

Research Article

Destructive Complicated Polyonychomycosis and Nail Incarnations: Peculiarities of Interventions, Author's Views on Complex Treatment of Patients with Comorbid Background Pathology, Diabetes Mellitus

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Introduction

Surgical onychopathology includes a group of nosological forms of purulent-necrotic and mycotic-associated lesions of the nail phalanx, nail and peri-nail tissues, epidermophytia of the feet occupies one of the prominent places among pathological skin lesions; poses a risk of spreading to patients with diabetes due to high contagiousness, frequency of various complications; leads to a violation of the quality of life. Onychomycotic lesions are macroscopically classified into superficial mycosis, proximal and distal-lateral onychomycosis, onychocheilosis, subungual hyperkeratosis, and onychogryphosis. Pathological changes in the nail plate of the foot in patients with diabetes are often combined: hypertrophy and onychogryphotic deformation of the nail (in the form of an eagle's or vulture's beak) with its secondary growth, which is combined with the presence of dermatophytes (trichophytes, onychomatrichoma), pathological layering on the nail bed (brown color with destruction, disintegration) and the formation of multiple purulent bacterial-mycotic foci with abscessation. Complex treatment of patients with severe fungal lesions, complicated destructive onychomycosis with multiple nail lesions, onychogryphosis with incarnation, in particular in patients with diabetes, determines the removal of nail plates and the use of antifungal therapy, correction of background vascular pathology and is an urgent problem of outpatient surgery and dermatology. Some aspects of epidemiology, etiology, pathogenesis of onycheal and subungual pathology, macroscopic types of lesions, risk factors and cases of nail incarnations - ingrown nail (IN), localization, frequency of occurrence and causes of purulent onychia, paronychia, other complications and recurrences. In our previous publications, the effectiveness of various methods of surgical interventions, isolated and in combination with other methods of complex treatment, features of the postoperative period in isolated and combined lesions, in particular complicated destructive polyonychomycosis (UDP), were analyzed. It has been established that conservative and orthopedic treatment of IN and other mycotic surgical lesions of nails are not

very effective, while the main methods are Dupuytren's nail removal, Emmert-Schmid operation, etc. in 2-20% of cases (depending on the absence or presence of onychocryptosis and associated fungal lesions) cause relapses. Complicated mycotic lesions and HF in patients with diabetes are a special problem.

The goal of the work is to improve the implementation of interventions, comprehensive treatment of patients with complicated polyonychomycosis with comorbid background pathology, diabetes and to implement an original method of elimination of UDP - hyperkeratosis and onychogryphosis with nail incarnation - secondary nail growth, in particular in patients with diabetes to optimize early and long-term results.

Materials and Methods

In the 4th City Clinical Hospital of Lviv and MC "Salutas", the prospective material for a 10-year period was 496 cases of destructive onychomycosis complicated by secondary nail incarnation, of which 320 were men and 176 were women. The age of the operated patients is from 35 to 72 years. The main group consisted of 325 patients - 172 men and 153 women aged 43-68 years. The control group included 171 cases of onychodestruction that were treated according to "classical" schemes. All subsamples were statistically similar and comparable in terms of age and gender composition. Imperfect surgical techniques account for more than half of the causes of relapses, including cases of IN with subungual hyperkeratosis or onychogryphosis, $\chi^2=20.13$, $p=0.01$. The highest frequency of repeated INs among the technical reasons for recurrence was observed in unjustified refusal of partial matrixectomy - 19.8% and with traumatic mobilization/removal of nails (traumatic onychectomy). The hallux of the left foot was most often affected - in 48.85%, the right - in 33.26%, the presence of IN of both hallux was found in 17.89% of patients. In 18.8% of the sample, onychocryptosis occurred against the background of obliterating diseases of the arteries of the lower extremities: atherosclerosis in 13.76% and diabetes in 15.05%. All surgical interventions in

outpatient conditions were performed under adequate anesthesia. The Mann-Whitney U-test, χ^2 -test (V-square), χ^2 -test with Yates' correction for continuity, Fisher's exact test (Fisher exact p). We determined the χ^2 degree of influence of the studied phenomenon (etiological factor, morphogenetic mechanism) on the development of nail plate incarnation and other complications. "Classical methods" of descriptive statistics were also used, with a confidence interval of 95%, calculations were performed on licensed software. The study meets the requirements of bioethics.

Results and Discussion

We have researched clinical variants and peculiarities of the course of the pathological process, confirmed the optimal methods of surgical intervention, their phasing and the terms of complex treatment of complicated, combined mycotic processes and recurrences of reincarnations of nail plates and lesions of the nail structures. Adjuvant systemic three-day antimycotic pulse therapy with daily intake of 400 mg of itraconazole was applied for three days prior to interventional/operative treatment. The peak frequency of mycotic lesions with HF occurred in the subsamples of people aged 40-50 years and in people aged 50-60 years. Pathological incarnations of mycotically altered nail plates were characteristic of trichophytosis in elderly patients. It has been claimed that the free lateral edges of the nail with UDP due to the lifting of its central part by hyperkeratosis are "undermined", compressing perieponychial tissues and eponychia. We used the following methods of surgical treatment. "Classic" removal of VN (Dupuytren's operation) was performed in 64 people (12.90%), en bloc eponychectomy (excision of pathologically changed eponychial tissues) + nail removal through onycholised structures (low-traumatic) + dermatophytoma resection + partial matrixectomy + eponychoplasty - in 57 others cases (11.49%), nail removal through onycholised structures (low-traumatic) - in 51 (10.28%), "classic" nail removal + excision of pathologically changed eponychial tissues - in 43 (8.66%), en bloc eponychectomy (excision of pathologically changed eponychial tissues) + nail removal through onycholated structures (low-traumatic) + resection of dermatophytoma + partial matrixectomy - in 40 (8.04%) block-like eponychectomy + nail removal through onycholised structures (less traumatic) + partial matrixectomy - in other 8 (1.61%) patients. Thus, removal of ingrown nails was used in all cases, of which 64 people (12.90%) had Dupuytren's nail removal without anti-relapse supplements, extended ablation with excision of dermatophytoma - in other 57 cases (11.49%). In the vast majority of patients (87.1% of the sample), surgical treatment of UDP with VN with anti-recurrence components was applied - two- or three-component, supplemented by excision of pathologically changed eponychial tissues or (and) mechanical abrasion or (and) coagulation partial matrixectomy. Patients with diabetes accounted for 17% of the sample and were adequately represented in the main and control groups and in the clinical subsamples.

In patients with type 2 diabetes, probable strong positive correlations were recorded between all indicators of carbohydrate metabolism: glucose with insulin ($r=0.52$; $p<0.01$), with the NOMA index ($r=0.69$; $p<0.01$), with glycosylated hemoglobin ($r=0.76$; $p<0.001$); insulin with NOMA index ($r=0.74$; $p<0.01$) and glycosylated

hemoglobin ($r=0.65$; $p<0.01$); NOMA index with glycosylated hemoglobin ($r=0.69$; $p<0.01$). We proposed and implemented a method of removing affected nail plates in patients with UDP, in particular, in the presence of trichophytic nail hyperkeratosis, polyonychogryphosis. This method is applied and has proven itself positively in diabetic patients with purulent / incarnate lesions associated primarily with *Tr. Rubrum* infection.

After applying a tourniquet to the base of the finger, preparing the operating field and anesthesia, stepping back from the proximal edge of the onychogryphous nail by 2-3 mm, we perform a linear dissection of the soft tissues medially retronycheally to the nail plate, which is extended to the medialeponychial ridge, cutting out pathologically changed medial eponychial tissues in a block-like manner. We continue the medial dissection distally and linearly down 5 mm on the finger bundle. The remains of the medial eponychial tissues are separated from the medial edge of the onychogryphous nail with a pedicure spatula for an ingrown onychogryphous nail, a blade of a sterile pedicure tool PE-60/1 (an inclined manicure file with a blade). We visualize the medial edge of the onychogryphous nail and conduct a visual macroscopic assessment of it for the presence of deformations, delaminations, indentations, foci of hyperkeratosis. Similarly, retreating from the edge of the onychogryphous nail by 2-3 mm, we perform a lateral retronycheal linear dissection of the soft tissues to the nail plate, which we extend to lateral eponychial ridge, cutting out pathologically changed lateral eponychial tissues en bloc. We continue the lateral dissection distally and linearly down 5 mm on the finger bundle. The remains of the lateral eponychial tissues are separated from the lateral edge of the onychogryphous nail with a pedicure spatula for an ingrown onychogryphous nail, the blade of a sterile PE-60/1 pedicure tool (an inclined manicure file with a blade). We visualize the incarnated lateral edge of the onychogryphous nail and conduct a visual macroscopic assessment of it for the presence of deformations, delaminations, serrations, foci of hyperkeratosis. Under the distal corner of the onychogryphous nail, in the area of the smaller incarnation, through the onycholized structures between the nail plate and the nail bed in the proximal-lateral direction, we insert the ax-shaped tip of the sterile nail blade PE-10/2 (with a rounded pusher with an ax-shaped raspator), the sterile pedicure tool PE-60/1, with which we gradually mobilize the nail plate with pendulum-like movements to the germinal zone and the proximal edge of the onychogryphous nail, gradually removing hyperkeratoid masses by scraping with a sterile PE-10/2 manicure spatula and a small Volkmann spoon, mobilizing and lifting the nail plate. We insert the blade of a sterile PE-30/4 manicure tool (a rounded pusher with a bent blade) into the formed channel, which completes the mobilization with pendulum-like movements. We introduce the straight blade of a PE-30 sterile manicure tool (a rounded pusher with a straight blade) with which in the proximal-contralateral direction we finally separate the mycotically changed thickened incarnate nail plate en bloc with the main mass of hyperkeratotic masses, grab it with a sterile Kocher clamp and remove it. With the ax-shaped tip of the sterile manicure blade PE-10/2 (rounded pusher with ax-shaped rasp) and the bent blade of the sterile manicure tool PE-30/4 (rounded pusher with bent blade), we gradually isolate from the eponychial canals and the nail bed and

mobilize in the distal direction the remnants of hyperkeratoids masses and dermatophytomas, which are also captured en block with a sterile Kocher clamp and removed. We clean the nail bed and eponychal canals from the remnants of exfoliated epidermal structures. We clean the sinuses and eponychal canals with a Volkmann spoon and a sterile pusher. We perform a revision of the medial and lateral edges of the wound for the tactile detection of the remaining fragments of the jagged edges of the onychogryphous nail. After devulsion of the remnants of eponychal tissues in the area of incarnation of the onychogryphous nail with the bent blade of a sterile manicure tool PE-30/4, the remaining incarnate fragments of the nail plate are captured under visual and tactile control and removed with a Mosquito-type clamp. we perform bilateral partial marginal matrixectomy with longitudinal mechanical excision and diathermocoagulation of the germ zone and matrix of the onychogryphous nail in the areas of incarnations. Coagulated detritus is cleaned by scraping with the tip of a PE-60 sterile pedicure paddle. The sinuses, eponychal canals and nail beds are cleaned with a Volkmann spoon and a sterile pusher. We clean the wound three times with a 3% solution of hydrogen peroxide and an aqueous solution of povidone iodine. After repeated devulsion of the remains of the eponychal tissues with the blade of the PE-60/1 sterile pedicure tool, the eponychal channels are filled with tampons made of iodoform gauze, keeping the remains of the eponychal tissues removed. The central part of the wound is filled with povidone-iodine liniment, tightly tamped with gauze swabs under visual control. We remove the tourniquet from the base of the finger. Apply an aseptic bandage. We clean the wound three times with a 3% solution of hydrogen peroxide and an aqueous solution of povidone iodine. After repeated devulsion of the remains of the eponychal tissues with the blade of the PE-60/1 sterile pedicure tool, the eponychal channels are filled with tampons made of iodoform gauze, keeping the remains of the eponychal tissues removed. The central part of the wound is filled with povidone-iodine liniment, tightly tamped with gauze swabs under visual control. We remove the tourniquet from the base of the finger. Apply an aseptic bandage. We clean the wound three times with a 3% solution of hydrogen peroxide and an aqueous solution of povidone iodine. After repeated devulsion of the remains of the eponychal tissues with the blade of the PE-60/1 sterile pedicure tool, the eponychal channels are filled with tampons made of iodoform gauze, keeping the remains of the eponychal tissues removed. The central part of the wound is filled with povidone-iodine liniment, tightly tamped with gauze swabs under visual control. We remove the tourniquet from the base of the finger. Apply an aseptic bandage. tightly tampon with gauze tampons under visual control. We remove the tourniquet from the base of the finger. Apply an aseptic bandage. tightly tampon with gauze tampons under visual control. We remove the tourniquet from the base of the finger. Apply an aseptic bandage.

In the presence of polyonychomycosis with damage to more than 4 nail plates and damage to other structures of the foot (hand), surgical rehabilitation is divided into several stages. No more than four nail plates were removed simultaneously. In the case of other mycotic-associated pathology, no more than two simultaneous interventions were performed at the same time and no more than three nail plates were removed. The sequence of surgical interventions

was selected according to their urgency. Nail plates affected by subungual hyperkeratosis were mobilized from the nail bed through hyperkeratoid masses and onycholated structures by a blunt approach to the retronycheal (posterior nail) ridge with fixation by the distal edge of the secondary VN, onychectomy was performed. A bare nail bed with remnants of hyperkeratoid layers and dermatophytomas in the distal part and hyperkeratoses near the eponychal structures was visualized, which were removed by scraping, additional sanitation with a Volkmann spoon. Antimycotic pulse therapy was continued for the next 4 days of the postoperative period with daily intake of 400 mg of itraconazole. The remaining mycotically changed areas of the nails are cleaned daily with ciclopirox-containing antimycotic varnishes in order to prevent re- or mixed infection, as well as to prevent further fragmentation of the nails. In addition, three 7-day courses of pulse therapy with daily intake of 400 mg of itraconazole with a 10-day break between them were applied. In patients with existing obliterating lesions of the arteries of the lower extremities and in patients with diabetes, planned stages of surgical rehabilitation were performed only after complete epithelization under the guise of a course of vasodilator therapy. Dressings were performed every other day with treatment of surgical wounds with povidone iodine solution (until complete epithelization of wounds) and application of terbinafine liniment (until complete regrowth of nails) with sanitation of other remaining (unremoved) nails by applying antimycotic varnish every other day for 3 months. The last anti-recurrence course of UDP pulse therapy with itraconazole was carried out after the complete surgical rehabilitation of VN and polyonychomycosis. In patients with UDP and VN of the main group, in particular, in 57 patients with diabetes, in which the nail plates were removed due to onycholised structures, the healing time (crushing) of surgical wounds was 11-20 days (the average duration of healing - 16 days), in the control group - 15-25 days (the average duration of healing - 21 days); that is, in patients with UDP who underwent onychectomy due to onycholised structures, the healing time of onychectomy wounds was shorter. Good effectiveness of complex treatment was established in 284 patients of the main group (87.38%) and in 141 cases of the control group (82.46%). In general, a positive effect from the use of combined therapy with itraconazole and staged surgical removal of mycotically affected nails was confirmed in 425 patients (85.69%). who underwent onychectomy through onycholated structures, the healing time of onychectomy wounds was shorter. Good effectiveness of complex treatment was established in 284 patients of the main group (87.38%) and in 141 cases of the control group (82.46%). In general, a positive effect from the use of combined therapy with itraconazole and staged surgical removal of mycotically affected nails was confirmed in 425 patients (85.69%). who underwent onychectomy through onycholated structures, the healing time of onychectomy wounds was shorter. Good effectiveness of complex treatment was established in 284 patients of the main group (87.38%) and in 141 cases of the control group (82.46%). In general, a positive effect from the use of combined therapy with itraconazole and staged surgical removal of mycotically affected nails was confirmed in 425 patients (85.69%). In patients on the background of adjuvant systemic antimycotic treatment with daily pulse therapy of 400 mg of itraconazole, operative treatment of UDP with VN through onycholated structures with the use of podological pedicure

instruments, supplemented by excision of pathologically changed eponychial tissues, mechanical and coagulation partial matrixectomy, was applied to patients, this method can be recommended for the elimination of affected nails in patients with diabetes and obliterating lesions of the vessels of the lower extremities, as well as in patients with other vascular and/or neurotrophic pathology, elderly patients. The applied treatment scheme made it possible to achieve clinical and mycological recovery in 83.33% of the subsample. The achieved good result of the treatment was primarily determined by the peculiarity of the surgical approach, $\chi^2=48.25$, $p<0.01$.

The presence of foci of onycholysis and disintegration of areas of hyperkeratosis, which leads to detachment of part of the nail plate ($\chi^2=15.23$, $p=0.0211$), especially in elderly patients with background endocrine pathology - diabetes, justifies the feasibility of performing a minimally traumatic onychectomy. Patients with onychomycosis associated with secondary incarnation of the nail have a total hypertrophic fungal lesion with the formation of subungual hyperkeratosis or onychogryphosis ($\chi^2=20.41$, $p=0.01$) and subonycheal dermatophytoma, which complicates the mobilization and surgical removal of affected nails. Good effectiveness of the proposed treatment was established in 284 patients of the main group (87.38%) and in 141 cases of the control group (82.46%). In general, a positive effect from the removal of mycotically affected nails was confirmed in 425 patients (85.69%).

The Obtained Research Data Prove That

The author's developed methods of surgical interventions, based on low-traumatic mobilization and resection/removal of affected nails through onycholated structures, determine a decrease in intraoperative damage to the nail bed ($\chi^2=20.13$, $p=0.01$), reduce the risk of mycotic contamination of other adjacent structures ($\chi^2=27.41$, $p=0.01$); are characterized by a decrease in the intensity of pain ($\chi^2=48.32$, $p=0.01$), a statistically significant increase in the speed of wound healing, the Popova index ($\chi^2=32.14$, $p=0.01$), an improvement in the results of complex treatment and the quality of life of patients. In the postoperative period, we apply dressings with antiseptics, antifungal (antimycotic) ointments and varnishes until the nail(s) grow back completely, according to indications - adequate systemic antifungal therapy. Partial marginal matrixectomy ensures the absence of growth of the nail plate in the area of resection, narrowing the nail and preventing its re-incarnation. Adequate classification criteria of purulent-necrotic complications of onychomycosis are proposed with the selection of the main types of lesions, in each of which clinical variants are differentiated according to the severity of morphological changes, which are of practical importance for the sequence of removal of affected nails. It is claimed that the use of minimally invasive nail removal helps to accelerate the elimination of the fungus and the healing of wounds, improve the results of complex treatment and the quality of life of patients. Adequate classification criteria of purulent-necrotic complications of onychomycosis are proposed with the selection of the main types of lesions, in each of which clinical variants are differentiated according to the severity of morphological changes, which are of practical importance for the sequence of removal of affected nails. It is claimed that the use of minimally invasive nail removal helps to accelerate the elimination of

the fungus and the healing of wounds, improve the results of complex treatment and the quality of life of patients. Adequate classification criteria of purulent-necrotic complications of onychomycosis are proposed with the selection of the main types of lesions, in each of which clinical variants are differentiated according to the severity of morphological changes, which are of practical importance for the sequence of removal of affected nails. It is claimed that the use of minimally invasive nail removal helps to accelerate the elimination of the fungus and the healing of wounds, improve the results of complex treatment and the quality of life of patients [1-14].

Conclusions

For patients with destructive complicated polyonychomycosis, in particular, in the presence of secondary growths against the background of comorbid pathology, in particular, background diabetes, we have developed original methods of surgical interventions based on minimally traumatic mobilization and resection/removal of affected nails through onycholated structures, which determine the reduction of intraoperative damage to the nail bed, ($\chi^2=20.13$, $p=0.01$), reduce the risk of mycotic contamination of other adjacent structures ($\chi^2=27.41$, $p=0.01$); are characterized by a decrease in the intensity of pain ($\chi^2=48.32$, $p=0.01$), a statistically significant increase in the speed of wound healing, the Popova index ($\chi^2=32.14$, $p=0.01$), an improvement in the results of complex treatment and the quality of life of patients. In patients with incarnate onychomycosis, there is the formation of subungual hyperkeratosis or onychogryphosis and dermatophytoma, which complicates the mobilization and surgical removal of affected nails. In our clinic, in the complex treatment of complicated and combined fungal onychodestructions, we use minimally traumatic removal of nail plates in their destructive onychomycotic lesions. We remove the affected nail through onycholised structures using podological pedicure instruments, if there is an ingrowth, we supplement it with other local interventions - excision of pathologically changed eponychial tissues, mechanical and coagulation partial marginal matrixectomy. In the postoperative period, we apply bandages with antiseptics, antifungal (antimycotic) ointments and varnishes until the nail(s) grow back completely.

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