were measured from daily imaging acquired following setup using external setup marks ('non-IGRT'), and verification imaging obtained after IGRT and repositioning ('IGRT'). Treatment plans were exported from the treatment planning system to Matlab using Computational Environment for Radiotherapy Research (CERR) software tools. For each fraction, the planned dose distribution was shifted by the measured AP, LR, CC offsets (for 'non-IGRT' and 'IGRT' situations). For each patient, the daily dose distributions were summed to produce an estimated composite delivered dose with and without IGRT. These plans were compared to the prescribed plan, evaluating differences in liver effective liver volume (Veff), liver mean dose, minimum dose to the target and maximal duodenum and stomach doses.
Results: 435 images (242 AP: 193 LR) acquired from MV EPIDs (14 patients, 316 images) or kV CBCT (7 patients, 117 images) projections were evaluated. Residual offsets in non-IGRT and IGRT groups are shown in Table 1. Compared to the prescribed plan, the liver Veff was increased in 10 of 21 non-IGRT plans (mean 10.5%) and 6 of 21 IGRT plans (mean 4.8%). The minimum target dose was <93% of prescribed in 14 of 21 (67%) non-IGRT and 5 of 21 (24%) IGRT plans. Mean liver doses were increased >1% in 8 non-IGRT plans (mean 11.6%) and 5 IGRT plans (mean 2.8%). Duodenum max. dose was >5% of prescribed in 8 of 21 non-IGRT and 2 of 21 IGRT. Stomach max. dose was >5% of prescribed in 6 non-IGRT and 2 IGRT plans.
Conclusions: IGRT leads to delivered doses more similar to planned doses compared to a non-IGRT strategy.

Table 1

	Non-IGRT (mm)		IGRT (mm)	
	σ	Σ	σ	Σ
C-C	8.0	6.7	2.2	1.1
A-P	5.4	4.0	2.4	1.4
R-L	5.1	3.8	2.8	2.1

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Collection and comparative analysis of events in a department of radiation oncology

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Radiation treatment (RT) is susceptible of events: errors, incident, and accident. Some of them are of certain gravity; some of them seem to be of little or no importance. It can be also said that what ever the event, it could be of importance because it is premonitory of an incident or an accident. That is why we decided to report on ROSIS data base all the events that we detected in our department. We report here the analysis of the year 2003.
Method: Every event detected during the preparation, the control or the realizations of RT are collected and reported in ROSIS Data Base and are registered in the department. The gravity of the events was according to Macklis (JCO1998) and analysed according to the potential gravity (i.e. if the event was not detected and not corrected) and to the real gravity (ie if detected and corrected or if detected but not corrected).
Results: 609 patients were treated with linacs or cobalt. 13142 sessions of RT were done and 37880 beams treated. 46 patient-events were reported (i.e. 7.5% of the patients treated; 0.35% of sessions. In 4 patients 2 different events were reported. 93 beam-events were reported ie 0.025% of beams. Events were detected by a physician in 33% of the cases, by a physicist or a dosimetrist in 33%, by a technician in 25% and in 10% by other. 48% were detected on the chart; 25% on film-control before the first session; 10% by the record system; 12% at the time of treatment; and 5% in other conditions. All the events were of human origin. The types of events were: dose in 23 cases, blocks in 10 cases, beams in 8 cases, modification of the beam in 1 case, energy in 1 case and in 10 cases other types. The origin of the conditions which impacted on the dose were: physician (5 cases), dosimetry (7 cases), at time of treatment (16 cases). The impact according the Macklis classification was: potential LI 6cases, LII 2 cases, LIIa 8 cases, LIIc 2 cases, LIII 32 cases; the real impact was: L0 9 cases, LI 20 cases, LIIa 18 cases, LIIc 1 cases, LIII 2 cases.
Interpretation: if an event is detected at the beginning of the chain of treatment and precociously, it can be corrected and the treatment is delivered normally. If the event arrived at the time of the treatment it cannot be corrected. In our mind we attributed the left shift of the gravity of the events to our strategy of organization: pluridisciplinary daily meeting, no treatment without control of the dosimetry, of the control film and monitor units calculation by a senior physician and a senior physicist. In the 2 LII cases, this strategy was not respected.
Conclusion: reporting events, even very little, in a radiation department is of great importance to avoid incident or accident and to help continuous improvement of the quality

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Radiosensitization of chlorogenic acid in Lewis lung carcinoma through inhibiting NF-κB mediated cIAP2

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Background: Chlorogenic acid (5-caffeoylquinic acid), the ester of caffeic acid with quinic acid, is one of the most abundant polyphenols in the Chinese herb Coptis chinensis. It has been found to inhibit environmental carcinogen-induced carcinogenesis through suppression of ROS-mediated NF-κB and mitogen-activated protein kinase (MAPK) activation. Radiation activates several intracellular signaling pathway mediators, including MAPK. We aim to clarify the mechanism of chlorogenic acid in radiation sensitization.
Materials and Methods: Lewis lung carcinoma (LLC) cells were used in this study. The cytotoxic effect of chlorogenic acid was analyzed by MTT assay. The apoptotic status of cells was evaluated by annexin-V staining. The levels of protein kinase phosphorylation and cIAP2 (inhibitor of apoptosis 2) were determined by western blot. The NF-κB activity was measured by promoter assay. 1×10^6 LLC cells implanted in right hind limb of C57BL/6J mice were treated with radiotherapy (4 Gy daily for 5 days) in the in vivo test. Chlorogenic acid was administered orally with 2 mg per day (100 mg/kg) three days prior to irradiation for a total of 14 days.
Results: The MTT assay revealed that chlorogenic acid itself did not affect LLC cell growth. However, chlorogenic acid could enhance the cytotoxicity of radiation in LLC cells. The quantitative annexin-V staining showed that chlorogenic acid involved anti-apoptosis signaling for radiosensitization. NF-κB promoter assay demonstrated that radiation activated NF-κB could be reduced by chlorogenic acid. The western blot also showed significant inhibition of the radiation activated NF-κB p65 subunit nuclear translocation by chlorogenic acid. Moreover, chlorogenic acid enhanced the radiation induced LLC cell apoptosis through downregulating the NF-κB mediated anti-apoptosis protein cIAP2 expression. The tumor growth curves with combined radiation and chlorogenic acid on LLC cells implanted in C57BL/6J mice, showed the significantly ($p<0.01$) reduced LLC tumor size (702.4 ± 64 mm^3), as compared to either radiation alone (2370.8 ± 457 mm^3), or chlorogenic acid alone ($5,038.8\pm632$ mm^3).
Conclusions: Chlorogenic acid exerts its radiosensitization effect by inhibiting radiation induced NF-κB activation and the downstream anti-apoptosis protein cIAP2 expression in LLC cells.

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MVCT image-guidance derived bony setup accuracy for supine and prone pelvic radiation therapy

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Purpose: To investigate the impact of prone vs. supine patient setup on repositioning accuracy for radiation therapy of pelvic malignancies using volumetric mega-voltage CT (MVCT) imaging on a helical tomotherapy unit (TomoTherapy HiArt).
Materials and Methods: Of 30 patients treated by pelvic IMRT, setup was prone in 11 and supine in 19 patients, respectively. Prone setup always used a belly board. 829 MVCT image-guidance studies (299 prone, 530 supine) were acquired. We assessed corrective shifts for patient setup, based on mutual information fusion biased for bony alignment. Thus, patient and not target setup was assessed. Typical radiation target volumes in relationship to the pelvic bony anatomy included nodal treatments for prostate cancer, as well as rectal and anal cancer. We assessed if a no action level (NAL) protocol would provide for an effective means of limiting subsequent setup variability.
Results: Relative and absolute mean shifts along the x, y, and z axes were 1.5, −6.7, and 8.7 mm as well as 4, 7.9, and 8.9 mm for prone patient setup. The average 3D vector of displacement was 15.2 mm, with 88.5, 58.0, 27.1, and 17.5% of alignments with displacements larger 5, 10, 15, and 20 mm. For supine setup, mean and absolute daily shifts along the x, y, and z-axis were −2.1, −2.1, and 10.6 mm as well as 4.1, 4.1, and 11.1 mm, respectively. Mean length of the 3D corrective vector was 13.4 mm, with 95.1, 70.4, 36.8, and 10% of setups corrected by more than 5, 10, 15, and 20 mm.