

## **Reduction of Radiation Morbidity through Q.A. of Dosimetry and Evaluation of Morbidity (MORQA).**

### **Background:**

This lecture is named after a project carried out by the European Society for Therapeutic Radiology and Oncology (ESTRO) and supported by the European Commission (E.C). The project is just closed but a new and extended programme has been accepted by E.C. with participation of about 150 researchers. I will discuss some of the results.

In the E.U. countries 750 000 deaths were attributed to cancer in 1985. About 40% of all patients were successfully cured by surgery and/or radiation therapy. However, in 18% of all patients the local or local-regional treatment failed resulting in about 300 000 deaths/year. The most important reasons for failure were considered to be "poor treatments, tumours with difficult location, and tumours currently radioresistant". The suggested treatment remedies were "improved quality control of radiotherapy, conformal treatments, protons, light ions, and BNCT". Activities in all these fields have been initiated. ESTRO's project is mainly on quality control and audit.

### **Results and Discussion:**

Late effects of radiotherapy treatments have been studied and specially evidence of grade 3 and 4 toxicity (see Ann Barrett: [info@estro.be](mailto:info@estro.be)). The idea was to identify special treatment schedules that might give late toxicity in normal tissues. One reason for late toxicity seemed to be large doses per fraction. Results from large dose fraction treatments in my own centre showed that the time for development of paralysis after post-operation radiotherapy of breast cancer could vary between 2 and 30 years. A group of breast cancer patients were followed during 35 years. The dose-response curves at 5 years for brachial plexus complications had a  $\gamma$ -value  $> 6$ . It was also interesting to see that patients with radiation induced toxicity had the best survival.

Similar or steeper dose response curves have been reported for some tumours e.g. the response of prostate cancers. This implies that the uncertainty in dosimetry should be within at least 5% ( $1\sigma$ ) as otherwise the  $\gamma$ -value just will depend on the uncertainty in dosimetry. The accuracy in dosimetry in EU-countries has been evaluated in the sub-programme EQUAL.

About half of E.U.'s 800 radiotherapy centres have participated in a postal dosimetry audit. Of the centres 69% are small with 1 or 2 RT-units. Reference dose, depth-dose curves, beam output variation with field size,

and wedge transmission factors have been checked. For photon beams, 26% of all centres had to be rechecked as at least one parameter was off with 5% or more. The accuracy in dosimetry in the reference geometry is generally very good with a  $\sigma = 1.9\%$ . Larger deviations are seen for somewhat more complicated set-ups. Much less re-checks were needed for electron beams (4.5% of the centres), which might indicate that electron beams are used in more qualified departments. For some departments there are problems that cannot be solved with mail and in some cases site-visits were needed. For 45 of the checked beams there were "real" problems in dosimetry .

### **Conclusions:**

- Great efforts are made in Europe to improve the quality of radiation therapy. ESTRO is very active to create project groups on Q.A. in radiotherapy and has been successful with sponsoring from E.C.
- In the "MORBIDITY" part of the project reasons for late normal tissue complications are investigated. One of the reasons could be the uncertainty in dosimetry. A close co-operation in the project groups between radiation oncologists and physicists is of great importance and this is organised through ESTRO .
- In the EQUAL sub-programme at present 1143 beams have been checked. In at least 7% of the beams there are "dosimetric" problems. Dosimetric problems have been seen in particular in complicated set-ups. The reference dose level is in 99% of the beams within the tolerance level (5%)

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