·综 述 General review·

^{103}Pd 粒子组织间植入治疗恶性肿瘤的研究进展

张丽云， 王忠敏， 陈克敏， 黄 钢

【摘要】 近年来，放射性粒子组织间植入治疗恶性肿瘤正得到日趋广泛的应用，取得了较大进展，其植入局部放射剂量高、周围组织剂量低、局部控制率相对较高，并具有操作简单、微创等优点。^{103}Pd 是一种新型的放射性粒子，与 ^{125}I 粒子相比，其半衰期较短，初始剂量较高，更适用于增殖较快的肿瘤组织。本文对其治疗原理、临床应用、并发症等方面进行综述。

【关键词】 肿瘤；^{103}Pd；组织间植入

中图分类号：R45 文献标志码：A 文章编号：1008-794X(2009)-10-0789-04

Research progress in ^{103}Pd radioactive seeds implantation for the treatment of malignant tumors

ZHANG Li-yun, WANG Zhong-min, CHEN Ke-min, HUANG Gang. Department of Radiology, Luwan Branch of Ruijin Hospital, School of Medicine, Shanghai Jiaotong University, Shanghai 200020, China

【Abstract】 For recent years, implantation of radioactive seeds has been increasingly used in the treatment of malignant tumors and remarkable clinical results have been achieved. The radioactive seed can produce high radiation dose in the implanted site, while in its surrounding tissues the radiation dose is very low. The technique is minimally-invasive and easy-to-manipulate, moreover, it carries relatively high local control rate for the tumor. ^{103}Pd is a newly-manufactured radioactive seed, which, compared to ^{125}I seed, has shorter half-life period and higher initial dose. Therefore, 103Pd is more suitable for the tumors with higher proliferation rate. This article aims to make a broad overview of the principle, clinical application and complications of this new therapeutic method. (J Intervent Radiol, 2009, 18: 789-792)

【Key words】 Neoplasms; ^{103}Pd; interstitial implantation

放射性粒子组织间植入近距离治疗肿瘤已经有 100 多年的历史，是指采用放射源永久性植入肿瘤之内或附近受癌浸润的组织中（包括其淋巴扩散的途径等组织内）治疗癌症的一种方法[1-3]。早期使用 ^{226}Ra、^{222}Rn 和 ^{192}Ir 等核素，这些核素释放中到高能 γ 射线，难以防护，并发症高，临床应用受到了极大限制。近年来，由于新型低能核素如 ^{125}I、^{103}Pd 等应用于临床，及计算机三维立体定向治疗计划系统的问世，使放射性粒子组织间近距离治疗得以进一步发展。

1 放射性粒子治疗原理及优势

放射性粒子植入肿瘤组织内或受肿瘤侵犯组织中后，可发出持续低能量的 γ 射线。γ 射线对 DNA 分子链具有直接作用：单链断裂、双键断裂；同时具有间接作用：使机体内水分子电离，产生自由基。自由基与生物大分子相互作用，引起组织细胞损伤。在 DNA 合成期及有丝分裂期的肿瘤组织对 γ 射线最敏感，放射性粒子产生低剂量的 γ 射线能够持续对肿瘤组织起作用，不断杀死进入 DNA 合成期及有丝分裂期的肿瘤细胞而达到治疗目的[4]。同时，由于粒子放射活度小，可使肿瘤之外的正常组织所受剂量锐减，从而减少了周围正常组织的损伤。

2 ^{103}Pd 粒子的特点

^{103}Pd 放射粒子的半衰期较短（16.9 d），初始剂量较高，为 20 ~ 24 cGy/h，组织间穿透距离 1.7 cm，初始剂量是 ^{125}I 粒子 3 ~ 4 倍，半衰期为 16.9d，生物等效剂量为 115 Gy。而 ^{125}I 核素半衰期（60 d）较长，组织间穿透距离 1.5 cm，平均光子能量 27.4 keV，生物等效剂量为 160 Gy。在植入后 4.5 周时，^{103}Pd 和 ^{125}I 剂量率相等，约为 5.5 cGy/h。Lazarescu 等[5]

作者单位：200020 上海交通大学医学院附属瑞金医院卢湾分院（张丽云、王忠敏）；上海上海交通大学医学院附属瑞金医院（陈克敏）；上海交通大学医学院（黄 钢）

通信作者：王忠敏

认为有效治疗时间和肿瘤细胞倍增时间有关,倍增时间较短的肿瘤细胞宜采用初始剂量率较高的放射粒子,因此,对于增殖较快的肿瘤组织,^{103}Pd 较合适。体外实验表明对倍增时间小于 10 d 的肿瘤,^{103}Pd 的效果优于 ^{125}I[6]。但由于 ^{103}Pd 半衰期短,潜在出现并发症会比 ^{125}I 粒子早。

美国和西方国家专家认为 ^{125}I 和 ^{103}Pd 2 种放射性粒子可以混合应用。^{103}Pd 的半衰期为 17 d,释放 50%的剂量只有 8.5 d,成为攻击癌细胞的"一线部队",^{125}I 半衰期 60 d,释放 50%的剂量需 30 d,正好成为 ^{103}Pd 之后的"第二梯队",两者合用会更全面的攻击肿瘤细胞[7]。

3 放射性粒子植入的基本原则

放射性粒子植入应按巴黎系统原则,放射源应呈直线排列,相互平行;各放射源粒子之间应等距离(15 ~ 20 mm),放射源应与过中心点的平面垂直。所有放射源的线比释动能率必须相等。放射源断面排列为等边三角形或正方形。在中心平面上,各放射源之间的中点剂量率之和的平均值为基础剂量(参考剂量的 85%)[8]。

植入肿瘤中放射性粒子的活度,每个粒子可以在 0.4 ~ 1.1 mCi,活度较低的粒子,可能容易满足剂量匹配的需要,还可使不良反应降低。最近文献报道从 0.4 ~ 0.7 mCi 适度的粒子,既能满足剂量匹配的要求,又能达到设计的处方剂量。可能以 0.7 mCi 为宜.为避免粒子植入时边缘剂量过高,危及周围正常组织,可以在边缘植入低活度的粒子。在同一靶区内按剂量分要求,植入不同活度的粒子,是目前临床植入粒子达到有效剂量的一个技巧[7]。

4 适应证和禁忌证

4.1 病例选择标准

①病理学诊断明确;②KPS > 60 分;③预计生存期 > 3 个月;④无严重肝、肾功能不全;⑤无严重心脏病;⑥无严重糖尿病;⑦患者不接受或不宜手术切除。对于既往局部接受过放疗,局部可给予根治剂量性粒子植入。既往无放疗史,粒子植入后,参照术后验证结果,D90 较低者或有淋巴引流区放疗指证者应用外放疗。

4.2 禁忌证

对于以下情况,一般认为不宜行粒子植入治疗:身体状况较差,KPS < 60 分;预计生存期 < 3 个月,合并严重肝、肾功能不全;严重心脏病;严重糖尿病;肿瘤广泛转移,预计姑息效果不佳者。

5 应用

5.1 前列腺癌

美国近距离治疗学会(American Brachytherapy Society,ABS)推荐:单纯粒子植入近距离治疗前列腺癌的适应证为:T1-T2aN0M0、PSA ≤10 ng/ml、Gleason 分级 < 7、前列腺体积 < 60 cm^3 和证明无包膜外转移者[9]。

5.1.1 常用剂量 既往国外使用剂量多为 115 Gy[10-11],近年来,ABS 推荐单独 ^{103}Pd 放射粒子近距离治疗处方剂量由 115 Gy 改为 125 Gy。而外放疗 45 Gy 后补量,推荐处方剂量由 90 Gy 改为 100 Gy [12-13]。同时也有一些学者及机构认为单独 ^{103}Pd 放射粒子近距离治疗推荐剂量 135 Gy 更适合,而且相关不良反应较少[14-15]。

5.1.2 疗效评估 通常以 PSA 绝对值来评判疗效、复发和预测无瘤生存率,一般认为 PSA > 2.0 ng/ml 是局部控制失败指标,并将患者存活且 PSA 无进展定义为生物化学控制或无生化进展[16-17]。Peschel 等[18]报道,^{103}Pd 粒子植入治疗低危前列腺癌患者的 5 年 PSA 无生化进展生存率(biochemically noevidence of disease, bNED)为 92%,中危和高危患者的 5 年 bNED 为 74%。陈萍等[19]报道 ^{103}Pd 粒子组织间近距离治疗肿瘤 31 例,肿瘤缩小或未增大占 66.2%(21/31)。姜玉良等[20]对前列腺癌等恶性肿瘤 20 例行 ^{103}Pd 粒子植入治疗,局部控制率为 90%,但该组病例随访期间,12 例死亡,主要死亡原因为远处转移及肺感染、咯血等合并症。生存时间不高的原因在于治疗时病例分期较晚,而粒子植入作为近距离局部治疗手段,不能控制和预防远处转移,所以在有较高局部控制率同时,未获得明显生存改善。

5.1.3 并发症 并发症主要有直肠损伤、尿道狭窄和性功能障碍,还可能发生急性尿道狭窄和前列腺炎等。Wallner 等[21]采用多中心随机试验对比 ^{125}I 与 ^{103}Pd 治疗前列腺癌,发现两者尿道及直肠不良反应均较低,即使发生亦多为 1、2 级,但两者相比 ^{125}I 较 ^{103}Pd 有高不良反应的趋势,尤其是术后第 6 个月随访时最为明显。Wallner 认为可能与 ^{103}Pd 的半衰期比 ^{125}I 短有关。增加试验例数及随访时间,结果表明 ^{103}Pd 相关反应的恢复时间明显快于 ^{125}I,但较 ^{125}I 有较高的直肠炎发生率[22]。Gejerma 等[23]分析 50 例接受 90 Gy ^{103}Pd 粒子植入治疗后 21 d 内的急性并发症,出现 0 级泌尿系统并发症的占 32%,1 级占38%,

2 级占 30%。尿频、尿痛大多短期表现明显,其后逐渐缓解[16],血尿常见于术后 24 h 内,可自行消失[24]。前列腺癌粒子植入治疗的主要优势是保护性生活能力,明显高于手术或单纯外放疗。对低危组患者行单纯近距离治疗,有 80% ~ 85%可保留性生活能力。中危组患者行外放疗加粒子治疗,70%可保留性生活能力[25]。Yale Medical School Group (YMSG)在一项回顾性临床研究中对 ^{125}I 和 ^{103}Pd 进行了比较,得出以下结论:①使用 ^{125}I and ^{103}Pd 5 年的 bNED 生存率是相当的。②两者的主要并发症发生率都比较低。③使用 ^{125}I 粒子的总的并发症发生率较 ^{103}Pd 高[26]。

5.2 肝癌

肝癌手术切除的远期疗效尚不令人满意,其主要原因之一是术后肿瘤早期复发和转移,较小的肿瘤(小于 1 cm 或数毫米)术前、术中影像检查不一定能发现(特别是伴有大结节肝硬化时),术中认为是“根治”,术后 2 ~ 3 个月复发并非罕见(特别是包膜不完整的肝癌)[27]。粒子植入近距离治疗对肝癌的局部控制较好,可提高中晚期肝癌患者的生活质量并延长生存期[28]。

主要适应证是:①不可切除的肝恶性肿瘤,尤其是因其他原因不耐受肝切除的患者。②手术时已有肝外淋巴结转移,行姑息性治疗者。③部位特殊、术中很难做到根治性切除的肝癌患者。黄华容等[29]对 9 例巨块型肝癌患者行 ^{103}Pd 粒子植入治疗,术后 AFP 均大幅下降,收到了良好的疗效。卢惠琴等[1]应用放、化疗粒子联合植入法综合治疗复发性直肠癌 48 例。在治疗计划指导下,交替植入 5-Fu 缓释化疗粒子和放射性 ^{103}Pd 粒子,疼痛缓解率为 95.83% (46/48),平均疼痛缓解时间为 5 ~ 9 d。于术后 3 ~ 6 个月 CT 复查肿瘤变化,提示瘤体不同程度缩小,其中 11 例完全缓解,27 例部分缓解,9 例稳定,局部控制率为 79.17%。随访 6 ~ 28 个月,中位生存期为 17 个月。放、化疗粒子联合植入使其在瘤体内各自发挥作用的同时,化疗药物还能对放射治疗起到增敏作用,使两者发挥协同抗肿瘤效力。

5.3 胰腺癌

胰腺癌因其解剖学特点,临床很难早期发现,本病能接受根治性手术治疗的患者仅占 10% ~ 15%,总体 5 年生存率仅为 5% ~ 26%,外照射的疗效不肯定。粒子植入近距离治疗对周围重要脏器损伤很小。Raben 等[30]使用 ^{103}Pd 治疗了 11 例不能手术的晚期胰腺癌,5 例局部得到控制,5 例发生远处转移,全组中位生存期 6.9 个月。Nori 等[31]对 15 例确诊胰腺癌的患者在手术中行 ^{103}Pd 粒子植入,并在术后行外放疗及化疗,研究认为 ^{103}Pd 组织间植入可以作为无法手术切除的胰腺癌的替代治疗,其疼痛缓解较快且并发症较少。然而对于大部分晚期胰腺癌的患者,其中位生存率较 ^{125}I 粒子植入并没有明显的改善。

5.4 乳腺癌

Pignol 等[32]对 67 例乳腺癌患者保乳术后进行了 ^{103}Pd 粒子植入,在平均为 32 个月(11 ~ 49 个月)的随访中,没有出现复发。术后 17%患者有明显疼痛,只有 1 例出现急性皮肤反应。皮肤红斑和硬结的发生率分别为 42%和 27%。该作者认为 ^{103}Pd 粒子植入的适用性、安全性和耐受性较外照射好。

6 展望

^{103}Pd 粒子治疗恶性肿瘤,作为近距离局部治疗手段,植入局部放射剂量高、周围组织剂量低、局部控制率相对较高,并具有操作简单、恢复快及微创等优点。随着 CT 三维治疗计划系统的应用,粒子治疗定位更加精确,剂量分布更均匀、更合理。对于那些术后复发的肿瘤,尤其是外科和放疗后复发的肿瘤,粒子种植治疗是更合理、更有效的治疗途径。但临床尚有许多问题需要解决,如:①如何建立更详细、确切的病例选择标准。②粒子种植近距离放射治疗如何与手术、外放疗、激素治疗和化疗等多种治疗的合理结合。③针道出血及可能出现的针道种植转移、粒子迁移游走等问题尚待进一步研究解决。相信随着研究的深入,这项技术将得到进一步完善,临床应用具有广阔的前景。

[参 考 文 献]

[1] 卢慧勤, 兰树敏, 王顺官, 等. 放射性粒子 ^{103}Pd 与缓释化疗粒子联合应用靶向治疗肝癌[J]. 现代医学, 2006, 6: 24 - 26.

[2] 刘 健, 张福君, 吴沛宏, 等. CT 导向下 ^{125}I 粒子植入治疗肝门区肝癌[J]. 介入放射学杂志, 2005, 14: 606 - 609.

[3] 史 跃, 高从敬. 采用双重介入治疗中晚期肺癌的临床研究[J]. 介入放射学杂志, 2002, 11: 184 - 186.

[4] Ankem MK, DeCarvalho VS, Harangozo AM, et al. Implications of radioactive seed migration to the lungs after prostate brachytherapy[J]. Urology, 2002, 59: 555 - 559.

[5] Lazarescu GR, Battista JJ. Analysis of the radiobiology of ytterbium-169 and iodine-125 permanent brachytherapy implants [J]. Phys Med Biol, 1997, 42: 1727 - 1736.

[6] Ling CC. Permanent implants using Au-198, Pd-103 and I-125: radiobioligical considerations based on the liner quadratic model

[J]. Int J Radiate Oncol Biol Phys, 1992, 23: 81 - 87.
[7] 申文江. 放射性粒子植入的现状与进展[J]. 中国微创外科杂志, 2007, 7: 118 - 119.
[8] 周桂霞, 马 林, 刘永雄. 放射性粒子治疗胰腺癌的研究进展[J]. 中华肝胆外科杂志, 2004, 10: 862 - 864.
[9] Cattani F, Vavassori A, Polo A, et al. Radiation exposure after permanent prostate brachytherapy [J].Radiother Oncol, 2006, 79: 65 - 69.
[10] Nag S, Scaperoth DD, Badalament R, et al. Transperineal palladium-103 prostate cancer brachytherapy: Analysis of morbidity and seed migration[J]. Urology, 1995, 45: 87 - 92.
[11] Nag S, Beyer D, Fviedland J, et al. American brachytherapy society (ABS) recommendations for transperineal permanent brachytherapy of prostate cancer [J]. Int J Radiat Oncol Biol Phys, 1999, 1: 789 - 799.
[12] Blasko JC, Grimm PD, Sylvester JE, et al. Palladium-103 brachytherapy for prostate carcinoma[J]. Int J Radiat Oncol Biol Phys, 2000, 46: 839 - 850.
[13] Beyer D, Nath R, Butler W, et al. American brachytherapy society recommendations for clinical implementation of NIST-1999 standards for (103)palladium brachytherapy. The clinical research committee of the American Brachytherapy Society [J]. Int J Radiat Oncol Biol Phys, 2000, 47: 273 - 275.
[14] Bice WS, Prestidge BR, Sarosdy MF. Calibration, calculation, and prescription issues in permanent prostate brachytherapy with (103)Pd[J]. Int J Radiat Oncol Biol Phys, 2001, 49: 289 - 291.
[15] Lee PC, Moran BJ. 125 Gy or 135 Gy? Comments on the American Brachytherapy Society article by Beyer et al[J]. Int J Radiat Oncol Biol Phys, 2001, 49: 897 - 898.
[16] Merrick GS, Butler WM, Wallner KE, et al. Dysuria after permanent prostate brachytherapy [J]. Int J Radiat Oncol Biol Phys, 2003, 55: 979 - 985.
[17] 王俊杰. 放射性粒子近距离治疗前列腺癌: 临床篇[J]. 国外医学·放射医学核医学分册, 2002, 26: 101 - 104.
[18] Peschel RE, Colberg JW, Chen Z, et al. Iodine-125 versus palladium-103 implants for prostate cancer, clinical outcomes and complications[J]. Cancer J, 2004, 10: 170 - 174.
[19] 陈 萍, 魏献忠, 梁伟坚, 等. 放射活性 ^{103}Pd 粒子近距离照射治疗肿瘤初步研究[J]. 现代临床医学生物工程学杂志, 2001, 7: 426 - 428.
[20] 姜玉良, 王俊杰, 甄 鹏, 等. 放射性 ^{103}Pd 粒子组织间植入治疗恶性肿瘤[J]. 中国微创外科杂志, 2007, 7: 130 - 133.
[21] Wallner K, Merrick G, True L, et al. I-125 versus Pd-103 for low-risk prostate cancer: morbidity outcomes from a prospective randomized multicenter trial[J]. Cancer J, 2002, 8: 67 - 73.
[22] Herstein A, Wallner K, Merrick G, et al. I-125 versus Pd-103 for low-risk prostate cancer: long-term morbidity outcomes from a prospective randomized multicenter controlled trial[J]. Cancer J, 2005, 11: 385 - 389.
[23] Gejerman G, Mullokandov E, Saini AJ, et al. The effects of edema on urethral dose following palladium-103 prostate brachytherapy[J]. Med Dosim, 2002, 27: 221 - 225.
[24] Barker JJr, Wallner K, Merrick G. Gross hematuria after prostate brachytherapy[J]. Urology, 2003, 61: 409 - 411.
[25] 刘 峰, 王俊杰. 放射性 ^{103}Pd 粒子植入治疗前列腺癌[J]. 中国微创外科杂志, 2008, 8: 183 - 185.
[26] Peschel RE. Prostate implant therapy: iodine-125 versus palladium-103[J]. Cancer J, 2005, 11: 383 - 384.
[27] 周信达. 重视原发性肝癌的综合治疗 [J]. 肝胆外科杂志, 2000, 8: 401 - 402.
[28] Nag S, DeHaan M, Scruggs G, et al. Long-term follow-up of patients of intrahepatic malignancies treated with ^{125}I brachytherapy[J]. Int J Radiat Oneol Biol Phys, 2006, 64: 736 - 744.
[29] 黄华容, 邓 予, 罗小平, 等. ^{103}Pd 粒子植入治疗肝癌的初步探讨[J]. 现代临床医学生物工程学杂志, 2004, 10: 252 - 253.
[30] Raben A, Mychalczak B, Brennan MF, et al. Feasibility study of the treatment of primary unresectable carcinoma of the pancreas with 103Pd brachytherapy[J]. Int J Radiat Oncol Biol Phys, 1996, 35: 351 - 356.
[31] Nori D, Merimsky O, Osian AD, et al. Palladium-103: a new radioactive source in the treatment of unresectable carcinoma of the pancreas: a phase I-II study[J]. J Surg Oncol, 1996, 61: 300 - 305.
[32] Pignol JP, Rakovitch E, Keller BM, et al. Tolerance and acceptance results of a palladium-103 permanent breast seed implant Phase I/II study [J]. Int J Radiat Oncol Biol Phys, 2009, 73: 1482 - 1488.

(收稿日期:2009-06-19)

~(103)Pd粒子组织间植入治疗恶性肿瘤的研究进展

作者： 张丽云， 王忠敏， 陈克敏， 黄钢
作者单位： 张丽云,王忠敏(上海交通大学医学院附属瑞金医院卢湾分院,200020)， 陈克敏(上海上海交通大学医学院附属瑞金医院)， 黄钢(上海交通大学医学院)

刊名： 介入放射学杂志 ISTIC PKU
英文刊名： JOURNAL OF INTERVENTIONAL RADIOLOGY
年，卷(期)： 2009，18(10)

参考文献(32条)

1. 卢慧勤,兰树敏,王顺官,等.放射性粒子~(103)Pd与缓释化疗粒子联合应用靶向治疗肝癌[J].现代医学,2006,6:24-26.

2. 刘健,张福君,吴沛宏,等.CT导向下~(125)I粒子植入治疗肝门区肝癌[J].介入放射学杂志,2005,14:606-609.

3. 史跃,高从敬.采用双重介入治疗中晚期肺癌的临床研究[J].介入放射学杂志,2002,11:184-186.

4. Ankem MK,DeCarvalho VS.Harangozo AM,et al.Implications of radioactive seed migration to the lungs after prostate brachytherapy[J].Urology,2002,59:555-559.

5. Lazarescu GR,Battista JJ.Analysis of the radiobiology of ytterbium-169 and iodine-125 permanent brachytherapy implants[J].Phys Med Biol,1997,42:1727-1736.

6. Ling CC.Permanent implants using Au-198,Pd-103 and I-125:radiobioligical considerations based on the liner quadratic model[J].Int J Radiate Oncol Biol Phys,1992,23:81-87.

7. 申文江.放射性粒子植入的现状与进展[J].中国微创外科杂志,2007,7:118-119.

8. 周桂霞,马林,刘永雄.放射性粒子治疗胰腺癌的研究进展[J].中华肝胆外科杂志,2004,10:862-864.

9. Cattani F,Vavassori A,Polo A,et al.Radiation exposure after permanent prostate brachytherapy[J].Radiother Oncol,2006,79:65-69.

10. Nag S,Scaperoth DD,Badalament R,et al.Transperineal palladium-103 prostate cancer brachytherapy:Analysis of morbidity and seed migration[J].Urology,1995,45:87-92.

11. Nag S,Beyer D,Fviedland J,et al.American brachytherapy society (ABS) recommendations for transperineal permanent brachytherapy of prostate cancer[J].Int J Radiat Oncot Biol Phys,1999,1:789-799.

12. Blasko JC,Grimm PD,Sylvester JE,et al.Palladium-103 brachytherapy for prostate carcinoma[J].Int J Radiat Oneol Biol Phys,2000,46:839-850.

13. Beyer D,Nath R,Butler W,et al.American brachytherapy society recommendations for clinical implementation of NIST1999 standards for (103)palladium brachytherapy.The clinical research committee of the American Brachytherapy Society[J].Int J Radiat Oncol Biol Phys,2000,47:273-275.

14. Bice WS,Prestidge BR,Sarosdy MF.Calibration,calculation,and prescription issues in permanent prostate brachytherapy with (103)Pd[J].Int J Radiat Oncol Biol Phys,2001,49:289-291.

15. Lee PC,Moran BJ.125 Gy or 135 Gy? Comments on the American Brachytberapy Society article by Beyer et al[J].Int J Radiat Oncol Biol Phys,2001,49:897-898.

16. Merrick GS,Butler WM,Wallner KE,et al.Dysuria after permanent prostate brachytherapy[J].Int J Radiat Oncol Biol Phys,2003,55:979-985.

17. 王俊杰.放射性粒子近距离治疗前列腺癌:临床篇[J].国外医学·放射医学核医学分册,2002,26:101-104.

18. Peschel RE,Colberg JW,Chen Z,et al.Iodine-125 remus palladium-103 implants for prostate cancer,clinical outcomes and complications[J].Cancer J,2004,10:170-174.

19. 陈萍,魏献忠,梁伟峰,等.放射活性~(103)Pd粒子近距离照射治疗肿瘤初步研究[J].现代临床医学生物工程学杂志,2001,7:426-428.

20. 姜玉良,王俊杰,甄鹏,等.放射性~(103)pd粒子组织间植入治疗恶性肿瘤[J].中国微创外科杂志,2007,7:130-133.

21. Wallner K,Merrick G,True L,et al.1-125 versus Pd-103 for low-risk prostate cancer:morbidity outcomes from a prospective randomized muhicenter trial[J].Cancer J,2002,8:67-73.

22. Herstein A,Wallner K,Merrick G,et al.I-125 versus Pd-103 for Iow-risk prostate cancer:long-term morbidity outcomes from

a prospective randomized muhicenter controlled trial[J].Cancer J,2005,11:385-389.

23.Gejerman G,Mullokandov E,Saini AJ,et al.The effects of edema on urethral dose following palladium-103 prostate brachytherapy[J].Med Dosim,2002,27:221-225.

24.Barker JJr,Wallner K,Merrick G.Gross hematuria after prostate brachytherapy[J].Urology,2003,61:409-411.

25.刘峰,王俊杰.放射性~(103)Pd粒子植入治疗前列腺癌[J].中国微创外科杂志,2008,8:183-185.

26.Peschel RE.Prostate implant therapy:iodine-125 versus palladium-103[J].Cancer J,2005,11:383-384.

27.周信达.重视原发性肝癌的综合治疗[J].肝胆外科杂志,2000,8:401-402.

28.Nag S,DeHaan M,Scruggs G,et al.Long-term follow-up of patients of intrahepatic malignancies treated with ~(125)I brachytherapy[J].Int J Radiat Oneol Biol Phys,2006,64:736-744.

29.黄华容,邓予,罗小平,等.~(103)pd粒子植入治疗肝癌的初步探讨[J].现代临床医学生物工程学杂志,2004,10:252-253.

30.Raben A,Mychalczak B,Bronnan MF,et al.Feasibility study of the treatment of primary unresectable carcinoma of the pancreas with 103Pd brachytherapy[J].Int J Radiat Oncol Biol Phys,1996,35:351-356.

31.Nori D,Merimsky O,Osian AD,et al.Palladium-103:a new radioactive source in the treatment of unresectable carcinoma of the pancreas:a phase MI study[J].J Surg Oncol,1996,61:300-305.

32.Pignol JP,Rakovitch E,Keller BM,et al.Tolerance and acceptance results of a palladium-103 permanent breast seed implant Phase Ⅰ/Ⅱ study[J].Int J Radiat Oncol Biol Phys,2009,73:1482-1488.

相似文献(10条)

1.外文期刊 Nath R.Bongiorni P.Chen Z.Gragnano J.Rockwell S Development of a rat solid tumor model for continuous low-dose-rate irradiation studies using (125)I and (103)Pd sources.

PURPOSE: To develop an experimental technique for studying the radiobiology of continuous low-dose-rate irradiation (CLDRI) using clinical brachytherapy sources emitting low energy photons for a rat solid tumor model. METHODS AND MATERIALS: BA1112 tumors were grown between the ears of 14-week-old male WAG/Rij rats by interdermal inoculation. A radioactive source afterloading system, which consists of a lightweight helmet sutured to the rat and a nine-source polystyrene applicator, was fabricated for in vivo tumor irradiation by (125)I and (103)Pd brachytherapy sources. This system has a 12 x 12 mm opening in the center to accommodate the tumor and its growth during irradiation (the diameter of a typical BA1112 tumor was about 6 mm when radiation was applied). The spatial locations of the nine sources were optimized to produce an as uniform as possible three-dimensional dose distribution to the central portion of the applicator for both the (125)I and (103)Pd sources. Absolute dose delivered by the applicator was verified by point dose measurements using calibrated TLD in a polystyrene phantom that mimics the scattering environment of the tumor on the rat. RESULTS: The feasibility of tumor cure experiments using the experimental technique presented in this work was demonstrated. The technique was used to study the influence of initial dose rate on the in vivo tumor cure probability of BA1112 tumors irradiated by (125)I and (103)Pd sources at dose rates varying from 8-20 cGy/h. The technique was also used for studying the in vitro tumor cell survival following in vivo CLDRI irradiation of the tumor. CONCLUSION: An experimental technique using an in vivo tumor model has been developed for studying the radiobiological effects of continuous low-dose-rate irradiations using (125)I sources alone, (103)Pd sources alone, or a mixture of (125)I and (103)Pd sources.

2.期刊论文 陈萍.魏献忠.刘衍民.吴开俊.梁健新.陈汉章 103Pd种子源植入治疗肿瘤近期疗效观察 -中华核医学杂志2003,23(3)

目的评估103Pd种子源植入治疗恶性肿瘤的近期疗效.方法 21例确诊的恶性肿瘤患者,由治疗计划系统(TPS)通过不同术式植入103Pd种子源(196.1～2 127.5 MBq),其中15例采用均一布源,6例前列腺癌采用中心消融,外周布源.观察肿瘤大小、局部复发和远处转移情况;并按肿瘤放射协作组/欧洲肿瘤研究及治疗(RTOG/EORTC)急性或后期放疗副作用评分标准进行评分.结果随访期内21例患者均未见局部复发和远处转移,RTOG/EORTC评分为0分19例,占90.5%,1分2例,占9.5%.结论 103Pd种子源植入治疗肿瘤近期效果安全可行.

3.会议论文 刘峰.王俊杰 <'125>I和<'103>Pd对前列腺癌粒子植入治疗的比较 2007

目前用于永久粒子植入近距离放射治疗早期前列腺癌的粒子主要是<'125>I和<'103>Pd,二者的物理学、放射生物学等特点不同,导致二者在前列腺癌治疗中的差异。<'125>I适于治疗增殖慢、Gleason评分低的前列腺癌,而<'103>Pd适于治疗增殖快、Gleason评分高的肿瘤。<'125>I和<'103>Pd治疗各期前列腺癌的临床效果相似,但在临床治疗中<'125>I引起的并发症比率较<'103>Pd高,<'103>Pd治疗病人的放射相关症恢复较<'125>I快。

4.会议论文 刘峰.王俊杰 放射性<'103>Pd粒子植入治疗前列腺癌 2007

近距离放射治疗是前列腺癌治疗的主要方法之一。<'103>Pd粒子的半衰期短,初始剂量率高,近年已被更广泛用于前列腺癌治疗。永久<'103>Pd粒子植入治疗早期前列腺癌是一种安全、简便和微创的治疗方法,在提高疗效和降低周围组织损伤方面取得了长足进步。本文就<'103>Pd粒子植入治疗前列腺癌的机制、操作方法、适应证及禁忌证、并发症和疗效等方面进行综述。

5.会议论文 刘峰.王俊杰 放射性<'103>Pd粒子植入治疗前列腺癌 2007

近距离放射治疗是前列腺癌治疗的主要方法之一。<'103>Pd粒子的半衰期短,初始剂量率高,近年已被更广泛用于前列腺癌治疗。永久<'103>Pd粒子植入治疗早期前列腺癌是一种安全、简便和微创的治疗方法,在提高疗效和降低周围组织损伤方面取得了长足进步。本文就<'103>Pd粒子植入治疗前列腺癌的机制、操作方法、适应证及禁忌证、并发症和疗效等方面进行综述。

6.期刊论文 卢慧勤.兰树敏.王顺官.刘国红.温乃祥.徐豫滨 放射性粒子103 Pd与缓释化疗粒子联合应用靶向治疗肝癌 -现代医院2006,6(8)

目的探讨应用放、化疗粒子联合植入法综合治疗肝癌的可行性、安全性及短期疗效.方法自2001年12月～2004年12月,应用放、化疗粒子联合植入法综合治疗复发性直肠癌48例.在治疗计划指导下,交替植入5-FU缓释化疗粒子和放射性103Pd粒子.放射性粒子的肿瘤匹配周边剂量(Matched peripheral dose,MPD)为90～130 Gy.平均每例使用103Pd粒子10粒,5-FU 1 000 mg.结果48例病人手术均顺利完成,未发生出血、感染等并发症,经摄片证实放射性粒子的位置无变化.疼痛缓解率为95.83%(46/48),平均疼痛缓解时间为5～9 d.于术后3～6个月CT复查肿瘤变化,提示瘤体不同程度缩小,其中11例完全缓解,27例部分缓解,9例稳定,局部控制率为79.17%.随访6～28个月,中位生存期为17个月,最长1例随访时间为术后26个月,现仍存活.1例术后6个月死于全身广泛转移.结论放射性103Pd粒子和5-FU缓释化疗粒子联合应用局部植入技术具有安全、微创及并发症发生率低的特点,是综合治疗肝癌的较有效手段之一.

7.外文期刊 Wuu.CS.Ennis.RD.Schiff.PB.Lee.EK.Zaider.M Dosimetric and volumetric criteria for selecting a source activity and a source type ((125)I or (103)Pd) in the presence of irregular seed placement in permanent prostate implants.

PURPOSE: The dosimetric merit of a permanent prostate implant relies on two factors: the quality of the plan itself, and the fidelity of its implementation. The former factor depends on source type and on source strength, while the latter is a combination of skill and experience. The purpose of this study is to offer criteria by which to select a source type ((125)I or (103)Pd) and activity. METHODS AND MATERIALS: Given a prescription dose and potential seed positions along needles, treatment plans were designed for a number of seed types and activities, specifically for (125)I with activities ranging from 0.3 to 0.7 mCi, and for (103)Pd with activities in the range of 0.8 to 1.6 mCi. To avoid human planner bias, an automated computerized planning system based on integer programming was used to obtain optimal seed configurations for each seed type and activity. To simulate the effect of seed-placement inaccuracies, random seed-displacement

"errors" were generated for all plans. The displacement errors were assumed to be uniformly distributed within a cube with side equal to 2sigma. The resulting treatment plans were assessed using two volumetric and two dosimetric indices. RESULTS: For (125)I implants a coverage index (CI) of 98.5% or higher can be achieved for all activities (CI is the fraction of the target volume receiving the prescribed or larger dose). The external volume index (EI) (i.e., the amount of healthy tissue, as percentage of the target volume, receiving the prescribed or larger dose) increases from 13.9% to 20% as the activity increases from 0.3 to 0.7 mCi. For implants using (103)Pd, the external volume index increases from 10. 2% to 13.9% whenever CI exceeds 98.5%. Volumetric and dosimetric indices (coverage index, external volume index, D90, and D80) are all sensitive to seed displacement, although the activity dependence of these indices is more pronounced for (125)I than for (103)Pd implants. CONCLUSIONS: For both isotopes, the lower activities

8.外文期刊 Brezovich.IA.Pareek.PN.Duan.J.Fiveash.J Effect of Foley catheters on seed positions and urethral dose in (125)I and (103)Pd prostate implants.

PURPOSE: To estimate the perturbation of seed position and urethral dose, subsequent to withdrawal of urethral catheters. METHODS AND MATERIALS: A mathematical model based on the volume incompressibility of tissues was used to compute seed positions and doses following removal of the Foley. The model assumed that the central axis of the urethra remains stationary, and that prostate tissue and seeds move radially toward the center of the urethra to fill the void left by the catheter. Seed motion has also been measured using transrectal ultrasound. RESULTS: Based on the computations, seeds located originally close to the urethra travel relatively large distances toward the urethra upon Foley removal, whereas seeds located further away move substantially less. This seed motion leads to higher urethral doses than shown in a standard treatment plan. Dose enhancements increase with catheter size, decrease with increasing prostate volume, are more pronounced for (103)Pd than for (125)I, and range between 3.5% and 32.4%. Postimplant dosimetry is equally affected if images are taken with urethral catheters in place, showing lower urethral doses than actually delivered. Preliminary ultrasound based measurements of seed motion agree with the theory. CONCLUSION: During the implantation procedure, 12 fr or smaller urethral catheters are preferable to larger diameter catheters if urine drainage is sufficient. Treatment planners should avoid planning seeds at 5 mm or closer from the urethra. Special caution is indicated in prostates having about 20 cm(3) or smaller volumes, and when (103)Pd is used. Postimplant dosimetry is susceptible to the same errors.

9.外文期刊 Keller.BM.Pignol.JP.Rakovitch.E.Sankreacha.R.O'Brien.P A radiation badge survey for family members living with patients treated with a (103)Pd permanent breast seed implant.

PURPOSE: Sixty-seven patients with early-stage breast cancer were treated in a Phase I/II clinical trial using a (103)Pd permanent breast seed implant as adjuvant radiotherapy after breast-conserving surgery. We report the dose received by family members living with these patients and compare measured doses with theoretical worst-case scenario estimates. METHODS AND MATERIALS: Exposure-rate measurements were taken at 1 m from the patient by using a calibrated low-energy survey meter. Landauer (Landauer Inc., Glenwood, IL) Luxel badges, with sensitivity of 0.01 mSv, were given to family members to wear after the implantation. Badge readings for 33 spouses and 28 other family members were used to estimate effective doses, and these were compared with theory. RESULTS: Average preimplantation planning target volume from computed tomography was 50.3 ml (range, 18.0-96.7 ml), and average preimplantation distance between the skin and the most anterior planning target volume margin was 0.57 cm. The average maximum exposure rate was measured to be 2.4 +/- 1.1 mR/h, and average measured dose to a spouse was 0.99 +/- 1.0 mSv. The calculated exposure rates and spousal doses using preimplantation computed tomography scan data overestimated those measured. Average measured family member dose (excluding spouses) was 0.20 +/- 0.58 mSv. CONCLUSIONS: Based on measured and calculated spousal doses, a permanent breast seed implant using (103)Pd is safe for the public. However, it is recommended that extra precautions in the way of a breast patch be used when patients with an implant will be in the vicinity of toddlers or pregnant women.

10.外文期刊 Cavanagh.W.Blasko.JC.Grimm.PD.Sylvester.JE Transient elevation of serum prostate-specific antigen following (125)I/(103)Pd brachytherapy for localized prostate cancer.

Based on suggestions by anecdotal evidence to date, an attempt is made to estimate the occurrence of non-disease-related prostate-specific antigen (PSA) spiking in the serum PSA profiles of a series of men treated by (125)I/(103)Pd brachytherapy with or without external beam irradiation. Five hundred ninety-one patients treated between January 1988 and December 1993 were eligible for study. Patients whose clinical status was described as equivocal (declining PSA > 1.0 ng/mL or rising PSA without documented disease [9.6% of the cohort]) were not considered. Evidence of PSA increases that were followed by decline were identified. Treatment and disease-specific parameters were examined for influence of the occurrence of spiking. In patients judged biochemical successes at last follow-up (serum PSA < or = 1.0 ng/mL), 35.8% exhibited a temporary increase of 0.2 ng/mL or more. Seventy-five percent of these patients exhibited a temporary increase between 0.3 and 3.4 ng/mL. The average time of the temporary increases was 24.8 months after implant. Spiking was not associated with a higher risk of clinical failure in this data set. Conventional risk factors for recurrent disease were not associated with benign PSA spiking. Low-magnitude serum PSA spiking may occur in up to one third of patients following permanent, low-dose rate brachytherapy of the prostate. Most of these observations occur up to 3 years after implant and do not appear to be related to disease recurrence. Caution should be taken before initiating further therapy pursuant to the observation of PSA spiking of less than 2 to 3 ng/mL shortly following brachytherapy. Frequent serum PSA sampling following prostate brachytherapy with early follow-up may overestimate biochemical failure rates.