma accounts for 8% of childhood cancers, but 15% of childhood cancer deaths, with high-risk neuroblastoma carrying a poor prognosis. I-131 mIBG and radiosensitiser chemotherapy (Topotecan) is used to deliver high-dose molecular radiotherapy over two fractions, aimed at giving a total body dose of 4 Gy. Over the course of the 5 patient therapies (10 fractions) we have performed at our site, we have continually iterated on our radiation protection, patient preparation, and multi-disciplinary processes to continuously improve our service.

Processes. *Key processes/procedures used in the implementation of the therapy*.
Setting up a paediatric MRT service – room design, workup of necessary documentation and procedures, staff training. The development of feedback form for the patients and their families to allow them to guide future work on the therapy service.

Lessons Learned: *Identify elements that you changed during implementation or would do differently if implementing now.*

- Paediatric adaptions to therapy: design of the suite, a preview overnight stay to familiarise the patient with the room, minimising the impact of dosimetric measurements;
- Practical implementation of dosimetric measurements;
- SEPA/environmental permitting limits;
- Infusion rig, current development of a system not reliant on GE's giving set;
- Future-proofing: novel therapy agents, additional capacity/additional rooms?

Best Practice: *Highlight areas of success/best practice and why.*

Successful treatment with what we believe to be the highest single administration of I-131 to a patient in the UK – 23.7 GBq, and a total over both fractions of 36 GBq. The patient, who had relapsed neuroblastoma following immunotherapy and a 10-year history of treatment, has since had a completely clear scan with no evidence of mIBG-avid disease.

Staff development - training a multidisciplinary team for the delivery of these treatments and the implementation of a weekly MDT with input from oncology, nuclear medicine physicians, physics, technologists, nursing staff, and ward managers to ensure the smooth running of a treatment.

Improvements to the parent's suite following feedback, and producing information leaflets to walk them through what to expect from the experience before attending for pre-assessment.

Conclusion. *Overall thoughts - benefits/negatives of implementing the system*
Increasing access to these therapies for paediatric patients improves equitable access to treatment. This also provides a centre from which novel therapies may be developed based on existing experience with I-131 mIBG therapies.
Each therapy has been tailored to the patient and their family. Behind-the-scenes processes have been developed and improved on over the course of the SMaRT unit's life, with more improvements planned for the near future.

Dialysing patient requiring radioactive iodine (RAI) for treatment of recurrent thyroid cancer

- **Background:**

QEHB carry out approximately 100 radioiodine ablations each year, in 2 specialised isolation rooms adjacent to an Oncology ward. In early 2023, the therapy team were made aware of a patient who required retreatment due to thyroid cancer recurrence but who was in renal failure (eGFR <10 ml/min) and dialysing at home. The patient was last treated in October 2018 and was not on dialysis at that point.

- **Processes:**

Data was gathered from the literature and from helpful colleagues on the Medical Physics mailbase. A multidisciplinary group were involved in discussions about how best to treat this patient whilst maintaining a dialysis schedule which would keep them well. This included the referring oncologist (IR(ME)R practitioner license holder-IPLH), a renal consultant, home dialysis team, ward dialysis team, RPA and other members of the Nuclear Medicine physics and radionuclide therapy teams.

Discussions between the radionuclide therapy team, referrer and renal consultant resulted in the following decisions for the treatment protocol:

- Administered activity to be 50% of prescribed (5500 MBq reduced to 2800 MBq).
- 1 thyrogen injection, as opposed to 2, given 48 hours before administration of I-131.
- Dialysis immediately prior to thyrogen.
- Dialysis session 24 hours post I-131 administration.

Much consideration was given to the options for enabling this home dialysis patient to dialyse during the I-131 treatment. The chosen plan was that the patient would go home from the ward on day release to dialyse, returning to the isolation room after and would be discharged when below 800 MBq. The patient lived alone, so no one else would be irradiated at home and this option eliminated radiation dose to dialysis ward staff. The patient had a garage in which the radioactive clinical waste could be stored. Follow up visits to the patient's home were planned to assess the activity in this waste. RPA advice was sought for every step of this plan.

- **Lessons Learned:**

The most significant lesson learnt was that the MDT discussions should have included a dietician. The radionuclide therapy team was not made aware that dialysis patients must follow a low potassium diet. When the patient arrived at the hospital it was difficult for them to stick to the low iodine diet as well as satisfying their low potassium diet. This led to the patient having high potassium levels and requiring dialysis on the day of treatment. This dialysis session needed to be on the dialysis ward as opposed to at home so that his health could be monitored due to elevated potassium levels.

- **Best Practice:**

All risk assessments and contingency plans had been put in place ahead of treatment. When the patient needed to have dialysis on the dialysis ward on the day of treatment, we were able to put contingency plans (which had already been prepared) in place. This saved lots of time and stress.

- **Conclusion:**

Complex patients will be referred for radionuclide therapies. If there is a real need for radioiodine to be given to a dialysis patient it can be done, but requires careful consideration. Effort and thought must be put into planning and risk assessments for the worst-case scenarios; this is time intensive but essential. You should cast the net far and wide in multidisciplinary discussion and question everything.

Model based optimization of IV infusion for ^{177}Lu Dotatate PRRT.

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Background

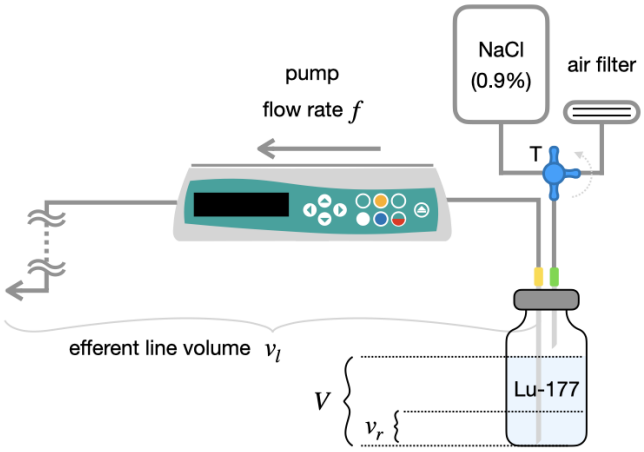
Dotatate ^{177}Lu PRRT doses are typically administered over ~30min [1-3]. The benefits of more rapid administration [2] include: lower staff doses; higher throughput; and even a mooted improved efficacy of tumour binding [2]. Syringe driver based infusion lends itself to rapid infusion at the expense of increased operator dose, due to the additional aspiration step, and modest dose loss for the same reason. Peristaltic pump based infusion is less amenable due to continuous dilution of the infusate, and the length of available giving sets. Nevertheless, the reduced operator dose and the intrinsic safety of the low pressures involved have led us to consider possible acceleration of this infusion method.

Methods

Infusion was modelled using the parameters shown in Figure 1. Here tap 'T' is initially set to the air inlet position (shown) and switched when the eluate volume has dropped from V to v_r. The model gives the fraction $\mathcal{F}(t)$ of dose delivered (to the patient) after time t as:

$$\mathcal{F}(t) = \begin{cases} 0 & \text{for } 0 \le t < t_1 \\ \frac{f}{V}(t - t_1) & \text{for } t_1 \le t < t_2 \\ 1 - \frac{v_r}{V}\exp\left(-\frac{f}{V}(t - t_2)\right) & \text{for } t \ge t_2 \end{cases}$$

where $t_1 = \frac{v_l}{f}, t_2 = \frac{V + v_l - v_r}{f}$



It follows that the time $t(\delta)$ needed to deliver all but a fraction δ of the dose is given by:

$$t(\delta) = \frac{V}{f}\ln\left(\frac{V}{v_r}\delta\right) + \frac{V + v_l - v_r}{f}$$

The veracity of this model has been investigated via dynamic imaging of a complete infusion setup, using ^{99m}*Tc*, on a gamma camera, together with final assay of the activity delivered. In addition, infusion line and vial residue from two therapy sessions were imaged and assayed.

Results

Within experimental uncertainties 99mTc measurements agree with model predictions. ^{177}Lu measurements agree to within ~5%. Here, line volume displacement may not completely remove the previous contents. Initial measurements suggest a flushing efficiency ~95%. Further measurements are needed to quantify this more accurately. Nevertheless, the model makes it easy to configure (and achieve) an infusion regime that can deliver 99.5% of the dose vial contents (δ = 0.005, $V = v_l \approx$ 25ml, $V/v_r \approx 10$) in less than 20 min, with a flow rate of only 150 ml/min throughout

Discussion

In our department this modelling has halved the time of our administration. Use of a constant flow rate means we no longer incur the operator dose penalty of adjusting flow rates mid administration; and at no point in the infusion process does the delivery rate rise above the highest levels of our previous regime.

Conclusion

The model presented provides an accurate reflection of the dynamics of the infusion process and makes it straightforward to reason about, and to optimise, infusion parameters.

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Implementation of Intravenous Liquid I^{131} Treatments for Thyrotoxicosis and Ablation Therapies

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Background. Sheffield Teaching Hospitals (STH) has a large molecular radiotherapy (MRT) department that undertakes a range of molecular radiotherapy treatments including, Ra^{223}, I^{131} MIBG, Lu^{177} Dotatate and I^{131} for thyrotoxicosis and ablation treatments. Occasionally patients are unable to swallow I^{131} capsules or refuse capsules for a variety of reasons. Previously liquid I^{131} has been administered orally, however this is no longer an acceptable administration method from a contamination risk perspective. In addition, the main supplier of liquid I^{131} ceased production. There is an alternative supply available, however this is as an unlicenced product. A protocol for i.v administration of liquid I^{131} was implemented, taking into account:

- The unlicenced nature of the radiopharmaceutical and associated patient information
- Additional radiation protection precautions for i.v. administration and dose monitoring
- Delegated authority considerations
- Infrequent nature of the requests
- Support to local district general hospitals
- Calibration factors

Processes. The STH team has significant experience administering other i.v. MRT treatments. A multidisciplinary team approach was taken to implement the I^{131} protocol, including MPEs, RPAs, Clinical Technologists, Radiopharmacy and ARSAC holders. Due to the infrequent nature of the test, a check list was implemented for the specific aspects that varied from capsule administrations, including the additional patient information required to inform the patient about the unlicenced nature of the radiopharmaceutical. Trust approval was sought to use the unlicenced product, including signed declarations from ARSAC holders and product specification checks prior to each administration. The advantages and disadvantages of different i.v. administration techniques were considered, and a dose/risk assessment was undertaken. Due to uncertainty around the new supply and ability to order the activity to within the specified limits, direct injection was selected. Liquid I^{131} was added as an exception to the thyrotoxicosis delegated authority as direct authorisation from the ARSAC holder was preferred. Calibration factors were determined for a range of syringe sizes and volumes. Due to the local expertise in i.v. therapies, support was offered to other district general hospitals where only capsule administrations are performed to enable them to refer patients who require non-oral administration. To date one patient has been treated with 5.5GBq of liquid I^{131}.

Best Practice: EPDs were worn during the administration. These showed that the largest dose was from the post-administration phase, with the person removing the cannula receiving a dose equal to that of the person administering. A single syringe factor for I^{131} was determined that gives activities to within 3% of a reference for 3, 5 and 10 ml syringes.

Lessons Learned: Although direct injection worked well, numerous syringes were required to inject the required volume. After ordering from the new supplier, the team have confidence that the range of DRLs required for I^{131} treatments can be ordered to within 10% of the DRL. For future administrations a set-up similar to I^{131} MIBG treatments will be investigated, to reduce whole-body and extremity doses, and the risk of personal and environmental contamination.

Conclusion. Oral administration of liquid I^{131} is no longer acceptable from a contamination risk perspective. Intravenous administration of liquid I^{131} can be easily implemented in centres with experience of delivering i.v therapies. Due to the infrequent nature of these requests, there is unlikely to be sufficient referrals for district general hospitals to maintain competence in i.v administrations solely for thyrotoxicosis treatments and therefore a more centralised approach is recommended for these patients.

Redesigning and developing a new Nuclear Medicine and MRT Department

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Background.

The Nuclear Medicine (NM) and Molecular Radiotherapy (MRT) service at Sheffield Teaching Hospitals (STH) NHSFT is delivered on three sites across Sheffield. Since 2019 we have been working on a major capital scheme to redevelop 2 of these 3 sites – the Royal Hallamshire Hospital (RHH) and Weston Park Cancer Centre (WPCC).

The three primary drivers for the scheme were:

1) Replacement of two aging gamma camera systems with upgraded equipment that did not fit in the existing space.

2) More expansive accommodation required to support increasing demand for MRT.

3) Implementation of MRT dosimetry – the original MRT site had no on-site gamma camera imaging and transfer of MRT patients between sites was not an option.

Processes.

The development of appropriate facilities which solved all three aspects whilst also working to the constraints of limited capital finance and estate availability was not a trivial process. Multiple design iterations were needed which had to consider operational functionality and legislative (radiation protection) requirements alongside constraints from the available accommodation. Significant collaborative input was vital throughout the scheme from a large multidisciplinary team including NM, Radiology Physics (RPA/ RWA expertise) and Estates. Due to the size of the overall scheme, and due to the nature of some of the accommodation that was to be re-born as our new department, we were also forced to contract in support from external radiation protection experts at significant cost.

For the RHH scheme, the existing NM facility had to be completely destroyed and rebuilt. The additional challenge therefore was to phase this work to enable clinical services to keep running throughout, albeit on reduced capacity.

Lessons Learned:

Managing large, complex schemes in parallel to running clinical services is not easy; the time and staff resource and the varied expertise required to develop a project of this size and complexity is significant and should not be underestimated. Maintaining clinical services to meet clinical demand, especially when also faced by post-pandemic recovery, is difficult.

The complexity and scale also resulted in unforeseen delays to original timescales: clinical services have had to continue with compromised facilities and at reduced capacity for a period of 12months longer than originally anticipated. Staff buy-in is absolutely necessary; we were extremely fortunate to have absolute support from our clinical teams who went above and beyond to keep services running in very difficult circumstances.

Best Practice:

Our multidisciplinary team worked well together throughout the whole process, the outcome being that we now have departments designed to meet the increasing demand for MRT treatments and dosimetry and for diagnostic SPECT-CT imaging. All teams involved were committed to delivering the best result. The commitment and professionalism of all staff involved could not have been better.

Conclusion.

Creating a new department that satisfies operational and legislative requirements is a huge challenge, especially when done in parallel with maintaining clinical services and with the additional complications of NHS financial constraints and squeezed estate envelopes.

A large multidisciplinary team is essential and effective team working and communication throughout is vital. The multidisciplinary project management time required for redevelopment / refurbishment schemes such as this is significant; without good planning this can impeded the ability to maintain clinical service support.

For a scheme that involves the destruction of a department and the building of two new ones it is very easy to underestimate staff time required, project timescales and costs, especially when also challenged by a pandemic. However much you allocate, you will quite possibly need more!