

## ORIGINAL PAPER

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**Induratio penis plastica: effectivity of low-dose radiotherapy at different clinical stages**

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**Abstract** This study describes the treatment of Peyronie's disease by means of low-dose radiotherapy. We treated 265 men aged 24.5–79.4 years (median = 57.7 years). No previous therapy had been carried out in 214 patients, and 41 patients had been pretreated (systemic: potassium *p*-aminobenzoate, vitamins a, b, e; topical: corticosteroids, teloradiotherapy). The disease was classified using criteria proposed by Alth in 1984 (location, number and size of foci, hardness of fibromatous foci and axis deviation, potentia coeundi and pain were evaluated). Radiotherapy was performed by local application of a special iridium-192 moulage developed at our institute. In 66.4% of the monitored patient group ( $n = 155$ ) therapy was successful. We obtained complete regression of the fibromatous foci in 9% ( $n = 14$ ), partial remission  $>50\%$  in 29.7% ( $n = 46$ ) and partial remission  $<50\%$  in 27.7% ( $n = 43$ ) of the patients. We found a significant correlation between hardness, size of the treated foci and therapeutic success. Eighty-three patients suffered from pain during penile erection before therapy, and in 61.4% ( $n = 51$ ) of these patients the pain disappeared after treatment. Moreover, the patients confirmed that both loss of pain and regression of deviation related to foci regressions were correlated with improvement in erectile function. No serious side effects were observed in any of our patients.

**Key words** Penile fibromatosis · Classification · Radiotherapy

**Introduction**

The clinical morphology of induratio penis plastica (IPP) is characterized by the spontaneous occurrence of fibrous plaques, mainly located in the fascial structures of the penis, but which may also be found in the corpus cavernosum and rarely in the corpus spongiosum. This disease, which is obviously associated with a pronounced impairment of sexual ability, is frequently observed in patients aged over 50 years [9]. The concomitant focal induration of the penis is benign and nonfatal, and management of the disease is based on helping patients improve the reduced functional status (which is often compounded by psychological problems), resulting in an improved quality of life. Hitherto, various therapeutic modalities have been used in the management of the disease: surgery, radiotherapy [4–6, 16] and systemic or topical administration of drugs such as corticosteroids, vitamins, potassium *p*-aminobenzoate and collagenase [7, 8, 10, 13, 15, 17, 18]. The problem of classification of penile fibromatoses and consecutive evaluation of therapeutic success in different stages of the disease and different therapy strategies was first tackled by Kelami [14] and Alth [1], who proposed that localization, number, size and hardness of the fibromatous foci be used as criteria of therapeutic success. Other criteria such as potentia coeundi and occurrence of pain seemed to be helpful for additional clinical evaluation. This study aimed to demonstrate the effectiveness of radiotherapy of classified fibromatous foci of induratio penis plastica using iridium-192 at different clinical stages. Cases of calcified foci were not included in the study, in accordance with the recommendations of Alth [2] and Dittmann [6].

**Methods and materials**

The treated patient group consisted of 265 men aged from 24.5 to 79.4 years (median = 57.7 years). Previous therapy included

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systemic drug administration ( $n = 33$ , drugs used: potassium *p*-aminobenzoate, vitamins a, b and e), topical administration of corticosteroids ( $n = 6$ ) and teleradiotherapy ( $n = 2$ ). Two hundred and fourteen patients had received no previous therapy. We used the classification criteria (Alth) for the disease listed in Table 1.

The number of fibromatous plaques varied within our patient group: in 203 patients we found a single penile fibromatous focus, in 57 patients we found 2 isolated foci and in 5 patients 3 foci. Location, dimensions and hardness (cartilaginous, fibrous or sclerotic) of the indurative foci before therapy are shown in Tables 2 and 3. Symptoms of the disease included pain in the case of erection ( $n = 131$ ),

impossible sexual intercourse ( $n = 38$ ) and difficulty in sexual intercourse ( $n = 173$ ). Only in 54 men sexual intercourse was possible without complications. Deviation of the penis during erection, which was classified according to the magnitude of the angle, was mentioned by all patients. Penile deviation was about  $<10^\circ$  in 75 patients,  $>10^\circ$  and  $<30^\circ$  in 122 and  $>30^\circ$  in 68 patients.

#### Technical data

Before therapy the fibromatous lesions were classified according to the above-mentioned criteria by palpation and ultrasonic monitoring [11]. Radiotherapy was performed by local application of an iridium moulage which consisted of a tubular piece of Plexiglas (Fig. 1) to cover the pars pendula of the penis. Eight iridium needles were placed around the cylindrical Plexiglas wall. The whole apparatus was fixed around the os pubis. Lead shielding of the testis was essential. The needles were inserted into the above-described Plexiglas cylinder at the patient's bedside. Patients were then subjected to the appropriate duration of radiation, which varied from 11.6 to 39.1 h (median = 24.1 h). During the irradiation the patients were monitored by videocamera. Irradiation data are given in Table 4 for the two different diameter moulages which were used (moulage A, 22 mm; moulage B, 25 mm) depending on penis shaft diameter. At the end of the treatment the patients were allowed to leave the hospital.

Therapy response was estimated by palpation and ultrasonic monitoring according to the following criteria: complete remission (CR) was defined as the disappearance of all clinical evidence of disease. Partial response was defined as reduction either between 25% and 50% or  $>50\%$  of the measurable lesions. No remission (NR) was taken to be a less than 25% reduction of the foci.

**Table 1** Classification of the penile fibromatoses according to Alth

Number	N1	
	N2	
	N...	
Size	T1	$<1.0$ ml
	T2	1.0–2.0 ml
	T3	$>2.0$ ml
Localization	DS	Dorsal
	VT	Ventral
	LL (R)	Lateral, left (right)
	SC	Sulcus coronarius
	S	Shaft
	B	Basis
Hardness	H1	Cartilage
	H2	Fibrous
	H3	Calcified
Deviation of the axis	A1	$<10^\circ$
	A2	$10^\circ$ – $30^\circ$
	A3	$>30^\circ$
	Al–3	L (R) left (right)
		D (V) dorsal (ventral)
Pain	S+	Yes
	S–	No
Potentia coeundi	PC++	Possible
	PC+–	Difficult
	PC–	Impossible

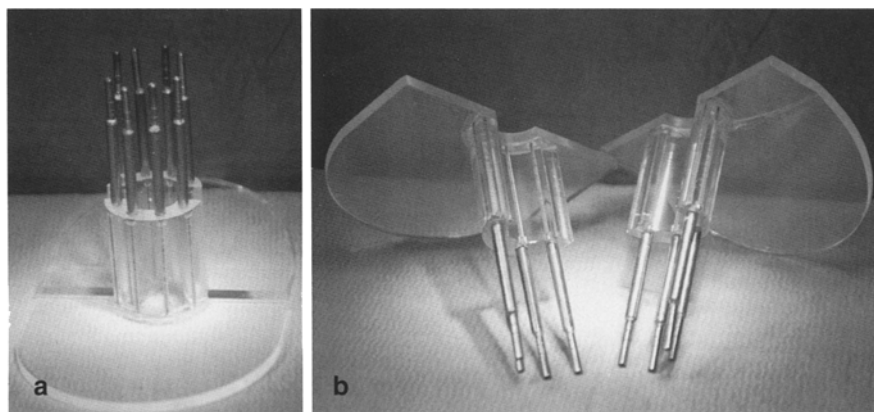
**Table 3** Hardness and size of the treated foci (according to the classification of Alth)

	H1	H2	T1	T2	T3
Number of patients ( $n = 265$ )	163	102	101	123	41
Number of treated foci ( $n = 332$ )	203	129	126	151	55

**Table 2** Localization of the treated fibromatous foci (according to the classification of Alth)

B	S	SC	B	B	B	S	DS	VT	LL	DS	DS	DS	VT
B	S	SC	S	SC	S, SC	SC	DS	VT	LL	VT	LL	VT, LL	LL
33	180	19	11	4	2	16	200	16	24	12	10	2	1

**Fig. 1a, b** Plexiglas moulage used for radiotherapy



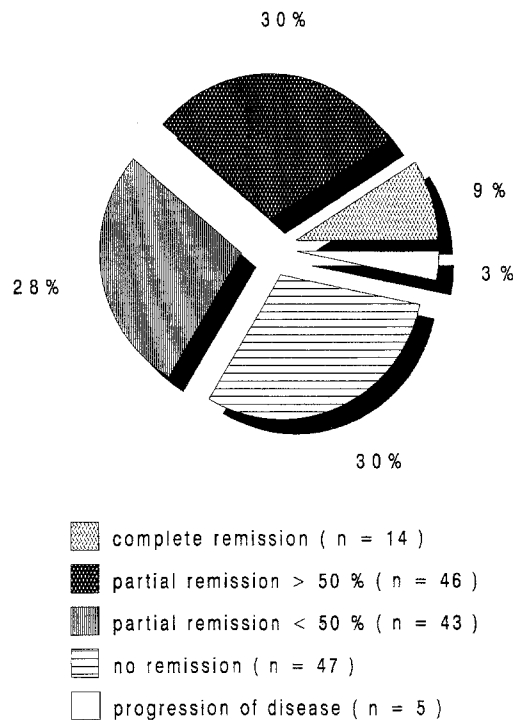
**Table 4** Technical data

Moulage 1 ( <i>n</i> = 265)				Moulage 2 ( <i>n</i> = 38)			
Dosage (cGy)		Dose rate (cGy/min)		Dosage (cGy)		Dose rate (cGy/min)	
Median	Range	Median	Range	Median	Range	Median	Range
945	721–1320	0.67	0.41–1.10	630	600–1000	0.69	0.39–1.20

**Table 5** Results according to dosage regime

	One moulage (M1) Dosage 721–1320 cGy ( <i>n</i> = 117)	Two moulages (M2) Dosage 1502–2082 cGy ( <i>n</i> = 38)	Dosage > 1000 cGy ( <i>n</i> = 76)	Dosage > 1000 cGy ( <i>n</i> = 79)
CR	12	2	5	9
PR > 50%	31	15	28	18
PR < 50%	34	9	22	21
NR	38	9	18	29
NR-PRO	2	3	3	2

Chi-square test (remissions vs no remissions): M1 vs M2 NS; dosage < 1000 vs dosage > 1000 cGy NS

**Fig. 2** Summary of therapeutic effects of low-dose irradiation

## Results

Results are based on 192 lesions in 155 patients. The remaining 110 patients were excluded from further participation in the study since they missed the follow-up inspections. This seems to be typical for this disease due to the patient's difficult psychological situation. Follow-up after therapy was carried out from 2.5 to 73.2 months (median = 12.1 months).

We obtained complete regression of the fibromatous foci in 9% (*n* = 14), partial remission > 50% in 29.7% (*n* = 46) and partial remission of between 25% and 50% in 27.7% (*n* = 43) of the monitored patients. In 30.3% (*n* = 47) of the patients no remission was achieved but only in 3.2% (*n* = 5) was further progression of the disease observed (Fig. 2).

We found no significant difference in therapeutic effectivity between patients who underwent one and those who underwent two moulage procedures or between dose groups < 1000 and > 1000 cGy (chi-square test, Table 5). There was no significant difference between the number of treated foci and effectiveness of therapy. On the other hand, using the criterion of degree of hardness, a significant improvement in therapeutic effect was observed in stages H1 (chi-square, *P* < 0.05) and T1 (chi-square, *P* < 0.01). Further results based on the criteria of hardness and volume are summarized in Tables 6 and 7. Of the monitored patients, 83 had suffered from pain in the case of erection before therapy. This symptom disappeared 5–6 months after radiotherapy in 61.4% (*n* = 51) of these cases. Our patients asserted that the loss of pain and the regression of deviation were connected with an improvement in erectile function (including frequency, duration and rigidity of erections). Figures on occurrence of pain and degree of penile deviation are given in Table 8.

## Side effects

The following complications occurred: pain (located in the minor pelvis after urethral catheter application and lumbalgia) during therapy in 38 patients and hematuria in seven cases after removal of the moulage. The observed hematuria diminished spontaneously after two urinations and, moreover, no further complications

**Table 6** Effectivity of low-dose radiotherapy on size and hardness of monitored indurative foci ( $n = 192$ )

	T1	T2	T3	H1	H2
CR	11	3	3	13	4
PR > 50%	22	23	8	29	24
PR < 50%	23	21	9	37	16
NR	13	32	18	31	32
NR-PRO	3	3	–	1	5

**Table 7** Size and hardness of the treated plaques vs therapeutic efficacy

	T1	T2	T3	H1	H2
Remissions	56	47	20	79	44
No remissions	16	35	18	32	37

Chi-square test: T1 vs T2  $P < 0.01$ ; T1 vs T3  $P < 0.01$ ; T2 vs T3 NS; H1 vs H2  $P < 0.05$

**Table 8** Influence of radiotherapy on pain and deviation

	Pain before therapy			Deviation after radiotherapy			
	(S+)	S+	S–	CR	PR	NR	PRO
CR	7	–	7	11	3	–	–
PR > 50%	27	7	20	4	34	7	1
PR < 50%	22	6	16	–	25	16	2
NR	24	18	6	–	4	42	1
NR-PRO	3	1	2	–	1	2	2

occurred in these patients. In one case irradiation had to be finished prematurely because of acute urine retention. No cystitis, proctitis or radiation fibroses were observed.

## Discussion

Peyronie's disease is a benign and nonfatal disease. It is the patient's decision to undergo treatment of this disorder of functional status, with the aim of improving quality of life. Various therapy modalities may be used for the management of the disease [2, 4–8, 10, 12, 13, 15–18]. However, comparison of the results has been difficult because of an absence of criteria of therapeutic success. In this study a number of criteria are used which may enable an objective estimation to be made of different therapeutic strategies. Improved therapeutic success of "soft foci" has been reported by other authors [2, 6], but we still lack criteria which are based on clinically comparable parameters. Our investigation suggests that both the degree of hardness and size of the fibromatous plaques determine the thera-

peutic success in low-dose rate radiotherapy [19]. The number of lesions, in contrast, does not seem relevant. In conclusion we recommend low-dose irradiation in cases of fibrous and cartilaginous lesions but not in cases of calcified foci. Additional therapeutic effects such as reduction or even loss of pain and decrease in deviation of the erect penis seem essential for an improvement in sexual function, which may be combined with an improvement in quality of life. Finally, it is worth mentioning that previous investigations have proved that no pathological spermiogenesis occurs provided the gonads are shielded by lead [3].

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