

# FETAL DOSE ESTIMATION IN A CASE OF UNINTENDED PREGNANCY DURING BRAIN RADIOTHERAPY

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## Introduction

Pregnancy during radiotherapy is not a common clinical situation. We describe a fetal dose estimation necessary before starting a course of radiotherapy for a brain tumor in a patient unexpectedly pregnant at the time scheduled for the beginning of treatment.

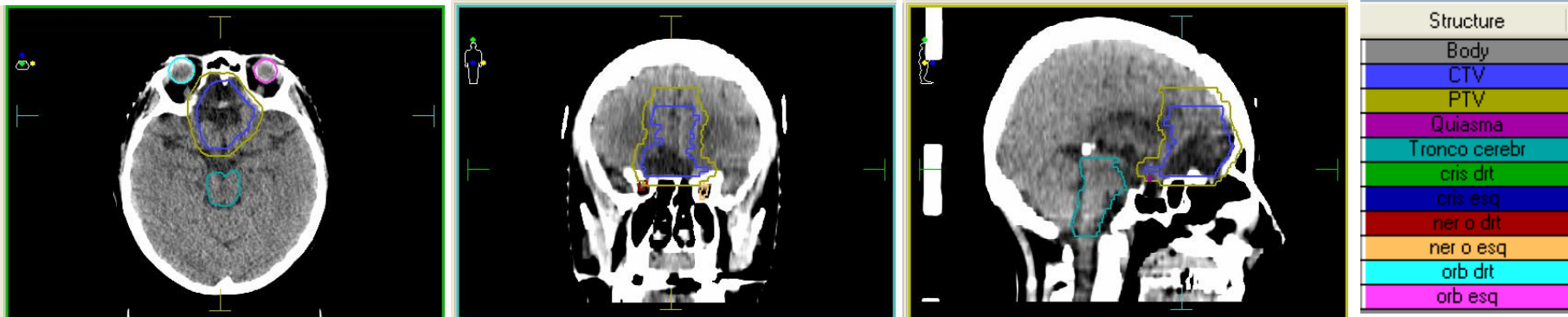
## Purpose

To estimate the dose to the fetus during the programmed course of radiotherapy before deciding if the patient should advance with the treatment or not.

## Materials and Methods

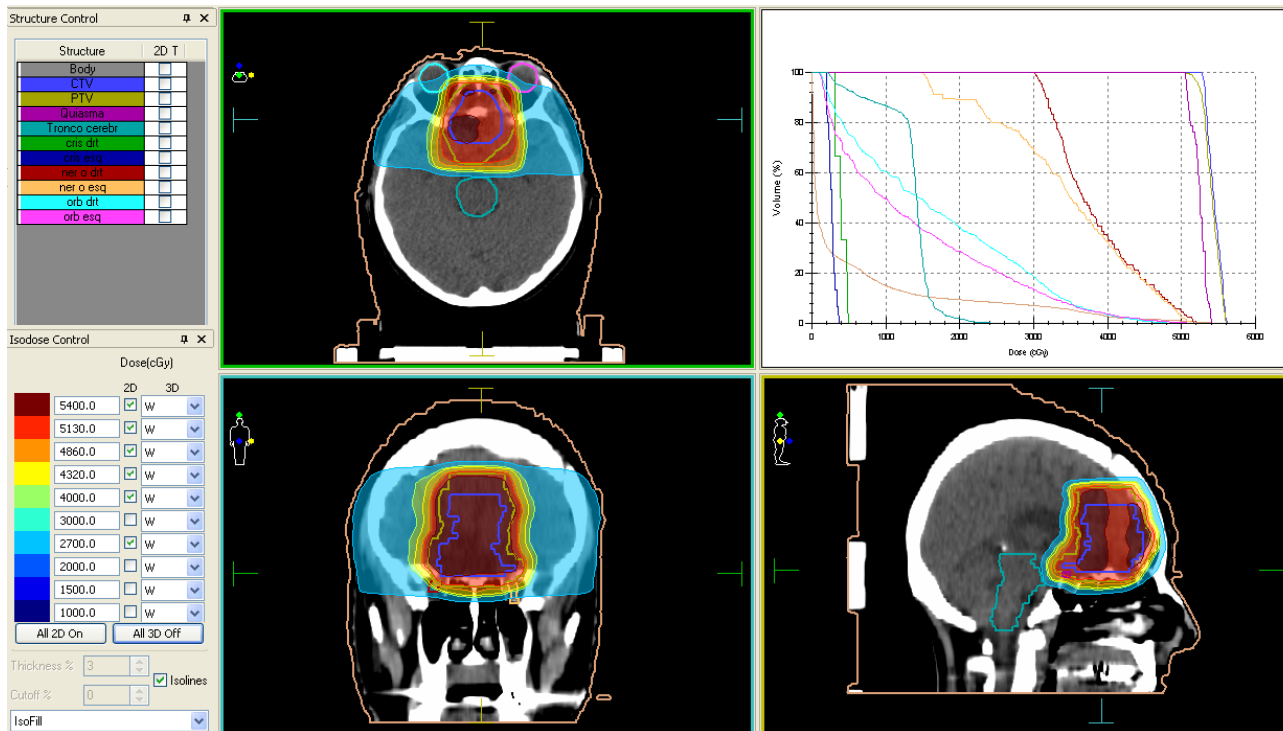
A 37 years old patient diagnosed with a Papilar Meningioma (Grade III), located on the base of the skull, found out that she was 21 weeks pregnant on the day she was starting a radiotherapy course.

The treatment was suspended and postponed for about 5 weeks to allow for an evaluation of the involved risks and to complete a set of confirmation measurements.



## Materials and Methods

The first step was to optimize the initial plan to minimize fetus exposure to radiation without compromising dose to the target volume.



### Treatment Machine

Siemens Primus with 82 leaves MLC

### Beam Type

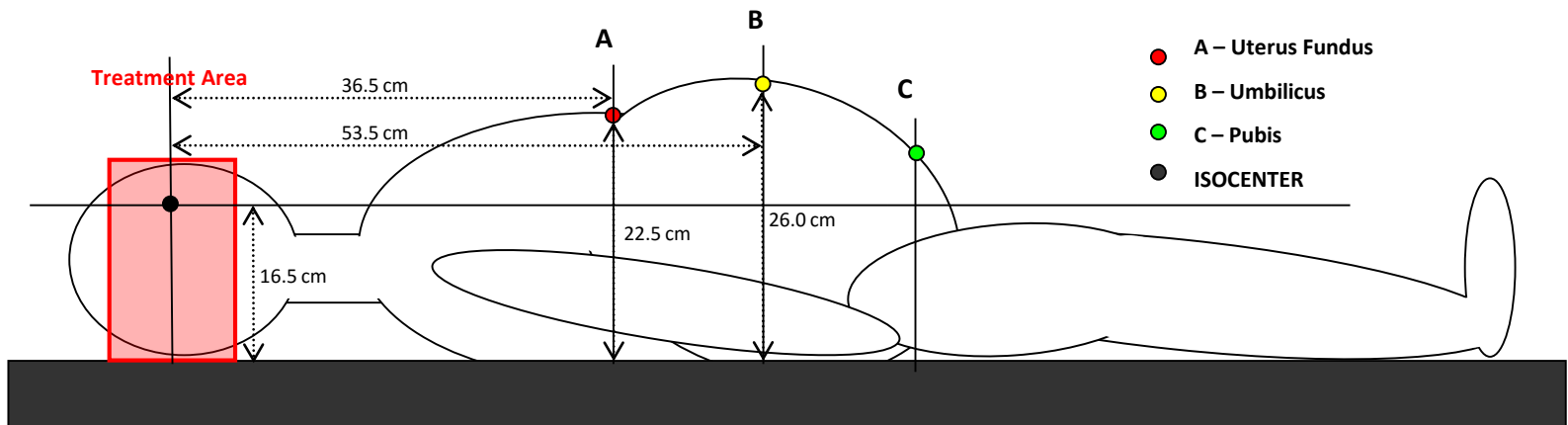
6MV Photons

### Plan Type

3D Conformal RT with 5 non coplanar fields

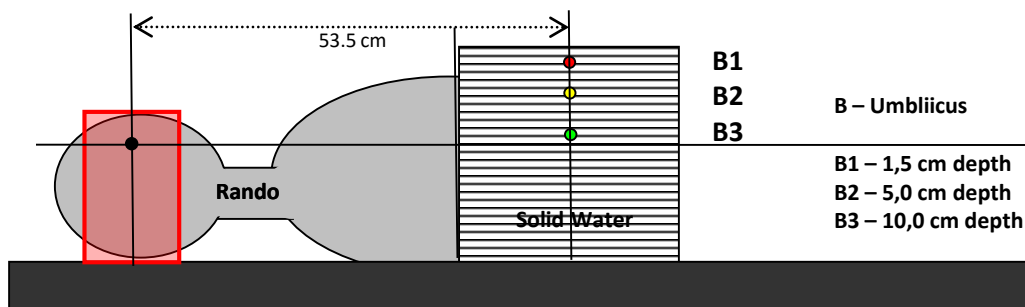
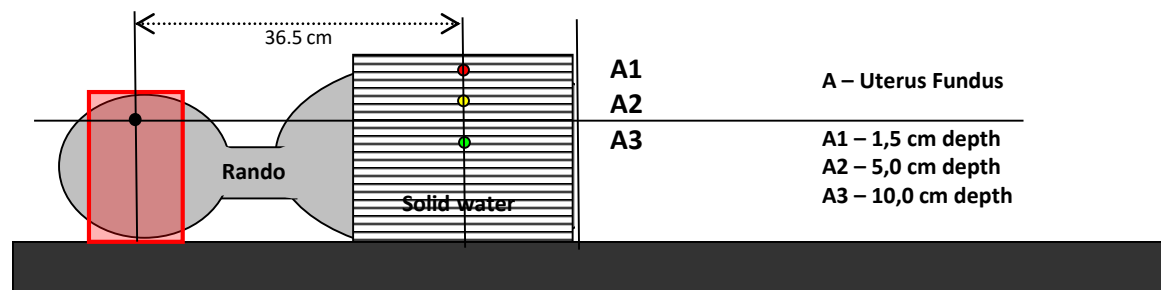
## Materials and Methods

The real patient distances between plan isocenter and 3 critical points were taken: uterus fundus, umbilicus and pubis.



## Materials and Methods

Using an anthropomorphic phantom and solid water slabs, a set of measurements were done positioning an ionizing chamber at different depths, corresponding to these points, to estimate doses for the complete course of radiotherapy.



## Results

The maximum dose value measured was 2,5 cGy, well below the 10 cGy reported tolerance value.

Dose Prescription - 30x180 = 5400 cGy

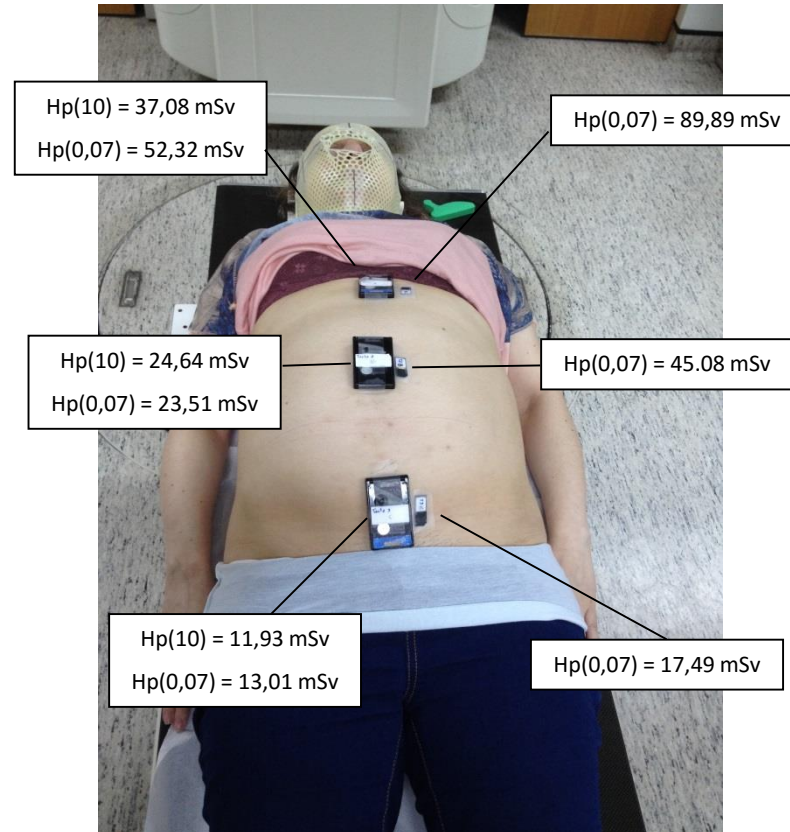
Point	Depth (cm)	Distance to isocentre	Dose (cGy)	Dose (cGy)	% Dose to Isocenter
			Per fraction	Total (30F)	
A1	1.5	36,5 cm	0.0818	2.536	0.045%
A2	5		0.0742	2.300	0.041%
A3	10		0.0656	2.034	0.036%
B1	1.5	53,5 cm	0.0493	1.528	0.027%
B2	5		0.0427	1.324	0.024%
B3	10		0.0405	1.256	0.023%

After explaining to the patient the situation and the risks involved, a decision was taken to go on with the treatment as planned.

## Results

With the cooperation of IST/CTN Lab, a set of 3 pairs of TLD dosimeters was used over the patient's belly, in the corresponding positions, during every treatment fraction.

The TLDs readings at the end confirmed the estimated values measured in the phantom.



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## Conclusion

The results indicate that even in the most unfavorable point (A1), the estimated dose of 2.5 cGy was lower than the 5cGy and 10cGy values reported in literature for these situations.

The previous evaluation of the estimated dose to the fetus allowed the patient to successfully complete the radiotherapy course. The pregnancy went on normally and the patient delivered a healthy child.



## Conclusion

The main risks to the fetus after irradiation with ionizing radiation are malformations, mental retardation, and induction of cancer. The deterministic threshold for these effects was estimated to be 10 cGy. It is important to ensure that the dose to the fetus is below this value throughout the treatment.

In late pregnancy ( $> 25$  weeks) the first two risks are negligible, greatest risk being development of cancer. However, these risks are considered very low for doses less than 5 cGy.

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