

Fungal infection of burn wounds in patients with open and occlusive treatment methods

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العدوى الفطرية في إصابات الحروق، لدى تطبيق طرائق المعالجة المفتوحة والغالقة

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خلاصة: تم بحث العدوى الفطرية في إصابات الحروق، من خلال دراسة مستقبلية لمئة وثلاثين مريضاً عولجوا إما بطرق علاجية مفتوحة أو غالقة. ولقد تم، إجمالاً، استفراد ثلاثين معزولة فطرية من ستة وعشرين مريضاً كانت بهم جميعاً عدوى جرثومية كذلك، باستثناء مريض واحد. وكانت أنواع الرشاشيات والمبيضات هي أكثر الفطريات التي تم عزلها. ولقد تبين أن عدوى الفطريات كانت شائعة بين المرضى الذين يعالجون بطريقة التضميد المفتوح (25.5%) أكثر منها في طريقة التضميد الغالق (16.0%). كما أن استزراع الفطريات من عينات الأنسجة أعطى معدل استفراد (عزل) للفطريات أفضل مما أعطته مزارع العينات المأخوذة من المسحات القطنية.

ABSTRACT Fungal infection of burn wounds was investigated in a prospective study of 130 patients managed either with open or occlusive treatment methods. In all, 30 fungal isolates were recovered from 26 patients all of whom had bacterial infection also, except for one patient. The predominant fungi recovered were *Aspergillus* spp. and *Candida* spp. Fungal infection was more common in patients treated with open dressing (25.5%) than occlusive dressing (16.0%). Fungal culture from tissue specimens gave a better isolation rate of fungi than from cotton swab specimens.

Les infections fongiques des lésions de brûlure chez des patients pris en charge par méthode de traitement à ciel ouvert et de traitement occlusif

RESUME Les infections fongiques des lésions de brûlure ont été examinées dans une étude prospective de 130 patients pris en charge par méthode de traitement à ciel ouvert et de traitement occlusif. Dans tous les cas, 30 isolats fongiques ont été effectués chez 26 patients qui avaient tous une infection bactérienne également, à l'exception d'un malade. Les champignons prédominants qui ont été trouvés étaient *Aspergillus* spp et *Candida* spp. L'infection fongique était plus courante chez les patients traités par pansement à ciel ouvert (25,5%) que par pansement occlusif (16,0%). La culture fongique à partir de prélèvements tissulaires donne un meilleur taux d'isolement des champignons par rapport aux prélèvements réalisés à l'aide d'un écouvillon de coton.

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Introduction

Prior to the advent of topical antimicrobial agents, invasive fungal infections were not common. With the use of these agents, it has been reported that 25% of burn wounds seen at postmortem harbour fungi [1]. Fungi may invade deep tissue and the bloodstream leading to complications [2,3].

The aim of this study was to assess the prevalence and type of fungal infection in burn wounds in patients with open and occlusive treatment methods.

Patients and methods

A prospective study was carried out which included 130 patients admitted to the burn units of three medical centres from 15 March 1996 to 20 March 1997. The mean age of patients was 21 years (range 1–67 years); 59 were males and 71 were females. The mean total body surface area burned was 43% (range 7%–80%). Only patients with clinical signs of burn wound sepsis were included in the study. There were 17 patients with septic shock and 66 with fever at the time of specimen collection.

With regard to treatment, 75 patients were managed with occlusive dressing and 55 with open dressing. Topical antimicrobial agents were used in 111 patients and systemic antimicrobial agents were used in 116 patients.

Specimens for fungal culture were collected as a piece of tissue from under the eschar (nearly 0.5 g in weight) in 51 cases and by a cotton swab from the subeschar exudate in 79 cases. The following media were used for isolation of fungi: Sabouraud dextrose agar, potato-carrot agar and potato-dextrose agar. All these media were supplemented with gentamicin and chloramphenicol. For each patient, several spec-

imens from several sites were taken; some were incubated at 30 °C and others at 37 °C. The cultures were examined daily for up to 30 days. Aerobic and anaerobic bacterial cultures were also performed for all patients.

The microbial growth was determined semiquantitatively. Fungal burn wound colonization was regarded positive when the same organism was obtained from several sites of the wound or on several occasions, or when direct microscopic examination revealed the fungus. Fungi and bacteria were identified by conventional methods.

Results

In all, 30 fungal isolates were recovered from 26 patients (20.0%). All fungal infections were mixed with bacterial infection except in one patient who was infected with *Candida* spp. alone. The predominant fungi recovered were *Aspergillus* spp. and *Candida* spp. (Table 1).

There were 75 patients managed with occlusive dressing, of whom 12 (16.0%) had fungal infection. The other 55 patients were managed with open dressing, of whom 14 (25.5%) had fungal infection. Although the incidence of fungal infection was higher in patients with open dressing, the difference was statistically not significant ($\chi^2 = 1.77$, $df = 1$, $P > 0.05$).

The specimens for fungal culture were collected as a piece of tissue in 51 cases, of which 18 (35.3%) revealed positive fungal culture. The other 79 specimens were collected by cotton swabs, of which 12 (15.2%) revealed positive fungal culture. The difference between tissue and swab specimens with regard to fungal isolation was statistically significant ($\chi^2 = 7.07$, $df = 1$, $P < 0.01$).

Table 1 Organisms isolated by culture

Organism	No. of isolates	%
Fungi		
<i>Aspergillus niger</i>	8	2.05
<i>Candida</i> spp.	8	2.05
<i>A. flavus</i>	4	1.02
Zygomycetes	3	0.77
<i>Penicillium</i> spp.	3	0.77
<i>A. fumigatus</i>	2	0.51
<i>A. terreus</i>	2	0.51
Aerobic bacteria		
<i>Staphylococcus aureus</i>	74	18.93
<i>Pseudomonas aeruginosa</i>	74	18.93
<i>Klebsiella</i> spp.	41	10.49
<i>Proteus</i> spp.	14	3.58
<i>Escherichia coli</i>	11	2.81
<i>S. epidermidis</i>	11	2.81
<i>Streptococcus</i> spp.	10	2.56
Enterobacteriaceae	5	1.28
<i>Bacillus</i> spp.	5	1.28
Anaerobic bacteria		
<i>Bacteroides</i> spp.	66	16.88
<i>Peptostreptococcus</i> spp.	29	7.42
<i>Propionibacterium acnes</i>	6	1.53
<i>Fusobacterium</i> spp.	5	1.28
<i>Veillonella</i> spp.	5	1.28
<i>Clostridium perfringens</i>	2	0.51
<i>C. tetani</i>	1	0.26
<i>Lactobacillus</i> spp.	1	0.26
<i>Eubacterium</i> spp.	1	0.26
Total	391	100

Discussion

Isolation of *Candida* spp. alone from one patient and recovery of other fungi from other patients with clinical signs of burn wound sepsis suggest a significant role of fungi in burn wound infection. The incidence of fungal infection was 20%. This is similar to that reported by Nash et al. [1] who found an incidence of 25%. *Aspergillus* spp. was the most common fungal isolate and this is in agreement with previous studies [4,5].

In this study, the isolation rate of fungi was higher with tissue specimen culture than with cotton swab culture. Thus, it is better to obtain tissue specimens rather than swab specimens for fungal culture.

The rate of recovery of fungi was higher in patients with an open dressing (25.5%) than in patients with an occlusive dressing (16.0%). Therefore, the occlusive dressing method is recommended for patients with burn wounds. This supports the findings of many authors who have found that occlusive dressings accelerate the rate and quality of wound healing [6-9].

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