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Nodular Fasciitis: Definitive Diagnosis by Fine Needle Aspiration

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Key Words
Nodular fasciitis · Spindle cell lesion · Pseudosarcoma · Fine-needle aspiration · Head and neck region

Abstract
Objectives: Nodular fasciitis (NF) is a self-limited, mass-forming, fibrous proliferation that can occur in the head and neck and may mimic malignancy. Fine-needle aspiration biopsy (FNAB) is a minimally invasive, rapid, accurate method of obtaining diagnostic material from head and neck masses. In this study, we verify the usefulness of FNAB in obtaining a definitive diagnosis of NF. ***Methods:*** Cases were identified from our laboratory information system. Cytology slides were reviewed to note morphologic features and confirm diagnoses. Clinical history was obtained to document the case presentations and outcomes. ***Results:*** All 9 cases were found to have clinical presentations and common distinguishing morphologic features consistent with NF. Two cases were excised surgically, and the remainder regressed spontaneously. There were no recurrences. ***Conclusions:*** FNAB can produce a definitive diagnosis of NF, providing an opportunity to avoid surgical excision in patients with a typical clinical presentation.

Introduction

Nodular fasciitis (NF) is a self-limited, mass-forming, fibrous proliferation of unknown etiology that commonly occurs in the subcutaneous tissues. NF characteristically regresses spontaneously over a period of weeks to months, although local progression has been described in isolated cases. Prolonged disease progression is highly unusual and warrants an alternative diagnostic consideration [1, 2]. Because this is a benign, self-limiting process, accurate diagnosis via a minimally invasive method is desirable to help avert unnecessary invasive surgical procedures.

Fine-needle aspiration biopsy (FNAB) is a minimally invasive, rapid, accurate method of obtaining diagnostic material from head and neck masses. It can be performed with or without image guidance. When performed by a well-trained physician, FNAB, encompassing sample collection, microscopic-slide preparation and rapid on-site evaluation for adequacy and triage of material for ancillary studies, is an ideal procedure for the diagnosis of masses in the head and neck region. In the hands of an experienced individual, FNAB can be reliably utilized as an accurate diagnostic method with minimal invasiveness when compared to surgical procedures [3].

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In this study, we sought to verify the usefulness of FNAB for the evaluation of patients with NF. This case series summarizes our experience with FNAB in patients with NF of the head and neck.

Materials and Methods

Consecutive cases of NF, located in the head and neck and diagnosed with FNAB, were identified from our laboratory information system over a period of 12 years (2000–2011). Nine cases were examined by 2 attending pathologists (A.B.B. and B.-M.L.). Slides from the FNAB procedures were reviewed to note morphologic features and confirm diagnoses. Clinical information was obtained from the treating physicians to document the presentations and outcomes.

In each of the 9 cases, FNAB of a palpable lesion was performed by a fellowship-trained, board-certified cytopathologist, without imaging guidance, using a standard 23-gauge needle. At the time of sampling, a small portion of the aspirate was smeared on a glass slide, fixed in 95% ethanol and then immediately stained at the bedside with toluidine blue, for a rapid assessment to confirm the presence of diagnostic material. Additional smears were prepared for final analysis and were subsequently stained with Papanicolaou (PAP, 95% ethanol-fixed smears) and/or Giemsa stain (for air-dried smears, in some cases). In a subset, additional material was collected for a cell block preparation (based on the initial interpretation of the toluidine blue stain). Cell block preparations were formalin-fixed and embedded in paraffin to enable optimal immunohistochemical analysis with commercially available antibodies against smooth-muscle actin (SMA) and S-100 (DAKO; Carpinteria, Calif., USA).

Results

The 9 patients ranged in age from 27 to 59 years, with a mean age of 46 years and a median age of 51 years. They were approximately evenly matched for gender with a male-to-female ratio of 5:4. The size of the lesions varied from 0.5 to 8 cm in greatest dimension at presentation, with a mean size of 2 cm and a median size of 1 cm. The duration of the lesion prior to the FNAB varied from 2 to 52 weeks at presentation, with a mean duration of 15 weeks and a median duration of 4 weeks. Two of the lesions were excised and did not recur. All of the others spontaneously regressed (table 1; fig. 1).

Aspirate smears from all cases were highly cellular, with a predominant loosely cohesive and dyshesive proliferative myofibroblastic spindle cell population. High cellularity in some settings is a feature suggestive of malignancy, but in this setting, it is an indication of the nature of the lesion and of effective procurement technique. The variably sized myofibroblasts had round-to-elongated, plump nuclei, smooth and thin nuclear membranes, moderate amounts of dense, nonvacuoleated, typically tapered and often bipolar cytoplasm, small but frequently visible nucleoli and a bland, finely granular chromatin pattern (fig. 2a). Rare mitotic figures of typical type were observed in some cases. Mature, unremarkable lymphocytes were frequently identified in the background (fig. 2b) and some cases showed wispy, myxoid material in the background as well. Myxoid metachromatic stromal material was more prominent with Giemsa stain, as was cytoplasmic content. There was no evidence of necrosis. No features to suggest a malignant neoplasm were identified in any of the 9 cases.

Table 1. Summary of clinical data

Age, years	Gender	Location	Size, cm	Duration, weeks	Outcome
52	female	anterior neck	8	20	surgical excision
27	female	scalene muscle	2	7	regression
59	male	mandible	1.5	4	surgical excision
33	female	preauricular	2	40	regression
35	male	angle of jaw	1	4	regression
48	male	lower neck	1	2	regression
51	male	posterior neck	1	52	regression
59	female	supraclavicular	1	2	regression
53	male	left temple	0.5	4	regression

In 4 of the 9 cases, cell block material was collected, fixed in 10% buffered formalin and embedded in paraffin for immunohistochemical studies. Hematoxylin and eosin stained sections from the cell block material resembled the smears, with a proliferative myofibroblastic spindle cell population and admixed, scattered chronic inflammatory cells (fig. 2c). Immunohistochemical staining in all 4 cases showed strong cytoplasmic staining for SMA (fig. 2d) and no staining for S-100. One additional case included a positive immunohistochemical stain for SMA, performed on a smear. The combined clinical, cytomorphologic and immunohistochemical features confirmed the diagnosis of NF in all cases.

Discussion

Approximately 15–20% of NF cases present in the superficial tissues of the head and neck region in areas amenable to FNAB [4–6]. NF has a fairly typical clinical pre-

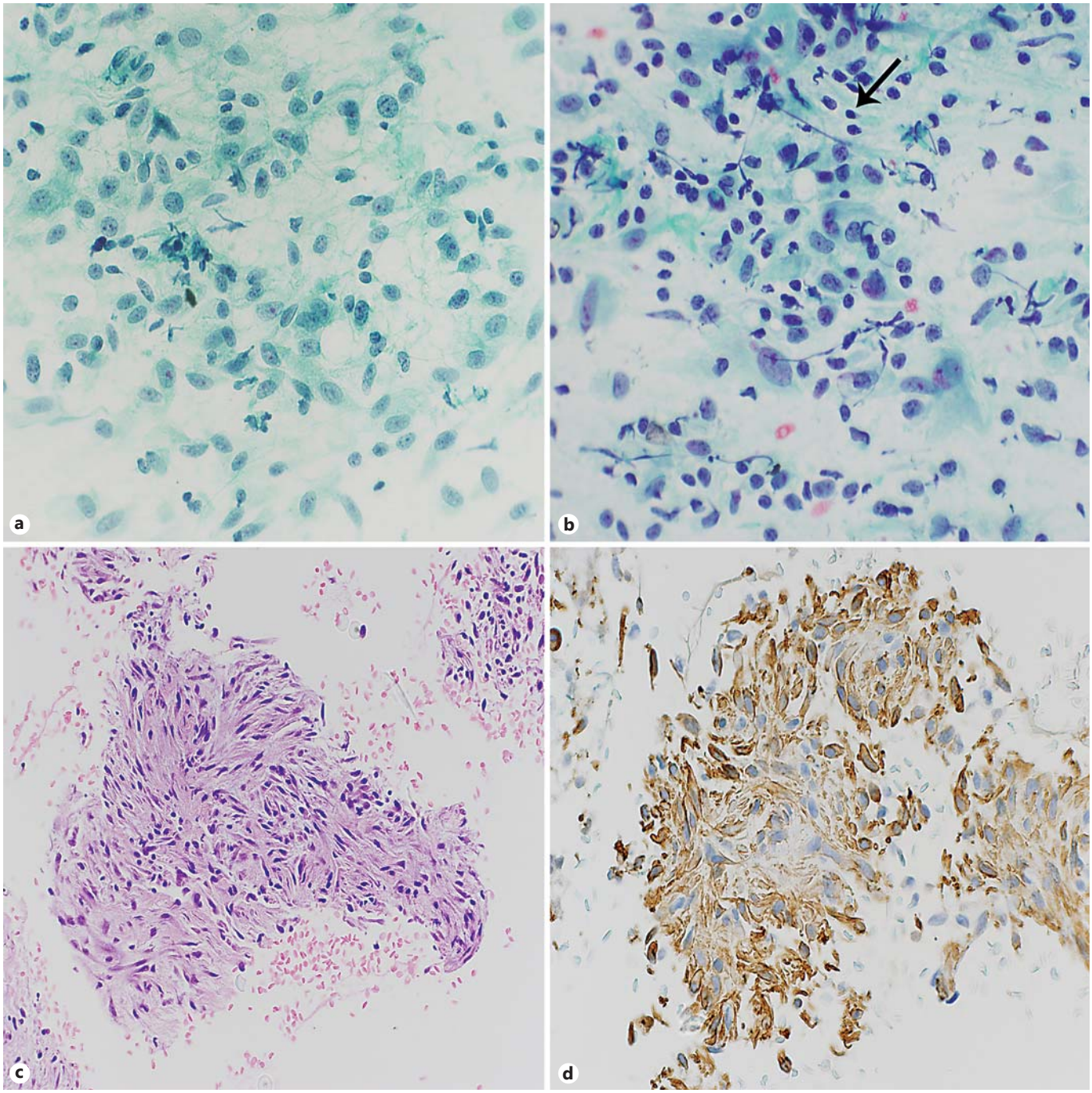

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Fig. 1. a Aspirate smears demonstrate a loosely cohesive population of reactive-appearing, spindled cells. PAP. ×400. **b** Admixed, mature lymphocytes are characteristic of nodular fasciitis. PAP. ×400. **c** Cell block material demonstrates a bland spindle cell population. HE. ×200. **d** Immunohistochemical staining demonstrates strong cytoplasmic positivity within the fibroblastic cytoplasm. SMA. ×400.

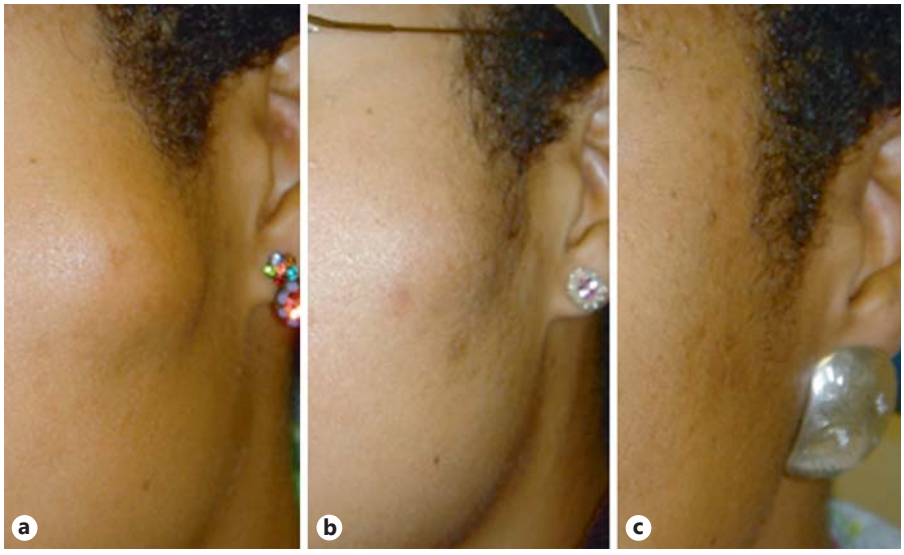

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Fig. 2. These 3 images are from the same patient at diagnosis (**a**), the 3-month follow-up appointment (**b**) and the 1-year follow-up appointment (**c**), showing resolution of the NF lesion.

sentation. The lesions are typically between 2 and 5 cm in size, occur equally in both genders and are most common in young adults. CT and MR imaging features of NF are nonspecific and it is typically characterized as a relatively well-defined, moderately to markedly enhancing nodule [7, 8]. Lesions characteristically undergo spontaneous regression within 2 or 3 months [9]. Lesions >5 cm that fail to show evidence of regression within 2 or 3 months should prompt an alternative diagnostic consideration [10, 11]. NF does not metastasize. When excised, NF only very rarely recurs.

Review of related head and neck medical literature has identified involvement of NF within the soft tissue underlying or adjacent to the auricle, mandible, sternocleidomastoid musculature, masseter muscle, forehead, cheek and parotid gland, where it has reportedly been mistaken for pleomorphic adenoma (benign mixed tumor). In the light of the different managements of these 2 lesions, careful distinction by adequate FNAB is essential [12–17]. Accurate diagnosis by FNAB can provide reassurance to the clinical team when deciding to observe the lesion for regression, rather than to excise it for diagnosis. If excision is deemed advantageous for other reasons, an accurate diagnosis can help in formulating an optimal surgical strategy.

NF has a characteristic cytologic appearance. Bland, loosely-cohesive and dyshesive, myofibroblastic, spindle-shaped cells are present in a background of scattered lymphocytes and myxoid material. Some of the myofibroblastic cells may be larger, more stellate-shaped and multinucleated, but should share the same nuclear features as the smaller, spindle-shaped cells. Typical mitotic figures may occur and should not prompt concern for malignancy. Large, ganglion-like cells with prominent nucleoli are present in a subset of cases. Abnormal mitotic figures, hyperchromasia, irregular nuclear membranes or marked pleomorphism should prompt additional work-up for malignancy. Immunohistochemical staining with SMA, while nonspecific, can confirm the myofibroblastic origin of spindle cells in NF [18, 19]. NF should only be diagnosed definitively on FNAB in the appropriate clinical setting.

The differential diagnosis of NF includes other reactive lesions such as proliferative fasciitis or granulomatous disease, benign and low-grade lesions such as fibrous histiocytoma, schwannoma, neurofibroma, dermatofibroma, inflammatory myofibroblastic tumor or fibromatoses and high-grade neoplasms such as malignant peripheral-nerve-sheath tumors, dermatofibrosarcoma protuberans or other high-grade sarcomas (i.e. leiomyosarcoma, fibrosarcoma and undifferentiated sarcoma) [20–24]. High-grade sarcomas are typically composed of tumor cells with marked hyperchromasia and irregular nuclear membranes, often with consistently prominent nucleoli and significant numbers of often atypical mitotic figures. Focal or, in some cases, extensive necrosis is commonly seen in high-grade sarcomas and is absent in NF. Synovial sarcoma may be composed of less hyperchromatic cells. However, the tumor cells in synovial sarcoma tend to present in larger multilayered clusters and

also typically have more monomorphous and elongated nuclei than what is seen in NF. These high-grade sarcomas almost always present in deep-seated locations rather than subcutaneously. Dermatofibrosarcoma protuberance typically presents more superficially than NF in the dermis-subcutis junction and often with bluish-red discoloration of the overlying skin. It is composed of monomorphous spindle-shaped cells with less tendency toward cell dissociation than is typically seen in NF. Inflammatory myofibroblastic tumor almost never occurs in the head and neck area, is positive for anaplastic lymphoma kinase and typically includes a prominent inflammatory component including plasma cells. NF, by comparison, typically includes only a sprinkling of lymphocytes. With adequate aspirate collection, careful morphologic evaluation, attention to clinical presentation and application of ancillary techniques, NF can be reliably distinguished from these entities. By eliminating a high-grade sarcoma and locally aggressive lesions from the clinical differential diagnosis, an extensive surgical resection and its potential morbidity can be avoided [25].

The patients in our series fell mostly within the expected clinical parameters (table 1). The accurate diagnosis of NF enabled 7 of the 9 patients studied to avoid a surgical procedure entirely, and all 7 had resolution of their lesions over time, without recurrence. Of the 2 cases that were excised, 1 was due to the abnormally large size (8 cm) and the other due to the patient's preference. Both of them were able to comfortably proceed with a limited excision of their lesions. Neither has experienced a recurrence.

Aspiration cytopathology of soft tissue lesions has sometimes been considered controversial; however, when performed and interpreted by well-trained, experienced physicians, FNAB can provide accurate and timely information regarding these lesions, with little discomfort or morbidity to the patient [3]. Adequacy of the biopsy sample is assured through on-site evaluation and the material can be triaged immediately for ancillary studies. In our NF series, we were able to collect adequate cell block material in all cases where it was deemed appropriate, and immunohistochemical studies were successfully performed. Depending on the morphologic impression at the time of the FNAB procedure, material can be collected for many additional ancillary studies, including cultures, flow cytometry and tumor karyotyping. Because mass-forming lesions of the head and neck can vary greatly in type and etiology, access to this wide range of diagnostic modalities is helpful in establishing an accurate diagnosis quickly and with the least discomfort to the patient.

In summary, FNAB is a reliable and accurate method for the definitive diagnosis of NF in the head and neck. Integrating the FNAB findings with the clinical and radiographic presentation, through collaboration with the surgeon and radiologist, the pathologist can provide a definitive diagnosis that will obviate the need for surgical excision in most cases. When a surgical procedure is indicated, an accurate FNAB diagnosis will aid in planning the most appropriate procedure and approach.

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