with the AC set up as recommended by the manufacturer. All measurements were corrected for daily output variations.
3DVH software (Sun Nuclear Corporation, Fl, USA) was used to create a measurement guided 3D dose estimation in the patient's planning CT. Plans were created in Eclipse TPS v11 using AAA and DVO v11.0.30 and delivered using a Varian 21iX linac (Varian Medical Systems, Ca, USA). The plans included both 6 and 10 MV photon energies and covered a range of treatment sites.
The measured and planned 2D dose distributions were compared using a 2%G/2mm 2D gamma pass rate (GPR). The 3DVH and TPS 3D dose distributions were compared using a 2%G/2mm 3D GPR and DVH analysis for the PTV and OARs.
Results: AC and MC 2D GPRs are equivalent for plans with mean field area ≤ 120 cm^2 (figure 1). However, after processing with 3DVH, calculated 3D GPRs for AC deteriorate significantly compared to MC, particularly for 10 MV plans. This is caused by the different processes involved in converting the AC and MC measurements to 3D dose distributions by 3DVH.
For plans with a mean field area > 120 cm^2 the 2D and 3D GPRs for AC are significantly worse than for MC. This may be due to the obliquity of the fields relative to the diodes at the edge of the array leading to shielding and directional dependence effects. The AC software does correct for these effects but our measurements suggest these corrections are not sufficient. Overall, MC based 3D dose estimations are in closer agreement with the TPS for all field sizes and energies.

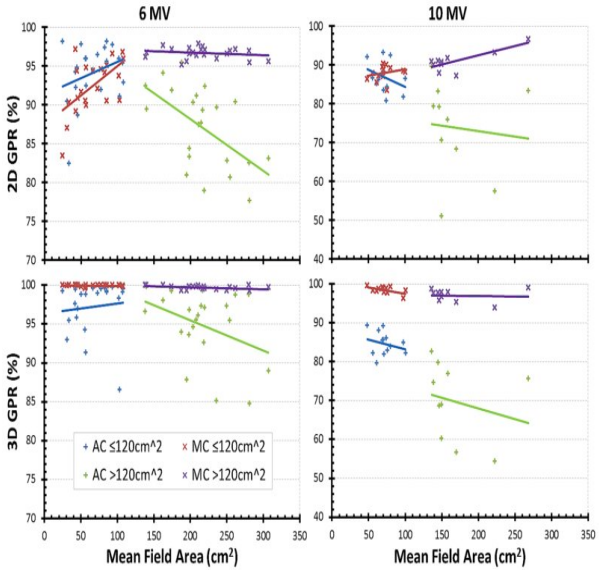

Figure 1: 2D and 3D GPR versus mean field area (cm^2).
Table 1 shows that the conversion from 2D to 3D for AC leads to reduced GPRs for 10 MV plans. The primary cause of this is a difference between the 10 MV 3DVH AC PDDs and the measured PDDs. In contrast, the 6 MV 3DVH AC PDDs match measured PDDs and the conversion to 3D improved the GPRs for 6 MV plans. The difference between 6 and 10 MV 3D dose estimation is also evident in the PTV D_{mean}.
Table 1: Mean (±s) 2%/2mm GPRs and percentage variation in mean dose to the PTV calculated by 3DVH compared to the TPS.

Energy		6 MV		10 MV	
Mean field area		≤120cm²	>120cm²	≤120cm²	>120cm²
No. of plans		22	22	13	10
AC 2D GPR		94.1 ± 3.7	87.1 ± 5.2	86.8 ± 3.9	73.9 ± 12.1
MC 2D GPR		92.5 ± 3.4	96.7 ± 0.7	87.9 ± 1.9	91.0 ±2.6
	p-value*	0.096	<0.001	0.417	0.001
AC 3D GPR		97.2 ± 3.4	94.9 ± 4.5	84.7 ± 3.0	69.8 ± 9.9
MC 3D GPR		99.9 ± 0.1	99.7 ± 0.3	98.4 ± 0.8	97.0 ± 1.6
	p-value*	0.001	<0.001	<0.001	<0.001
AC PTV D_{mean} (%)		1.8 ± 1.2	1.4 ± 0.8	4.2 ± 0.8	4.2 ± 1.0
MC PTV D_{mean} (%)		-0.1 ± 0.4	0.5 ± 0.4	1.5 ± 0.3	1.7 ± 0.5
	p-value*	<0.001	<0.001	<0.001	<0.001

* from paired T-test

Conclusions: For IMRT QA, ArcCHECK is not an ideal system for plans with field area > 120 cm^2. For 3D dose estimation using 3DVH, the ArcCHECK performed significantly worse for 10 MV than for 6 MV plans. Overall, we found that the MapCHECK2 was more suitable than the ArcCHECK for 3D dose estimation using 3DVH.

PO-0875

Evaluation of a dedicated brain metastases planning algorithm for radiosurgery: a new treatment paradigm

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Purpose/Objective: Stereotactic radiosurgery alone has become a popular treatment option in the management of patients with brain metastases. Multi- or single-isocenter dynamic conformal arcs (DCA) and volumetric modulated arc therapy (VMAT) are two common used delivery techniques. Recently, a dedicated inverse optimized brain metastases treatment planning solution using single isocenter multiple DCA has been developed, with intend to carefully balance normal tissue protection, target coverage and treatment speed. The purpose of the current study was to investigate the feasibility of this novel software and to benchmark it against well-established multi-isocenter DCA and single isocenter VMAT approaches.
Materials and Methods: Ten previously treated patients were selected representing a variable number of lesions, range of target sizes and shapes most frequently observed in the practice of SRS for brain metastases. Number of lesions ranged between 1 and 8. The original multi-isocenter DCA (MIDCA) treatment plans were replanned with both single-isocenter VMAT approach and the novel brain metastases tool (Elements, Brainlab AG, Germany). The treatment dose was 20 Gy at the 80% prescription isodose. For all the plans, the dose to the surrounding healthy brain tissue (brainstem, cochlea, optical nerve, eyes and lens) was optimized to minimize normal tissue complications. The plans were evaluated by calculation of Paddick conformity and gradient

index, and the volume receiving 10 and 12 Gy indicating risk of radionecrosis.

Results: All plans were judged clinically acceptable, but differences were observed in the dosimetric parameters. MIDCA achieved conformal plans (CI = 0.66 ± 0.07) with steep dose fall-off (GI = 4.47 ± 1.57), a V12 of 35.56 ± 26.41 cc and a V10 of 49.03 ± 38.10 cc. The VMAT plans had comparable conformity (0.67 ± 0.12) than MIDCA, worse GI (7.11 ± 3.12) and higher V10 (67.93 ± 55.93 cc) and V12 (46.34 ± 35.92 cc). The brain metastases software tool generated plans with similar CI (0.65 ± 0.08) then the two established treatment techniques while improving the GI (3.94 ± 1.42) and managing comparable V10 (48.47 ± 35.93 cc) and V12 (36.30 ± 27.09 cc) compared to MIDCA.

Conclusions: Our results suggest that the automated brain metastases planning algorithm can achieve similar conformity and low dose spread compared to multi-isocenter DCA while increasing efficiency in both treatment planning and delivery due to the use of a single-isocenter approach. In terms of efficiency, VMAT radiosurgery was already likely to replace the multi-isocenter DCA technique for multiple lesions at the cost of increased low dose spread. Comparable efficiency was found with the new algorithm while improved dose gradient was observed suggesting that this novel software offers the best of both world (i.e. efficient single-isocenter DCA delivery).

PO-0876

Clinical considerations for introduction of VMAT for paediatric medulloblastoma

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Purpose/Objective: In our clinic, the treatment technique of choice for the majority of patients is Volumetric Arc Therapy. At present, paediatric medulloblastoma patients undergoing cranial spinal radiotherapy will be offered proton therapy elsewhere. Sometimes, due to bad prognoses and physical shape of the patient, the patient is treated locally with classical 3D-CRT photon fields. Overlapping posterior fields induces high dose maximums and the dose distribution will be sensitive to patient positioning. Moreover, this technique is prone to high heart doses and inhomogeneous target coverage. This study compares VMAT plans with classical 3D-CRT plans while comparing the risk for mortality attributable to secondary cancer and heart toxicity using the Life Years Lost-principle (LYL[1]) as well as the risk for hematologic effects[2]. Furthermore, the VMAT plans can be optimized in a fashion that the dose distribution will be less sensitive to patient positioning and the benefit of such an approach will be assessed.

Materials and Methods: Five patients were treated with the 3D-CRT cranial spinal technique. On those patients all OAR were retrospectively delineated including the bone producing bone marrow. The VMAT plans consists of fields that are deliberately field overlapping, ranging from 1 to 4 cm. The total dose was 36 Gy in 20 fractions. The robustness of the dose distribution towards patient positioning errors was tested by moving the isocentres in the treatment plan by 5 mm in the cranial-caudal direction. The LYL estimates were calculated and compared for lung and heart. The acute haematological toxicity was investigated by calculating the V_{3Gy} of the red marrow (trombocytes) and the V_{2Gy} (leukocytes), V_{3Gy} (hæmoglobin) to the total body.

Results: As a result, the dose max for both planning techniques changes according to table 1. The LYL for lungs increases with a factor 1.5 to 3 and the LYL for myocardial infarction decreases with a factor 0.5 to 1.0 when using VMAT. The V_{3Gy} of the bone marrow and V_{3Gy}, V_{2Gy} of the body increases with a factor 2 when using VMAT.

Conclusions: The VMAT technique provides a more robust dose distribution. The LYL principle can be used as a measure to compare plans and to re-optimize the dose distribution. The LYL estimates are intrinsically uncertain due to the limited knowledge of second cancer dose-response and the incidence profile across attained age, and the results should be interpreted in this context. The VMAT technique will induce a higher risk of acute Anaemia, leukopaenia and Thrombocytopaenia, but can be controlled when the patient is monitored daily.

[1] Brodin NP et al, Life Years Lost-Comparing potentially fatal late complications after radiotherapy for pediatric medulloblastoma on a common scale, Cancer, *2012 Nov 1;118(21):5432-40*

[2] Petersson K et al, Haematological toxicity in adult patients receiving craniospinal irrdation – indication of a dose-bath effect, Radioth and Onc, 2014 Apr;111(1):47-51

Results	Dose max (%) 0 mm		Dose max (%) 5 mm		LYL-Lung		LYL-heart		V2Gy Body (%)		V3Gy Body (%)		V3Gy Bone Marrow (%)	
	VMAT	3D-CRT	VMAT	3D-CRT	VMAT	3D-CRT	VMAT	3D-CRT	VMAT	3D-CRT	VMAT	3D-CRT	VMAT	3D-CRT
Patient 1	115.5	122.9	129.0	156.2	0.43	0.17	0.45	0.43	77.0	39.3	70.0	33.9	91.5	64.1
Patient 2	112.1	126.5	146.7	139.0	0.81	0.48	0.11	0.20	75.9	42.1	68.9	34.7	78.4	54.0
Patient 3	111.1	118.4	133.3	142.4	0.45	0.31	0.39	0.80	75.0	47.0	68.2	40.6	73.1	33.4
Patient 4	110.7	124.7	138.6	142.9	0.44	0.18	0.3	0.39	85.7	43.9	79.6	37.0	72.7	10.9
Patient 5	114.7	143.8	126.2	143.7	0.88	0.28	0.1	0.18	77.6	35.7	71.1	29.0	74.4	16.8

PO-0877

Knowledge-based treatment planning of IMRT for prostate cancer

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Purpose/Objective: Varian RapidPlan™ knowledge-based planning software is designed to increase consistency and improve efficiency in treatment planning. The aim of this study was to compare the quality of plans produced using RapidPlan with those produced following local standard planning procedures for prostate treatments.

Materials and Methods: A dose prediction model was trained using clinical treatment plans for 35 prostate patients previously treated with 37 fractions of 5-field IMRT. A high-dose PTV (prostate + 0.5cm/0cm posterior margin) was planned to 78Gy, with additional PTVs treated to 71Gy (prostate + 1.0cm/0.6cm) and 60Gy (seminal vesicles + 1.0cm) using Varian Eclipse v13.5. 10 additional patients previously planned using local clinical procedures were then replanned using the RapidPlan model to predict DVHs and thereby generate patient-specific initial plan optimization objectives. Priorities for minimum target dose objectives