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Fungal infections in corn picker hand injury

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SUMMARY

Introduction Hand injuries caused by corn pickers are relatively rare but in most cases extensive, with massive tissue destruction. Severe wounds sustained during agricultural work are contaminated, with high incidence of infection.

Objective The aim of the study was to determine the frequency and type of fungal infection in corn picker injuries and their impact on the course and outcome of treatment.

Methods Corn picker hand injuries for the period 2006–2012 were analyzed. After setting up clinical suspicion, direct examination of repeated swabs and histopathological analysis of biopsy material were done in order to detect fungi.

Results From the total number of 60 patients, there was a fungal infection in nine of them (which makes 15% of the total number of patients). *Aspergillus* spp. was isolated in seven patients, *Candida* spp. in three, and *Mucor* spp. in one patient. None of the patients had increased risk factors for developing a fungal infection. In most cases, there was loss of graft and tissue necrosis in previously normally looking wound, after seven or more days. All patients were treated with repeated surgical debridement and concomitant parenteral and topical application of appropriate antifungal agents. There was no need for reamputation in any patient.

Conclusion A high degree of suspicion and a multidisciplinary approach are needed for early diagnosis of fungal infection. Confirmation of diagnosis and the initiation of surgical and appropriate antifungal therapy are essential for a successful outcome.

Keywords: hand injuries; occupational injuries; wound infection; mycoses; *Candida*; *Aspergillus*

INTRODUCTION

Hand injuries caused by corn picker are relatively uncommon. Fortunately, the incidence of such injuries showed a tendency to decrease compared to the previous period, due to the increasing use of modern machinery and better education of farmers [1, 2]. The significance of such injuries is that they are extremely severe; in most cases there is a traumatic amputation and/or destruction [3]. Preservation and reconstruction possibilities are minimal. On the other hand, these patients are relatively young and capable of work.

If there is a fungal infection, sometimes there is a need for reamputation on a higher level due to the nature of the agent, which permeates the tissue and blood vessels, creating a new necrosis. This increases permanent disability with possible fatal outcome.

OBJECTIVE

The aim of the study was to determine the frequency and type of fungal infection in corn picker injuries and their impact on the course and outcome of treatment.

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METHODS

For the purpose of this study, we have used data from the electronic database of the Clinical Centre of Vojvodina, which was approved by the Board of Ethics of the same institution. In the period from 2006 to 2012, 1,235 patients with injuries were treated in the Clinic of Plastic and Reconstructive Surgery, Clinical Center of Vojvodina in Novi Sad. The majority of the patients suffered from hand injuries (704 patients). Sixty of these patients were suffering from severe injuries caused by corn picker (8.52% of all hand injuries). The majority of the patients (95%) were between 21 and 59 years of age, while the rest were older than 60 years. There were 53 (88.33%) men and seven (11.66%) women.

All the patients were surgically treated without delay after admission to the Clinic, within six hours after the trauma. This type of injuries were severe, destructive, mutilating, and often with proximal tears of the skin. After amputation and debridement of nonviable parts, very often remained a certain skin defect. Primary skin defects were usually treated with split-thickness skin grafts. Povidone-iodine solution was routinely used for disinfection in the operating room. After surgery, wet dressings with povidone-iodine or ethacridine lactate compresses were regularly conducted. The patients received anti-tetanus and antibiotic prophylax-

is, since the wounds were primarily contaminated (dirt, plant fragments, engine oil, etc.), with a broad-spectrum antibiotic, usually an aminoglycoside and a cephalosporin, in combination with metronidazole.

The occurrence of fungal infections among these patients was analyzed. Wound swabs were taken routinely, twice a week, or more often if there was clinical suspicion of an infection. Saubouraud agar was used for fungal growth. Identification and antifungal susceptibility was carried out with ATB fungus and VITEK 2 automatic test (BioMérieux, Marcy-l'Étoile, France). Biopsy with a histopathological examination was also performed. Besides the standard hematoxylin and eosin staining, periodic acid–Schiff and Gomori's methenamine silver staining were used.

RESULTS

During the analyzed period, a fungal infection was detected in nine patients with hand injuries caused by a corn picker (15%). None of these patients had increased risk factors for developing a fungal infection. In the same period, only one patient (0.16%) among the group of 644 patients with other types of hand injuries developed *Aspergillus* spp. infection after trauma with circular saw for wood.

Figure 1. Fungal infection of injured hand – necrosis and skin graft loss

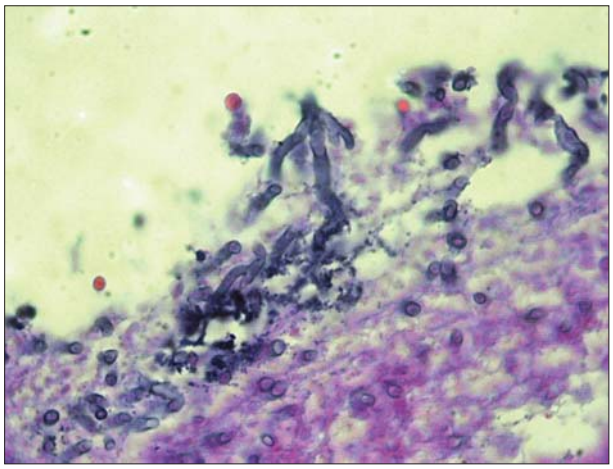

Figure 2. Fungal colonies on the surface of necrotic mass with broad non-septate branched hyphae (HE, ×630)

Among nine patients with fungal infections, *Aspergillus* spp. was the most common causative agent that was recovered in seven patients. *Candida* spp. and *Mucor* spp. were isolated in three and one patient, respectively. One patient had combined infection with all the aforementioned three fungal species.

The clinical features led to the suspicion of underlying fungal infection. In most cases, after seven or more days there were color changes of the granulation tissue, necrosis, and loss of skin graft (Figure 1). Diagnosis of fungal infection was based on direct examination of repeated swabs and histopathological analysis of biopsy material (Figures 2 and 3). Routine wound swabs for bacteriology were taken, and *Staphylococcus aureus* as well as *Enterococcus* spp. were isolated from all these patients. None of the patients had positive blood culture. All the patients had mild fever and moderate leukocytosis during the first few days; other laboratory findings were within normal range.

Upon establishing clinical suspicion of a fungal infection, every antibiotic prophylaxis or therapy was discontinued. Administration of topical and systemic antifungal drug was initiated. The surgical treatment consisted of repeated debridement of the tissue affected by the infection. There was no need for reamputation in any of the patients.

Patients with *Aspergillus* spp. infection were treated with parenteral amphotericin B, fluconazole and voriconazole according to mycogram (sensitivity/resistance) analysis. In one patient with mucormycosis, amphotericin B was administrated followed by voriconazole; wounds were dressed with topical application of miconazole; compresses with silver-calcium alginate were put after local application of miconazole in wounds with *Aspergillus* spp, *Mucor* spp and *Candida* spp. mixed infection; infections with *Candida* spp. were treated with topical application of nystatin solution and miconazole cream.

DISCUSSION

Fungal infections (aspergillosis, mucormycosis) usually occur in immunocompromised patients, but may also oc-

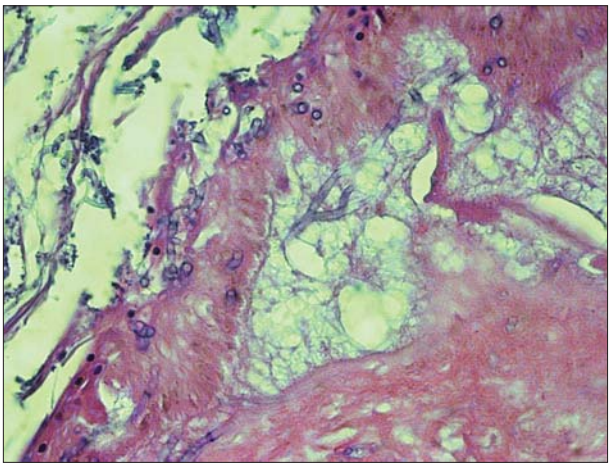

Figure 3. Fragment of necrotic tissue with colonies of fungi with non-septated hyphae and spores (HE, ×400)

cur in people who have no risk factors for developing this type of infection [4]. Normal skin is commonly contaminated with spores or even short lengths of mycelium of saprophytic species. Usually, such species are present in small amounts, and may without difficulty be dismissed as contaminants that have an impact on the skin. From time to time, however, reports appear in the dermatological literature of cases in which species such as those of *Aspergillus* appear to colonize damaged tissues, become firmly established and perhaps cause secondary tissue destruction. Most authors counsel caution before accepting any sort of pathogenic role for molds in these cases [5]. To develop a primary fungal infection there must be a wound in the skin through which the spores are inoculated into the tissue [6, 7]. Thorough wound toilet during the first surgical treatment, as well as removal of all foreign material from the wound and the debridement of all necrotic tissue reduces the chances of developing any kind of infection. Severe and extensive wounds sustained in agricultural work are contaminated with soil and frequently plant material which contains a large number of fungal spores. The existence of acidosis due to large tissue damage and loss of vitality, along with local immunosuppression, may be an explanation for the development of fungal infection in previously healthy individuals [4, 7]. The infection is often accompanied by fever and changes in the wound. Local fungal invasion of tissue and blood vessels occur, with the risk of dissemination [4]. Patients with primary skin aspergillosis show less severe necrosis and systemic toxicity than patients with wound mucormycosis [6]. Clinically, mucormycosis is characterized by necrosis with a dark central part or necrotizing cellulitis, while in a case of *Aspergillus* infection, papules, nodules, and/or necrosis are found.

The criteria for accepting the fungus as dominant etiological factor are the absence of any significant bacterial pathogens and the presence of large masses of fungi. If there is a considerable amount of fungal material in specimens (biopsy) taken for direct examination, this may be quite adequate [5]. Cultures are not always reliable, since the results are positive in only 30% of histologically proven mucormycosis [4, 7]. Repeated swabs and repeated biopsies are required.

Histologically, in mucormycosis, necrosis with invasion of blood vessels can be seen; hyphae are broad, non-septate (rarely septated) and with irregular branching; granulomatous inflammation and focal necrosis are present subcutaneously. In *Aspergillus* infections, histological findings correspond to granuloma or abscess, there is septated, hyaline, dichotomous branching at 45° angles, as well as vascular invasion and occlusion [8].

If species such as those of *Candida* colonize damaged tissue, loss of graft or visible plaques whitish and yellowish in color can develop. Histologically, the biopsy material shows the presence of blastospore 3–6 μm in diameter, and pseudohyphae 3–5 μm in width. On a standard hematoxylin and eosin staining they are purple in color, but are more distinguishable with a histological periodic acid–Schiff staining.

It is essential to set a clinical suspicion of a fungal infection in due time and to microbiologically and histologically confirm the diagnosis. Appropriate parenteral and topical antifungal therapy combined with a surgical debridement of all the necrotic and hyphae invaded tissue should be initiated as soon as possible [9]. Correction of local and systemic precipitating factors are also important for successful treatment, as well as the discontinuation of antibiotics. In infections with *Aspergillus* and *Mucor*, the parenteral administration of antifungals is recommended (posaconazole, amphotericin B, voriconazole, itraconazole). The therapy is conducted preferably according to the antimycogram with available drugs. The treatment of choice for aspergillosis is voriconazole and for mucormycosis is amphotericin B (in the absence of posaconazole). In *Candida* infection, surgical debridement and application of topical antimycotics (nystatin, miconazole) is usually sufficient [4, 6]. Repeated surgical debridement is required along with the antifungal parenteral and topical therapy. Sometimes amputation is also needed [7, 10]. Adequate and timely treatment can reduce the possibility of complications and allow healing without further functional deficits.

CONCLUSION

For successful treatment of patients with corn picker hand injuries, high degree of suspicion and multidisciplinary approach are needed for early diagnosis of fungal infection. Confirmation of diagnosis and the initiation of surgical and appropriate antifungal therapy are essential for favorable outcome.

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Гљивичне инфекције код повреда шаке берачем кукуруза

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КРАТАК САДРЖАЈ

Увод Повреде шаке изазване берачем кукуруза су релативно ретке, али у већини случајева тешке, праћене великим оштећењем ткива. Повреде задобијене током обављања пољопривредних радова су контаминиране, с високом инциденцијом секундарних инфекција.

Циљ рада Циљ рада је био да се утврде учесталост и врсте гљивичних инфекција код повреда комбајном и њихов утицај на ток и исход лечења.

Методе рада Анализиране су повреде изазване берачем кукуруза у периоду 2006–2012. године. После постављене клиничке претпоставке, идентификација гљивица се вршила на основу поновљених брисева ране и патохистолошких анализа материјала узетих за биопсију.

Резултати Међу 60 испитаника, до развоја гљивичне инфекције је дошло код девет болесника (15%). *Aspergillus* spp. је изолован код седам болесника, *Candida* spp. код три, а *Mucor* spp. код једног болесника. Ниједан болесник није имао повишене факторе ризика за развој гљивичне инфекције. У већини случајева је у претходно нормално зарастајућој рани после седам или више дана од повређивања дошло до губитка графта и ткивне некрозе. Сви болесници су лечени поновљеним хируршким дебридманом и пратећом парентералном и локалном применом одговарајућих антимикотичких лекова. Није било потребе за реампутацијом ни код једног испитаника.

Закључак За рано откривање гљивичне инфекције потребни су брзо препознавање клиничких знакова инфекције и мултидисциплинарни приступ. Потврда дијагнозе и започињање хируршке и одговарајуће антимикотичке терапије од суштинског су значаја за успешан исход лечења.

Кључне речи: повреде шаке; професионалне повреде; инфекција ране; микозе; *Candida*; *Aspergillus*

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