

## Extent and Level of Fascial Involvement in 100 Cases With Nodular Fasciitis

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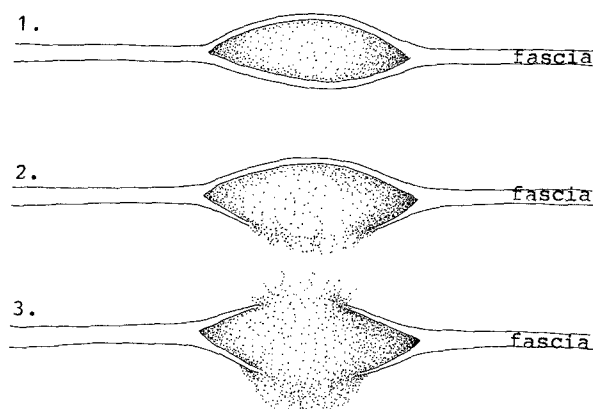
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**Summary.** Nodular fasciitis (NF) shows a cellular proliferation which leads to widening of the fascia. Frequently unilateral or more often bilateral disruption of the fascia, with an infiltrative pattern is present. Subcutaneous fascia and surrounding fat are involved. Superficially the cellular proliferation may extend into dermal connective tissue. Deeper muscular tissue may be involved, with transitional forms or purely intramuscular changes, compatible with proliferative myositis. Proliferative myositis is considered to be a deep-seated variant of NF with muscular involvement. Intramuscular myxoma may be thought of as an intramuscular and mucoid variant of NF. A bilateral infiltrative pattern was most frequently found at all levels; in cases with muscular involvement it was always present.

**Key words:** Nodular fasciitis — Extent and level of fascial involvement.

**Zusammenfassung.** Die Beurteilung der Ausdehnung und des topographischen Niveaus der Fascienveränderungen bei 100 Fällen mit nodulärer Fasciitis ergab z.T. nur intrafasciale Zellproliferation mit spindeligem Auftreibung der Fascie. Häufiger fand sich jedoch einseitig von der Fascie ausgehendes infiltratives Wachstum, am häufigsten eine vollständige Unterbrechung der ursprünglichen Fascienstruktur mit beidseitiger Infiltration der Umgebung.

Die noduläre Fasciitis befiel nicht nur die subcutane Fascie und das umgebende Fettgewebe. Veränderungen der oberflächlichen Fascie führen zu einer Mitbeteiligung der Cutis. Bei tief gelegener nodulärer Fasciitis greifen die Veränderungen auf die Muskulatur über. Es finden sich entweder Übergangsformen zur proliferativen Myositis bei Befall der supramuskulären Fascie oder bei rein intramuskulären Veränderungen das typische Bild des proliferativen Myositis, die demnach als tiefsitzende Variante der nodulären Fasciitis mit Muskelbeteiligung aufgefaßt werden kann. Intramuskuläre My-



**Fig. 1.** Nodular fasciitis: different extents of fascial changes and cell proliferation

xome, die ebenfalls z.T. Übergangsformen zur typischen nodulären Fasciitis erkennen ließen, scheinen eine intramuskuläre mucoide Variante der nodulären Fasciitis darzustellen.

Insgesamt fand sich am häufigsten eine bilaterale Infiltration in allen Lagen der nodulären Fasciitis. In Fällen mit Muskelbeteiligung fand sich ausschließlich eine Zellproliferation mit Zerstörungen der Fascie und bilateraler Infiltration der Umgebung.

## Introduction

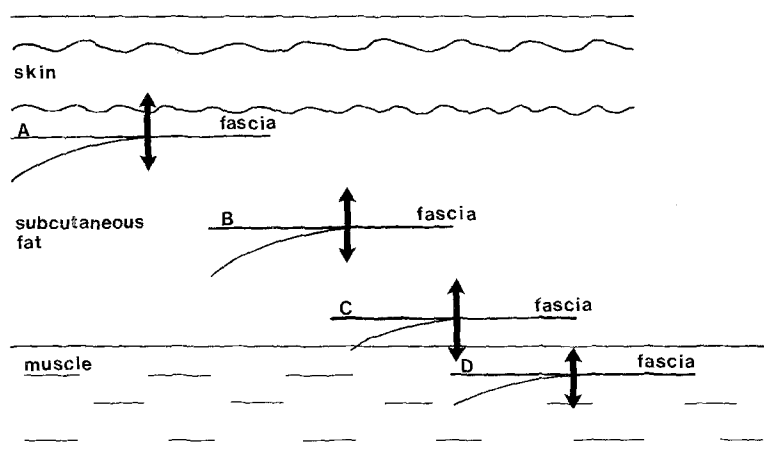
Nodular fasciitis (NF) is not included in the group of fibromatosis (Mackenzie, 1970) because of obvious "reactive" morphological characteristics. Cellular proliferation related to fascial structures can almost always be recognized to be associated with NF, even on routinely examined single sections (Meister et al., 1978). Transitional lesions between classical nodular fasciitis and proliferative myositis are often found (Meister et al., 1978).

The purpose of this study is 1. to examine the extent of fascial changes, in particular fascial destruction by NF and 2. to identify the level of fascial disease, i.e. whether there is involvement of superficial, or deep muscular fascial tissue.

## Material and Methods

100 cases of NF (Bückmann: Pathologisches Institut, Allgemeines Krankenhaus, Hagen und USAREUR, Medical Laboratories, 1964–1976; Meister: Pathologisches Institut der Universität, München 1960–1969) were included in this study.

Three grades of fascial involvement were identified (Fig. 1): 1. intrafascial cell proliferation with fusiform widening of the fascia, but peripheral limitation by intact fascial connective tissue; 2. intact fascial tissue along one surface, with contralateral destruction and infiltrative pattern of adjacent tissue, and 3. bilateral destruction of fascial tissue with infiltrative pattern and original



**Fig. 2.** Nodular fasciitis: possible levels of fascial involvement with directions of infiltrative growth (↓)

fascial tissue preserved only at the transitional point between the fusiform tumorous swelling of the fascia and normal fascia.

The level of fascial involvement was determined (Fig. 2): Type A) represented superficial subcutaneous fascial involvement with possible infiltration of the dermis and fat, B) deeper subcutaneous fascial involvement with bilateral fat infiltration, C) deep subcutaneous muscular fascia, with possible infiltration of fat and muscle tissue and D) intramuscular cell proliferation.

Cases in which determination of the level of involvement was not possible due to lack of perifascial tissue, were labelled X.

The possible relationships of the extent and the level of fascial involvement to the age and sex of the patients, the location and size of lesions, the cellular or fibrillar densities and the presence of giant cells were evaluated.

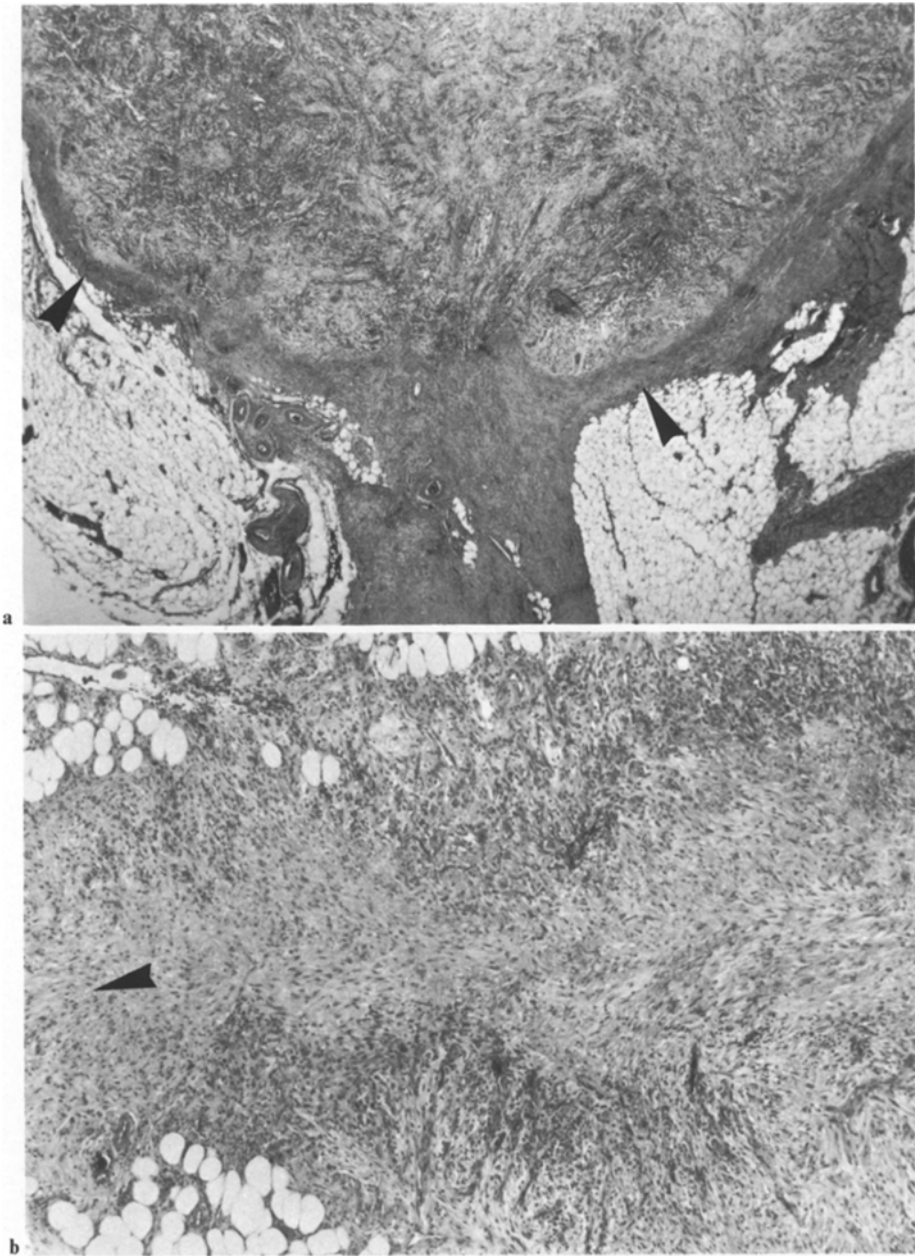
## Results

Classification of NF according to the extent of fascial involvement was carried out in 99 cases (Fig. 3; Table 1).

Most cases showed the bilateral infiltrative pattern (group 3), followed by unilateral infiltration (group 2) and lastly by a solely intrafascial growth (group 1). With bilateral infiltration a higher incidence of giant cells was found. Intrafascial NF lesions were larger and were less frequently found in the upper extremities. There were no significant differences with age or sex nor with cellular and fibrillar densities.

Classification according to the level of fascial involvement was possible in 89 cases (Fig. 4; Table 2). Most frequently the subcutaneous fascia was affected (group B), followed by NF of supramuscular, or intramuscular fascia, with about equal incidences (groups C and D). Least commonly NF of the superficial fascia (group A) was seen with possible extension into the dermis.

Whereas superficial NF showed an equal incidence in all three localisations, with NF of the subcutaneous and intramuscular fascia a predilection of the



**Fig. 3. a** Intrafascial NF (group 1): proliferation with markedly distended fascia, but intact surface (▶). HE,  $\times 10$ . **b** Bilateral infiltration (group 3) of subcutaneous fat tissue; transition into fascia (▶). HE,  $\times 10$

**Table 1.** Extent of fascial involvement in relation to other parameters

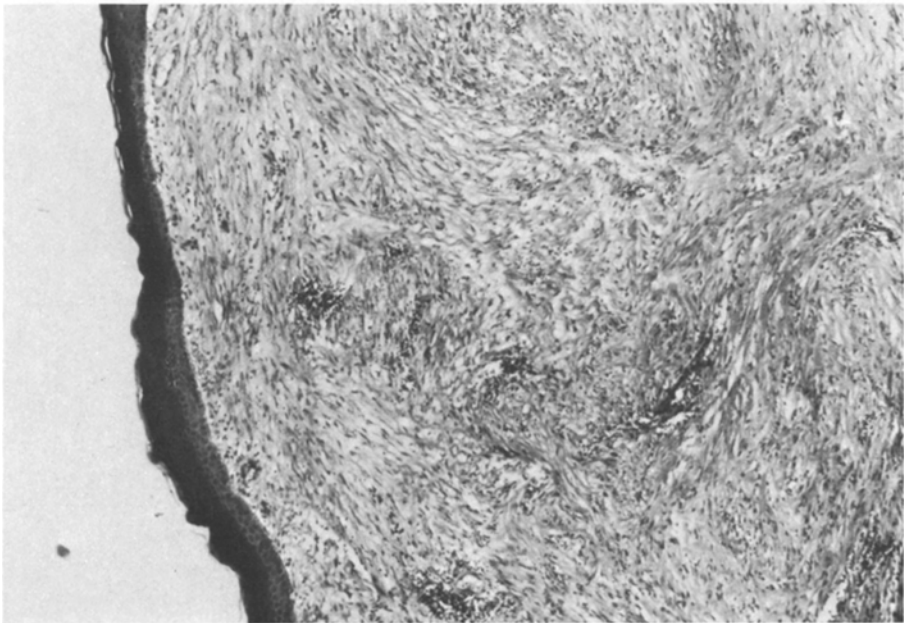
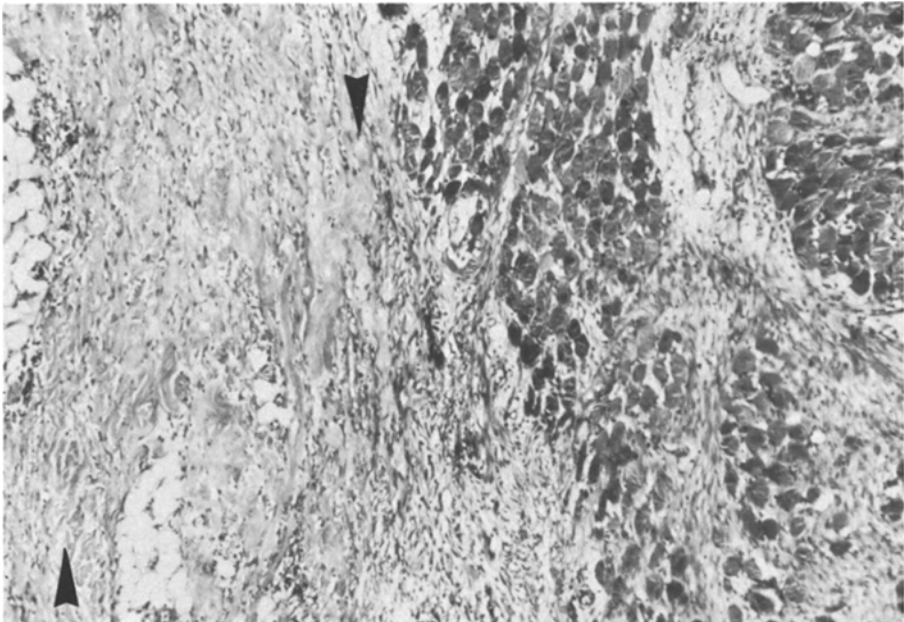
	1. Intrafascial	2. Unilateral infiltration	3. Bilateral infiltration
Number of cases	9	21	69
Mean age/years	42.5	39.5	45.3
Sex preponderance	$m \geq f$	$f \geq m$	$m \geq f$
Mean size/cm	2.79	1.77	1.90
Localisation: Head + trunk	3	1	22
Upper extremity	2	13	33
Lower extremity	3	5	14
Cellular + fibrillar densities	predominance of moderate (+ +) values throughout!		
Giant cells	2 (22%)	5 (24%)	27 (39%)

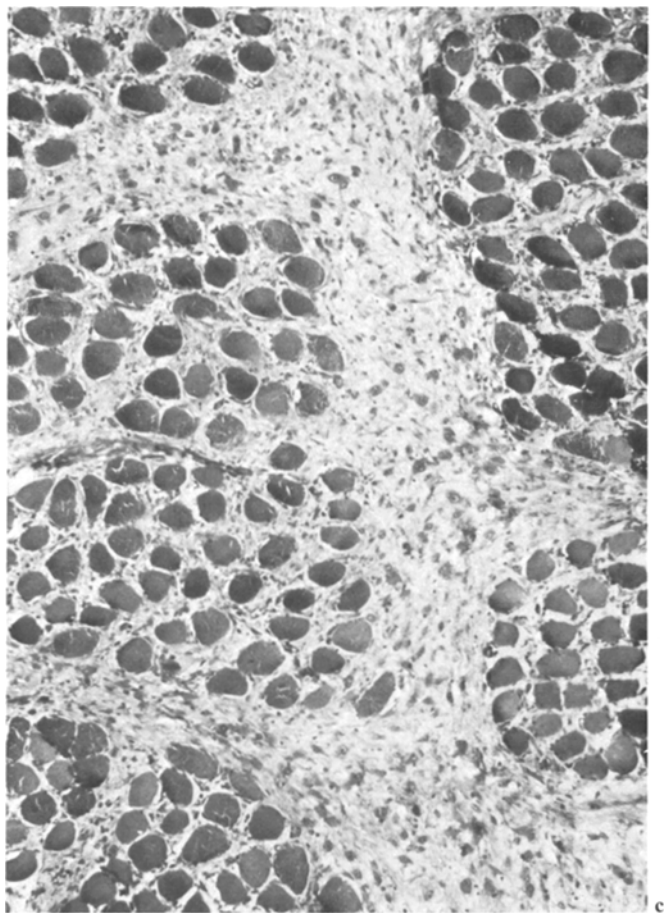
**Table 2.** Level of fascial involvement in relation to other parameters

	A superficial f.	B subcutaneous f.	C supramuscular f.	D intramuscular f.
Number of cases	10	52	14	13
Mean age/years	47.20	43.21	50.21	42.76
Sex preponderance	$f \geq m$	$m \geq f$	$f \geq m$	$f \geq m$
Mean size/cm	1.74	2.00	2.06	1.93
Localisation: head + trunk	4	9	8	3
Upper extremity	3	30	5	7
Lower extremity	3	11	1	3 (thigh!)
Cellular + fibrillar densities	predominance of moderate (+ +) values throughout!			
Giant cells	1 (10%)	12 (23%)	7 (50%)	7 (54%)

**Table 3.** Relation between levels (A–D) and extents (1–3) of fascial involvement

Level of fascial involvement	1) Intrafascial lesion	2) Unilateral infiltration	3) Bilateral infiltration	Y) Unknown
A) Superficial fascia with dermis (10 pat.)	1	4	5	0
B) Deeper subcutaneous fascia surrounded by fat (52 pat.)	5	11	36	0
C) Deep fascia with subjacent muscle (14 pat.)	0	0	14	0
D) Intramuscular fascia (13 pat.)	0	0	13	0
X) Unknown fascial level (11 pat.)	3	6	1	1
	9	21	69	1





**Fig. 4.** **a** Superficial NF (group A) within the dermis. HE,  $\times 25$ . **b** Supramuscular NF (group C) with involvement of subcutaneous fat (above) and musculatur (below), fascial remnants ( $\blacktriangleright$ ). HE,  $\times 25$ . **c** Intramuscular NF (group D), with larger "ganglion-like" cells; compatible with "proliferative myositis". HE,  $\times 63$

upper extremities was evident, whereby the supramuscular fascia was most frequently involved in the trunk and head. There was a distinctly higher incidence of giant cells in all NF with muscular involvement (groups C and D). No significant differences were found between the various subgroups A to D and sex, mean age or size or cellular or fibrillar densities.

Comparison of the levels and extent of fascial involvement (Table 3) showed an exclusively bilateral infiltration in all cases of NF showing muscular extension (groups C and D).

## Discussion

A nodular shape, evidence of fascial involvement and proliferative changes of a reactive inflammatory character with additional mobile inflammatory cells

can be demonstrated in almost all cases of NF (Meister et al., 1978). In contrast to Soule's (1962) impression of cellular proliferation along the fascial surface, with extension into adjacent tissue—most characteristically subcutaneous fat—cases with purely intrafascial proliferation and fusiform thickening of the fascia also can be seen (compare WHO: Fig. 6, Enzinger et al., 1969). The inflammatory character becomes evident at the starting points of the fascial thickening with a transitional zone resembling granulation tissue between the regular fascial connective tissue and tumorlike cell proliferation (Meister et al., 1978). Occasionally small necrotic foci can be seen. With unilateral infiltrations one surface shows sharp delineation by fascial connective tissue, the other reveals extension or infiltration into the adjacent tissue. Areas similar to granulation tissue could also be found along these margins of infiltration. For those cases of NF in which granulation tissue like areas predominated, the term "repair type" was coined by Allen (1972). Most frequently there was bilateral infiltration, with complete lack of regular fascial connective tissue in the zone of proliferation and tumorous fascial thickening. Only 2 cases showed central remnants of fascial connective tissue in presence of a pattern of bilateral infiltration, which might be compatible with an initial cell proliferation restricted to the fascial interface. These findings, however, could also be due to the three-dimensional arrangement of fascia and lesion. Hutter et al. (1962) emphasized that a greater content of mature collagen fibers is no proof of "older" NF. Allen (1972), Dahl et al. (1972), Stout (1961) mentioned cases of NF with predominance of collagen fibers, sometimes keloid-like with hyalin. These cases also showed bilateral extension into the neighbouring tissue (Meister et al., 1978). This finding might be used as argument against the suggestion that older lesions might stop infiltrating and round off, with sharp delineation by capsule-like connective tissue. No explanation could be found for the higher mean size of NF with intrafascial localisation in our material. Originally NF was also called "subcutaneous", although deep seated NF has been reported (Allen, 1972; Price et al., 1961). This is important in the differential diagnosis of aggressive fibromatoses ("desmoid fibromas"), because of their infiltration into muscular tissue and alleged larger size, as well as a greater content of mature collagen fibers. Bückmann (1966) observed the origin of NF from muscular fascia with involvement of muscular tissue, which was demonstrated in 27% of our collected material. Enzinger and Dulcey (1967) and Mackenzie (1970) drew attention to "proliferative myositis", originally described by Kern (1960) as a variant of NF. Indications for a relationship between "classical" subcutaneous NF and proliferative myositis could be seen in transitional forms, showing NF of the supramuscular fascia, with infiltration of the subcutaneous fat tissue above and the muscle tissue below (Meister et al., 1978). Focally, "proliferative myositis" may show areas with histological findings which are interchangeable with NF. Ganglion-cell like cells might not always be present with proliferative myositis, but on the other hand were seen with "classical" NF in a subcutaneous location. However, in general giant cells were more frequently found with NF affecting muscle than in other cases. Moreover, there were also qualitative differences; giant cells with subcutaneous NF were more frequently of "osteo-



clastic-type" and were unlike ganglion-cells (Meister et al., 1978). In this study proliferative myositis was not treated as an entity, but as a variety of NF.

Intramuscular myxoma, also considered to be an intramuscular variant of NF (Mackenzie, 1970), showed transitional forms towards NF of the supramuscular fascia, with simultaneous infiltration of fat by highly cellular areas, as well as typical poorly cellular, mucoid areas.

27 cases of this series of NF showed muscular involvement, 10 with ganglion-cell like cells as in "classical" proliferative myositis. 4 cases would have been classified as intramuscular myxoma of which 2 also presented typical features of NF.

Knowledge of the existence of superficial NF is of importance in differential diagnosis. Because of simultaneous involvement of subcutaneous fat and dermal connective tissue, histological changes reminiscent of fibrous histiocytomas may be present (Meister, 1978).

Comparison of the level and extent of fascial involvement showed an equal incidence of unilateral infiltration with NF of the superficial fascia extending into the dermis or into the subcutis. At all levels a bilateral infiltrative pattern, frequently depicted as characteristic finding for NF, predominated. It was found exclusively in cases of NF with muscular involvement in our series.

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