

# Metabolic effects of prostate cancer after brachytherapy as measured by three dimensional magnetic resonance spectroscopic imaging

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**Purpose:** To investigate the metabolic effects of prostate after brachytherapy in the patients with prostate cancer with 3D MRSI.

**Material and Method:** 21 patients with pathologically confirmed prostate cancer who underwent either short (<12 weeks, 5cases) or long-term (>12 weeks, 16 cases) brachytherapy and 19 cases of untreated prostate cancer patients were quantitatively assessed by MRS. All the patients were proved by ultrasound guided systemic biopsy. The locations of the tumor were marked by the pathologist and were enrolled in one of the six areas(right tip, right middle, right bottom, left tip, left middle and left bottom). The levels of choline, creatine and citrate and (Cho+Cre)/Cit ratios were calculated on the basis of the MRS metabolic map and were compared with the levels of serum PSA.

**Results:** 1)After brachytherapy, the choline, creatine and citrate levels decreased. Citrate levels decreased more prominent than choline and creatine levels ( $\chi^2 = 7.86, P < 0.01$ ). 2) In long-term treated group, the metabolic atrophy areas of choline, creatine and citrate was significant more than that of short-term group and untreated group( $\chi^2 = 6.62, P < 0.05$ ). 3) In long-term treated patients, for PSA normal patients the metabolic atrophy areas of choline, creatine and citrate was significant more than that of PSA abnormal patients( $\chi^2 = 13.01, P < 0.01$ ).

**Conclusion:** 3D MRS can be used to evaluate the metabolic changes of prostate after brachytherapy.

**Key Word:** prostate neoplasm , brachytherapy, magnetic resonance spectroscopy

Table 1 Time dependent loss of prostate metabolites in brachytherapy and untreated control patients

Metabolites	Control group (n=19)		Short-term group (n=5)		Long-term group (n=16)	
	PCa foci	Other area	PCa foci	Other area	PCa foci	Other area
Total areas	72	44	17	13	57	39
Cho detectable areas	72/72(100%)	44/44(100%)	17/17(100%)	13/13(100%)	34/57(59.6%)	11/39(28.2%)
Cre detectable areas	69/72(95.8%)	44/44(100%)	8/17(47.1%)	10/13(76.9%)	24/57(42.1%)	6/39(15.4%)
Cit detectable areas	66/72(91.7%)	44/44(100%)	2/17(11.8%)	10/13(76.9%)	9/57(15.8%)	5/39(12.8%)

Table 2 Prostatic metabolites in PSA normal and PSA abnormal groups in long-term treated patients

Metabolites	PSA normal (n=6)		PSA abnormal (n=10)	
	PCa foci	Other area	PCa foci	Other area
Total areas	17	19	40	20
Cho detectable areas	4/17 (23.5%)	4/19(21.1%)	30/40(75%)	7/20(35%)
Cre detectable areas	1/17(5.9%)	2/19(10.5%)	23/40(57.5%)	4/20(20%)
Cit detectable areas	1/17(5.9%)	3/19(15.8%)	8/40(20%)	2/20(10%)

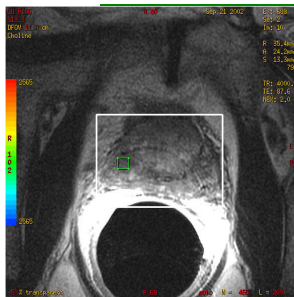


Fig.1

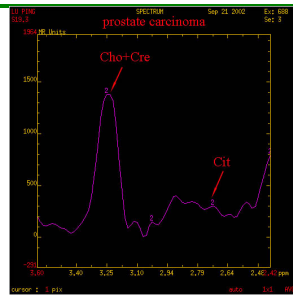


Fig.2

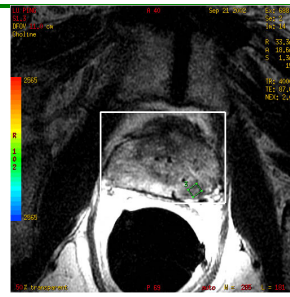


Fig.3

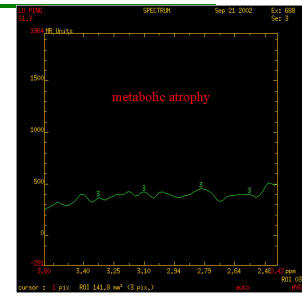


Fig.4

Fig.1 and Fig.2 demonstrate high choline peak of the low signal nodule in the right top of the prostate.

Fig.3 and Fig.4 demonstrate metabolic atrophy of the low signal nodule in left middle of the prostate. The low signal spots are the brachytherapy seeds.