

## 前立腺癌の放射線生物学的な特徴(確率的アプローチ)

関根 広

BIOLOGICAL CHARACTERISTICS OF RADIATION THERAPY FOR PROSTATE  
CANCER: A STOCHASTIC APPROACH

Hiroshi SEKINE

*(Received 29 August 2006, accepted 9 November 2006)*

**Abstract:** Prostate cancer, unlike many other carcinomas, is characterized by a very slow growth rate. Therefore, low-dose-rate brachytherapy has been shown to be effective, resulting in excellent outcomes. This fact offers a very important factor in considering radiotherapy strategies for prostate cancer. While external irradiation alone is one option for the treatment of prostate cancer, external irradiation plus high-dose-rate brachytherapy or low-dose-rate brachytherapy has added more options. However, the following 2 things remain unclear: 1) the relationship among time, dose, and fractionation, 2) the resulting biological effects. In the present study, radiation effect was regarded as a stochastic phenomenon. Further lethal damage and repair from sublethal damage were explained according to the LQ model. In addition, this theoretical model was also applied to fractionated irradiation and low-dose-rate brachytherapy. Biological parameters were estimated with the aid of nonlinear regression. Prior to the estimation, we had used clinical results of fractionated irradiation and low-dose-rate brachytherapy. We had also applied the LQ model to TCP. The  $\alpha/\beta$  value is reportedly smaller in prostate cancer than that in many other carcinomas, and biological parameters may be about the same or smaller than those in late reacting tissue. With accurate values in the parameters, this model appears to be useful in establishing indications for treatment strategies such as hypofractionation.

Key words: Prostate cancer, Radiotherapy, Linear quadratic formula,  $\alpha/\beta$  ratio

## 口腔癌に対する超選択的動注療法を併用した放射線治療の成績

鈴木 弦<sup>\*1</sup>, 田中 法瑞<sup>\*1</sup>, 淡河恵津世<sup>\*1</sup>, 江藤 英博<sup>\*1</sup>, 末藤 大明<sup>\*1</sup>, 安倍 等思<sup>\*1</sup>,  
早濑 尚文<sup>\*1</sup>, 岩本 修<sup>\*2</sup>, 古賀 千尋<sup>\*2</sup>, 楠川 仁悟<sup>\*2</sup>, 中島 格<sup>\*3</sup>

## HIGH-DOSE SUPERSELECTIVE INTRA-ARTERIAL CISPLATIN AND CONCOMITANT RADIATION THERAPY FOR CARCINOMA OF THE ORAL CAVITY

Gen SUZUKI<sup>\*1</sup>, Norimitsu TANAKA<sup>\*1</sup>, Etuyo OGO<sup>\*1</sup>, Hidehiro ETO<sup>\*1</sup>, Hiroaki SUEFUJI<sup>\*1</sup>, Tosi ABE<sup>\*1</sup>,  
Naofumi HAYABUCHI<sup>\*1</sup>, Osamu IWAMOTO<sup>\*2</sup>, Chihiro KOGA<sup>\*2</sup>, Jingo KUSUKAWA<sup>\*2</sup>, Tadashi NAKASIMA<sup>\*3</sup>

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**Abstract:** Purpose: To evaluate the effect of high-dose superselective intra-arterial cisplatin and concomitant radiation therapy for carcinoma of the oral cavities.

Methods and Materials: The subjects consisted of 18 patients with carcinoma of the oral, and cavity treated with superselective intra-arterial infusion of high dose cisplatin (100mg/body) concomitant with delivery of external beam radiotherapy (median total dose, 60.8 Gy) between 2001 and 2004. Sodium thiosulfate was administered intravenously to provide effective cisplatin neutralization. They were UICC1997 stage II-IV (stage II: 4 patients, stage III: 4 patients, stage IV: 10 patients). Patients ranged from 43-81 years of age, with a median of 60 years, and included 14 men and 4 women. A follow-up period was 6 months minimum from the start of the radiation therapy, the median follow up period at 28 months.

Results: The three-year overall survival rate was 71%. The three-year disease free rate and local control rate were 60% and 65%, respectively. Three-year local control rate of the T2-3 was achieved at 83%, and that for T4 at 50%. There was borderline significant difference in local control rate between T2-3 and T4 ( $p = 0.05$ ).

Conclusion: We conclude that the high-dose superselective intra-arterial cisplatin and concomitant radiation therapy provides effective results in organ preservation for cancer of oral cavities. Further studies are also required to determine the validity of this method.

Key words: Oral cancer, Arterial infusion, Radiation therapy, Chemotherapy

\*1 久留米大学放射線科(〒830-0011 福岡県久留米市旭町67)

Department of Radiology, Kurume University( 67, Asahi-cho, Kurume-city, Fukuoka 830-0011, Japan )

\*2 久留米大学歯科口腔医療センター

Dental and Oral Medical Center, Kurume University

\*3 久留米大学耳鼻咽喉科

Department of Otolaryngology, Kurume University

## 術中計画法による前立腺癌 I-125シード治療の経験 術前計画法との比較

戸矢 和仁, 大橋 俊夫, 萬 篤憲

### EFFECTIVENESS OF THE I-125 SEED PERMANENT IMPLANT FOR LOCALIZED PROSTATE CANCER WITH THE INTRAOPERATIVE PLANNING TECHNIQUE —COMPARISON WITH PRE-PLANNING TECHNIQUE—

Kazuhito TOYA, Toshio OHASHI, Atsunori YOROZU

(Received 2 October 2006, accepted 20 December 2006)

**Abstract:** Purpose: To report the effectiveness of the I-125 seed permanent implantation for localized prostate cancer with an intraoperative planning method. With one retrospectively compared the two techniques using post-implant CT-based evaluations: a pre-planning method and an intraoperative planning method.

Materials and methods: Two hundred forty four patients with T2b or less localized prostate cancer underwent the permanent seed implant between September 2003 and March 2006. One hundred twenty two patients were treated with a pre-planning method while the other half patients were treated with an intraoperative planning.

Results: Baseline parameters closely resemble in both groups. However, there were important differences in preoperative prostate volume, source activities, needles and operation time of both groups. Based on a month post-implant CT, patients treated with the pre-planning method marked 155.3 Gy in median prostate D90 (minimal dose covering 90% of the prostate volume) and 92.1% in V100 (percent prostate volume receiving 100% of the prescribed dose). While the intraoperative group marked 169.4 Gy and 97.1%, respectively ( $p < 0.01$ ). Prostate D90 and V100 in the intraoperative group was noted as meaningful improvement. Postoperative dosimetry of the urethra and the rectum followed and conducted as planned.

Conclusion: Seed implantation with an intraoperative planning method was more effective than the one with a preoperative planning method. We plan to expand its use of the treatment in the future.

Key words: Prostate cancer, Brachytherapy, I-125 seed implantation

## 腹臥位による乳房接線照射法の検討

加藤 貴弘<sup>\*1, \*2</sup>, 柳川 繁雄<sup>\*3</sup>, 島田 秀樹<sup>\*1</sup>, 村山 洋<sup>\*1</sup>, 小幡 康範<sup>\*4</sup>

## EVALUATION OF PRONE POSITION TANGENTIAL BREAST IRRADIATION TECHNIQUE

Takahiro KATO<sup>\*1, \*2</sup>, Shigeo YANAGAWA<sup>\*3</sup>, Hideki SHIMADA<sup>\*1</sup>, Hiroshi MURAYAMA<sup>\*1</sup>, Yasunori OBATA<sup>\*4</sup>*(Received 29 September 2006, accepted 18 January 2007)*

**Abstract:** Purpose: The purpose of this study was to evaluate an alternative prone position tangential breast irradiation technique for women with early stage breast cancer.

Materials and Methods: Nine patients who underwent CT simulation in both the supine and prone positions were included in the study. An originally designed prone breast positioning device was used for the prone setup to displace the contralateral breast away from the tangential field border. Plans were compared using dose distribution and dose volume histograms (DVH) for the target volume, ipsilateral lung, and heart. Setup reproducibility was also analyzed comparing portal images with simulator images.

Results: Significant improvements in the doses to surrounding normal structures were achieved in the prone position compared to the supine position. Dose homogeneity within the target volume was also improved using the prone position especially in the patient with huge breasts. Setup reproducibility of the prone position was as good as the supine position in patients with normal or average sized breasts.

Conclusion: A prone position tangential breast irradiation technique may result in improved dose homogeneity within the target volume as well as sparing of surrounding normal structures compared with conventional supine position tangential breast irradiation technique.

Key words: Breast cancer, Prone position, Radiotherapy

\*1 豊橋市民病院放射線技術室 (〒441-8750 豊橋市青竹町字八間西50)

Department of Radiological Technology, Toyohashi Municipal Hospital (50, Hachikennishi, Aotake, Toyohashi, 441-8750 JAPAN)

\*2 名古屋大学大学院医学系研究科医療技術学専攻医用量子科学分野

Department of Radiological and Medical Laboratory Sciences, Nagoya University Graduate School of Medicine

\*3 岐阜県立岐阜病院放射線科

Department of Radiology, Gifu Prefectural Hospital

\*4 名古屋大学医学部保健学科

School of Health Sciences, Nagoya University

## Flat Panel Detectorを用いた放射線治療時照射線量監視システムの構築と臨床応用

高田 康弘<sup>\*1</sup>, 上紺屋 憲彦<sup>\*1</sup>, 富士原 将之<sup>\*1</sup>, 坪井 慶太<sup>\*1</sup>, 井上 裕之<sup>\*2</sup>, 山本 鋭二郎<sup>\*2</sup>,  
中川 英雄<sup>\*2</sup>, 田ノ岡 征雄<sup>\*2</sup>, 小田 雅彦<sup>\*2</sup>, 廣田 省三<sup>\*1</sup>, 中尾 宣夫<sup>\*1</sup>

### A FUNDAMENTAL AND A CLINICAL STUDY OF DIRECT DOSE MONITORING SYSTEM WITH USING FLAT PANEL DETECTOR

Yasuhiro TAKADA<sup>\*1</sup>, Norihiko KAMIKONYA<sup>\*1</sup>, Masayuki FUJIWARA<sup>\*1</sup>, Keita TSUBOI<sup>\*1</sup>,  
Hiroyuki INOUE<sup>\*2</sup>, Toshihiro YAMAMOTO<sup>\*2</sup>, Hideo NAKAGAWA<sup>\*2</sup>, Masao TANOOKA<sup>\*2</sup>,  
Masahiko ODA<sup>\*2</sup>, Shozo HIROTA<sup>\*1</sup>, Norio NAKAO<sup>\*1</sup>

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**Abstract:** We need to improve set-up accuracy of the quality assurance for irradiation fields to avoid incorrect irradiation. Thus, we have explored the possibility of using a commercially available flat panel detectors (FPD) portal imager for absolute dosimetric verification in delivery of irradiation fields. Our system is characterized by evaluation with the close ratio at each point. It does not use the absolute value of the dose at each point obtained with FPD as it is.

**Patients and Methods:** Fundamental study: We investigated the basic dosimetric correlativity between the dose evaluation with FPD and the survey dose with the dosimeter (semiconductor detector). The basic dosimetric characteristics of FPD were investigated in any size of irradiation field and in any arbitrary points of irradiation field, using a phantom model.

**Clinical study:** From January to February 2006, 13 patients with breast cancer were enrolled in the study. Three points—the point of evaluating target organ, the point of evaluating critical organ, and the point of evaluating external body—were assigned to the irradiation field on the FPD image of the breast cancer patient. The dose of each setting upz point in FPD was designated as the survey dose. The set-up error of a patient was verified by measuring data at daily irradiation in the same patient.

**Results and Conclusion:** Fundamental study: Although approximation types differed slightly, the correlation between the dose evaluation with FPD and the survey dose with the dosimeter in any size of irradiation field and in any arbitrary points of irradiation field, was within an accepted range.

**Clinical study:** In this experience, the ratio of each point on FPD at daily irradiation there was a day of irradiation when the difference was accepted in those patients. Motions during the radiotherapy caused the difference. Our experience suggests that this system is useful to improve the accuracy of radiotherapy and to avoid the incorrect irradiation.

**Key words:** EPID, Flat panel detector (FPD), Irradiation positioning system, Dose monitoring system

<sup>\*1</sup> 兵庫医科大学放射線医学教室 (〒663-8501 西宮市武庫川町1-1)

Department of Radiology, Hyogo College of Medicine (1-1, Mukogawacho, Nishinomiya, Hyogo, 663-8501 JAPAN)

<sup>\*2</sup> 兵庫医科大学病院中央放射線部

Department of Clinical Radiology, Hospital of Hyogo College of Medicine

頸部食道癌の化学放射線療法による急性粘膜炎に対する  
和漢薬治療の効果：予備的経験

小川 心一<sup>\*1</sup>, 野村 邦紀<sup>\*1</sup>, 野口 京<sup>\*2</sup>, 嘉戸 祥介<sup>\*3</sup>, 瀬戸 光<sup>\*2</sup>

THE EFFECT OF CHINESE HERBAL MEDICINE (KANZO-SHASHIN-TO) FOR ACUTE  
MUCOTITIS DUE TO CHEMORADIOTHERAPY FOR CERVICAL ESOPHAGEAL  
CANCER: PRELIMINARY STUDY

Shinichi OGAWA<sup>\*1</sup>, Kuninori NOMURA<sup>\*1</sup>, Kyo NOGUCHI<sup>\*2</sup>, Shosuke KATO<sup>\*3</sup>, Hikaru SETO<sup>\*2</sup>

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**Abstract:** We report preliminary study in which Chinese herbal medicine (Kanzo-Shashin-to) was administered to three patients with acute mucotitis due to chemoradiotherapy for cervical esophageal cancer. The treatment of cervical esophageal cancer for the three patients includes a combination of external beam radiotherapy (65 to 66 Gy) and chemotherapy (CDDP and 5-FU) from March to August 2005. We used Chinese herbal medicine during and two weeks after treatment to relieve acute mucotitis—induced discomfort. No patients showed severe dysphagia during treatment, allowing the herbal regimen to be conducted for all patients on schedule. The outcome of our study suggests that Chinese herbal medicine may be good to alleviate acute mucotitis—induced discomfort due to chemoradiotherapy for cervical esophageal cancer.

Key words: Kanzo-Shashin-to, Chemoradiotherapy, Acute mucotitis

<sup>\*1</sup> 富山大学附属病院放射線科(〒930-0194 富山県富山市杉谷2630)

Department of Radiology, Toyama University Hospital( 2630, Sugitani, Toyama City, Toyama, 930-0194 JAPAN )

<sup>\*2</sup> 富山大学医学部放射線医学教室 Department of Radiology, University of Toyama

<sup>\*3</sup> 富山大学附属病院放射線部 Department of Radiology, Toyama University Hospital

## 第2回JASTRO将来計画セミナー報告 日本の放射線治療構造の改善に向けて

日本放射線腫瘍学会将来計画委員会 / 第2回日本放射線腫瘍学会将来計画セミナー事務局  
小宮山 貴史<sup>\*1</sup>, 大西 洋<sup>\*2</sup>, 永田 靖<sup>\*3</sup>, 手島 昭樹<sup>\*4</sup>

### A REPORT OF THE 2nd JASTRO FUTURE PLANNING SEMINAR IN KOFU —FOR THE STRUCTURAL REFORM OF RADIATION THERAPY IN JAPAN—

Takafumi KOMIYAMA<sup>\*1</sup>, Hiroshi ONISHI<sup>\*2</sup>, Yasushi NAGATA<sup>\*3</sup>, Teruki TESHIMA<sup>\*4</sup>

(received 27 November 2006, accepted 18 January 2007)

**Abstract:** The 2nd JASTRO future planning seminar was held on March 11–12, 2006 in Kofu. The purpose of this seminar was to offer junior JASTRO members aged 45 and under as well as manufacturers the opportunity to address the issues on radiation therapy in Japan, and to make suggestions on JASTRO structural reform. The subjects were 1) how to increase the number of radiation oncologists, 2) opinions from manufacturers and/or venture business operators, 3) Properly balanced distribution of radiation oncologists and radiation treatment devices, 4) opinions from medical physicists on the quality control, and 5) others. Eleven radiation oncologists, three medical physicists and six manufacturers presented their suggestions and exchanged their views. We hope that the discussion will prompt JASTRO to develop some specific and concrete measures in the very near future.

Key words: Future planning seminar, Radiation therapy, Structural reform

<sup>\*1</sup> 市立甲府病院放射線科(〒400-0832 甲府市増坪町366)

Department of Radiology, Kofu Municipal Hospital( 366 Masutsubocho, Kofu, Yamanashi, 400-0832, JAPAN )

<sup>\*2</sup> 山梨大学医学部放射線医学教室

Department of Radiology, Yamanashi University

<sup>\*3</sup> 京都大学医学部放射線医学教室

Department of Radiology, Kyoto University

<sup>\*4</sup> 大阪大学大学院医学系研究科医用物理学講座

Department of Medical Physics & Engineering, Osaka University Graduate School of Medicine

## 同室設置型CT/X-ray simulatorにおける共通治療寝台のたわみ測定 実際の照射部位と体重心を模した患者モデルを想定して

大澤 敦<sup>\*1</sup>, 橋本 竹雄<sup>\*1</sup>, 吉野 慎一<sup>\*1</sup>, 木村 雅春<sup>\*1</sup>, 伊藤 照生<sup>\*1</sup>, 中島 大<sup>\*1</sup>,  
五月女 達子<sup>\*1</sup>, 大友 結子<sup>\*1</sup>, 高橋 豊<sup>\*2</sup>, 佐藤 智春<sup>\*1</sup>, 倉本 秋夫<sup>\*1</sup>

### SAG MEASUREMENT ON COMMON TREATMENT COUCH FOR INTEGRATED CT/X-RAY SIMULATOR SYSTEM —THROUGH PATIENT MODEL CASES FOLLOWING ACTUAL IRRADIATION SITES AND CENTER OF BODY GRAVITY—

Atsushi OSAWA<sup>\*1</sup>, Takeo HASHIMOTO<sup>\*1</sup>, Shinichi YOSHINO<sup>\*1</sup>, Masaharu KIMURA<sup>\*1</sup>, Teruo ITO<sup>\*1</sup>,  
Masaru NAKAJIMA<sup>\*1</sup>, Satoko SAOTOME<sup>\*1</sup>, Yuko OTOMO<sup>\*1</sup>, Yutaka TAKAHASHI<sup>\*2</sup>,  
Tomoharu SATO<sup>\*1</sup>, and Akio KURAMOTO<sup>\*1</sup>

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**Abstract:** The aim of this study is to analyze couch sag from the weight of a newly-installed Integrated Computed Tomography (CT) /X-ray simulator system. The system requires that the same sag characteristics be maintained regardless of any sliding and extended distance of a top plate, and/or any loading condition before and after rotational transfer of a treatment couch. This requirement is a dominating factor to ensure location accuracy of the integrated system.

We measured sag on the top plate at isocenter in the case of treating pharynx, lung, and prostate. Under the conditions that the sliding and extended distances of the top plate were adjusted to each model, the weighted load was put on the center of body gravity. The displacements in both anterior-posterior and inferior-superior directions were measured between the CT and X-ray simulator. In addition, by reproducing evenly loaded condition in an acceptance test, we analyzed the sag at the isocenter, which was defined as a measurement benchmark. We also carried out a test to verify the sag depends on the sliding and extended distances of the top plate under evenly loaded condition in the anterior-posterior direction.

Displacement caused by the weighted load mainly occurred in the posterior direction. The displacement value was greater in the prostate case because the center of gravity was placed in the superior position to the isocenter. The finding revealed that some sag characteristics depend on the sliding and extended distances of the top plate. The approximately 1mm sag occurred in the posterior direction at 10 cm of extension from the top plate. However, the sag characteristics by weighted load upon between the CT and the X-ray simulator showed strong correlation ( $r = 0.998 \sim 1.00$ ,  $p < 0.01$ ) and the differences of displacement value between the CT and the X-ray simulator were kept within 1 mm on every model and loading dose.

Key words: Couch sag, Common treatment couch, Center of gravity, Integrated CT/X-ray simulator system

<sup>\*1</sup> 財団法人癌研有明病院放射線部

Department of Radiology, The Cancer Institute Hospital of Japanese Foundation for Cancer Research (3-10-6 Ariake, Koto-ku, Tokyo 135-8550, JAPAN)

<sup>\*2</sup> 財団法人癌研究会癌研究所物理部

Department of Physics, The Cancer Institute of Japanese Foundation for Cancer Research

〒135-8550 東京都江東区有明 3-10-6