

# Successful application of nuclear technologies for the therapy of eye tumors at Moscow Helmholtz Research Institute of Eye Diseases

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19–20 September 2017

IAEA Scientific Forum

**Nuclear Techniques  
in Human Health**

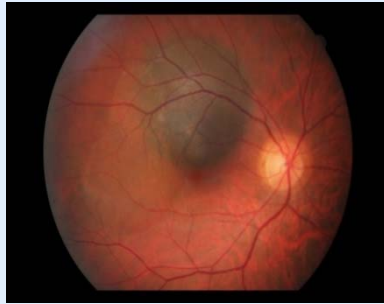
*Prevention, Diagnosis, Treatment*



# The most common primary malignant intraocular tumors

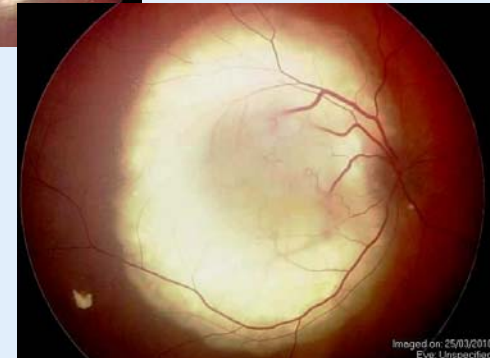
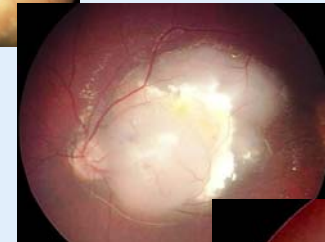
## Uveal melanoma

- Adults
- 6 – 8 patients per 1 million adults per year (WHO - 1-23)
- 50% of patients die due to the metastatic disease in 10 years after initial diagnosis



## Retinoblastoma

- Children
- Incidence varies from 1 per 15000-20000 newborns with a tendency to increase over the last years.
- Monolateral – 60%, bilateral – 40% and is due to hereditary factors



For many years, the main method of malignant intraocular tumors treatment was the enucleation of the affected eye.

## An idea of UM contact irradiation belongs to *P.Moore (1930)*

1960 -1978 yrs - cobalt ophthalmic applicators (OA) ( $^{60}\text{Co}$ ) *L.Stallard, R. Ellsworth*

1973 – strontium OA ( $^{90}\text{Sr} + ^{90}\text{Y}$ ) *G.D. Zarubey, A.F.Brovkina (Russia)*

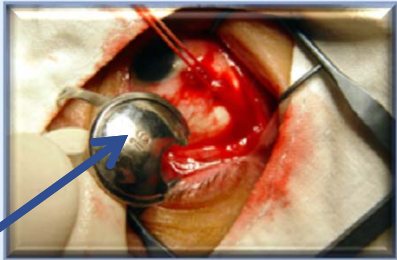
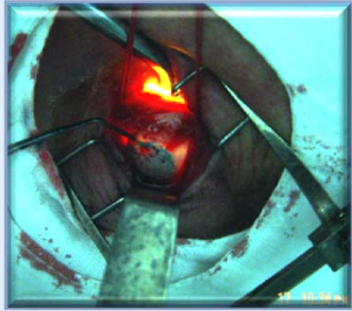
1974 – ruthenium OA ( $^{106}\text{Ru} + ^{106}\text{Rh}$ ) *P.Lommatch*

1980 – iodine OA ( $^{125}\text{I}$ ) *R. Seedly, H.Burret*

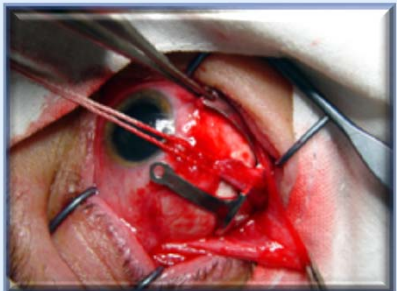
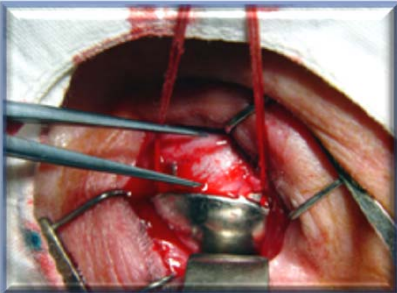




# Surgical steps of plaque application

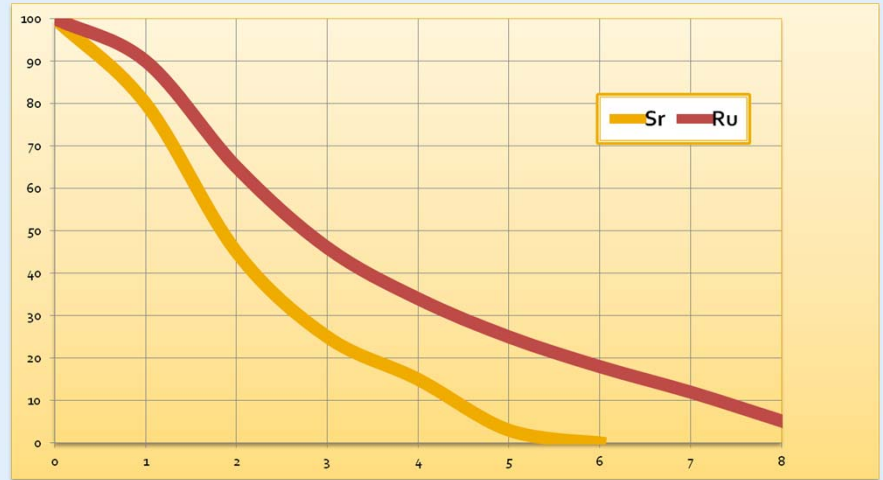


plaque



OA irradiation dose decrease (in %) depending on **biological tissue thickness** (in mm)

Surface dose percent



Biological tissue thickness (mm)

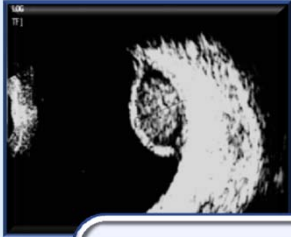


Russian plaques (Obninsk)

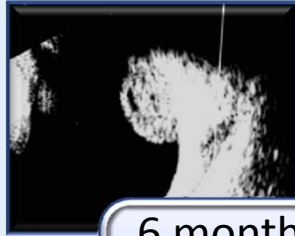
*More than 5600 patients with intraocular tumors (uveal melanoma and retinoblastoma) have been treated in Moscow Helmholtz Research Institute of Eye Diseases by the year 2017. Head – RAS corresponding member, prof. Neroev V.V.*

- A unique group of ophthalmic applicators (plaques) for intraocular tumors and tumors of the anterior eye segment irradiation with isotopes Rh-106 and Sr-90 is developed and produced in Russia (**I.I. Leypunsky Institute of Physics and Power Engineering, Obninsk city**)

## Uveal melanoma regression after brachytherapy



Before  
treatment.  
7.0 x 13.6 mm



6 months after  
treatment  
5.2 x 10.1 mm



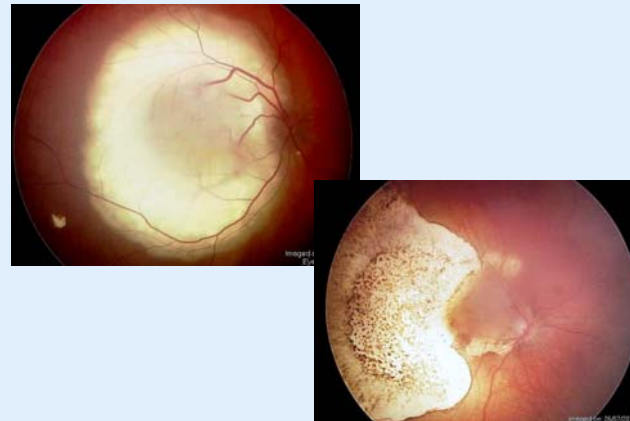
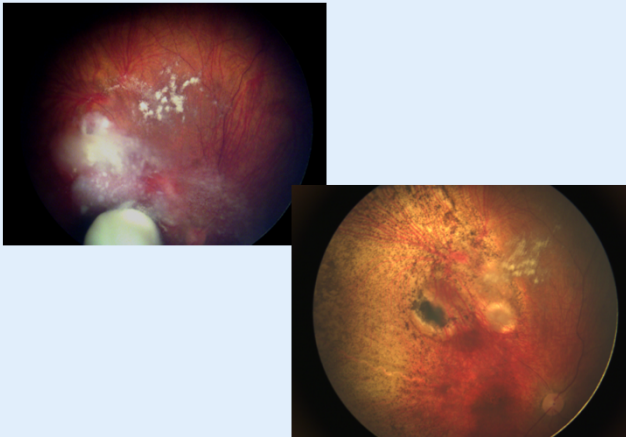
12 months after treatment  
No signs of tumor

## UM patients survival rate

Follow-up period	Survival rate %	
	Enucleation	Brachytherapy
5 years	83.5	94
10 years	42	90

## Results of retinoblastoma combined treatment:

- ❖ Eye-preserving treatment was successful in 85 – 95% of children depending on the tumor stage;
- ❖ Visual functions are preserved in 70% of children;
- ❖ 5-year survival rate is 92 – 95% depending on the tumor stage.



**We use ophthalmic applicators with isotope Sr90+Y90 for anterior segment tumors brachytherapy (G.D. Zarubey, A.F. Brovkina 1973)**



More than 1570 patients with malignant eye lids and conjunctival tumors were treated over a period of 2001 – 2016

**Complete resorption in**  
Epithelial tumors- **92,8%**,  
Lymphoma- **98%**  
Skin and mucosal melanoma- **67%**



before



after



# The future perspective is



## For anterior segment and eye lids:

- With isotopes  $^{90}\text{Sr} + ^{90}\text{Y}$  and  $^{106}\text{Ru} + ^{106}\text{Rh}$
- Irradiation rate- 90-110 cGy/min.

### •New OA shapes and sizes

## For intraocular tumors:

- With isotopes  $^{90}\text{Sr} + ^{90}\text{Y}$ ,  $^{106}\text{Ru} + ^{106}\text{Rh}$  and  $^{125}\text{J}$
- Irradiation rate - 1000-2300 cGy/hour.

**Brachytherapy allows to preserve life, the eye and visual functions.**

**It improves patient`s quality of life.**



Thank you!