



The Royal College of Radiologists
RCR-Cyclotron Trust Visiting Fellowships 2017 (Clinical Oncology)

POST-VISIT REPORT

PLEASE NOTE: This report must be completed and emailed to the RCR within 2 months of the end of your visit.

1. Name of Visiting Fellow	Dr Cheng Boon	
2. Name of joint Visiting Fellow (if applicable)	Dr Spyros Manolopoulos	
3. Institution(s) of Visiting Fellow(s)	Worcestershire Acute NHS Trust University Hospitals Coventry and Warwickshire	
4. Name of Host(s)	Cristina Bono (CNAO) Dr Francesco Dionisi (APSS)	
5. Institution(s) of host(s)	Centro Nazionale di Adroterapia Oncologica (CNAO) Azienda Provinciale per i Servizi Sanitari (APSS)	
6. Expenses claimed	£2000	
7. Visit Dates (ACTUAL)	a. Start Date 21 May 2017 28 May 2017	b. End Date 27 May 2017 (CNAO) 3 June 2017 (APSS)
8. 2nd visit dates (if applicable)	a. NA	b. NA
9. Aims of the visit		
<ol style="list-style-type: none"> 1) Understand and appreciate high energy particle beam therapy in practical terms. 2) Understand and appreciate the technical differences between Carbon Ion particle beam therapy compared with Proton Ion particle beam therapy. 3) Understand and appreciate patient selection criteria for particle beam therapy particularly any potential cancer types with radiobiological properties that could benefit from Carbon Ion beam versus Proton Ion beam. 4) Understand and appreciate the potential risk versus benefits of dose escalation using particle beam therapy in re-irradiation cases. 5) Experience the entire patient pathway from referral for opinion, patient selection, treatment planning, delivery and finally patient follow-up for any long term sequelae. 6) Experience particle beam (Carbon Ion and Proton Ion) treatment planning and delivery pathway for adult patients. 7) Experience particle beam (Proton Ion only) treatment planning and delivery pathway for paediatric patients. 8) Experience the differences in practices between two different particle beam therapy centres in Europe. 		
10. Activities undertaken		
First week – CNAO		
Observe particle beam therapy delivery including Carbon Ion and Proton beam therapy.		

- I understood the immobilisation technique for particle beam therapy is very important as CNAO particle treatment is delivered without the use of gantry.
- Patients are matched daily to angled X-ray images with no soft tissue matching possible.

Attend the weekly MDT to discuss all patients and referrals for particle beam treatment.

- I understood the importance of patient selection and the Italian National Health Service selection criteria for particle beam treatment.
- I also understand the limitations of particle beam therapy without gantry (limited degrees of movement and treatment).

Observe and discuss cases being planned for Carbon Ion and Proton beam therapy.

- I learnt about the radiobiological uncertainties of Carbon Ion therapy with particular the difficulty repeating the Japanese data and fractionation regime (treatment with four fractions per week over 4 weeks).
- I understood that the RBE factor of the Japanese Carbon Ion therapy and the European Carbon Ion Therapy (including Germany and Italy) may differ by up to twenty percent (20%).
- I learnt that for re irradiation cases, the potential radiobiological benefits of Carbon Ion therapy may not be relevant and Proton Beam therapy with a more established RBE would be preferred.

Manage toxicities during radiotherapy.

- Patients undergoing particle beam therapy are seen weekly by clinicians (radiation oncologist or specialist nurses) to manage toxicities.
- Skin toxicities from carbon ion and proton beam therapy are fairly similar to conventional photon beam treatment and are managed accordingly (topical moisturiser creams, pain relief).

Contouring and planning of a case with radiation oncologist mentor.

- I managed to gain experience contouring and having my work peer reviewed by experienced particle beam radiation oncologist.
- We planned a case of patient with an inoperable recurrent meningioma and I learnt that CNAO particle beam therapy plans do not utilise conventional PTV margins.

Second week- APSS

Observe Proton beam therapy delivery.

- APSS uses the proton beam machine made by IBA and it has the benefit of having a gantry and CT on rail.
- Patients are matched daily to angled X-ray images and soft tissue images from the CT on rail post treatment are available.
- APSS have started using "gating" with body surface image tracking in order to treat targets within the thoracic cavity.
- I and my physicist were also able to witness stereotactic radiosurgery (SRS) using proton beams for an intra-cranial lesion.

Attend the weekly MDT to discuss all patients and referrals for particle beam treatment.

- I understood the importance of patient selection and the Italian National Health Service selection criteria for particle beam treatment.
- Patients with complex tumour location and anatomy were also referred for gantry based proton beam treatment from CNAO.
- APSS had started treating paediatric cases with proton beam therapy and we were very fortunate to observe how they had developed Italy's first paediatric proton beam therapy service.

Observe and discuss cases being planned for Proton beam therapy.

- I learnt about the Italian government and the Italian National Health Services' intention to allow patients to be selectively treated with particle beam therapy.
- I understood that the Italian National Health Service does not have an upper age limit for particle beam therapy and all eligible patient groups suitable for particle beam therapy will be supported to have treatment.
- I learnt that the Proton beam therapy RBE of 1.1 is fairly reproducible and the proton beam technology has made dramatic improvements in terms of image guided delivery and data from long term follow up of patients from USA and Europe are maturing.

Manage toxicities during radiotherapy.

- Patients undergoing particle beam therapy are seen weekly by clinicians (radiation oncologist or specialist nurses) to manage toxicities.
- Skin toxicities from proton beam therapy are fairly similar to conventional photon beam treatment and are managed accordingly (topical moisturiser creams, pain relief).
- Managing paediatric cases during proton beam therapy is a multidisciplinary process with involvement of play therapist, anaesthetics, oncologist and family.

Contouring and planning of a case with radiation oncologist mentor.

- I managed to gain experience contouring and having my work peer reviewed by experienced particle beam radiation oncologist.
- We planned a case of patient with an inoperable recurrent spinal metastases and I appreciated that APSS uses conventional PTV margins.

11. Benefits of the visit (short term)

Immobilisation, gating and robust planning.

- I have learnt that conventional photon radiotherapy are very good at delivering sharp dose gradients but at the expense of increased low dose bath.
- With sharp dose gradients from IMRT/VMAT or particle beam treatment, it is imperative that the basics of delivering radiotherapy including patient positioning, immobilisation, gating, tracking and the whole pathway is done correctly.
- I learnt and understood that gantry based radiotherapy is immensely important in order to deliver complex treatment volumes.

Image guided radiotherapy

- Particle beam therapy at present is still matched daily using X-ray images but the next generation proton beam machines (that will be installed in UK) will all have image guided capability (cone beam CT) included.

Patient selection

- Particle beam therapy is increasingly utilised worldwide (USA, Europe and Asia) due to the better physical beam properties compared to photons to deliver complex radiotherapy treatment volumes.
- The patient selection criteria are still to be determined based upon clinical trials data, clinicians experience and costs (to patients as well as to the healthcare system).
- I believe that as the cost of particle beam therapy continues to fall (machine costs will reduce with technological advancement) and clinicians gain experience; more patients will be treated with particle beam therapy.
- I have learnt that particle beam therapy is not to be feared but to be recognised as a potential treatment option for all patients in future. (Other costly treatments include immunotherapy and biological agents).

12a Envisaged benefits of the visit longer term (your own practice)

Personal

I and my physicist will hopefully contribute to the development of radiotherapy techniques in UK using our experiences gained from this visit.
We hope that our deeper understanding of the benefits and limitations of current photon therapy technology compared to particle beam therapy will allow us to utilise current photon therapy to the maximal potential benefit (adaptive IGRT/VMAT).
The immobilisation and tracking techniques and solutions used in both centres were different and very innovative.

National

I and my physicist will be part of the UK body of NHS professionals and fellows with experience of particle beam therapy and will be open to any collaboration with fellow colleagues as opportunities arise.

12b. Envisaged benefits to the wider group (dissemination to others in your centre/clinical oncology community/multi-professional team)

Local and regional

I and my physicist submitted a joint centre application and we will share our experiences and the technical advances from particle beam therapy to both our cancer centres.

Particle beam therapy is rapidly maturing as a field and UK will have 2 NHS centres very soon. We would like our two regional cancer centres to have some particle beam exposure as this is likely to be something our patients will ask for and may benefit from in the near future.

We aim to also organise regional meetings with our fellowship applicants from West Midlands (Birmingham, Coventry and Worcester) to collaborate and share ideas.

We will share with our colleagues about the Cyclotron Fellowship Trust and the opportunities available so that others will also utilise and benefit.

13. Please outline any problems you encountered before, during or after your visit

Approval

Our joint application was the first RCR Cyclotron fellowship to visit two particle beam therapy centres in one application.

This required a significant degree of organisation to coordinate both centres to host our visit for consecutive weeks.

We had managed to get both centres to agree to host our visit and then had to inform and gain permission from RCR trustees for approval within a short period of time.

Each step required significant time and effort but we are very grateful for both particle beam centres in Italy and also RCR trustees for allowing this visit to be successfully undertaken.

Travel within Italy

The travel within Italy to both centres had to take into consideration the Italian national day bank holiday occurring during the final weekend of our visit.

We did not encounter any significant problems travelling between centres as the Italian railways system were fairly cost efficient and timely. (early logistical planning recommended)

Health and weather

Our trip occurred in early summer and the pollen count in Pavia (CNAO) was high and we were using anti histamine medications regularly due to quite severe pollen allergy.

The second centre in Trento (APSS) is close to the Italian-Austria border and the weather was milder.

We did not suffer significant health or weather problems.

RCR Cyclotron fellowship is an invaluable resource for college fellows to gain exposure to particle beam therapy.

I would encourage the college to consider allowing more joint visits (2 centres) at once as it would make full use of the limited time and resources to maximise exposure and experience.

I take this opportunity to again thank the Royal College of Radiology Cyclotron Trustees for the opportunity to gain experience of world class particle therapy centres.

15. Do you have any 'top tips' that you would like to share with prospective visiting fellows?

Technical

Early preparation and advanced understanding of current photon beam radiotherapy techniques (IMRT/VMAT, IGRT) will help visiting fellows appreciate and understand the potential benefits of particle beam therapy but also any potential pitfalls.

Lingual

Italian is the predominant language spoken but English is also commonly used within the particle beam centre.

The patients referred for treatment do come from throughout Europe and the world.

Languages used include Portuguese, Spanish and German.

Personality

Both CNAO and APSS are centres not located in major population centres.

The team is very friendly and approachable.

I proactively asked my host in Trento (APSS) to be allowed to plan a case of re-irradiation of the spine using Proton beam therapy.

I managed to contour and plan the case during my week stay.

Proactive and enthusiastic personality will maximise learning experiences.

Signed: csboon **Date:** 15/7/17

Report approved by: Clinical Oncology Professional Support and Standards Board

Date 06.10.2017

Please return this form to Miss Irina Beleca, Professional Standards Administrator at:
irina_beleca@rcr.ac.uk