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Clotrimazole as the Standard Treatment for Otomycosis: An Analysis of Effectiveness Compared to Selected Antifungal Treatment Methods in Fungal External Otitis. State-of-the-Art Review

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ABSTRACT

Otomycosis or fungal external otitis is a fungal infection of the external auditory canal, typically caused by *Aspergillus* and *Candida* species. This review aims to summarize current research on the effectiveness of clotrimazole in treating otomycosis, comparing it with other antifungal treatments. Clotrimazole, an azole antifungal, has a broad spectrum of action and is commonly used in otomycosis therapy. The article evaluates its effectiveness against other treatment methods, including other antifungal preparations. Additionally, it discusses the etiology, epidemiology, and risk factors of otomycosis, providing a comprehensive understanding of the condition and the most effective pharmacological interventions. Clotrimazole demonstrates high efficacy against yeasts and fungi causing otomycosis, surpassing other antifungal drugs. Histological and physiological studies on animal models confirm their safety and lack of ototoxic effects, and long-term use in clinical practice is considered safe. Clotrimazole is a secure, affordable, and effective treatment option for otomycosis of the external ear. It delivers the expected results and meets the therapeutic needs of doctors and patients dealing with this condition, bringing satisfaction with the treatment outcomes.

Key words: *Aspergillus*, Clotrimazole, Otomycosis, External Otitis

1. INTRODUCTION

Otomycosis is a superficial fungal infection that affects the external auditory canal and occurs relatively frequently (Bojanović et al., 2023). It typically follows a chronic course and often recurs. It is most commonly unilateral, although bilateral cases are observed in patients with weakened immunity. The infection is facilitated by the specific anatomical structure of the ear, the narrowing of the external auditory canal, and skin damage that disrupts the integrity of the epidermis (Bojanović et al., 2023; Pajczkowska et al., 2017; Nowak & Szyfter, 2008).

The pathogenesis of otomycosis results from maceration of the skin in the external auditory canal by external and internal factors such as moisture, damage, allergies, and diabetes. These lead to a loss of skin elasticity, atrophy of the ceruminous and sebaceous glands, and a change in pH, which increases susceptibility to fungal and bacterial infections. For this reason, patients often report previous use of antibiotic ear drops to treat bacterial infections, and this promotes the growth of fungi (Verse et al., 2016).

Studies have shown that maceration of the skin in the auditory canal, leading to an increase in pH, promotes the growth of fungi. High humidity and temperature can contribute to the moist conditions in the external auditory canal. As a result, otomycosis is particularly common in tropical and subtropical climates, and in temperate zones, it primarily occurs in the summer (Bojanović et al., 2023; Pajczkowska et al., 2017; Abdelazeem et al., 2015; Viswanatha et al., 2012).

The clinical symptoms of otomycosis are typically nonspecific. An acute inflammation is accompanied by an ear canal swelling and the eardrum is not visible. Initially, patients experience a feeling of fullness and pressure in the ear, which later progresses to intense pain that worsens with touch, movement of the auricle, or pressure on the ear lobe. In the chronic phase of inflammation, severe itching of the external auditory canal develops, causing the patient to scratch, which ultimately leading to superinfection with acute dermatitis, with or without perichondritis (Verse et al., 2016). Other symptoms include hearing impairment and tinnitus. Otoscopic examination reveals inflammatory changes, erythematous areas with scaling, and greenish or dark plaques depending on the fungal species (Pajczkowska et al., 2017). A characteristic symptom is the presence of a thin, fluffy mass in otoscopy, easily removable, ranging in color from off-white to yellowish or greenish-black (Verse et al., 2016).

Fungal infections account for about 10% of all external ear infections. The most common pathogens associated with otomycosis are fungi from the *Aspergillus* genus (particularly *Aspergillus flavus* and *Aspergillus niger*), which are responsible for 80-90% of cases, as well as *Candida* spp. (10-20% of cases) (Bojanović et al., 2023).

The treatment of otomycosis can be challenging and requires careful clinical supervision. The foundation of therapy is the mechanical cleaning of the auditory canal while avoiding irrigation to prevent creating a "moist chamber" that promotes fungal growth (Verse et al., 2016). Pharmacological methods include the application of local antifungal drugs and antiseptic agents (Nowak and Szyfter, 2008). The prognosis for fungal infections is worse in individuals with weakened immune systems, as in immunocompromised patients. Otomycosis can progress with serious complications such as hearing loss or mastoiditis (Viswanatha et al., 2012). The disease presents many challenges for patients and otolaryngology specialists, and relapses can occur despite prolonged treatment and close monitoring.

2. METHODOLOGY

The review is an analysis of literature from available sources, including databases such as PubMed, Google Scholar, ScienceDirect, and StatPearls, as well as national journals such as Polish Journal of Otolaryngology. In addition to database searches, standard academic textbooks were also reviewed to provide background and support for clinical context. These included: Diseases of the Ear, Nose, and Throat with Head and Neck Surgery (Verse et al., 2016), and Clinical Otolaryngology (Bochenek & Zakrzewski, 1981). Literature review included studies published between January 1981 and January 2025, with a particular emphasis on research from the past 10–15 years to ensure relevance and timeliness.

3. RESULTS AND DISCUSSION

Clotrimazole - Mechanism of Action

Antifungal medications work by disrupting the integrity and permeability of the fungal cell membrane or cell wall, leading to cell growth inhibition or cell death. Azoles inhibit the synthesis of ergosterol, an essential component of the fungal cell membrane, destabilizing the membrane. Echinocandins block the synthesis of 1,3- β -D-glucan, weakening the cell wall. Polyenes bind to ergosterol in the fungal cell membrane, causing increased permeability (Quindós et al., 2019).

Azoles inhibit the activity of 14- α -demethylase, a cytochrome P-450 (CYP51)-dependent enzyme, which plays a crucial role in ergosterol biosynthesis in fungi and cholesterol synthesis in mammals. The accumulation of 14- α -demethylase in cells treated with azoles disrupts the structure and function of the cell membrane, leading to inhibition of fungal growth (Hitchcock et al., 1990). Clotrimazole is a synthetic imidazole with a broad spectrum of antifungal activity. This is an FDA-approved drug used to treat infections caused by *Candida* spp., dermatophytes, and infections such as oral candidiasis, vulvovaginal candidiasis, and dermatomycosis (Khatter and Khan, 2025). Polyenes and echinocandins are fungicidal, while azoles exhibit fungistatic activity against *Candida* and dermatophytes at therapeutic doses (Quindós et al., 2019).

Clotrimazol - Safety of Use

Patients using clotrimazole for the topical treatment of fungal infections most commonly report a burning sensation as a side effect. Other possible adverse effects include rash, hives, blister formation, pricking, skin peeling, redness, swelling, discomfort, and other irritation symptoms at the application site (Haq and Deshmukh, 2022). Lee et al., (2011) conducted a systematic review of clinical studies that evaluated the efficacy and safety of topical azoles in the treatment of otomycosis. An allergic reaction was the most common adverse effect. The allergic reaction occurred in the form of local hypersensitivity, irritation, redness, and itching. There are reports of potential hearing loss, but there is a lack of precise data regarding its mechanism and frequency.

Tom (2000) assessed the ototoxicity of topical antifungal drugs in guinea pigs by analyzing the loss of hair cells. For a week, antifungal medication was administered to the middle ear. Scanning electron microscopy showed no damage in the lower turns of the cochlea in the untreated group, while neomycin caused the expected loss of hair cells. Clotrimazole, miconazole, and tolinaftate showed no ototoxicity, while nystatin left a deposit in the round window niche. Gentian violet caused vestibular damage and intense bone growth. The results suggest that guinea pigs may be more sensitive to ototoxic substances than humans, but clotrimazole, miconazole, and tolinaftate appear safe.

Isaacson (2020) analyzed three off-label drugs that gained significance in caring for patients with tympanostomy tubes. Only a few drugs are FDA-approved for treating infections in patients with a perforated tympanic membrane or tubes. The effectiveness and safety of a nasal spray with oxymetazoline, a 2% ointment with mupirocin, and a 1% cream with clotrimazole were evaluated. None of these drugs showed ototoxicity either in animal studies or with long-term clinical use. It turned out that the topical application of 1% clotrimazole is safe and effective in treating otomycosis. There were no signs of ototoxicity in experimental models and clinical practice in children with tympanostomy tubes. Azoles have a beneficial use profile and are characterized by a low risk of adverse reactions. The long-term effects of the therapy, especially ototoxicity, remain unknown, so further clinical research is needed (Lee et al., 2011).

Treatment principles for otomycosis

Non-pharmacological approaches focus on cleaning and drying the external auditory canal (Verse et al., 2016). The basis of the treatment is cleaning the external auditory canal from accumulated fungal masses (Nowak and Szyfter, 2008). If possible, it is important to avoid irrigating the ear to prevent a "moist chamber" that promotes fungal growth; therefore, keeping the ear dry is recommended throughout treatment (Verse et al., 2016).

The pharmacological treatment of external ear fungal infections involves the prolonged topical application of antifungal agents and mycelium-destroying substances such as nystatin, iodoform powder, natamycin, hydrocortisone, neomycin, miconazole, clotrimazole, or alcohol-based drops. In more severe or treatment-resistant cases, systemic therapy (itraconazole, ketoconazole) may be necessary for at least 14 days (Nowak and Szyfter, 2008). Specific topical medications include clotrimazole, miconazole, and nystatin, while nonspecific agents include acidifying solutions and gentian violet (Yassin et al., 2023). In topical therapy, the most commonly used medications are clotrimazole or miconazole, often administered with ceftazidime, an antibacterial agent (Haq and Deshmukh, 2022). Clotrimazole is the most commonly used topical azole for otomycosis, with efficacy ranging from 95% to 100%, except for one study that reported a lower efficacy of 50%.

Efficacy of Clotrimazole in Topical Treatment of Otomycosis

Single-Dose Application of 1% Clotrimazole Cream

In a prospective study by Chavan et al., (2022), the efficacy of a single-dose local application of 1% clotrimazole cream in treating otomycosis was assessed, along with the recurrence rate after one month and three months. The study involved 112 patients, with the most commonly isolated pathogen being *Aspergillus niger*. After three days, clinicians removed the cream through suction and conducted clinical follow-ups. After one month, 91.0% of patients showed complete recovery, while 9.0% still had symptoms or experienced a relapse. After three months, the cure rate was 84.8%, with a recurrence rate of 6.3%.

Dundar and İynen (2019) conducted a prospective study involving forty patients diagnosed with unilateral otomycosis. After cleaning the external auditory canal of fungal debris, 1% clotrimazole cream was applied to fill the entire ear canal in all patients. Clinicians conducted follow-up examinations on days 7, 15, and 45 after the medication was applied. After treatment, 38 patients fully recovered from the infection within 7 days of completing the therapy, while two patients showed no improvement. After 45 days following treatment, 39 out of 40 patients reported no symptoms.

The efficacy of clotrimazole in the treatment of recurrent otomycosis

Kiakojuri et al., (2019) performed a clinical study to assess the inhibitory effect of topically applied clotrimazole drops on the recurrence of otomycosis. Clinicians initially screened 207 individuals, confirming the diagnosis in 161 cases (*Aspergillus* spp. – 80%, *Candida* spp. – 19.3%). All participants were treated for 4 weeks with clotrimazole (ointment, drops) along with cleaning and drying of the ear canal. Among the 161 individuals with otomycosis, only 3.1% experienced a recurrence after completing the treatment cycle and showed complete improvement in the disease, according to the otolaryngologist and patient satisfaction with the treatment. This study demonstrated the high efficacy of clotrimazole in the treatment of otomycosis.

In another clinical study conducted by Naqi et al., (2014), 119 patients with confirmed otomycosis participated. All patients applied clotrimazole cream twice a day for two weeks. After completing the treatment, the patients were followed up after 2 weeks to assess the effectiveness of the therapy based on the complete absence of fungal hyphae in microscopic examination. Clinicians observed unsatisfactory treatment outcomes in only 7 (5.88%) out of 119 patients, while achieving satisfactory outcome in the remaining 112 (94.12%) patients.

Isaacson (2020) presented clotrimazole-containing medications for the local treatment of otomycosis in 157 children. After cleaning the ear, the clinician applied a 1% clotrimazole solution into the auditory canals of children with tympanic membrane perforation, followed by daily use for one week. In children with tympanic membrane perforation. Complete recovery was observed in 146 children during the follow-up visit one week after starting the treatment, while the remaining children did not attend the observation. Seven children required repeated therapy, and four returned after a month with a recurrence. The patients did not report any hearing loss.

Clotrimazole, in comparison to betadine and iodine tincture

Further studies on the effectiveness of clotrimazole focused on comparing the treatment outcomes with an iodine-based medicinal product. In a clinical study undertaken by Mofatteh et al., (2018), the effectiveness of clotrimazole and betadine in treating otomycosis among 204 patients was examined in a clinical study. *Aspergillus* spp. accounted for 74% of infections, while *Candida albicans* accounted for 26%. The study group, which had a confirmed diagnosis of otomycosis, was divided into two subgroups: 102 patients received treatment with clotrimazole, and another 102 received treatment with betadine. Clinicians assessed the treatment response in three categories (good, partial, none) on days 4, 10, and 20. By day 20, a good response was observed in 68.6% of patients treated with betadine and 67.6% of those treated with clotrimazole, showing no significant difference between the groups.

Mofatteh et al., (2021) initiated a later clinical study to compare the effectiveness of clotrimazole and iodine tincture in treating otomycosis among 160 patients. *Aspergillus* spp. was the most commonly isolated pathogen. The patients were divided into two groups of 80 each. Researchers evaluated the treatment response on days 4, 10, and 20. They observed a good treatment response in 67.5% of patients using iodine tincture and 62.5% in the clotrimazole group. The results indicate that both treatments demonstrated comparable effectiveness in managing otomycosis.

Clotrimazole in comparison to thiocarbamate

Jimenez-Garcia et al., (2019) conducted a randomized clinical trial comparing clotrimazole and tolnaftate in 48 otomycosis patients, with *Aspergillus niger* as the most common pathogen. Clinicians divided patients into two groups: 28 received a single application of clotrimazole cream for 7 days, while 20 used tolnaftate drops twice daily for the same period. After one week, clinicians observed infection resolution in 75% of the clotrimazole group and 45% of the tolnaftate group. Tolnaftate was linked to higher recurrence (20%)

and treatment failure (15%), requiring greater patient involvement. Clotrimazole was more convenient and cost-effective as it was applied in a medical setting with weekly follow-ups.

Comparative efficacy of azole antifungals

The study by Nemati et al., (2022) assessed the efficacy of sertaconazole, miconazole, clotrimazole, and placebo in 138 patients with otomycosis (230 ears). The patients were divided into four groups and monitored for four weeks. Patients achieved a positive treatment response in 96.43% of patients using sertaconazole, 94.83% with miconazole, 91.38% with clotrimazole, and 79.31% with placebo. Sertaconazole was more effective than miconazole and clotrimazole, especially in terms of total and partial treatment response. The authors recommend further studies on larger samples and in different populations.

Comparison of Antifungal Agents' Efficacy – In Vitro Study

A study by Stern et al., (1988) evaluated 13 antifungal agents for otomycosis pathogens. Clotrimazole showed the largest growth inhibition zone, outperforming nystatin, amphotericin B, miconazole, and natamycin. Tolnaftate was effective only against *Penicillium* sp., while flucytosine lost efficacy after 48 hours. Nystatin was most effective against rare fungi, except *Cryptococcus* sp. Clotrimazole, amphotericin B, and natamycin inhibited 75% of organisms, with clotrimazole and miconazole also showing antibacterial properties. Clotrimazole proved most potent against common fungi, nystatin had the broadest spectrum, and tolnaftate was ineffective.

Combined Therapy Effectiveness - Clotrimazole and Ceftizoxime

In a clinical study by Mahdavi Omran et al., (2018) involving 87 patients with otomycosis, the combined therapy with clotrimazole and ceftizoxime was evaluated. Clinical symptoms improved significantly – pain decreased from 77.8% to 11.1%, swelling from 57.8% to 2.2%, and itching from 84.4% to 15.6%. The control group treated only with clotrimazole had worse treatment results. The study results indicate that adding ceftizoxime increases the chance of curing otomycosis.

All studies presented in Table 1 demonstrate the high efficacy of clotrimazole in the treatment of otomycosis, with various treatment regimens and observation times showing positive results in most cases, both for single and multiple applications of the medication.

Table 1. Summary of Key Findings on Clotrimazole Efficacy in Otomycosis Treatment

Study (Author, Year)	Sample Size	Treatment Regimen	Fungal Pathogens	Follow-up Period	Main Outcomes
Chavan et al., 2022	112 patients	Single application of 1% clotrimazole cream	<i>Aspergillus niger</i> (most common)	1 and 3 months	91.0% recovery at 1 month; 84.8% at 3 months; 6.3% recurrence
Dundar and İynen, 2019	40 patients	Single application of 1% clotrimazole cream; follow-ups on days 7, 15, 45	Not specified	7 and 45 days	38 fully recovered; 1 partial recovery; 1 no response; 97.5% success rate
Kiakojuiri et al., 2019	161 confirmed cases	Clotrimazole drops and/or ointment for 4 weeks	<i>Aspergillus</i> spp. (80%), <i>Candida</i> spp. (19.3%)	Exact timing not specified	96.9% success; 3.1% recurrence
Naqi et al., 2014	119 patients	Clotrimazole cream twice daily for 2 weeks	Not specified	2 weeks post-treatment	94.12% success; 5.88% unsatisfactory outcome
Isaacson, 2020	157 children	Daily 1% clotrimazole solution for 1 week	Not specified	1 week, with 1 month follow-up for some patients	146 recovered (93%); 7 needed retreatment; 4 had recurrence; no hearing loss reported

Mofatteh et al., 2018	204 patients	Clotrimazole vs. Betadine	<i>Aspergillus</i> spp. (74%), <i>Candida albicans</i> (26%)	Days 4, 10 and 20	67.6% good response with clotrimazole; 68.6% good response with betadine; no significant difference
Mofatteh et al., 2021	160 patients	Clotrimazole vs. Iodine tincture	<i>Aspergillus</i> spp. (most common)	Days 4, 10 and 20	67.5% good response with iodine tincture; 62.5% with clotrimazole; comparable efficacy
Jimenez-Garcia et al., 2019	48 patients	Clotrimazole vs. Tolnaftate	<i>Aspergillus niger</i> (most common)	1 week	75% recovery with clotrimazole; 45% with tolnaftate; tolnaftate had higher recurrence rate
Nemati et al., 2022	138 patients	Sertaconazole vs. Miconazole vs. Clotrimazole vs. Placebo	Not specified	4 weeks	Sertaconazole: 96.43% success; Miconazole: 94.83%; Clotrimazole: 91.38%; Placebo: 79.31%
Mahdavi Omran et al., 2018	87 patients	Clotrimazole + Ceftizoxime	Not specified	Exact timing not specified	Significant improvement in pain, swelling, and itching; control group with clotrimazole alone showed worse results

4. CONCLUSIONS

Clinical studies show that clotrimazole is very effective in treating otomycosis, especially in infections caused by *Aspergillus niger*. Clotrimazole exhibits a strong antifungal activity, surpassing the efficacy of other commonly used medications for the treatment of otomycosis, such as miconazole, nystatin, and iodine-based preparations. Some studies have shown that a single application of 1% clotrimazole cream is highly effective, which provides satisfaction with the treatment of otomycosis. While its efficacy is extensively established, we recommend further research to confirm these findings. We also consider clotrimazole as a safe medication, as it does not exhibit ototoxicity, and animal studies have not indicated a risk of hearing damage. However, we recommend further research in this area. Due to its lack of significant systemic side effects, it can be used in combination therapy, such as ceftizoxime, to improve outcomes. Clotrimazole's high efficacy, favorable safety profile, and convenient use, confirmed in the aforementioned clinical trials, make this medication the preferred first-line treatment for otomycosis.

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Author's Contribution

Adrianna Domańska: Project management, conceptualization, literature selection; Aleksandra Łubińska-Kowalska: Conclusions and recommendations; Adrianna Witkowska: Validation, writing – original draft; Julia Piotrowska: Synthesis of results; Antonina Teresa Witkowska: Language correction; Barbara Anna Zapalska: Critical analysis of literature; Krzysztof Julian Długosz: Writing – review

and editing; Agata Żak-Gontarz: Writing – original draft; Aleksandra Minda: Writing – review and editing; Justyna Janikowska: Data analysis; Monika Wendland: Data analysis. All authors contributed in the preparation of the final manuscript.

Informed consent

Not applicable.

Ethical approval

Not applicable.

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Conflict of interest

The authors declare that there is no conflict of interest.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES

- Abdelazeem M, Gamea A, Mubarak H, Elzawawy N. Epidemiology, causative agents, and risk factors affecting human otomycosis infections. *Turk J Med Sci*. 2015;45(4):820-826. doi:10.3906/sag-1407-17.
- Bochenek Z, Zakrzewski A. Clinical otolaryngology. 2nd rev. and updated ed. Warsaw: Państwowy Zakład Wydawnictw Lekarskich; 1981.
- Bojanović M, Stalević M, Arsić-Arsenijević V, Vasiljević D, Đorđević M, Pavlović M, Jovanović M, Stanković S. Etiology, predisposing factors, clinical features and diagnostic procedure of otomycosis: A literature review. *J Fungi*. 2023;9(6):662. doi:10.3390/jof9060662.
- Chavan RP, Ingle SM, GSK Resident. Single topical application of 1% clotrimazole cream in otomycosis. *Indian J Otorhinolaryngol Head Neck Surg*. 2022;75(Suppl 1):147. doi:10.1007/s12070-022-03206-x.
- Dundar R, İynen İ. Single dose topical application of clotrimazole for the treatment of otomycosis: Is this enough? *J Audiol Otol*. 2019;23(1):15-19. doi:10.7874/jao.2018.00276.
- Haq M, Deshmukh P. Review of recurrent otomycosis and clotrimazole in its treatment. *Cureus*. 2022;14(10):e30098. doi:10.7759/cureus.30098.
- Hitchcock CA, Dickinson K, Brown SB, Evans EG, Adams DJ. Interaction of azole antifungal antibiotics with cytochrome P-450-dependent 14 alpha-sterol demethylase purified from *Candida albicans*. *Biochem J*. 1990;266(2):475-480.
- Isaacson G. Oxymetazoline, mupirocin, clotrimazole – safe, effective, off-label agents for tympanostomy tube care. *Ear Nose Throat J*. 2020;99(1_suppl):30S-34S. doi:10.1177/0145561320912885.
- Jimenez-Garcia L, Celis-Aguilar E, Díaz-Pavón G, García-Zúñiga N, Romero A, Sánchez C, Vargas J. Efficacy of topical clotrimazole vs. topical tolnaftate in the treatment of otomycosis: A randomized controlled clinical trial. *Braz J Otorhinolaryngol*. 2019;86(3):300-307. doi:10.1016/j.bjorl.2018.12.007.
- Khatter NJ, Khan MA. Clotrimazole. In: StatPearls. StatPearls Publishing; 2025.
- Kiakoşuri K, Rajabnia R, Mahdavi Omran S, Pournajaf A, Karami M, Taghizadeh Armaki M. Role of clotrimazole in prevention of recurrent otomycosis. *BioMed Res Int*. 2019;2019:5269535. doi:10.1155/2019/5269535.
- Lee A, Tysome JR, Saeed SR. Topical azole treatments for otomycosis. *Cochrane Database Syst Rev*. 2011;9:CD009289. doi:10.1002/14651858.CD009289.
- Mahdavi Omran S, Yousefzade Z, Khafri S, Taghizadeh-Armaki M, Kiakoşuri K. Effect of combination therapy with ceftizoxime and clotrimazole in the treatment of otomycosis. *Curr Med Mycol*. 2018;4(1):18-23. doi:10.18502/cmm.4.1.30.
- Mofatteh MR, Ahi Fersheh M, Nikoomanesh F, Namaei MH. Comparing the therapy of otomycosis using clotrimazole with iodine tincture: A clinical trial. *Iran J Otorhinolaryngol*. 2021;33(117):229-235. doi:10.22038/ijorl.2021.51647.2751.
- Mofatteh MR, Naseripour Yazdi Z, Yousefi M, Namaei MH. Comparison of the recovery rate of otomycosis using betadine and clotrimazole topical treatment. *Braz J Otorhinolaryngol*. 2018;84(4):404-409. doi:10.1016/j.bjorl.2017.04.004.

16. Naqi SA, Bashir F, Khan AM, Mahmud T. Old is gold: Topical clotrimazole remains an effective treatment of otomycosis. *Proceedings-Shaikh Zayed Postgraduate Medical Institute*. 2014;28(1):39-43. Available from: IMEMR.
17. Nemati S, Gerami H, Faghih Habibi A, Keshavarz M, Mansouri M, Ghasemi M. Sertaconazole versus clotrimazole and miconazole creams in the treatment of otomycosis: A placebo-controlled clinical trial. *Iran J Otorhinolaryngol*. 2022;34(120):27-34. doi:10.22038/IJORL.2021.54805.2872.
18. Nowak K, Szyfter W. Problematics of fungal infections in the ear. *Otolaryngol Pol*. 2008;62(3):254-260.
19. Pajęczkowska M, Iciek WM, Iciek G, Jermakow K. Otomycosis of the external ear caused by *Aspergillus* species – a report of three cases. *Otarynolaryngologia - Przegląd Klin*. 2017;16(2): 62-67.
20. Quindós G, Gil-Alonso S, Marcos-Arias C, Sánchez-Sarmiento L, Castro P, Pérez-Díaz A. Therapeutic tools for oral candidiasis: Current and new antifungal drugs. *Med Oral Patol Oral Cir Bucal*. 2019;24(2):e172-e180. doi:10.4317/med oral.22978.
21. Stern JC, Lucente FE, Shah MK. In vitro effectiveness of 13 agents in otomycosis and review of the literature. *The Laryngoscope*. 1988;98(11):1173-1177. doi:10.1288/00005537-198811000-00005.
22. Tom LW. Ototoxicity of common topical antimycotic preparations. *The Laryngoscope*. 2000;110(4):509-516. doi:10.1097/00005537-200004000-00003.
23. Verse T, Gołębek E, Kowalska B, Klusek J. Diseases of the ear, nose, and throat with head and neck surgery. 2nd ed. Wrocław: Edra Urban & Partner; 2016.
24. Viswanatha B, Sumatha D, Vijayashree MS. Otomycosis in immunocompetent and immunocompromised patients: Comparative study and literature review. *Ear Nose Throat J*. 2012;91(3):114-121. doi:10.1177/014556131209100308.
25. Yassin Z, Amirzargar B, Ghasemi R, Valizadeh F, Fattahi M. Comparison of acidifying agents and clotrimazole for treatment of otomycosis: A comprehensive one-way mini-review. *Curr Med Mycol*. 2023;9(2):45-51. doi:10.18502/cmm.2023.345035.1402.