Radiotherapy of pediatric patients at KBC Zagreb – in relation to interworking with children and their parents

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- In developed countries, childhood malignant tumours are the second highest cause of death among children.

- Annually there are approximately 130 new diagnosed patients per million children under the age of 15.

- The total number of malignant tumours in children:
  - 45 % leukaemia and lymphoma
  - 55 % solid malignant tumours:
    - 19 % tm CNS
    - 8 % neuroblastomas
    - 7 % soft tissue sarcomas
    - 6 % tm kidney
    - 5 % bone tumours
    - 3% retinoblastoma
    - 3 % seed epithelial tumours
    - 1 % liver tumours
    - 1 % tumours of the gonads
    - and other cancers

- Today we have many techniques for diagnosing and following the course of the disease.

- In children, most common examinations are radiography, ultrasound, CT, MR, scintigraphy and PET/CT.

- Levels of ionizing radiation should be specifically taken into consideration during examination of children.

- A strong and direct cooperation between experienced staff and the patient is required.

- In young children which refuse cooperation out of fear and/or are restless, short-term sedation is possible to get better examination results.

- DPIR (Department of planning and implementation of radiotherapy) at KBC Zagreb is the first institution in Croatia that can administer sedation during radiotherapy.

- WILLMS's TM - Nefroblastoma:

- Forming of TM is attributed to genetic or somatic mutations.
- Based on histology type it's separated into two group – favourable histology FH and unfavourable histology.
- It most often occurs in the form of asymptomatic mass in the abdomen.
- It belongs to the group of tumors sensitive to radiation.

- Radiation doses for Willms's tumour:

- 10 - 20 Gy to the whole abdomen or kidney tray, with an additional 10 - 15 Gy to the area of residual tumor.

- If the radiating is only done on residual tumor, the dose is 15 - 20 Gy.

- NEUROBLASTOMA
- Malignant tumors of the autonomic nervous system.
- The most common extracranial solid tumour in children.
- Gamma rays or x-rays 6 - 10 MV.
- Radiation field includes the area where the tumour disseminated (after general surgery), or is still located.
- Radiation doses are different depending on the localization process.
- Tumors in the abdomen are radiate by a dose of 25-40 Gy.
- The bigger the tumour mass, daily dose of radiation is smaller.

- EWING‘S SARCOMA

- About 2% of all malignant tumors during childhood.
- It is usually detected in the age group 6 - 16 years, and is prevalent in males.
- Its origin is neural and is now a part of periphery primitive neuroectodermal tumour group.
- The most common symptoms which accompany Ewing’s sarcoma are pain, palpable mass, pathological fractures, and fever.

- The radiation dose is 30-40 Gy, and if the tumor does not respond to chemotherapy, radiation dose is increased to 50-55 Gy.

- Radiotherapy should be carefully planned, eg. in order to maintain zones of bone growth (ossification).

- RHABDOMYOSARCOMA

- It most often occurs untill the ages of 5 years, or between 10 to 15 years, equally in both sexes.

- The most common objective of the application of radiotherapy is local control of residual disease after partial resection or biopsy.

- The total radiation dose should be between 40 and 60 Gy.

- PURPOSE OF RADIOTHERAPY:

- Eradication of tumour cells while preserving surrounding healthy tissue.
- Sometimes this is difficult to achieve in children because of possible growth stunting and development of secondary tumors as a result of radiation.
- Precisely because of this need, special attention needs to be given to the planning field, immobilization and sedation during radiation.

- In the Department for the implementation and planning of radiotherapy at UHC Zagreb a joint team of experts work in planning and implementing radiotherapy:
  - MD specialized in radiotherapy and oncology
  - Medical physicist
  - Radiation technologist
  - Nurses from radiotherapy ambulance
  - MD anesthetist and anesthetic technician

- Planning is carried out on the CT simulator:

  - Somatom sensation open

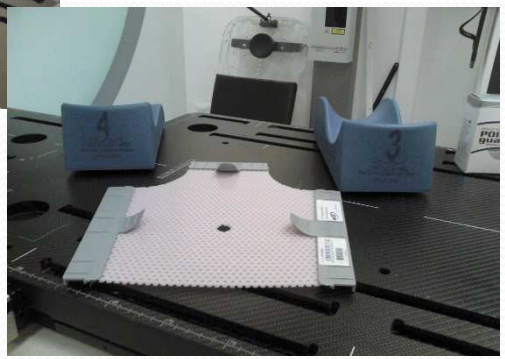
  - Toshiba aquilion

Plan development steps

The patient (child) comes to a CT simulator, anesthesia is applied by the Anesthetic team if the child is not entirely peaceful.

- We take care of everyday reproducibility while setting and positioning the child in treatment position
  - comfortable for the child
  - doesn’t cause pain
  - allows the application of multiple radiation lobes
  - respiratory and venous access is accessible

- We are using different pads for the body and head - immobilization and fixation resources.

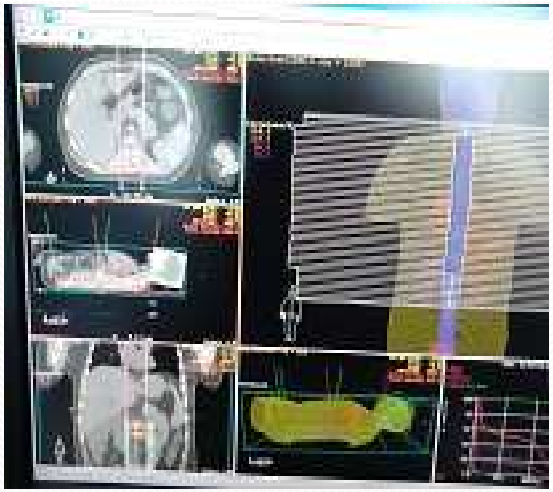


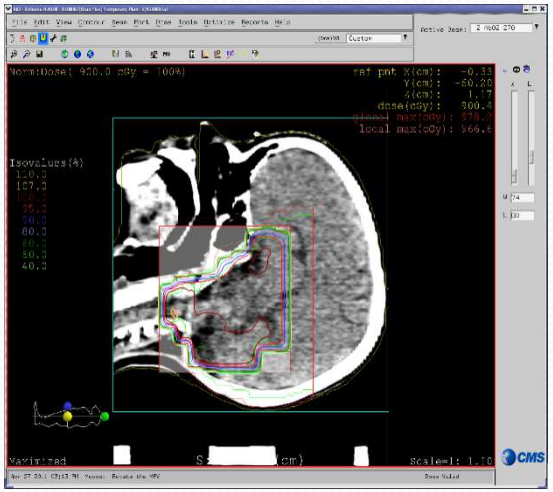
- After adjusting the patient and application of anesthesia (if needed), we apply thermoplastic immobilization mask (3 - 6 points, depending on the region), mark reference points, and put CT markings(CT spots).

- We perform a CT scan, take off the mask, draw marks on the patient's body and protect them with point guard label (for all regions except the head).

- After carrying out the CT simulation we send CT scan to work stations for treatment planning, Dosimetrist and XIO

- Skin and organ contouringis performed
- Determination of the PTV
- An individual Treatment plan is created, and after completion the plan is imported in the Radiotherapy Unit

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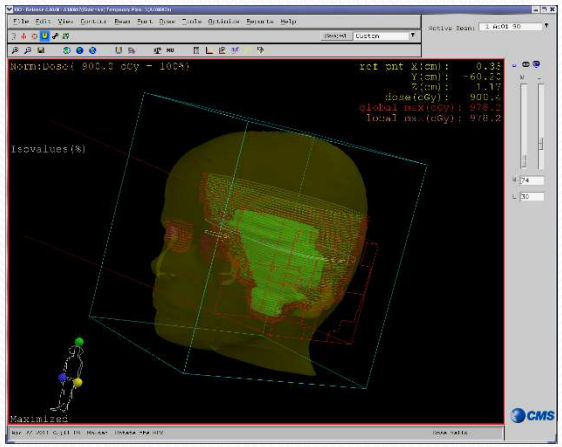
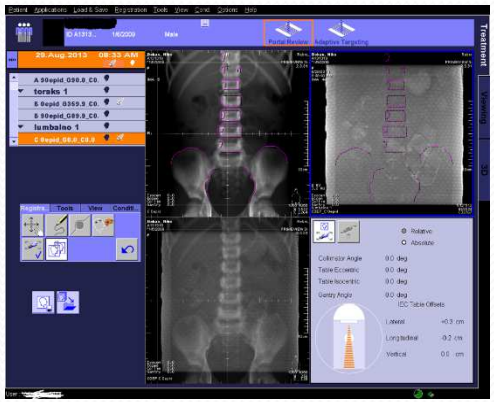
Isovalues(%)
Maximized
CMS

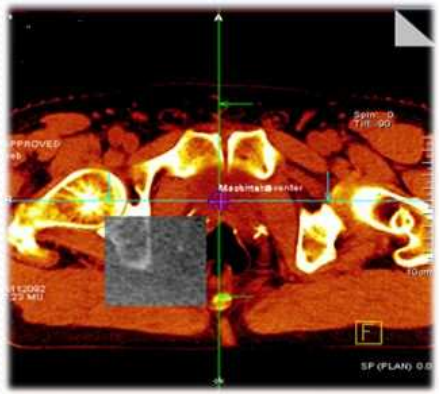

Norm:Dose(900.0 cGy = 100%)
Isovalues(%)
Maximized
CMS

- Quality control of implementing the radiation:

- EPID and CBCT
- Verification of the accurate position of the patient's body, and accurate Target volume
- The same work is necessarily repeated at the 1st, 2nd, and 3rd fraction, and after every fifth time, or more often if necessary

CBCT and Epid Image





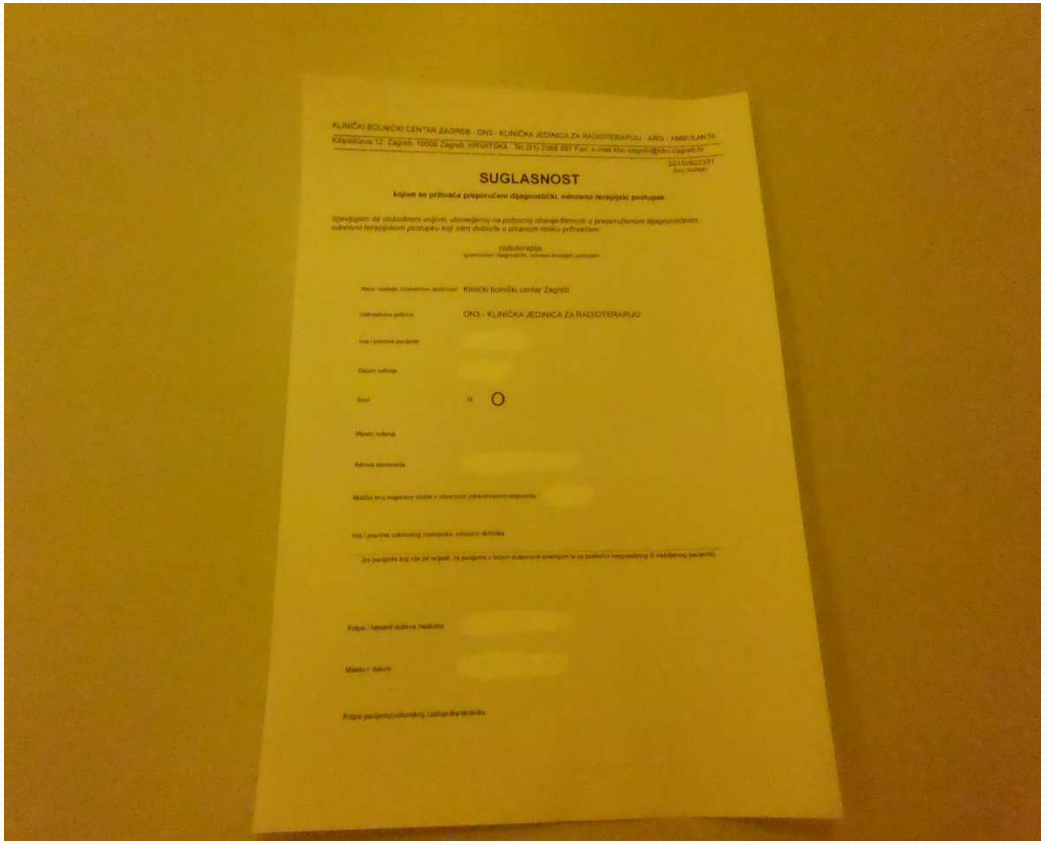
- At our department there is a possibility of using short-term anesthesia in restless and uncooperative patients in planning and implementing radiotherapy.

- Our goal is to get the patient as peaceful and relaxed as possible in order to gain results of higher quality.

- Anesthesia team:
  - Physician specialist in anesthesia and reanimation
  - Anesthetic medical technician-nurse

- UHC Zagreb is the first institution in Croatia to start undertaking radiotherapy in children with the help of sedation.
- Mandatory position during sedation is lying on the back to make the aerodigestive path available.
- Parents/guardians signed consent for sedation is mandatory, with written instructions.

Approval example



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2015/062331
(broj zahtjeva)

SUGLASNOST

kojom se prihvaća preporučeni dijagnostički, odnosno terapijski postupak

Izjavljujem da slobodnim voljom, utemeljenoj na potpunoj obavijestenosti o preporučenom dijagnostičkom odnosno terapijskom postupku koji sam dobivši u pisanom obliku prihvaćam:

radioterapija
(preporučeni dijagnostički, odnosno terapijski postupak)

Naziv nositelja zdravstvene djelatnosti: Klinički bolnički centar Zagreb

Odgovarajuća jedinica: ON3 - KLINIČKA JEDINICA ZA RADIOTERAPIJU

Ime i prezime pacijenta:

Datum rođenja:

Spol: M O

Mjesto rođenja:

Adresa stanovanja:

Matični broj osiguranog osobe s obveznim zdravstvenim osiguranjem:

Ime i prezime zakonskog zastupnika, odnosno skrbnika

(za pacijente koji nije pri svijesti, za pacijente s teškim duševnim smetnjama te za poslovno nesposobnog ili nezakonitog pacijenta)

Potpis i titula/ili službena mećatnica

Mjesto i datum

Potpis pacijenta/zakonskog zastupnika/skrbnika

KLINIČKI BOLNIČKI CENTAR ZAGREB
Zagreb, Kišpatićeva 12

Ustrojbena jedinica: ZAVOD ZA PLANIRANJE I PROVOĐENJE RADIOTERAPIJE

Obavijest pacijentu o dijagnostičkom odnosno terapijskom postupku

RADIOTERAPIJA

Ime i prezime pacijenta:	Datum rođenja:	Spol: M Ž
Mjesto rođenja:	Adresa stanovanja:	Matični broj osigurane osobe u obveznom zdravstvenom osiguranje:

Ime i prezime zakonskog zastupnika, odnosno skrbnika:
(za pacijenta koji nije pri svijesti, za pacijenta s težom duševnom smetnjom te za poslovno nesposobnog ili maloljetnog pacijenta)

OPIS POSTUPKA

Radioterapija je jedan od oblika liječenja različitih vrsta tumora. U liječenju bolesnika s tumorima koristimo se fotonima i česticama visoke energije poput X-zraka, gama-zraka i elektrona, kako bi ionizacijom oštetili ili uništili tumorske stanice. Ovakve snopove zračenja proizvode uređaji za zračenje koje zovemo linearni akceleratori. Cilj terapije je pomoću zračenja uništiti tumorske stanice i pri tomu sačuvati okolno zdravo tkivo. Uz kirurško liječenje i kemoterapiju, radioterapija je osnovni način liječenja tumora bilo samostalno ili u kombinaciji s kemoterapijom. Za razliku od kemoterapije koja djeluje na cijeli organizam, radioterapija ima prvenstveno lokalne učinke na onaj dio tijela koji se zrači (tzv. „ciljni volumen").

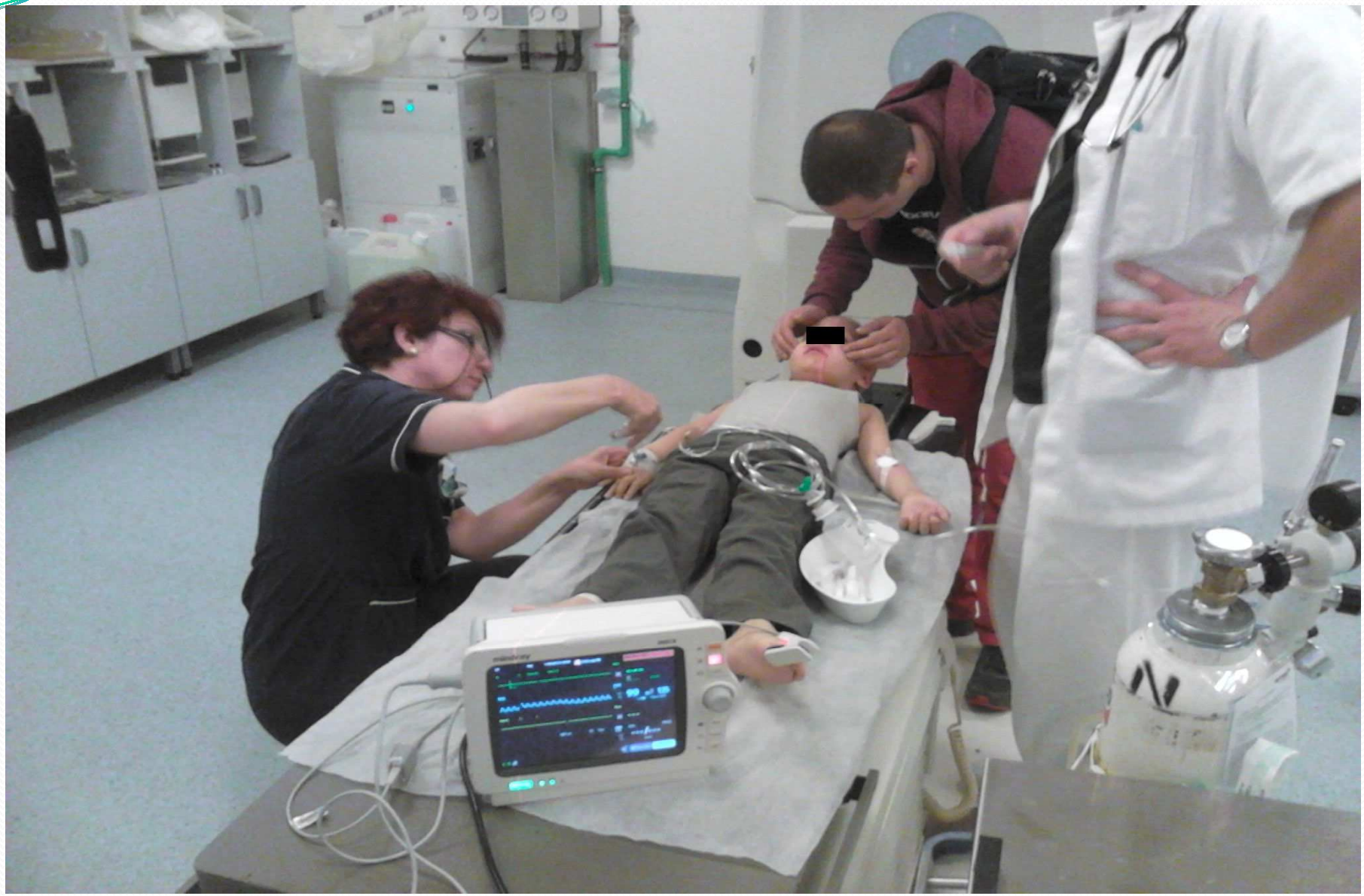
1. SIMULACIJA

Prije početka zračenja nužno je provesti pripremu koja uključuje simulaciju i planiranje zračenja. Ovaj postupak prethodi samom početku radioterapije nekoliko dana do tjedana. Planiranje i simulacija zračenja provodi se ovisno o tipu i stadiju karcinoma na CT-simulatorima na lokacijama Rebro, Jordanovac i Petrova. Na simulaciji se izvodi snimanje, kao na rendgenu. Razlika je u tomu što se snimanje na simulaciji izvodi u specifičnom položaju u kojem će se poslije primati radioterapija na linearnom akceleratoru. Položaj u kojem je pacijent ležao za vrijeme simulacije, kao i lice pacijenta se slikaju fotoaparatom, zbog veće sigurnosti identifikacije i reprodukcije parametara za radioterapiju.
Ponekad se za snimanje koriste kontrastna sredstva, koja se mogu primiti putem injekcije ili oralno.

2. PLANIRANJE ZRAČENJA

Prije svakog početka zračenja izrađuje se optimalan individualizirani plan zračenja. Svaki plan zračenja mora biti prihvaćen i odobren od radioterapijskog konzilija. Na taj se način odabire optimalan način zračenja uz maksimalnu poštedu zdravih tkiva. Proces planiranja traje od nekoliko dana do nekoliko tjedana, ovisno o kompleksnosti plana zračenja.

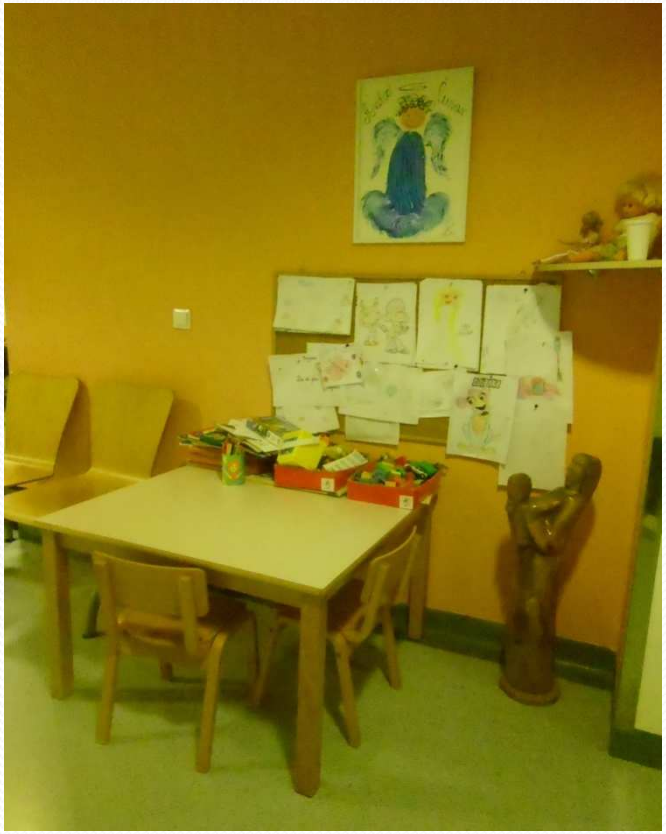
- Our goal is to achieve adequate sedation, deep enough to prevent the movement of the patient, while avoiding the risk of apnea and loss of reflexes.
- The goals of anesthesia:
  - short duration, painless application
  - fast recovery
  - minimum effect on food intake and activity with the child during the day
  - safety during subsequent applications
  - the possibility of inspection and maintenance of the airway

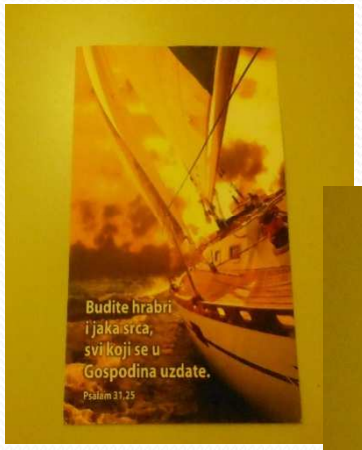


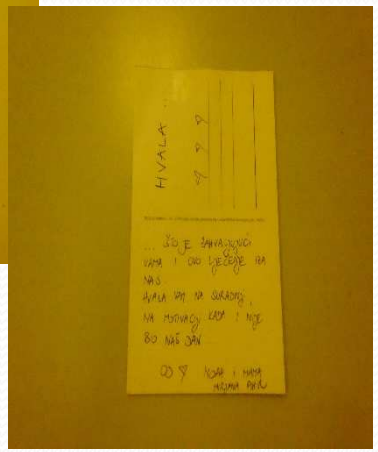
•Permanent monitoring and oxygenation of patients while under anesthesia is secured, along with permanent video and audio surveillance.

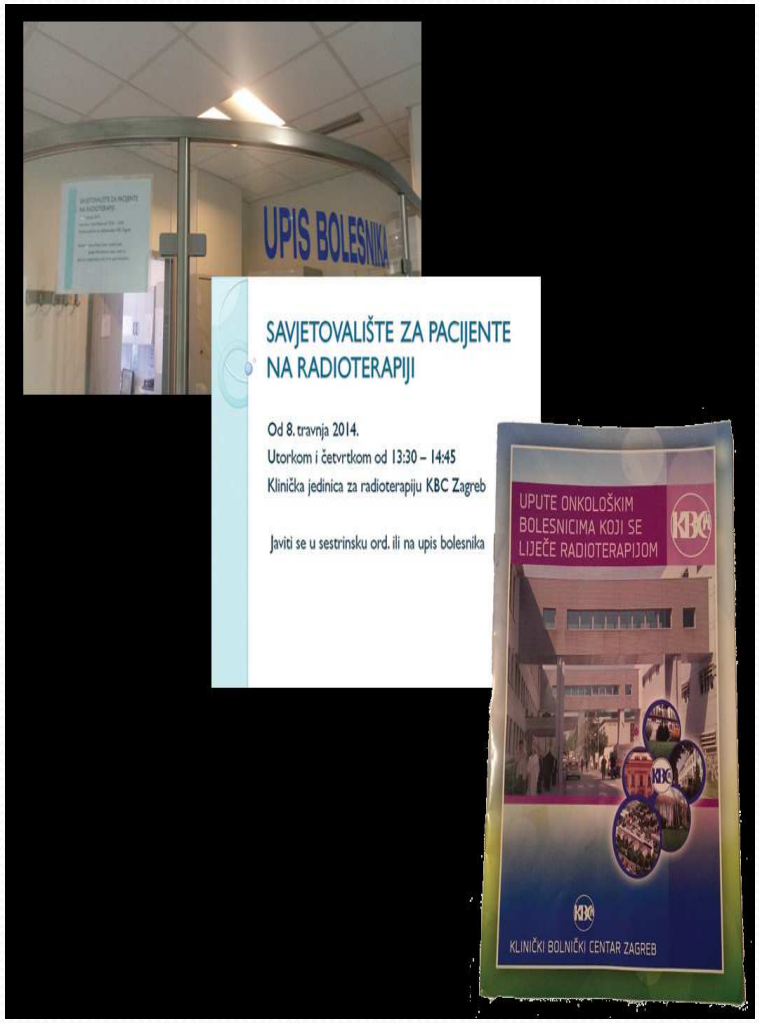
- Great attention is given to cooperation with parents during planning and implementation of radiotherapy.
- Our goal is to achieve as pleasant and relaxed atmosphere as possible, especially for child patients so they can feel secure in the hands of our professional team.
- For children who do not require anaesthetics, we try to maintain child-parent contact, and enable them to hear their parents voice through speakers while they are in progress of radiation, which is proving to be very effective.
- We try to provide a pleasant atmosphere in the waiting room as well during the examinations.

Picture of the children's corner





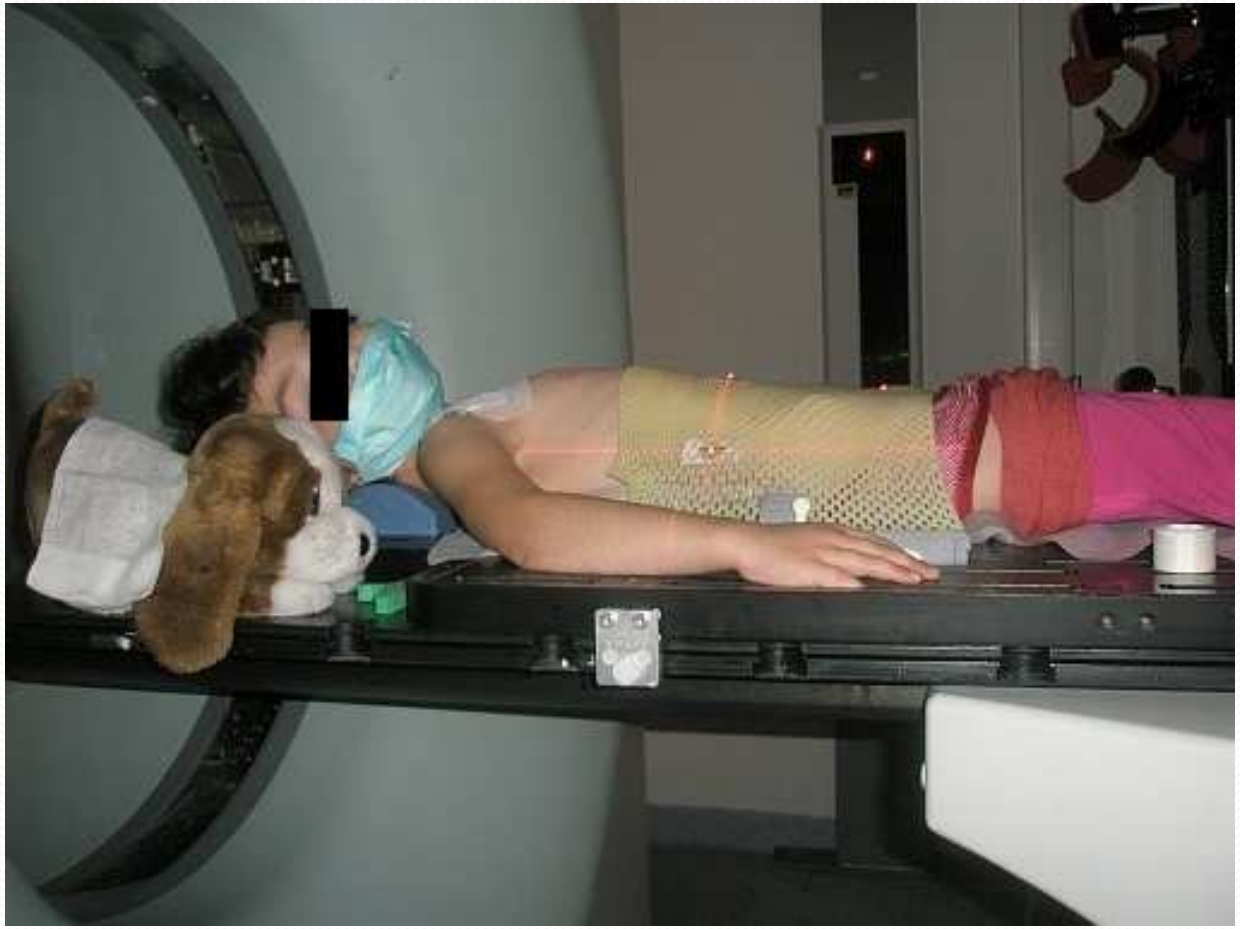




- Patients (children) as well as their parents are often insufficiently informed about radiotherapy. They don't know what is happening and what to expect.
- Sometimes overwhelmed with unclear suggestions from various sides (media, internet, internal communication), and sometimes because of ignorance, they make wrong moves and contribute to the development of symptoms.
- Our goal is to explain and help patients in everyday situations during radiotherapy.
- For this purpose at UHC Rebro we established counseling for patients.
- We also prepared a little book with instructions so that the patients can more easily pass through treatment and cope with the possible side effects.

Conclusion

- We have shown how valuable is to have good cooperation with parents and children during radiotherapy, to offer security and inspire confidence in the medical team, and because of that we're able to undergo the planning process and therapy without resorting to anesthesia, even with children of a younger age.



Thank you for your attention