Treatment of Rheumatoid Joint Inflammation with Triamcinolone Hexacetonide

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Prolonged (more than 1 year) reversal of inflammation, as judged by decreased swelling, tenderness and synovial thickening, occurred in 12 patients in whom the joints of one hand and the wrist were treated locally with triamcinolone hexacetonide. Better preservation of grip strength, structural joint integrity and range of motion on the treated side were evidence of a beneficial effect on function. Fewer new lesions developed on the treated side as observed radiographically over the period of follow-up, which averaged 21 months. Recurrence and progression of arthritis, both clinical and radiologic, definitely occurred in some injected joints. Unwanted effects such as soft tissue atrophy and periarticular calcification were common; their true incidence and the significance of the latter remain to be determined. The doses used here are regarded as experimental and, while promising, warrant further study before adoption as a possible method of "medical synovectomy."

Local injections of microcrystalline adrenocorticosteroid esters have been used since 1950 to control joint inflammation (1). Such therapy is generally considered palliative and temporary (2). Its use in joint diseases characterized by sustained inflammation, such as rheumatoid arthritis, often produces prompt reversal of signs and symptoms, but recurrence after several weeks is the rule. In 1961, Hollander *et al* reported that triamcinolone hexacetonide produced a considerably longer local remission of inflammation than other adrenocorticosteroids (3). Our early experience confirmed these findings. Random clinical observations suggested that the drug produced remarkable reversal of synovial thickening. When combined with joint rest (bed rest or splints), local remissions of more than 12 months were not uncommon.

These properties of triamcinolone hexacetonide suggested that it might be used to arrest the rheumatoid process locally by producing a "medical synovectomy." A controlled study designed to test this possibility is the subject of this report. Unequivocal beneficial effects of the drug could be demonstrated in most joints 2 years after treatment; atrophy of skin and soft tissue, and heretofore undescribed capsular calcification were frequent complications.

MATERIALS & METHODS

Patients

Patients showing severe sustained inflammation not controlled satisfactorily by a basic program of high dose salicylate therapy, anti-inflammatory drugs, systemic rest, splints and appropriate physical therapy were selected from the inpatient service and outpatient clinic of the Section of Arthritis and Metabolism of the University of Chicago.

Nineteen patients were treated with local injections of triamcinolone hexacetonide; 4 were lost to followup and 3

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Table 1. Clinical Data Relevant to Patients Treated with Local Injections of Triamcinolone Hexacetonide

	Age (yr)	Sex†	Race†	Diagnosis†	Disease duration (yr)	Clinical course	Follow-up period (mo)	Serum / joint fluid CH_{50} (units)	SSCA‡	Other drugs*
IP	49	F	C	deferred	1	Progressive disease‡	14		0	ASA 6.0 g
LS	40	F	C	RA	3	Progressive disease‡	17	200/40	4,096	ASA 4.5 g
EF	29	F	C	RA	1	Severe progressive disease‡	21		8,192	ASA 4.2 g, G 50 mg (total 3 g)
DH	22	F	C	JRA	0.4	Partial remission	26	330/100	0	ASA 4.2 g
FH	46	F	C	RA	7	Progressive disease	24	400/80	16,384	ASA 3.6 g, C 250 mg
SL	36	F	C	RA	0.9	Partial remission	26	300/40	4,096	ASA 4.8 g, G 50 mg (4 g total), P 5 mg, C 250 mg
EM	54	F	C	RA	1.5	Progressive disease	25	300/65	4,096	ASA 3g
DS	67	F	N	RA	31	Progressive disease	20		0	ASA 2.7 g, I 75 mg
DB	40	F	C	psoriatic	1	Progressive disease‡	28	300/40	8	ASA 3.6 g, P 5 mg, 6 mercaptopurine 4 months
RM	63	M	C	RA	4	Nearly asymptomatic	21		256	ASA 4.5 g, P 5 mg
HK	42	F	C	RA	6	Progressive disease	13		512	ASA 3.6 g, C 250, G 400 mg, I 50 mg, cytoxan 75 mg
JB	18	F	C	JRA	1	Sustained disease improved	26	330/	0	G 50 mg (total 2.5 g)
WY	64	M	C	RA	5	Died of vasculitis	25	250/	16,384	P 10 mg, ASA 1.8 g

†F=female; M=male; C=Caucasian; N=Negro; RA=rheumatoid arthritis; JRA=juvenile RA (onset adult life)

‡Reciprocal titer of rheumatoid factor by sensitized sheep cell agglutination; normal <16; no patient had rheumatoid nodules; normal serum level of hemolytic complement = 180-300 units

‡New joints involved during follow-up period in addition to sustained disease in joints initially involved.

*ASA=aspirin; G=gold compounds; I=indomethacin; C=chloroquine; P=prednisone; daily doses are indicated except for gold, which was given at weekly intervals.

died of systemic complications of their disease. The results of treatment in 12 patients followed for 14–27 months are given here. Pertinent clinical data are given in Table 1.

Eight patients had definite or classic rheumatoid arthritis (RA) by ARA criteria (4), 2 were postpubertal young women with the juvenile pattern of RA (JRA), 1 had severe psoriatic arthritis and 1 showed an asymmetric polyarthritis of unknown etiology. An additional patient (WY) died of disseminated vasculitis; only serial radiograms were available for comparison. Gross and microscopic examinations of injected joints were carried out in this patient.

We had previously inferred from random observations that long term suppression was not impressive in patients treated in the first year of their disease, nor were long term results in severely eroded joints encouraging. We decided to restrict local treatment with triamcinolone hexacetonide to those joints that many clinical rheumatologists might consider for surgical synovectomy—ie, those with a thickened synovium and none-to-moderate irreversible damage. Patients DH with JRA and SL with classic RA were exceptions; both showed severe inflammation but were treated in the first year of their disease.

Physiotherapy and systemic anti-inflammatory drug therapy were administered and managed in these patients just as if the local corticosteroid injections had not been given. Concomitant therapy is summarized in Table 1.

Technic of Injection

The preparation of triamcinolone hexacetonide used was identical to that now marketed commercially as Aristospan® and each milliliter contained 20 mg of the ester. The dose and joints injected are given in Table 2. Hand joints and synovial structures about the wrist were injected on one side only. Rheumatoid joint inflammation is strikingly symmetric (5), as are associated structural and functional changes (6). There usually was little to choose between hands; therefore the selection of one hand for treatment was left up to the patient. In those instances, in which inflammation was clearly more severe on one side, that side was chosen for treatment. All injections were made by the author at a single session in a given case. Each joint was injected once only.

The joint was entered on the dorsal surface with a 25-gauge needle; a large dose (5–20 mg of triamcinolone hexacetonide in 0.5–1 ml of 1% procaine hydrochloride) was injected, using sufficient pressure to balloon the capsule markedly. Frequently, a small portion of the injectate squirted back through the needle track. After the joints of a given hand and wrist were treated, the patient was asked to wear a cock-up splint for 3 weeks, removing it once daily so that each joint could be moved actively through a complete range of motion. This procedure was prescribed *in strong terms as an integral part of the treatment.* The average dose and range of dose (in milligrams) is given in Table 2 for each anatomic category of structure injected. In most instances, a splint was also prescribed for the opposite wrist. After the 3-week period, the splints were generally worn only at night.

Table 2. Intrasynovial Triamcinolone Hexacetonide Dose, Site Injected, Untoward Effects and Number of Recurrences

					Tendons						
Site*	DIP	PIP	MCP	CMC	Flexor	Extensor	Ulnar bursa	Carpus	Wrist	FCR	Total
Joints (no.)	2	39	27	2	28	2	7	7	4	8	124
Dose (mg)†											
mean	7	9.4	13	10	12.8	30	13	39	40	14.3	
range	(4–10)	(5–15)	(8–20)		(8–15)	(20–40)	(10–20)	(20–70)	(20–60)	(10–20)	
Skin atrophy		13	5		—	—	1	3	3	3	28
Other effects	1‡	5§	5§	—	—	—	—	—	1	1	13
Recurrences‖	1	4	1	0	7	0	1	1	0	1	16

*DIP—distal interphalangeal; PIP—proximal interphalangeal; MCP—metacarpophalangeal; CMC—carpometacarpal; FCR—Flexor carpi radialis

†mean (mg); range in parentheses

‡lateral instability

§hyperpigmentation of skin, ecchymosis in area of injection

‖at time of last examination (see Table 1)

Evaluation of Results

The joints were divided into 3 groups for purposes of analysis based on whether or not they were inflamed at the time of treatment, and if inflamed, whether or not they were treated. Group I comprised noninflamed joints; Group II, those that were inflamed but not injected; Group III, those that were both inflamed and injected.

Clinical Examination

A thorough clinical examination for synovial thickening, instability and contractures was performed before injection and at approximately yearly intervals thereafter. Each of the small hand joints, flexor and extensor digitorum tendons, ulnar bursae, radiocarpal joint (wrist), carpal joints (considered as a unit—"carpus"), and flexor carpi radialis tendons in each patient were inspected and palpated for evidence of synovial thickening.

Dolorimeter scores, using a 20-pound instrument (7, 8), and circumference of PIP joints, using a jeweler's tape, were recorded before, and at periodic intervals after injection. Grip-strength, using a sphygmomanometer cuff in a standard fashion (5), was determined in each hand before and at intervals after injection.

Radiograms

A stereoroentgenogram of each joint and its contralateral mate was obtained before injection, and in most instances at yearly intervals thereafter. The presence of erosions, joint space narrowing, and severe localized osteoporosis was noted on special forms prepared for this purpose.

Technetium ^{99m} scintiphotography

Scintiphotos were obtained before and after treatment in several instances. The technic used was as previously described (9).

Structure-function estimation

Structure and function of both hands was estimated in 10 patients by a recently described technic (6) at the time of last followup. This method had not yet been developed at the time most of these patients were treated. Only 2 patients, IP and HK, had this examination before injection as well as in followup.

RESULTS

General

The effects of local treatment of synovial structures with triamcinolone hexacetonide were usually apparent at the time of follow-up examination. Analysis of the data was complicated by the involvement of new joints and tendons and by spontaneous or induced remissions in joints not treated locally. Patients DH and SL, with disease of relatively short duration when injected, subsequently experienced satisfactory remissions; both were nearly asymptomatic when last evaluated. Both had shown widespread involvement initially, and together they account for most of the remissions in the "inflamed and not injected" group.

Synovial Thickening

The number of recurrences of clinically detectable synovial thickening is given for each anatomic category of synovial structure treated in Table 2. Only 16 of 124 treated structures showed synovial thickening at the time of last follow-up, which averaged 21.7 months.

The status at the time of last examination of the 360 small hand joints in patients 1–12 is given in Table 3. Synovial thickening was significantly less in the 70 joints that were treated locally as compared with 59 such joints that were not ($P < 0.01$).

Table 3. Clinical Examination of Rheumatoid Hand Joints† for Synovial Thickening

Synovial thickening	Initial	Follow up*
I—none present	23	209
II—present and not treated	59	28
III—present and treated	70	6 $P<0.01$‡ (III vs II)

†Data on patient WY not available

*Same time period indicated in Table 1; 29 joints developed synovial thickening during observation period, 31 joints not treated locally showed disappearance of synovial thickening.

‡χ^2 test with Yates modification

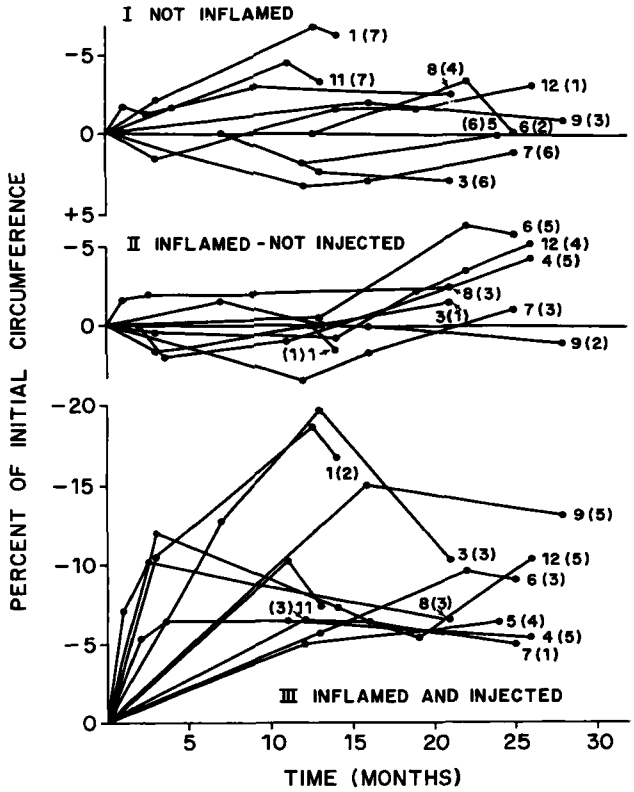


Fig 1. Serial measurements of the circumference of the 10 proximal interphalangeal joints in each patient are shown: **I**= for the initially noninflamed joints; **II**=the inflamed and noninjected joints; and **III**= the inflamed and injected joints. The mean change in circumference for each group at each point in time is expressed as a percent change from the initial mean for that group. The numbers correspond to the patients listed in Table 1. The number of joints in each group is given in parentheses. See text for details.

Joint Circumference

Serial measurements of the circumference of the PIP joints falling into each of the 3 groups are presented graphically in Figure 1. The numbers refer to the patients listed in Table 1; the numbers in parentheses refer to the number of joints in each group. Each point is plotted against time as a percent of the initial circumference.

The noninflamed joint groups (I) showed no change (Patient 5 and 6), less swelling (Patient 1,8,9,11,12) and increased swelling (Patient 3 and 7). Seven of eight groups of "inflamed-not injected" joints (II) showed less swelling at the last evaluation; but only the groups from patients 6 and 12 showed more than a 5% decrease in swelling. In contrast, all 10 groups of treated joints (III) showed a 5% or greater decrease in swelling. In every instance save 2 (Patient 5 and 12), the percentage decrease in swelling had been greater at an earlier evaluation. Some of this "late increase" in swelling is due to the recurrence of synovial thickening in the injected joints (eg, Patient 3) and some to the development of tenosynovitis in a flexor digitorum tendon (eg, Patient 7). Group III joints were significantly ($P < 0.01$) less swollen than Group II joints at the last time of last follow up.*

Grip strength

The initial and final grip strengths in the hand in which the joints were locally injected are compared to the grip strength of the contralateral "control" hand in Table 4. Preservation of grip was significantly greater on the treated side ($P < 0.05$).

* Wilcoxon nonparametric ranking test for paired data.

Table 4. Grip Strength in Rheumatoid Hands‡

		Grip strength (mmHg)					
		Treated			Control		
Patient	Hand*	Initial	Final	Change	Initial	Final	Change
IP	R	110	190	+80	280	240	-40
LS	R	110	90	-20	100	110	+10
EF	R	165	120	-45	160	80	-80
DH	L	150	230	+80	250	220	-30
FH	L	90	150	+60	185	120	-65
SL	R	120	170	+50	110	150	+40
EM	L	130	240	+110	170	110	-60
DS	L	70	90	+20	90	70	-20
DB	R	95	140	+45	80	100	+20
HK	L	80	110	+30	90	70	-20
JB	L	110	200	+90	130	200	+70

‡Data from Patients 10 and 13 were not available

*R=right; L=left. The right hand was dominant in all patients. Difference between groups is significant using White's non-parametric ranking test (in Snedcor GW, Statistical Methods, Iowa State College Press, 1965, p 117). $P<0.05>0.01$

Quantitative Pain Threshold (Dolorimeter) scores

Serial scores for each of the 30 small hand joints, divided into Groups I–III, are given in Figure 2. The number of joints in each group and the mean score for each date is indicated.

These data are somewhat difficult to interpret unequivocally because the method detects tenderness in underlying flexor tendons as well as that localized to the joints *per se* (7). It is likely that tenderness due to flexor tendonitis is distributed randomly as differences between groups from patients with tendonitis and those without are not apparent. With this assumption, the decrease in tenderness scores between Group III and both Group I and Group II are significant, using Wilcoxon's nonparametric ranking test to compare the differences (increase or decrease) in mean scores on the first (pretreatment) and last follow-up examination ($P < 0.01$).

Radiographic Changes

The radiographic findings before injection and at the time of maximum followup are summarized in Table 5 (a and b). In 2 of 12 treated hands and 6 of 12 control hands destructive lesions progressed; 17 distinct new lesions appeared on the control, and 5 new lesions on the treated side. Findings in the various structures comprising the wrists were difficult to interpret because of the small numbers involved. In 8 of 12 untreated, and 1 of 8 treated wrists radiologically evident disease or progression of already evident disease developed. Occasionally the differences were striking (Figure 3 a–d); in other patients little difference could be seen (Figure 4).

An unexpected and heretofore undescribed finding was the development of capsular calcifications in the injected joints (Figure 5); 30 of 70 injected small hand joints and 1 ulnar bursa (Figure 4) showed this phenomenon. These deposits first became apparent between 1 and 2 years after injection.

Necropsy Findings in Patient WY

This patient was lost to followup for some time, and entered the hospital in moribund condition with disseminated vasculitis affecting

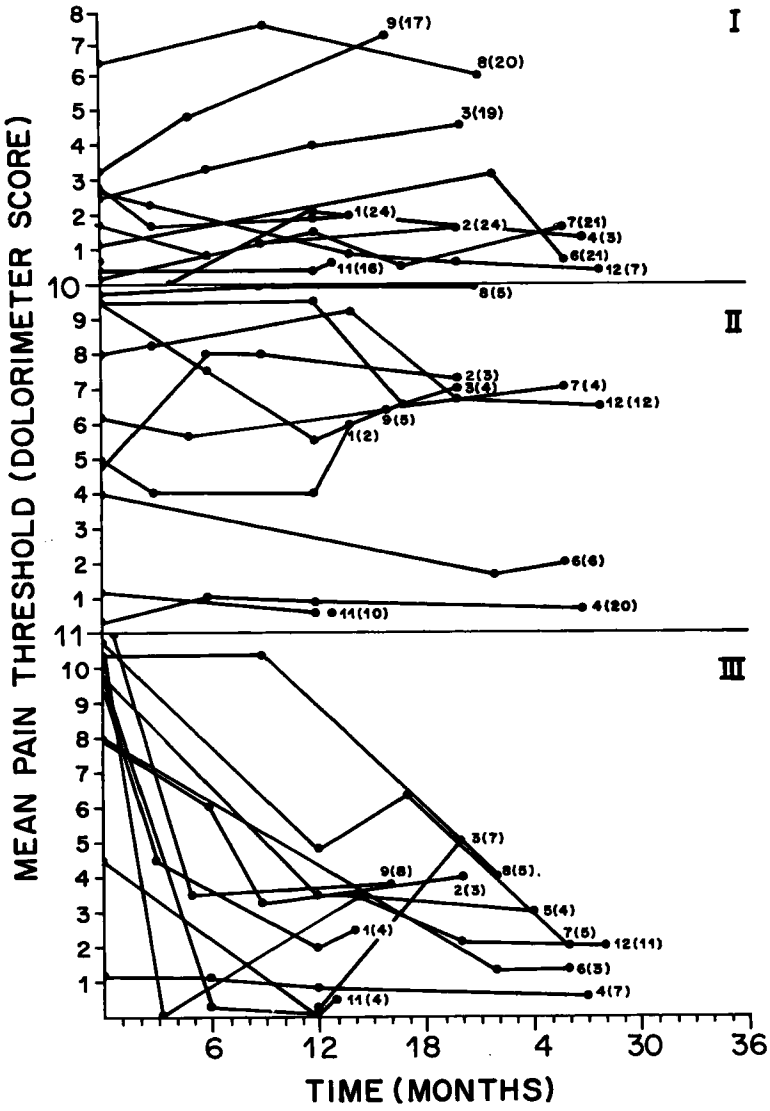


Fig 2. Serial measurements of the quantitative tenderness scores in the 30 small hand joints in each patient are shown; **I** represents the groups of initially nominflamed joints, **II** represents the groups of inflamed, noninjected joints, and **III** represents the groups of inflamed and injected joints. The mean scores in each group are presented; the number of joints in each group is given in parentheses. See text for details.

the brain, heart, lungs, pleura, peripheral nerves and skin (nailfold thrombi). Permission for necropsy inclusive of joints was obtained.

Gross examination revealed erosions of multiple joints, mild but definite synovial thickening and small calcific deposits in the deeper layers of the articular capsule. Microscopic examination revealed mild but definite inflammatory changes in the synovium of injected joints. Calcifications were located within small inflammatory foci. Wet smears of calcific material suspended in immersion oil were examined by phase contrast and polarized light microscopy (10). No birefringent material was seen; spherules of various sizes could be seen and these resembled those of the apatite calcifications previously described (11). An x-ray diffraction pattern obtained on this material by diffractometer was consistent with hydroxyapatite. D spacings were found at .002, 1.02,

Table 5a. Abnormal Radiographic Findings in the Hands before and after Local Treatment with Triamcinolone Hexacetonide

	"Test" hand				Control hand	
	Treated joints		Untreated joints			
Patient	Before	After	Before	After	Before	After
IP	PIP 4 narrow joint space	No change	None	None	None	Erosion MCP 2
LS	Erosion DIP 2 and MCP 2	No change	Erosion DIP 3	No change	None	2 erosions DIP 3; narrow joint space DIP 2
EF	None	Erosions PIP 3, 5 MCP 1 calcification MCP 3, 4, 5* CMC, PIP 3, 5	None	None	None	Erosions CMC MCP 1, 2, 3, 4 PIP 1
DH	None	calcification PIP 2, 3, 4, 5	None	None	None	None
FH	Erosion PIP 3	Unchanged calcification PIP 1, 5*	None	None	None	None
SL	None	None	None	None	None	None
EM	None	None	None	None	None	Erosion PIP 4
DB	None	PIP 1 destroyed; narrow joint space MCP 2; calcification capsule* PIP 2, 3, 4 5	None	Erosion CMC	None	MCP 1 subluxed and eroded; severe flexion deformities PIP 2, 3, 5
RM	None	None	None	None	None	None
HK	Erosion DIP 3; PIP 2, 3; MCP 4	Same			Erosions DIP 4; PIP 2, 3; MCP 1; CMC	Same
JB	None	None, calcification* PIP 2, 3 MCP 1, 2, 3, 4, 5 CMC			None	None
WY	Erosions PIP 1, 2, 3, 4, 5; DIP 2; CMC MCP 1, 2, 4	Same calcification* PIP 1, 2, 3, 4, 5 MCP 5			Erosion PIP 3 MCP 1.5	Erosions PIP 2, 3, 5 MCP 1, 2, 3, 4 CMC

*Evident after 2 years but not after 1. Follow-up films on patient 8 (DS) were not obtained.

Table 5b. Abnormal Radiographic Findings in the Wrist before and after Local Treatment with Triamcinolone Hexacetonide†

	Test wrist*				Control wrist	
	Treated		Untreated			
Patient†	Before	After	Before	After	Before	After
IP			None	None	None	None
LS	Feathery erosion ulnar styloid	Pointed smooth styloid			Erosion of carpus, wrist ulnar styloid	Progression of lesions
EF	None	Erosions carpus, wrist‡ calcification ulnar bursa‡			None	Erosion wrist and carpus
DH			None	None	None	None
FH		CMC, carpus, wrist	Erosions	Progression	None	None
SL	None	None			None	Osteoporosis around ulnar bursa
EM	Small erosion in carpus	Same, no progression			Small erosions in carpus	Marked progression
DB	None	None			None	Osteoporosis of wrist
RM	None	None	None	None	None	None
HK	Erosions wrist carpus	Same			Severe erosion wrist, carpus, ulnar styloid	Moderate progression
JB	None	None			None	None
WY	Small erosions	Same			Small erosions	Progression

*Refers to wrist ipsilateral to treated hand
†No follow-up films available on Patient DS (No. 8 in Table 1)
‡After 2 years but not after 1

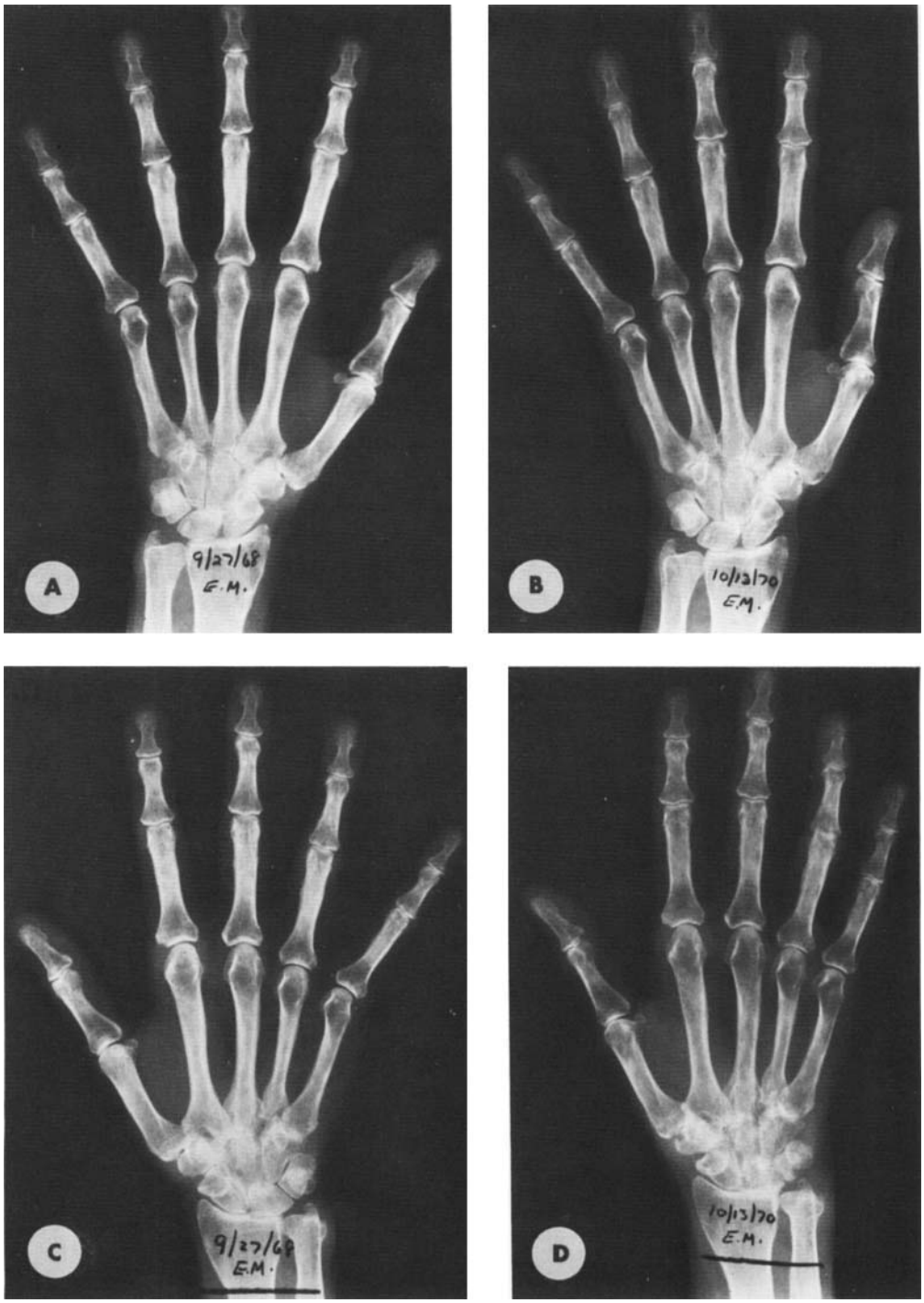
1.12, 2.10, 2.11, 3.00. There was no evidence of peaks due to pyrophosphate, acid phosphate or other mineral phase. Chemical analysis for pyrophosphate was negative (12).

Scintiphotography

^{99m}Technetium scintiphotos were obtained on several patients as previously described (9). Scintiphotos of patient DB obtained before injection and at the time of last followup 28 months later are shown (Figure 6).

Structure-Function Evaluation

Evaluation by this method has been described in detail recently; it permits a numerical score to be assigned to a given hand (6). Rheumatoid structural changes and functional deformity are generally symmetric. We feel that it is justified, therefore, to present scores for both hands at the time of the last follow-up examination. These are plotted in Figure 7. Seven of 10 treated hands showed lower scores than did the contralateral controls 21 months after treatment. The scores before and after treat-


A
9/27/68
E.M.
B
10/13/70
E.M.
C
9/27/68
E.M.
D
10/13/70
E.M.

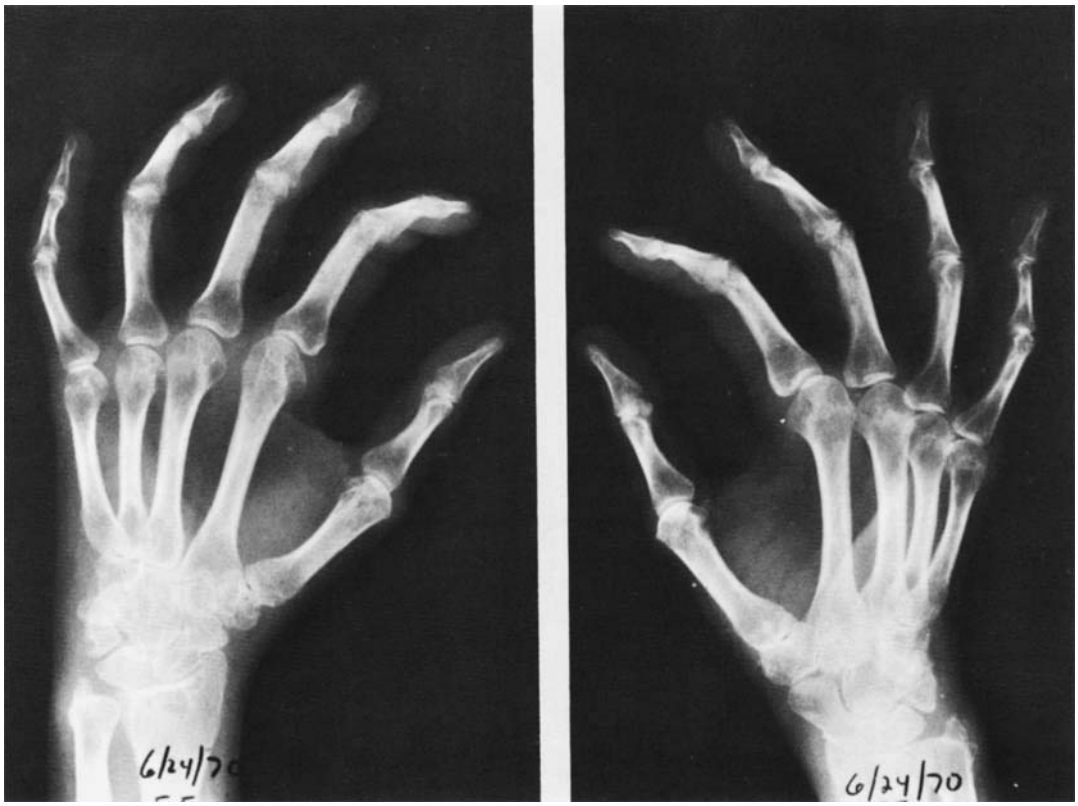


Fig 4. Oblique roentgenograms of both hands of patient EF obtained 21 months after local treatment of right hand and wrist joint with triamcinolone hexacetonide. Destruction of bony and cartilaginous structures has occurred on both sides, although changes are more extensive on the untreated side. Soft tissue calcification is visible near the right ulnar styloid. Films obtained at the time of treatment showed only soft tissue swelling and are therefore not reproduced here.

ment are shown for Patient 1 and 11. In both the disease had been much worse on the side treated initially (as had Patient 2). Scores in both control hands rose slightly. Although a marked drop in score occurred in both treated hands, the final score in Patient 1 was still higher than that of the control. Thus, in 8 of 10 treated hands function (range of motion) was better and structure was better preserved on the treated side as judged by a standardized method of examination.

DISCUSSION

Evaluation of any form of therapy in a capricious chronic syndrome like rheumatoid arthritis is an extremely difficult problem. Should one measure the effect on inflammation

← **Fig. 3 a–d.** Anteroposterior roentgenograms of the hands of patient EM obtained 2 years apart are shown. Little change can be appreciated in the joints of the left hand and wrist **(a)** vs **(b),** but deterioration is clearly evident in the right PIP 4 and in the right wrists and carpus **(c)** vs **(d).**

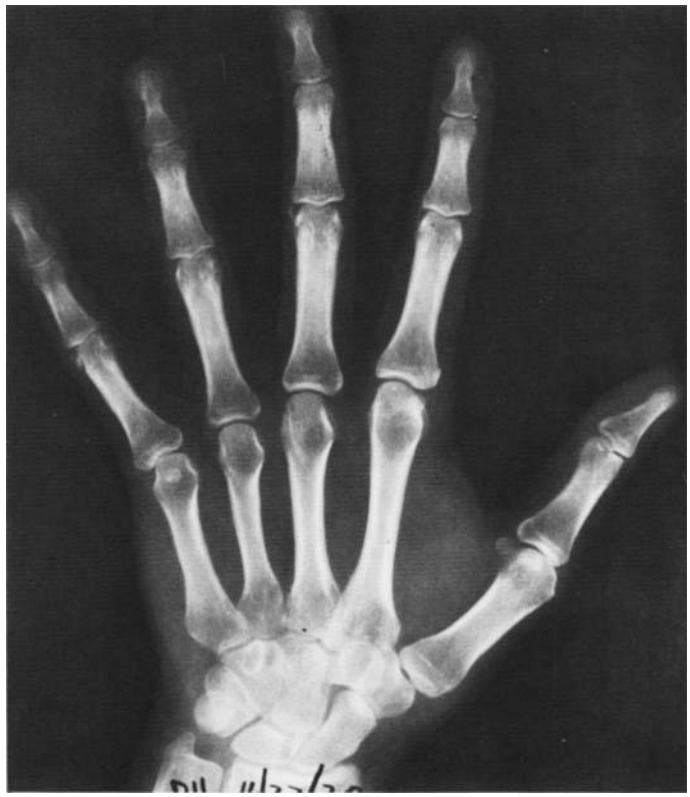


Fig 5. An anteroposterior roentgenogram of patient DH, obtained 26 months after treatment of the small hand joints with triamcinolone hexacetonide, shows calcific deposits in the ulnar aspect of the articular capsule of PIP joints 2, 3, 4 and 5. Such deposits generally occurred at the point of needle entry into the joint.

itself, or should one concentrate on the longer range anatomic changes and functional consequences of these changes? For example, evidence in support of clinical value judgments regarding the indications for, and results of, surgical synovectomy is still less than entirely satisfactory.

Local injections of adrenocorticosteroid esters in microcrystalline suspension generally reverse joint inflammation transiently; using prednisone TBA, the average duration of symptomatic improvement before relapse is about 3 weeks (2). The present study was undertaken to determine whether intrasynovial injections of relatively large doses of triamcinolone hexacetonide would induce prolonged local remission of inflammation. This hypothesis arose from observations made during random clinical use of the drug over a period of several years. Triamcinolone hexacetonide is less water soluble than other types of corticosteriod (13). The next most soluble ester, prednisolone tertiarybutylacetate, is 2.5 times more soluble. Hollander *et al* (3), Bilka (13), Astorga (14) and Kendall (15) have reported that triamcinolone hexacetonide has a longer duration of action.

Patients with destructive joint disease of long duration were excluded from this trial on the basis of prior random observations suggesting that: a) the duration of anti-inflammatory effect was less predictable in patients with advanced changes; b) rapid reversal of synovial thicken-

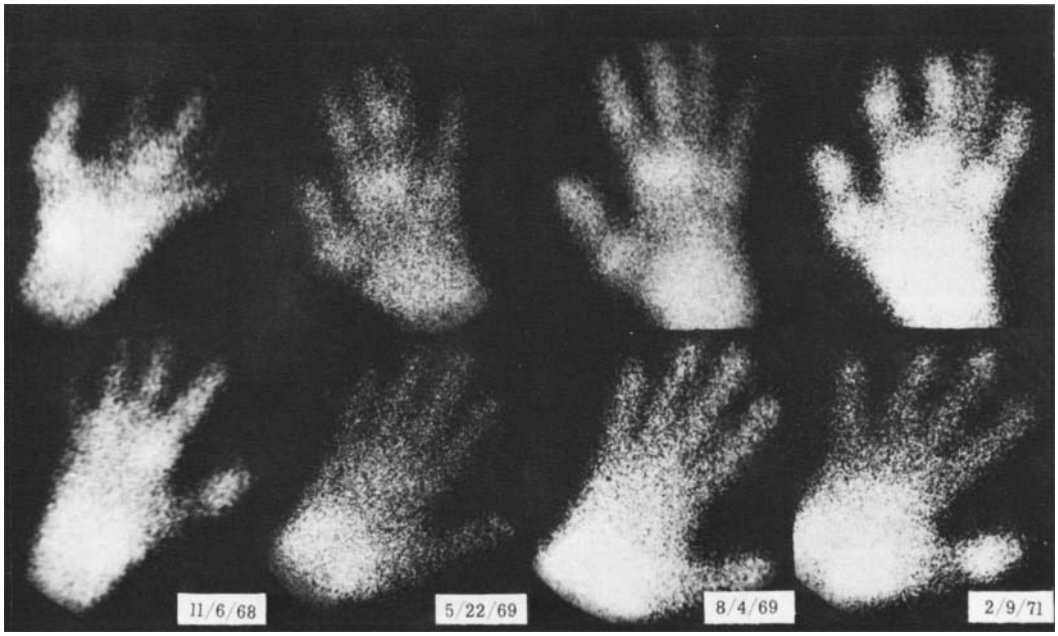


Fig 6. Anteroposterior scintiphotos of the hands of patient DB with severe psoriatic arthritis obtained before November 6, 1968 and after local joint treatment with triamcinolone hexacetonide. The right hand and wrist were treated **(lower photos)**. Recurrence in the right first IP joint is evident.

ing occasionally led to *increased* deformity after treatment; c) the trauma of the injection itself sometimes led to *increased* deformity. Rapid reversal of synovial thickening of a metacarpophalangeal joint led to acute ulnar displacement of extensor digitorum tendons in 3 instances. Although the joints were improved from the standpoint of inflammation, the function of the hand was less satisfactory than before treatment. The central slip of the extensor digitorum tendon ruptured in three additional proximal interphalangeal joints, one at the time

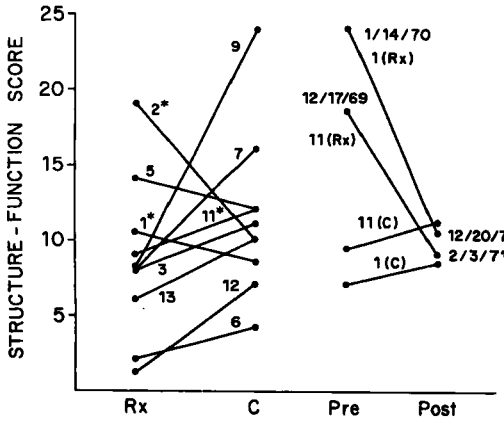


Fig 7. Numerical scores representing structural and functional changes as determined with a standardized method (6) are shown for 10 pairs of hands at the time of most recent follow-up examinations (average 21 months after treatment). In 7 instances, the treated (Rx) hand scores were lower than the "control" **(c)** hand scores. Only 2 patients had evaluations before **(pre)** and after **(post)** treatment. Both showed a marked fall in score in the treated hand and a slight rise in the "control" hand. The three instances where the treated side showed more severely inflamed joints are marked with an asterisk.

of injection, and the others 2 and 6 weeks after injection. Repair of one of these joints was attempted; the surgeon reported finding "no synovial proliferation and a sharp ridge of bone on the dorsal surface of the head of the proximal phalanx that had cut the central slip like a knife."

The results of unilateral intrasynovial injections of triamcinolone hexacetonide in 12 patients with inflamed joints form the substance of this report. Two of these, DH and SL, were treated 4 and 9 months after onset of their disease. Both subsequently went into near total remission that coincided with vigorous systemic antirheumatic therapy. All other patients showed sustained or even progressive disease despite aggressive medical therapy.

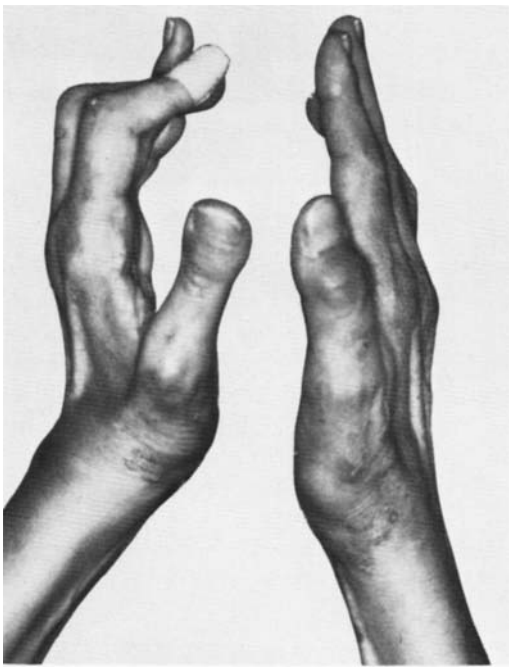


Fig 8. Hands of patient DB with psoriatic arthritis, 28 months after treatment of the right wrist and small hand joints with triamcinolone hexacetonide. Marked flexion contractures developed in the left hand but on the right only the fourth finger could not be straightened voluntarily. Synovial thickening of the left wrist is visible. There was no significant deformity of either hand at time of treatment.

The recurrence rate of synovial thickening at the time of last followup, averaging 21 months, was approximately 13% (16 of 124 synovial structures). In data analysis, comparisons were drawn between three groups of small hand joints in each patient. Each joint was classified into one of three groups at the time of injection: Group I—noninflamed, Group II—inflamed but not injected, and Group III—inflamed and injected. Comparison of data obtained from examination of injected small hand joints with data from inflamed and noninjected joints in the same patient showed recurrent synovitis in 6 of 70 treated joints as compared to persistent synovitis in 28 of 59 inflamed joints not treated locally (Table 3). Proximal interphalangeal joint circumference measurements made with a jeweler's tape showed a significant decrease in each group of injected joints (Figure 1 A) as compared to the groups of inflamed joints not treated locally, (Figure 1–3), although most of the latter also showed less swelling. Serial quantitative pain threshold measurements made with a standardized instrument (dolorimeter) also showed significantly less tenderness in inflamed joints that had been treated locally, compared with those that had not been so treated.

Comparison of grip strength measurements before and after treatment showed greater improvement (or less loss of strength) on the treated side compared to the "control" side (Table 4). Radiologic examination showed development of new or progression of previously existing destructive lesions in 2 of 12 treated and 6 of 12 control hands (Table 5). In the treated wrists only 1 of 8 showed such lesions compared to 8 of 12 in the untreated wrists (Table 5 b). A recently described method was used to estimate function and structure in the hands of 10 patients; 7 of 10 treated hands showed lower scores than did contralateral control hands. Two pairs of hands were examined before and after treatment; both showed marked improvement on the treated side. These differences were often obvious on inspection (Figure 8 and 9). Thus the locally

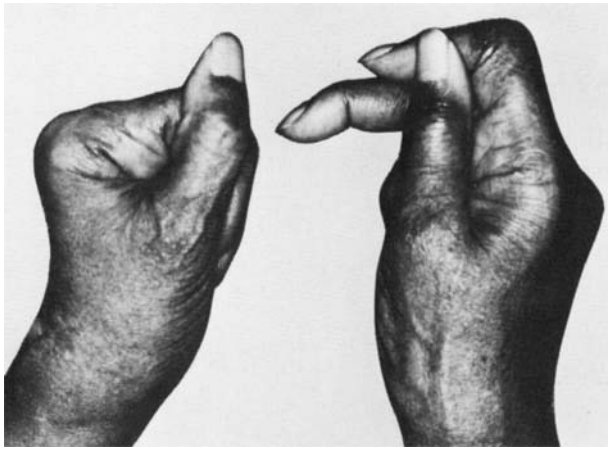


Fig 9. Hands of patient DS with seronegative rheumatoid arthritis of many years duration. Treatment of the affected joints on the left resulted in the ability to make a nearly normal fist.

treated side showed the beneficial effect on synovitis and on joint structure and function when compared with the contralateral control side.

Unwanted effects were common. Atrophy of the skin and subcutaneous tissue occurred after 28 of 124 injections (Figure 10). This phenomenon has been described previously by Cas-

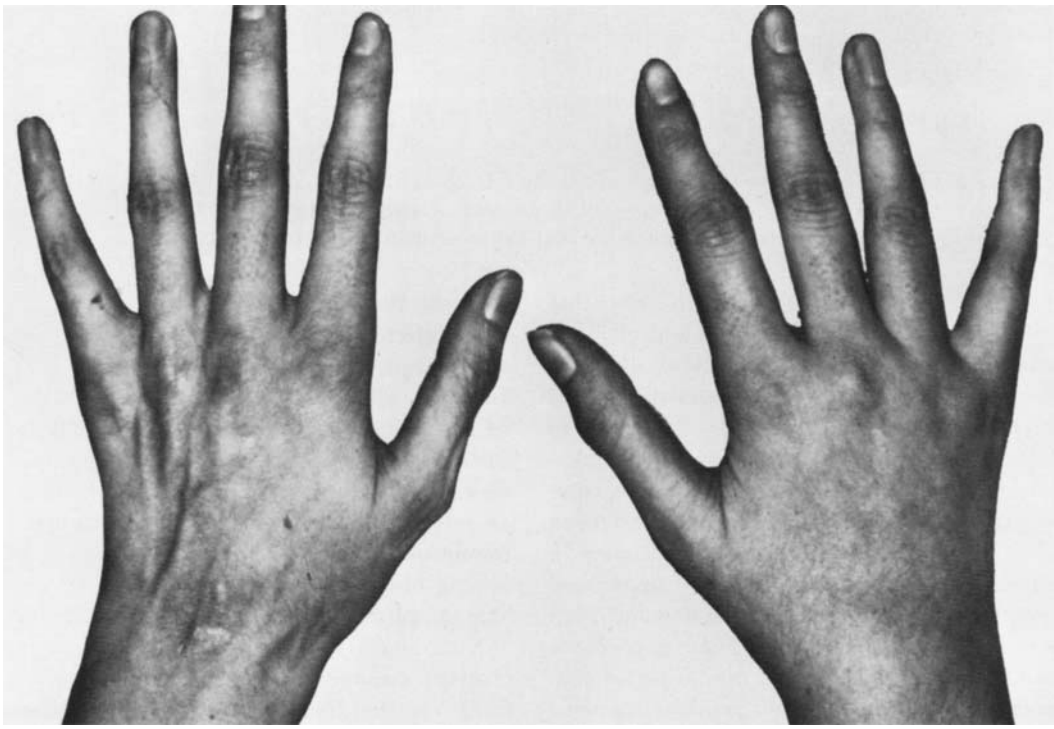


Fig 10. The skin over the left wrist and left PIP joints of 18-year-old patient JB with juvenile rheumatoid arthritis is thin and depigmented. Synovial thickening persists on the right side.

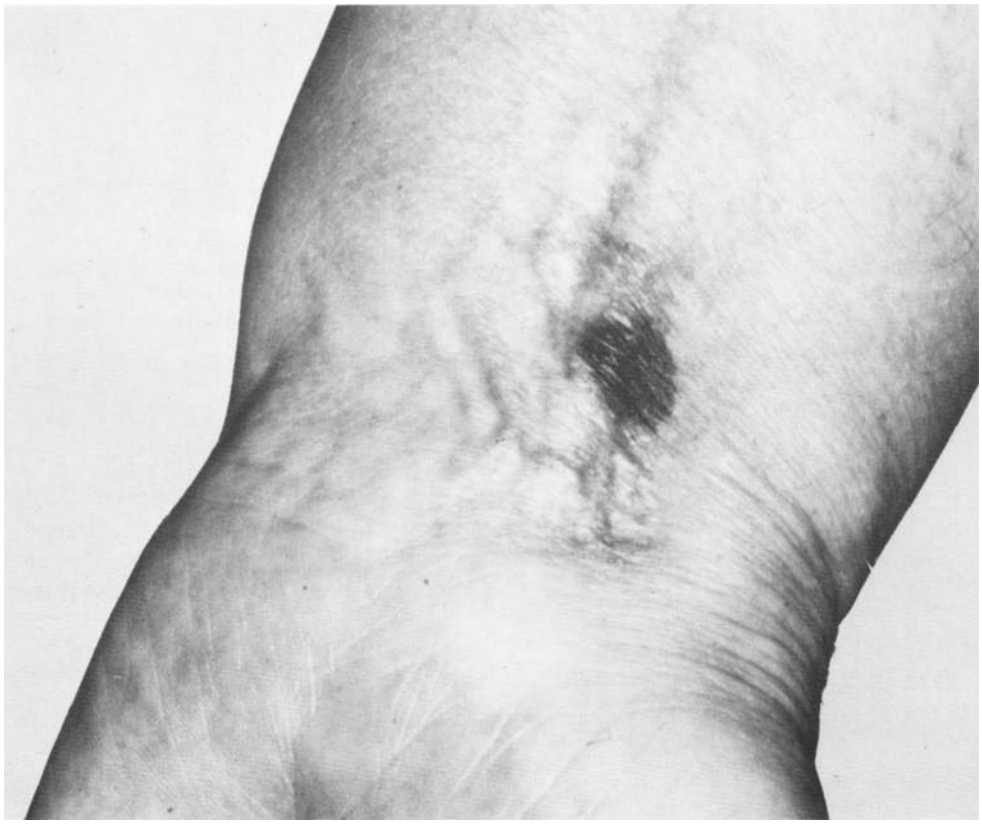


Fig 11. An ecchymosis is present in an area of atrophic skin over a flexor carpi radialis tendon in patient EM that had been injected 25 months earlier.

sidy and Bole (16) and is a cosmetic defect that should not be dismissed lightly. It is probably a sequela of the drug leaking out of the joint along the needle track. Sometimes ecchymosis resembling "steroid purpura" developed in these areas of atrophic skin (Figure 11). Calcification of joint capsule was seen as a late complication, appearing in roentgenograms taken 2, but rarely 1 year after treatment (Figure 5). These appeared in 30 of 70 injected small hand joints, and probably represent dystrophic calcification in areas of necrosis. Their appearance predominately at the site of needle perforation suggests that they too are a result of the drug leaking out of the joint space into surrounding tissue. Their incidence may well increase with longer follow-up periods.

In the future we intend to use this drug to treat selected synovial structures of patients with progressive disease of more than 1 year's duration, without severe destructive changes, when the inflammatory process is refractory to conventional medical treatment. We plan to continue to prescribe splinting injected joints as an integral part of treatment, but will not, in the future, inject the drug under pressure, thus hoping to reduce or eliminate the incidence of skin atrophy and capsular calcifications.

Note added in proof: Many capsular calcifications disappeared between the second and third year after treatment.

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