

ORIGINAL ARTICLE

The diagnostic value and cost effectiveness of routine fungal stains in a dermatopathology service of a district general hospital

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Aims: To evaluate the use and effectiveness of fungal stains in a dermatopathology service of a district general hospital.

Methods: A retrospective analysis of skin biopsies submitted over three years, where fungal stains were used; the results were correlated with clinical history and case notes.

Results: In total, 99 cases were studied for fungi with the periodic acid Schiff stain with diastase. Fungi were present in seven cases; fungi had been suggested in the differential diagnosis of three of these cases but were an unexpected finding in four cases.

Conclusion: Non-specific clinical details should prompt early fungal staining and non-specific microscopic findings or inappropriate well recognised skin reaction patterns should warrant the exclusion of fungal infection. The finding of at least one case of unexpected fungal infection is justified financially and for patient best management where clinical and microscopic findings are non-specific or inappropriate.

Filamentous fungi, dermatophytes, which invade and colonise the keratinised layers of the skin, are the main cause of skin fungal infection. Fungal infection is the reason for about 3-4% of dermatological consultations.¹ Clinically, the diagnosis may not be clear cut, presenting differential diagnoses of dermatitis, parapsoriasis, psoriasis, lichen planus, and possible mycosis fungoides. Fungal infection may coexist with another inflammatory or neoplastic condition of the skin. Patients with diabetes mellitus, relative or absolute immunosuppression, or with a history of foreign travel may be at risk for fungal skin infection. The diagnosis is usually clinical, with the support of ancillary procedures, including the use of Wood's light and/or direct microscopy of skin scrapings with potassium hydroxide. Only rarely is the histopathologist asked to confirm the presence of a dermatophyte in paraffin wax embedded tissue.

"Fungal infection is the reason for about 3-4% of dermatological consultations"

Histopathologically, the diagnosis of fungal skin infection is not straightforward. Fungal skin infection may present as a psoriasiform, spongiotic, vesiculobullous, granulomatous, or vasculopathic reaction pattern. The psoriasiform pattern is usually associated with chronic fungal infection. The vesiculobullous pattern is usually subepidermal in type with lymphocytes.¹ Other documented skin reaction patterns associated with fungal infection include superficial perivascular inflammation, superficial and deep dermal inflammation, and folliculitis/perifolliculitis. Certain clues in a skin biopsy suggest the presence of fungi, including compact altered keratinisation,³ neutrophils in the epidermis and cornified layer, and the so called sandwich sign, with entrapped neutrophils and layering of surface keratinisation.⁴ One needs to have a high index of suspicion for the associated presence of fungi when dealing with both specific and non-specific dermatoses. We carried out a retrospective three year analysis of the use of fungal stains in our dermatopathology service.

RESULTS

The periodic acid Schiff (PAS) stain is the most frequently used fungal stain in our department. In the three year period, a total of 99 skin biopsies had been studied for the presence of fungi with PAS with diastase (table 1). In 14 cases, fungal infection featured in the clinical differential diagnosis, but the study of skin scrapings had been negative. The presence of fungi within the surface keratin layers of the skin was confirmed in seven cases, three of which were cases where fungal infection had been suggested in the clinical diagnosis. In four cases, the presence of fungi was an unexpected finding and a new diagnosis. In most cases, the presence of fungi was in addition to another dermatological diagnosis. In 11 cases with non-specific clinical and microscopic findings fungi were not identified. For many clinicians working in dermatopathology this group is the most difficult to manage, and requires close clinicopathological correlation in a multi-disciplinary team.

DISCUSSION

In our study, performing a simple stain to exclude the presence of fungi resulted in a 7% yield, with fungi found in an additional four cases where they were not clinically expected. Fungi were found in three cases in which skin scraping studies were negative. Fungal infection is amenable to treatment. Confirmation or exclusion of fungi in a skin biopsy with non-specific findings will allow appropriate management and prevent further unnecessary referrals.

The skin has only a limited repertoire of reaction patterns to varying exogenous and endogenous stimuli. Fungi may infect the keratin layer of the skin, hair, or nail without extending deeper into the skin. The fungi are thought to use the soluble non-keratin parts for nutrition and rely on the keratin for protection from the host response. In a histological section of skin fungi are known to induce a wide

Abbreviations: PAS, periodic acid Schiff; PASd, periodic acid Schiff with diastase

Table 1 Consultation outcomes

Clinical	Pathology			Total
	Diagnosis confirmed	New diagnosis	No diagnosis	
Diagnosis given	25 (1*) (1†)	14 (3*) (1†)	14	53
Differential diagnosis	21	8	6 (1†)	35
No diagnosis	0	0	11	11
Total	46	22	31	99

*Cases where fungi were an unexpected finding; †cases where fungi were present and clinically suggested.

Take home messages

- Performing a simple stain to exclude the presence of fungi resulted in a 7% yield, with fungi found in an additional four cases where they were not clinically expected
- Non-specific clinical details should prompt early fungal staining and non-specific microscopic findings or inappropriate well recognised skin reaction patterns should warrant the exclusion of fungal infection
- The finding of at least one case of unexpected fungal infection is justified financially and for patient best management where clinical and microscopic findings are non-specific or inappropriate

spectrum of reaction patterns. Varied stimuli will cause similar responses. Exclusion of the presence of fungi becomes important where findings are non-specific or do not fit with those suggested clinically. The PAS stain is a simple stain that demonstrates polysaccharides. Cellulose and chitin, two substances rich in polysaccharides, are found in the cell walls of fungi.³ The addition of the enzyme diastase (PASd) eliminates the potential of confounding results caused by the presence of glycogen. In particular, the use of PASd is recommended in skin pathology because glycogen granules within the keratinocytes may simulate fungal spores.⁶ The silver methenamine stain (Grocott modification) will also demonstrate the presence of fungi, but is a more involved procedure, and may give differing results in different hands. Alternatively, antibodies to fungal antigens may be used, but will prove expensive.

"Fungi were found in three cases in which skin scraping studies were negative"

Allowing for hospital overheads, staff time, and consumables, the processing and examination at different levels of a routine skin biopsy costs about £26. Performing a PASd simultaneously might only cost a further 30p, whereas if the fungal stain is performed at a later time it could cost up to £4. In our retrospective study involving 99 cases, the cost of fungal stains, which established the presence or absence of fungi in all cases, was only £27. If the fungal stains were performed at a separate time either during the analytical session or after analysis the cost might be as high as £360.

The finding of at least one case of unexpected fungal infection of the skin where the clinical findings are non-specific must justify simultaneous staining for fungal infection. At the time of macroscopic examination of surgical specimens/surgical cut up, non-specific clinical details on the request card should prompt early fungal staining. At microscopic examination, varied well recognised reaction patterns or non-specific findings in the skin should warrant the exclusion of fungal infection.

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