REVIEW ARTICLE

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3D IMAGE-BASED GYNECOLOGIC BRACHYTHERAPY PHYSICS

Hideo KUBO

Abstract: This paper is based on my invited talk at the JASTRO Brachytherapy Subcommittee meeting in June of 2003 in Tokyo. The talk materials are derived from the presentation of low dose-rate (LDR) gynecologic cancer therapy given at the University of California, Davis Cancer Center by Dr. Fritz Lerma of Mallinckrodt Institute of Radiology (MIR), Washington University, St. Louis. For more than 5 years, a brachytherapy program has been pushed forward at MIR and the University of California at San Francisco. In particular, Dr. Jeff Williamson of MIR, now at the Medical College of Virginia, emphasized the importance of CT image-guided brachytherapy treatment, 3D simulation of anatomy and applicators, and dose calculations based on Monte Carlo applicator simulations. The use of CT images has differentiated the treatment modalities from the past in that it allows more quantitative data analysis and provides more accurate dose distribution information. Dr. Williamson has single-handedly developed the frontier of gynecologic brachytherapy in the U.S. Dr. Lerma was his disciple and worked with him for two years during the program development period. Therefore, I believe Dr. Lerma's materials reproduced here with his permission belong in the forefront of the brachytherapy treatment approach to gynecologic cancers in North America.

This paper begins with an Introduction followed by the LDR Gynecologic brachytherapy program, and Motivations to push CT image-guided treatment planning forward at Mallinckrodt. As a practical example of 3 dimensional image-guided radiotherapy, this paper will elaborate on the accurate matching of applicator contours delineated in a CT space and Monte Carlo simulation methods. The use of CT and Monte Carlo simulations of applicator in a CT space allows treatment plan dose calculations solely on the basis of the Monte Carlo method if the full Monte Carlo calculations and dose measurements by 3 dimensional (3D) water phantom scan are in agreement. The conventional 2D single source superposition method does not take into account the presence of applicators. Therefore, the scattering and absorption of photons produced by the nearby sources are not accounted for. As a result it shows some dose deviations, in particular, near the source.

At the end, this paper introduces positron emission tomography (PET) image-guided brachytherapy treatment planning[1), 2)]. This modality is compared with the conventional 2D image-guided treatment plans. The PET images are known to reflect more physiologic information than CT images, even though the CT images provide better geometrical resolution than PET. The PET-based 3D treatment planning certainly belongs to the frontier of 3D image-guided brachytherapy treatment planning and delivery. As proved from the prostate study by magnetic resonance spectroscopy (MRS)[3)], the tumor cell concentration within the tumor is not necessarily uniform. In this respect, though not proven yet, the PET images may shed some light on the tumor cell distribution for the gynecologic (GYN) cancer.

Key words: Cervix cancer, Intracavitary brachytherapy, 3D image-based brachytherapy, PET guided implant

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小線源治療の線量率と分割の生物モデルの再考に向けて

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RECONSIDERATION OF A BIOLOGICAL MODEL FOR DOSE-RATE AND FRACTIONATION IN BRACHYTHERAPY

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Abstract: Clinical results of HDR brachytherapy show better than those of the LDR one. Most radiation biologists could not predict these results. At the beginning, they presumed that LDR brachytherapy was one of the best treatment modalities for cancers of the uterine cervix, mobile tongue and others. They criticized that HDR brachytherapy was a harmful modality from a biological standpoint. They proposed equations such as Nominal Standard Dose (NSD), Time Dose and Fractionation factor (TDF), Cumulative Radiation Effect (CRE) to be mandatory for the biological dose-rate conversion from LDR to HDR brachytherapy. However, these equations had not included the parameter of treatment volume that was one of the most valuable factors. Moreover, these equations consisted of parameters that were obtained from clinical results, not from the biological experiments. Instead of these biological equations, the new concept of the linear-quadratic (LQ) model was proposed. Effects of dose-rate for LDR brachytherapy and fractionation for HDR could be considered, however that of treatment volume could not be considered. In the classical Manchester system for brachytherapy, dose-rate was mainly affected by the treatment volume, because of the standard application of the Radium employed. The original prescribed dose in LDR brachytherapy of interstitial and intracavitary technique for cancers of the mobile tongue and uterine cervix using Paris and Manchester systems was 60 Gy over 144 to 168 hours. Although the prescribed dose was apparently changed by dose-rate, however, the variety of dose rate originally resulted from the size of the treatment volume in clinical practice. In addition, the ^{60}Co from a high intensity source and the new ^{192}Ir micro-source of relatively short half-life changed these rules. However, these sources enable us to use HDR brachytherapy with more accuracy. Now we need a new biological model with original treatment parameters obtained from the modern HDR brachytherapy itself.

Key words: Brachytherapy, Dose rate, Fractionation, Biological model

要旨：小線源治療は低線量率照射から高線量率照射へと着実に移行している．高線量率照射が低線量率照射よりも好成績であることも示され始めた．これは放射線生物学的には予想だにされなかったことである．これまで低線量率小線源治療が子宮頸癌や舌癌に対して最上の放射線治療法であるとされてきた．放射線生物学的には高線量率小線源治療は危険な方法であると批判の矢面に立たされた．低線量率から高線量率小線源治療へ安全に移行するためには，線量率変換係数が必須でNSD，TDF，CREなどの等価変換式が提案された．しかし，これらの式には治療体積のパラメータが含まれていないと云う欠点があった．さらにこれらの式は放射線生物学的な実験にもとづいて導かれたのではなく，臨床結果から得られたものであった．替わってLQモデルが出てきた．低線量率小線源治療の線量率効果と高線量率小線源治療の分割効果は考慮されるが，やはり治療体積は考慮されていない．本来Manchester法では使用されるRa線源の制約のために，線量率は主として治療体積の影響下にある．Manchester法でもParis法でも，舌癌低線量率組織内照射と子宮頸癌低線量率腔内照射の標準処方線量は60 Gy/144～168時間である．処方線量は一見線量率で増減されるように見られるが，臨床的には低線量率小線源治療の線量率のばらつきは基本的に治療体積に支配されている．比較的大線源の^{60}Coと短半減期の^{192}Irマイクロ線源の出現でこのあたりの事情が変わった．しかしこれらの線源のおかげで，精度の高い高線量率小線源治療が可能になった．今こそ高線量率小線源治療で得られた独自の治療パラメータに基づいた新しい生物モデルが必要とされる．

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REVIEW ARTICLE

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医療における具体的なリスクマネジメント―安全と安楽―

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MEDICAL ACCIDENTS AND RISK MANAGEMENT

Shigemi OSHIDA, Sumitoshi KATSUMATA

Abstract: When a medical accident happens there are instances where patients, their relatives or the bereaved sue for compensation and this is referred to as "medical conflict." If a medical conflict, the patient's side goes to court and this is "medical litigation". In a medical accident happened, there is an inquiry as to whether or not a civil act, and/or criminal act, and/or the administrative responsibility has been committed. The purpose of medical risk management is investigation into the cause, building a prevention system, and decreasing accidents.

Key words: Medical accident, Malpractice, Risk management, Incident report

要旨：医療に関連して生じた事故を医療事故といい，過失によって生じた医療事故のみを医療過誤という．医事紛争になり，患者側が裁判を提起すると，医事裁判になる．医療事故発生時には，民事責任（損害賠償の有無），刑事責任，行政処分の有無が法的責任として問われる．医療事故防止のためのリスクマネジメントは「真の事故原因を究明し，事故防止のシステムを構築し，事故を減少させること」である．

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ORIGINAL CONTRIBUTION

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T2声門癌に対するUFTおよび低濃度CDDP同時併用化学放射線療法の初期経験 ―MRIによる治療前評価―

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CONCOMITANT CHEMORADIATION THERAPY WITH UFT AND LOW DOSE CDDP FOR T2 GLOTTIC CARCINOMAS —PREDICTIVE VALUE OF MR IMAGING—

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(Received 3 September 2003, accepted 1 December 2003)

Abstract: Purpose: To improve the local control of T2-stage glottic carcinomas, we performed concomitant chemoradiation therapy with UFT (uracil and tegafur) and low dose CDDP. The predictive value of MR findings was also evaluated.
Methods and Materials: Thirty six patients with T2N0-stage glottic carcinomas were included in this study. Tumors adjacent to the thyroid cartilage on MRI were classified as "adjacent", and undetectable tumors or tumors separate from the cartilage were classified as "intact". Radiation therapy with 64 Gy/32 fractions was delivered by 4 MV linear accelerator. Intravenous infusion of CDDP (4 mg/m^2) and oral administration of UFT (450 mg/body) were continued concomitantly from day one of irradiation for four weeks. Kaplan-Meier methods were used to estimate the time to local recurrence distribution. Differences were determined using log-rank tests for univariate analysis.
Results: No severe acute and late adverse effects (grade 3 or more) were observed. Two-year local control rate with chemoradiation therapy was 82%. According to MR findings, local control rates were 95% for intact lesions (n=20) and 68% for adjacent lesions (n=16) (p=0.0249).
Conclusion: Concomitant chemoradiation therapy with UFT and low dose CDDP was considered to be effective for T2-stage glottic carcinomas. However, the results were not enough for tumors adjacent to the thyroid cartilage on MRI.

Key words: Glottic carcinoma, Radiation therapy, Chemoradiation therapy, MRI

要旨：【目的】T2声門癌に対する放射線治療の成績向上を目指して，UFT内服および低濃度CDDP点滴静注による化学療法を同時併用し，その初期経験を治療前MRI所見と合わせてprospectiveに検討した．
【対象と方法】T2N0声門部扁平上皮癌初回治療36症例（男性33，女性3）を対象とした．治療前MRI所見は，intact（描出されない，甲状軟骨に接していない），adjacent（甲状軟骨に接する）の2群に分類した．放射線治療は，4 MV-X線左右対向2門，照射野5×5 cmで，総線量64 Gy/32回を目標とした．化学療法は，UFT 450 mg/body，CDDP 4 mg/m^{2}を照射日のみに40 Gyまで併用した．放射線治療開始日からを観察期間とし，局所制御率をKaplan-Meier法にて算出した．
【結果】grade 3以上の急性および晩期の有害事象は観察されなかった．2年局所制御率は全36例で82%であり，MRI分類でのintact（n=20）95%とadjacent（n=16）68%に有意差を認めた（p=0.0249）．
【まとめ】T2声門癌に対して，UFTおよび低濃度CDDP併用化学放射線治療の有用性が示唆されたが，MRIにて甲状軟骨に接する病変に対する効果は不十分であった．

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^{103}Pd線源使用時の周辺線量当量率測定とその安全性

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DOSE EQIVALENT RATE MEASUREMENT IN USING THE ^{103}PD BRACHYTHERAPY SOURCE AND EXAMINATION ON SAFETY

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Abstract: In the U.S. and Europe, brachytherapy by permanent implantation of radioactive seeds, ^{125}I or ^{103}Pd is often performed for treatment of prostate cancer. In Japan, in March 2003, the Ministry of Health, Labor and Welfare permitted the use of ^{125}I seeds under the observance of the related laws and discharge criteria. With a view to popularize ^{103}Pd seeds like ^{125}I, we implanted ^{103}Pd seeds into the prostate site of a humanoid body phantom, measured dose equivalent rate around it, and obtained basic data on which discharge criteria are based upon. We also calculated the exposure dose of carers, based on obtained data.

As a result, the 1 cm dose equivalent rate, considering absorption at the prostate or other organs, was calculated 0.00006 $\mu Sv \cdot m^2 \cdot MBq^{-1} \cdot h^{-1}$, and the exposure dose of carers was sufficiently below the dose limitation of IAEA or NRC.

Therefore, for the use of ^{103}Pd seeds, there is almost no need to be concerned about the risk of radiation exposure to people around the patient, and its safety seems superior to ^{125}I seeds. We consider outpatient treatment is possible under the existing law, which is a standard treatment pattern in the U.S. and Europe.

Key words: ^{103}Pd seeds, Brachytherapy, Prostate, 1 cm dose equivalent rate

要旨：欧米では前立腺癌に対する治療法として，永久挿入用線源である^{125}I，^{103}Pdを使用した組織内照射法が盛んに施行されている．本邦においては，平成15年3月の厚生労働省通知により退出基準と関係法令の遵守等を担保に，^{125}Iシード線源の使用が可能となった．

^{125}I線源と同様，^{103}Pd線源の本邦での普及を目的に，人体ファントム前立腺部に^{103}Pd線源を挿入し周辺線量当量率測定を行い，退出基準の根拠となる基礎データを取得した．また，この値を基に介護者等の被曝線量の試算を行った．

その結果，前立腺部での患者の組織・臓器による吸収を考慮した見掛けの1 cm線量当量率定数は，0.00006 $\mu Sv \cdot m^2 \cdot MBq^{-1} \cdot h^{-1}$という値となり，介護者等の被曝線量は，IAEA，NRCの線量拘束値を十分下回る結果を得た．

前立腺部への^{103}Pd線源の使用は，患者周囲の者が受ける放射線被曝のリスクを懸念する必要はほとんどなく，その安全性は^{125}I線源よりさらに優れていると考えられる．また，欧米で行われている外来での日帰り治療が本邦の現行法規制下においても十分可能であると考える．

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ORIGINAL CONTRIBUTION

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肺癌放射線治療症例の肺血流シンチグラフィSPECT不均等分布の定量化による肺血流損傷の評価の試み

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THE EVALUATION OF THE DEGREE OF IMPAIRMENT OF PULMONARY PERFUSION IN LUNG CANCER PATIENTS TREATED BY RADIOTHERAPY BY THE QUANTIFICATION OF NONUNIFORM DISTRIBUTION OF LUNG PERFUSION SCINTIGRAPHY SPECT

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Abstract: Purpose: By means of quantifying the nonuniform distribution of pulmonary perfusion in Lung Perfusion Scintigraphy SPECT (Single Photon Emission Tomography), which is called "SPECT" for short, we evaluated the degree of functional impairment of pulmonary perfusion in non-operated lung cancer patients treated by the radiotherapy.

Materials and Methods: Sixty-eight patients with non-operated lung cancer treated with radiotherapy, and who either received or did not receive chemotherapy, from February, 1996 to August, 2002, were examined using SPECT within 6 weeks prior to, or within 2 weeks following radiotherapy. This group was called "irradiated lung cancer patients". Twenty-six patients, who were called "follow-up irradiated lung cancer patients", were reexamined within four weeks after radiotherapy. On the other hand, 323 patients without lung cancer, who were subdivided into four groups; pulmonary, cardiac, cardio-pulmonary, and non-cardiopulmonary. The SPECT was examined in the supine position after infusing Tc-99m-MAA, 185 MBq in a bolus, mainly into an antecubital vein with the patient's arm elevated. From reconstructed SPECT images, the volume of lung as a whole calculated at 10 % of thresholds was assumed to be the "Baseline Lung Perfusion Volume" (BPV), and the functional volume rates were calculated in 10 % threshold widths from 10 % to 100 % of the threshold. Assuming the total absolute differences in functional volume rate between each subject and the control to be the distribution index of the lung as a whole (D index), we quantified the degree of nonuniform distribution of the lung as a whole in each subject. In the same way, the distribution index of the left or right lung respectively was calculated as D_l or D_r index assuming the volume of left or right lung were calculated at 10 % of the threshold as left or right BPV and calculating the functional volume rates of each lung in 10% threshold widths from 10 % to 100 % of the threshold.

Results: The D index of irradiated lung cancer patients was 26.4±1.4, which was almost equal to that of the pulmonary group including the chronic obstructive pulmonary diseases, and significantly higher than that of cardiac or non-cardiopulmonary group. The irradiated lung cancer patients with complications of pulmonary or cardiopulmonary diseases showed a significantly increased D index, compared with patients without complications. Distribution index of tumor-bearing lung ($D_{r/l}$ index) was significantly higher than that of non-tumor-bearing lung. The $D_{r/l}$ index of tumor-bearing lung of small cell carcinoma patients significantly increased, compared with that of adenocarcinoma patients, and significantly increased according to whether or not the primary tumor occupied the hilar region and degree of extension of tumor invasion especially in the hilum as well as the mediastinum. In the follow-up irradiated lung cancer patients, the D index and $D_{r/l}$ index of non-tumor-bearing lung post-radiotherapy significantly increased, compared with pre-radiotherapy.

Conclusions: It is considered that the distribution index quantifying nonuniform distibution in the SPECT enables evaluation of the degree of impairment of lung as a whole, tumor-bearing lung, and non-tumor-bearing lung in lung cancer patients, and results in presenting a useful indicator for radiotherapeutic planning and following up respiratory function after radiotherapy.

Key words: Lung perfusion scintigraphy, SPECT, Lung cancer, Radiotherapy

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要旨：【目的】肺血流シンチグラフィSPECT（Single Photon Emission Computed Tomography）（以後，SPECTと略す）の血流分布の不均等性を定量化した不均等分布値を用いて放射線治療の対象となった肺癌症例の全肺および原発腫瘍を有する片側肺（担癌肺）とその対側肺（非担癌肺）の機能的な損傷の程度を把握，評価した．
【方法と対象】1996年2月から2002年8月まで，肺切除例を除き，放射線治療が単独または化学療法に併用された症例のうちで，初回放射線治療の開始前6週間から開始後2週間以内にSPECTが施行された68例（放治肺癌例）を対象とした．また，放治肺癌例で，放射線治療が終了して4週間以内にSPECTが追跡施行された症例（放治追跡例）は26例で，これらを放射線治療前後の不均等分布値を検討する対象とした．同時期の非肺癌症例323例を大きく肺疾患，心疾患，心肺疾患，非心肺疾患に分けた．SPECTは，対向型ガンマカメラで，被験者は，安静時，仰臥位で左右上肢を挙上させ，主として，右上肢の上腕皮静脈から^{99m}Tc-MAA，185 MBqを急速静注し，Dynamic imageを収集した．終了後，直ちにProjection画像データを収集し，SPECTの再構成を行った．SPECT画像から10% Thresholdで算出された全肺容積を全肺の基準肺血流容積，Baseline Lung Perfusion Volume（BPV）とした．さらに，全肺のBPVにおける10%～100%までの10%幅毎にThreshold width number（n, n=1～9）を定め，各nに対応したBPVに対する容積の割合，機能的容積比率を求めた．各nでの，コントロール8例の機能的容積比率の平均値との差の絶対値の合計値から全肺の不均等分布値（D index）を算出した．また，左右の片側肺毎に，基準肺血流容積（$_{l}$BPV，$_{r}$BPV）および機能的容積比率を求め，同様の方法で左右肺の不均等分布値（D_l index，D_r index）を算出した．
【結果】放治肺癌例のD indexの平均値は26.4±1.4で，非癌症例の慢性閉塞性肺疾患などの肺疾患と同様で，心疾患や非心肺疾患より有意に高かった．また，基礎疾患を合併した症例は非合併例に比し有意に高かった．担癌肺の不均等分布値$D_{r/l}$ indexは対側の非担癌肺に比して有意に高かった．また，小細胞癌例は腺癌例に比して有意に高く，担癌肺の原発腫瘍の占拠部位，腫瘍の進展の程度に応じて，特に肺門リンパ節転移がある場合に有意に増加した．放治追跡例では，全肺および非担癌肺の不均等分布値が治療開始時に比して有意に増加した．
【結論と考察】SPECTの血流分布の不均等性を定量化した不均等分布値は，担癌肺，非担癌肺，そして全肺の呼吸機能を定量的に把握することを可能とし，放射線治療計画や治療後の経過観察において有用な指標の一つとなりえるのではないかと考えられた．

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PALLIATION OF RECURRENT ESOPHAGEAL CANCER AFTER DEFINITIVE RADIOTHERAPY WITH INTRALUMINAL BRACHYTHERAPY —A PRELIMINARY REPORT—

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Abstract: Purpose: The objective was to assess the feasibility, toxicity, and efficacy of palliative intraluminal brachytherapy (ILBT) for recurrent esophageal cancer after definitive radiotherapy.
Method: From January 2000 to December 2002, 10 consecutive patients with recurrent esophageal cancer after definitive radiotherapy completed allocated ILBT, were enrolled into the analysis. All patients presented with a WHO dysphagia score III or more (III: 7; IV: 3). The ILBT was delivered with a special assembled applicator composed of three layers of plastic tubes, inserted transorally. The active treatment length of ILBT was defined as the site of recurrent esophageal tumor plus 1 cm each from the proximal and distal margins. The ILBT was performed by high-dose-rate iridium-192 remote after-loading technique. The ILBT consisted of 2 to 4 fractions of 3 Gy at 1-week intervals. The prescribed dose was specified at a 1 cm depth from the mid-dwell position and the dosimetry was calculated using computer-based software. Patients were followed up monthly and assessed for relief of dysphagia and development of complications.
Result: All patients completed the allocated ILBT schedule. Eight patients died (2 from distant metastasis; 3 from respiratory failure by tumor invasion; 2 from aspiration pneumonia; 1 from chemotherapy-induced sepsis). The median survival of the 10 patients was 5 months (range 2 to 32), and the estimated 1-year actuarial survival was 24%. Time to recurrence of more than 3 months was the only prognostic factor for longer survival (p=0.01). When the response of ILBT was assessed one month after treatment, eight patients achieved improvement of dysphagia, while two patients got worse. The median dysphagia progression-free interval (DPFI) of the 8 responders was 3 months (range 2 to 7). The predictive parameter for good ILBT response was an initial dysphagia score (p=0.01). Only one patient developed tracheo-esophageal fistula 3 months after ILBT
Conclusion: Fractionated ILBT is a feasible method of palliation for recurrent esophageal cancer after definitive radiotherapy. Prescribed dose with 9-12 Gy in three to four fractions weekly is well tolerated

Key words: Esophageal cancer, Brachytherapy, Recurrence, Palliation

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ORIGINAL CONTRIBUTION

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ケロイドの術後照射に対する至適線量の検討
―低線量での耳介ケロイド術後照射を中心に―

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INVESTIGATION OF THE OPTIMAL DOSE ON POSTOPERATIVE RADIOTHERAPY FOR KELOID
―LOW DOSE RADIOTHERAPY FOR EARLOBE KELOID―

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Abstract: Radiotherapy following excision for keloids has shown to decrease the recurrence rate. But until now, no literature has reported the optimal dose of postoperative radiotherapy for keloids. We investigated the optimal dose of postoperative radiotherapy for keloids following excision.

Between July 2000 and March 2003, 21 patients with 29 keloid sites were treated with excision, sutured, and postoperative irradiation with a 4 MeV electron beam. The total dose were 12 Gy per 3 fractions. The results were evaluated at 6-38 months (Ave. 18 months) after treatment.

The effectiveness rate of total sites was 79%. The effectiveness rate was 43% in sites with highly stretched tension such as the chest wall, shoulder, abdominal wall and fingers and 91% in sites without highly stretched tension such as earlobes. As the results of analyzing therapeutic outcomes, the effeciveness rate in sites without highly stretched tension were significantly higher than those with highly stretched tension (p=0.0062). Our study suggested that the optimal dose of postoperative radiotherapy was 12 Gy or less for keloids in sites without highly stretched tension, much as the earlobe.

Key words: Keloid, Postoperative radiotherapy, Electron beam irradiation, Optimal dose

要旨：古くからケロイドに対する放射線治療は行われてきているが，これまでケロイドの術後照射に対する至適線量に関する報告が無かった．今回，我々は耳介を中心としたケロイドに対する術後電子線照射療法の至適線量を検討した．対象は平成12年7月から平成15年3月までに術後電子線照射を施行した21例29部位で，発生部位を高張力部位（前胸壁，下腹壁，肩，手指）と低張力部位（耳介）の二つに分け，それぞれ5例7部位，16例22部位となっている．全例12 Gy/3回（4 MeV）の照射を施行しており，観察期間は術後6ヶ月～38ヶ月（平均18ヶ月）である．ケロイド全体の有効率は79%であったが，高張力部位のケロイドの有効率43%（再発率57%）に対し，低張力部位のケロイドの有効率が91%（再発率9%）と有効率に有意な差を認めた（p=0.0062）．12 Gyという低線量でも耳介の様な低張力部位のケロイドに対して非常に良好な有効率が得られ，同部に対する術後電子線照射療法の至適線量は12 Gy以下であることが示唆された．

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CASE REPORT

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放射線治療が著効した血管芽細胞腫（中川）の1例

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A CASE REPORT OF ANGIOBLASTOMA (NAKAGAWA) EFFECTIVELY TREATED WITH RADIATION THERAPY

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Abstract: Angioblastoma, that was first reported by Nakagawa in 1949, is a rare vascular tumor that usually appears in early childhood. It is seen as an erythematous patch to a reddish-brown area, that is frequently an indurated plaque with tenderness and usually occurs on the trunk or thigh. We report a case: a 5-month-old girl with angioblastoma on the temple, which showed a good response after 6- Gy irradiation. Low dose electron beam irradiation with 6-10 Gy may be an effective method for management, if other treatments have a high morbidity rate or result in a poor outcome.

Key words: Angioblastoma, Tufted angioma, Radiation therapy

要旨：血管芽細胞腫は多くは乳児期にみられる血管腫であり，1949年中川によって最初に報告された．一般的に体幹部や大腿部などの皮膚に紅斑から赤茶色斑を呈し，しばしば圧痛を伴った硬結を認める．今回われわれは6 Gyの放射線治療により良好な反応，経過が得られた生後5ヶ月の少女の側頭部に発生した血管芽細胞腫を経験したので報告する．他に有効な方法がない場合には6〜10 Gyの電子線による放射線治療は有用な治療法と考える．

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TECHNICAL NOTE

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照射野照合における擬似セットアップエラー

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EFFECTS OF INCORRECT PLACEMENT OF PORTAL FILMS ON TREATMENT FIELD VERIFICATION

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Abstract: Purpose: To evaluate, at our facility, the effects of incorrect placement of portal films on treatment field verification and the slant angles of portal film acquisition.
Methods and Materials: Geometric differences (pseudo-setup errors) between the correctly placed portal films (in which the film plane is perpendicular to the x-ray beam axis) and the incorrectly placed portal films (the film plane is not perpendicular to the x-ray beam axis) were mathematically calculated. Thirty-four portal films (25 patients) were analyzed in this study. These portal films were grouped into 2 categories according to the gantry angle: (1) the orthogonal group (i.e. treatment beam angles are of 0°, 90°, 180° and 270°), and (2) the oblique group (other beam angles). The slant angles of each group were evaluated.
Results: Mathematical calculations showed that pseudo-setup errors increased with an increase of the slant angle of the portal film and increased distance between the field-edge and an anatomical reference point. The mean slant angles of portal film acquisition for the orthogonal group and the oblique group were 3.4° (max=12.3°) and 6.0° (max=24.5°), respectively.
Conclusion: To minimize pseudo-setup errors associated with incorrect placement of portal films, an anatomical marker nearest to the field edge should be selected as the reference point for treatment field verification. However, the best way to completely eliminate the pseudo-setup errors is for film plane to be perpendicular to the x-ray beam axis.

Key words: Pseudo-setup errors, Incorrect placement of portal films, Treatment field verification

要旨：我々の施設では，ライナックグラフィー撮影時のフィルム固定に移動式の器具を使用しており，ビーム軸とフィルム面が垂直である確実性がない．本稿では，非垂直撮影ライナックグラフィーにおける擬似セットアップエラー，対策法及び当施設でのライナックグラフィー撮影時のフィルム傾斜角度について検討した．数値計算より，撮影時のフィルム傾斜角度，照合距離が大きくなるほど，擬似セットアップエラーが大きくなることが判った．当施設でのライナックグラフィー撮影時の平均傾斜角度は直交方向照射野で3.4度（最大12.3度），斜入方向照射野で6.0度（最大24.5度）であった．擬似セットアップエラーを除去する最善の方法は，垂直撮影を行うことであるが，非垂直撮影の可能性がある場合に擬似セットアップエラーを小さくするには，できる限り照合距離を小さくすることである．照合距離が5 mm以内であれば，フィルム傾斜角30度の場合でも2 mm以内の擬似セットアップエラーに抑えられる．

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RESEARCH GROUP REPORT

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評価線量の統一及びその精度の向上に関する研究

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A STUDY ON STANDARDIZATION AND PRECISION IMPROVEMENT OF DELIVERED DOSE ESTIMATION

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