SP-0613
Target volume definition in upper GI malignancies
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This teaching lecture will focus on oesophageal and gastric cancer. It remains a challenge to treat these patients outside a context of clinical trials. Different published delineation guidelines will be discussed and compared in oesophageal and gastric cancer. The role of imaging modalities such as endoscopy, endoscopic ultrasound, CT scan, FDG-PET-CT in the delineation process and during (chemo) radiotherapy will be highlighted.

Whether squamous cell carcinoma and adenocarcinoma of the esophagus can be regarded as one tumor entity remains unclear. The same holds true for adenocarcinomas of the GE junction and the stomach.

Organs at risk and dose constraints will be considered. The challenge of organ motion and tumor shrinkage during a course of (preoperative) chemoradiation will be discussed.

Learning objectives:
1. To understand the impact on target definition and delineation when comparing preoperative versus postoperative chemoradiation
2. To understand the impact of different imaging modalities on the delineation process
3. To understand the impact of organ motion during treatment
4. To understand the impact of tumor shrinkage during treatment

SP-0614
Clinical audit
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As part of a comprehensive approach to quality assurance in the treatment of cancer by radiation, an independent external audit (peer review) is important to ensure adequate quality of practice and delivery of treatment [1]. Historically, clinical audits in radiotherapy have been promoted by IAEA, after the development of a specific methodology in which ESTRO members played an active role. It is available on the IAEA website under the name QUATRO (quality assurance team for radiation oncology).

To capture the actual level of competence of a department, the audit addresses simultaneously the issues of equipment, infrastructure and operation of clinical practice. A major part of the audit is patient oriented. It is carried out by experts in the main disciplines: RTT, medical physics and radiation oncology.

A clinical audit is not a pass or fail test; it is a process by which a comprehensive quality management system is measured against pre-defined standards or codes of good practice. Its result is a series of recommendations that could fail in 3 categories: (1) urgent corrective actions needed (with or without consecutive re-audit), (2) corrective actions to be implemented in the future without urgent need, and (3) no specific recommendations. The latter category implies that the department runs at an appropriate level of quality safety. This does not mean that quality and safety have been achieved, as both should be permanently developed and updated, but that the department has an dynamic and organised management system that constantly checks upon its appropriateness.

An appropriate management system is a system with an organized prospective and retrospective quality and safety monitoring, a system that learns from its mistakes (implying that mistakes are actively recorded and analysed), and a system reactive to innovation (proactive safety management through FMEA). Indeed, quality is not a goal, quality is away.

Well over 50 hospitals have been already audited in Europe (Central and Eastern) and, in some countries, the clinical audits are already a legal requirement, in compliance with EURATOM directives.

More recently, Belgium, through its Federal College of Radiotherapy, has launched a program for systematic auditing of radiotherapy departments, drawing upon the IAEA experience and with the help of some of its experts. Ten hospitals have already been audited (out of 25) and results will be presented at the conference.


SP-0615
Collective cancer invasion: an integrin-dependent, normoxic radioresistance niche
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The tumor microenvironment contributes to cancer invasion, growth and survival and thereby impacts tumor responses to therapy. We have developed an intravital infrared multiphoton imaging model for the multi-parameter visualization of collective cancer cell invasion, guidance by the tumor stroma, and short- and long-term resistance to experimental anti-cancer therapy. The data show for orthotopic fibrosarcoma and melanoma xenografts deep invasive growth driven by proliferation concurrent with collective invasion of multicellular strands along the normoxic perivascular stroma. Invasion was fast (up to 100 um per day), non-contact and independent of B1 and B3 integrins. Despite normoxia, perivascular invasion strands were resistant to high-dose hypofractionated irradiation which otherwise was sufficient to induce regression of the tumor main mass. This invasion-associated radioresistance was sensitive to the simultaneous inhibition of B1 and B3 integrins by RNA interference or combined anti-B1/aV integrin antibody treatment caused by proliferation arrest, anoikis induction ablating both tumor lesion and invasion strands. In conclusion, collective invasion is an important invasion mode in solid tumors into a microenvironmentally privileged survival niche which conveys radioresistance by integrin-dependent signals. These findings show how “dynamic in vivo cell biology” identifies a key role for integrin-mediated signaling in mediating cross-talk (reciprocity) between the peri-tumor stroma and the tumor cells to mediate altered biology and response to therapy (plasticity).

SP-0616
How will the new International Basic Safety Standards affect the medical physics practice?
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This paper presents the main elements of the new Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards (the BSS) as it relates to the field of medical radiation physics and highlights the potential benefits for the professionals working in this field.

The BSS is developed by the IAEA and the co-sponsoring organizations through an open and transparent process including inputs from IAEA Member States and international organizations such as the International Organization for Medical Physics (IOMP). The BSS consists of a chapter giving general requirements for all practices, including uses of radiation in medicine, research and teaching, and also emergency exposure situations and existing exposure situations. This is followed by three chapters giving detailed requirements for each of the three exposure situations, one of which addresses medical exposure. The section on medical exposure covers the responsibilities of those involved including medical physicists, the justification of medical exposures, the optimization of protection covering design and operational considerations, calibration, dosimetry of patients, diagnostic reference levels and quality assurance, the release of patients after radionuclide therapy, the investigation of unintended and accidental medical exposure, and records. The BSS plays an important role in many countries; it is often taken as a template for national regulations, and it is mandatory for those countries receiving technical cooperation assistance from the IAEA.

In the field of medical radiation physics, significant changes have been introduced in the new BSS. First, the medical physicist is identified in the new BSS as one of the key professionals, together with the radiological medical practitioner and technologist/radiographer, with responsibilities for quality assurance and patient radiation protection. Training and clinical competence requirements for medical physics practice are identified in the BSS. Medical physicists can practice only if they are specialized in the appropriate area, such as radiotherapy, nuclear medicine, diagnostic radiology or image guided interventional procedures. The details of the specialization have to be defined at the national level by the relevant professional body, health authority or other appropriate organization. According to the BSS, for therapeutic uses of radiation, the requirements for calibration, dosimetry and QA, including the acceptance and commissioning of medical radiological equipment, need to be fulfilled by or under the supervision of a medical physicist. For diagnostic uses and image-guided interventional procedures, the requirements for imaging, calibration, dosimetry and QA, including
the acceptance and commissioning of medical radiological equipment, need to be fulfilled by or under the oversight of or with the documented advice of a medical physicist. The degree of involvement of the medical physicist in diagnostic cases and image-guided interventional procedures is determined by the complexity of the radiological procedures and the associated radiation risks. In conclusion, the new BSS identifies the medical physicist as a key professional with a specialized training, skills and competence in clinical medical physics and radiation protection. The medical physicist has significant responsibilities in the many activities that are needed to successfully implement the quality assurance programme and radiation protection principle of optimization. Medical exposure in a given hospital or medical centre. If these new BSS requirements are effectively implemented, they will help pave the way for a full recognition of the medical physicist as a health care professional alongside other professionals working in the medical field.

SP-0617
An overview of imaging techniques for patient positioning
R. Moeckli

Purpose/Objective: Imaging for patient positioning is part of the image guided radiation therapy (IGRT) workflow and is routinely used in clinical practice. The primary objective is to check and correct the patient position with such an improved day to day reproducibility that dose delivery to the target volume and organs at risks is the most similar to the planned one. This can be accomplished by plenty of imaging techniques based on kV, MV or ultrasound imaging and made available by companies in various mechanical configurations. The objective of this teaching lecture is to provide an overview of the different techniques used and to evaluate their respective pros and cons.

Materials/Methods: A review of literature is presented from the simplest two dimensional imaging techniques to the most advanced ones capable of imaging the movement of the patient in four dimensions (4D). Special focus is presented on high precision irradiation techniques such as stereotactic radiosurgery, where treatment outcome is the most dependent on accurate patient positioning.

Results: Globally, the performance of the most advanced imaging techniques allows us to position the patient and the target volume within millimeters and even under 1 mm for parts of the body which can be rigidly immobilized. Also taking into account target volume movements with 4D imaging techniques prior to treatment, e.g. for lung treatments, allow us to reduce the irradiated volume and therefore potentially reduce toxicity. The great improvement of imaging techniques in recent years raises then the question of the impact of frameless high precision irradiation techniques, because these techniques, based on imaging without invasive frame content, are definitely providing equivalent degree of accuracy in patient positioning.

Conclusions: IGRT techniques for patient positioning are widespread in clinical practice. Recent improvements allow us to position the patient and the target volume within 1mm accuracy. Most advanced imaging techniques even take into account target volume movement by 4D imaging of patient positioning. Stereotactic high precision irradiation based on frameless imaging also challenges the usual invasive frame-based technique for patient positioning precision.

SP-0618
Motion brachytherapy: The technical opportunities
M.A. Moerland

The strength of brachytherapy (BT) is that the radiation sources are inside or in the vicinity of the target volume and that they generally move with the target. The target dose is high and due to the inverse square law the dose to the surrounding normal tissue (organs at risk) can be reduced considerably. Therefore, BT has gained a definite place in the treatment of patients with gynaecological, head and neck, breast and prostate tumours. Brachytherapy has been applied since 1901, a few years after the discovery of x-rays and radium. Important developments in the medical application of radionuclides were the dosimetry systems (Stockholm, Paris, Manchester), the discovery of artificial radioactivity ( 60Co,137Cs, 198Au, 192Ir) and the development of remote afterloading devices. The field of BT continues to develop and the introduction of new technology brings new questions and challenges [1]:

new afterloading devices, new dose calculation algorithms, 3D image based dose planning, new applicators, application of knowledge of radiobiology to optimize treatment schedules, robotic brachytherapy for prostate seed implant, electronic brachytherapy sources and in vivo dosimetry.

A major improvement of BT may be expected from the use of 3D imaging, especially magnetic resonance imaging (MRI). MRI does not completely replace clinical investigation and other imaging modalities, but its superior soft tissue contrast often helps to better define tumor stage, target volume extension and organs at risk at time of diagnosis, at time of BT and for treatment planning purposes. During the last years we see a development towards MR guided BT in different tumor sites (gynaecology, prostate). This presentation will focus on technology for MRI guided BT and how anatomic and functional MRI optimize and individualize BT approaches.


JOINT SYMPOSIUM: ESTRO-JASTRO: ESOPHAGEAL CANCER: STANDARD OF PRACTICE COMPARISON

SP-0619
Chemoradiotherapy for early-stage esophageal cancer - Japanese perspective
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Superficial esophageal cancer (SEC) is defined as esophageal cancer limited to the submucosal layer and includes mucosal and submucosal cancer. Based on the criteria of the Japanese Society for Esophageal Disease, Mucosal and submucosal cancer is classified according to location: epithelial layer (m1); proper mucosal layer (m2); muscularis mucosa (m3); upper third of the submucosal level (sm1); middle third of the submucosal layer (sm2); and the lower third of the submucosal level (sm3). Irrespective of the treatment method, the depth of invasion is one of the most important prognostic factors of SEC because lymph node metastasis markedly increases in lesions involving the lamina muscularis mucosa (m3). The best management of small m1 and m2 esophageal cancer is generally endoscopic resection (ER). For m3-sm3 SEC, extensive lymph node dissection has been the most popular choice of treatment. However, after introduction of chemoradiation therapy, good treatment outcomes which are comparable with those of surgery have been reported. In a Japanese phase II study of CRT for T1 esophageal carcinoma (JCOG 9704), 4 and 5 year overall survival rates were 80.5% and 76.5%, respectively. In our prospective single institutional phase II study, local control rate, and overall survival rate was 80.3%, 78.9 and % respectively. From these data, we think CRT for early state esophageal carcinoma is one of the standard treatment methods. Combination of ER and CRT is another approach. If the depth of invasion reached to submucosa, surgery has been added to most patients because of the high rate of lymph node metastasis. However, treatment outcomes of post ER CRT to prevent lymph node recurrence seems to be excellent and this approach may become a standard treatment method for endoscopically resectable esophageal cancer.

SP-0620
Neoadjuvant chemoradiotherapy for early-stage esophageal cancer - European perspective
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Early-stage esophageal cancer can be defined as locally resectable disease (I(1)) Ever since, several important developments (including Barrett surveillance, improvement of clinical staging by e.g. PET scanning, centralization of care, refined perioperative therapy, and more radical surgical techniques) have improved short-term and long-term outcome. However, 5-year survival after potentially curative surgical resection still rarely exceeds 35%. Many clinical trials have tested the potential value of neoadjuvant chemo- and/or radiotherapy to improve long-term outcome. In five randomized controlled trials (RCTs) the efficacy of neoadjuvant radiotherapy has been tested. A meta-analysis showed a non-significant 4% increase of 5 year survival rate. (2) Nine RCTs have been