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Editorial

Dear Readers,

It is with immense joy that I assume the role of Editor-in-Chief as we proudly mark the 10th anniversary of Turkish Medical Student Journal (TMSJ).

It is a time where we reflect on a decade of our editors' efforts to make our journal a cherished platform for medical students where they can publish their valuable research. TMSJ still stands as the sole journal of its kind in Türkiye, and our mission to foster scientific research among medical students has never been more important as many of these future physicians are often discouraged from publishing their own findings, or conducting research altogether. For the past decade, our editorial board set an excellent example to medical students by inspiring them to start doing research in the earliest years of their education, paving the way for lifelong commitment to scientific research.

Turkish Medical Student Journal transcends its role as a mere journal, embodying a profound sense of community, friendship, and family. The experience passed down from our predecessors is the very foundation of our endeavours as the editorial board, and it is our duty to preserve and build upon this legacy. Our current and former editors were invited to share their thoughts on this editorial as a celebration of the 10th anniversary of TMSJ.

I would like to express my heartfelt gratitude to each and every single author, reviewer, editor, and reader for their endless support, contributions, and their faith in TMSJ as well as being an integral part of our journey.

Here's to the unwavering spirit that defines Turkish Medical Student Journal. May the next decade grant us the fortitude and wisdom to inspire the upcoming generation of editors.

Eylül Şenödeyici, Editor-in-Chief

As TMSJ celebrates its 10th year, this marks my 4th year with this wonderful team. From the first ever published issue up to today, TMSJ has continuously provided a chance for medical students from all around the world to present their first ever steps into scientific literature. With high publishing standards, akin to those seen in high-ranked journals, TMSJ is rapidly approaching its well-deserved position to be indexed in PUBMED, indicating a very important milestone not only for TMSJ but for any journal in the medical sciences. To me, TMSJ is more than just a journal; it's a cherished family that has warmly guided me through my initial steps into academic world as a medical student, offering a sense of belonging and support far from my home in Türkiye.

Berkin Ersoy, Deputy Editor-in-Chief

For 10 years, TMSJ has been a platform that gives medical students a chance to take part in the scientific publishing community. And in this time TMSJ itself has grown into a community spanning many countries and regions, bringing people that would've had very little chance of meeting together across countries, and doing so under the righteous cause of scientific progress. I feel incredibly privileged to see the growth of this incredible organization from within, and even more so to being a part of this progress. What TMSJ accomplished in 10 years unprecedented in its region and I thank all of my fellow editors for being a part of the journey.

Sarper Kızılkaya, Deputy Editor-in-Chief

I am honored and proud to be a part of TMSJ, Türkiye's first and only indexed medical student journal. TMSJ has taught me so many things along the way, and it will always be a privilege to be a part of this team. As a member of the TMSJ team, it is an honor to create a platform for our enthusiastic authors. I celebrate the 10th anniversary of TMSJ with great pride and happiness!

Zeynep Nihal Er, Deputy Editor-in-Chief

Turkish Medical Student Journal continues to give us hope for progress. We came here alone, but we don't have to leave here alone. We can be part of something better. Happy birthday, TMSJ! Long may you live!

Sıla Ece Tiryaki, Deputy Editor-in-Chief

Being a TMSJ editor-in-chief has been one of the best titles I have ever had in my life! I am grateful for all the great people came into my life through this experience. I deeply appreciate all the editorial board and advisory board members who contributed TMSJ along the way. The best is yet to come!

Kübra Gökçe Tezel, Former Editor-in-Chief

Finding colleagues whom you get along with very well and work together harmoniously is truly a rare miracle. During the five years I worked as an editor at the Turkish Medical Student Journal, I made many valuable friends who are still in my life and will continue to be. I learned new things from everyone I met and worked with. The benefits of working as an editor at the journal has been astronomical. It makes me very proud to take part in this spectacular formation where I found people who became my chosen family. I wish all the best to our journal and our new members to come.

Beliz Koçyiğit, Former Editor-in-Chief

My beloved journal TMSJ, of which I am both an editor and deputy editor-in-chief... Throughout the four years I've been involved, not only has it contributed to our editorial team's scientific vision, but witnessing its international standing, a decade after its establishment, is truly pride-inducing. With our skilled editorial team, being the only indexed medical student journal in Türkiye, I have no doubt that it will continue to achieve many successes in the years to come. Here's to many more years.

Begüm Söyleyici, Former Deputy Editor-in-Chief

Make the most of your time while you are a medical student, even if you don't realise it yet, those are precious times and TMSJ will be one of the good memories in it. I am so glad to have been a part of this, it has contributed a lot to me and I wish many more happy and successful decades for our journal!

Ahmet Emin, Former Editor

Initially TMSJ was just a professional scientific journal for me, but over time it also became a passion, full of friendships. I am so glad to have been a member of this family!

Sezin Sayın, Former Editor

Being an editor is a privileged role in scientific publishing. An editor gets to be a part of the scientific contribution by editing it. Being a TMSJ editor is more than that. We touch medical students' lives by opening up a safe place to take their first steps into the academia. For 10 years, it has been a pride to be a part of TMSJ's mission. It is safe to say this mission wouldn't possible without the team. I am thankful for this.

İlayda Karakoç, Editor

I have recently finished my first year at TMSJ. Besides the joy of being an editor here, the best thing I love about this place is how we are like a family with former and present editors. How heart-warming that our ever-expanding family is celebrating its 10th year now!

Ekin Lâl Akat, Editor

Turkish Medical Student Journal is a place where passion for research, dedication, discipline and teamwork unite while medical students as future physicians create an impact on the scientific literature. As a TMSJ editor, I am honored to be a part of this unique family where I am constantly amazed and inspired by our hard work with my dear colleagues.

İpek Deniz Özkan, Editor

With great joy and honor, I congratulate all of the TMSJ family, from authors to editors, for the 10th year of the Turkish Medical Student Journal. The last year in which I joined the editorial board has been beyond compare and I am ecstatic to keep working with this beautiful group of people.

Emir İskifoğlu, Editor

TMSJ feels like finding a family away from home.

Elif Elveren, Editor

RESTORING SIGHT: EXPLORING CATARACTS AS THE LEADING TREATABLE CAUSE OF BLINDNESS: A NARRATIVE REVIEW

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ABSTRACT

Cataracts are the leading cause of treatable blindness worldwide, affecting millions of individuals. According to the World Health Organization, cataracts account for nearly half of all global blindness making them the leading cause of treatable and preventable blindness. This narrative review aims to explore the global prevalence, modifiable and non-modifiable risk factors, and symptoms of cataracts, as well as the transformative power of cataract surgery. Additionally, it discusses the impact of cataract surgery on visual outcomes and quality of life. The review synthesizes current literature on the global burden of cataracts, highlighting its prevalence across different regions. It examines various non-modifiable risk factors such as age, gender, race/ethnicity, and myopia, as well as modifiable risk factors such as smoking, alcohol consumption, nutrition and ultraviolet radiation exposure in relation to cataract development. It also explores and draws comparisons between the available techniques of cataract surgery such as phacoemulsification, extracapsular cataract extraction, and manual small incision cataract surgery. Understanding the challenges and advancements in cataract management is crucial for healthcare professionals and policymakers striving to address the global burden of blindness. With advancements in surgical techniques and access to quality healthcare, especially in developing countries, millions of individuals globally can be cured of blindness - restoring their sight. By raising awareness about cataracts, their identifiable symptoms and modifiable risk factors, as well as promoting timely interventions, we can work towards eliminating preventable blindness and empowering individuals to regain their vision, leading to a brighter future for all.

Keywords: Blindness, cataract, cataract extraction, quality of life, vision disorder

INTRODUCTION

Blindness, a global public health concern, affects millions of people worldwide, profoundly impacting their quality of life and hindering their ability to perform daily activities, work, and engage with their communities (1). However, amidst this darkness, there is a glimmer of hope: cataracts, the leading treatable cause of blindness (2). Cataracts, characterized by the clouding of the eye's natural lens, can be effectively addressed through surgical intervention, allowing individuals to regain their vision and restore their independence (1). This review article aims to explore the significance of cataracts as a treatable cause of blindness, delving into its global prevalence, risk factors, symptoms, and the transformative power of cataract surgery in restoring vision.

Cataracts have emerged as a major global health issue, affecting people of all ages, races, and socioeconomic backgrounds (3). According to the World Health Organization, the leading contributors to vision impairment and blindness are primarily uncorrected refractive errors and cataracts, with cataracts accounting for approximately 46.53% of global blindness making them the leading cause of treatable blindness (4). While there has been a general decline in prevalence, it is currently estimated that more than 10 million individuals globally suffer from blindness caused by cataracts, and over 35 million people experience moderate to severe vision impairment (5). This alarming statistic highlights the urgent need to address cataracts as a public health priority and underscores the potential impact of interventions on a global scale (2).



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By examining the current state of knowledge and advancements in treatment options, this narrative review seeks to shed light on the impact of cataract interventions, highlighting the potential to alleviate visual impairment and improve the lives of individuals affected by this pervasive condition. In recent decades, significant progress has been made in understanding the epidemiology, risk factors, and development of cataracts, as well as the connection between cataracts and certain systemic diseases (5). Through a greater understanding of the global prevalence, risk factors, symptoms, and advancements in treatment options, healthcare professionals, policymakers, and communities can work collaboratively to prioritize early detection, timely interventions, and improved access to cataract surgical services (5). Ultimately, this collective effort can contribute to reducing the burden of blindness and empowering individuals to lead more fulfilling lives, restoring not only their vision but also their hopes and dreams for the future (5).

Global Prevalence

The World Health Organization estimates that approximately 2.2 billion individuals worldwide are affected by either near or distant vision problems (4, 6). Alarmingly, almost half of these cases, totaling around 1 billion people with vision impairment that remain untreated to this day, could have easily been prevented (4, 6). This group of roughly one billion people can be divided into individuals with near vision impairment as a result of unevaluated presbyopia (826 million), and individuals with preventable blindness (202 million) (4, 6). The group of 202 million individuals with preventable blindness can further be broken down and presented as cataracts (46.53%, 94 million), followed by unaddressed refractive errors (43.76%, 88.4 million), age-related macular degeneration (3.96%, 8 million), glaucoma (3.81%, 7.7 million), and diabetic retinopathy (1.93%, 3.9 million) (4, 6). There are therefore 94 million individuals globally who are blind due to cataracts, that do not have to remain blind, because their cataract-related blindness can be cured through a simple ten-minute surgery (7).

Regional disparities exist in the prevalence of vision impairment as well, low- and middle-income regions have about four times higher rates of distance vision impairment compared to high-income regions (6). More than 90% of individuals in low- and middle-income nations who experience visual impairment caused by cataracts face obstacles in accessing cataract surgery, a relatively straightforward and affordable treatment (8). These barriers include limited awareness of available services, a scarcity of eye care facilities, and the burden of high user fees and transportation costs (8). The prevalence of cataract-related blindness in adults aged 50 years and older has been collected and presented by the Vision Loss Expert Group of the Global Burden of Disease Study as seven separate super regions (6). These super regions as well as their prevalence of cataract-related blindness in adults aged 50 years and older is listed as follows in ascending order (6):

- High-Income Countries, Western Europe & North America (17.50%),
- Central Europe, Eastern Europe & Central Asia (22.40%),
- North Africa & Middle East (33.60%),
- Latin America & Caribbean (35.40%),
- Sub-Saharan Africa (39.80%),
- South-East Asia, East Asia & Oceania (48.30%),
- South Asia (63.10%).

High-income countries such as the United States, Norway and Ireland enjoy the lowest prevalence of cataract-related blindness in adults aged 50 years and older at 17.50%, whereas countries in South Asia such as India, Bangladesh and Pakistan suffer from the highest rates of cataract-related blindness at 63.10% (6). Factors such as aging populations, limited access to eye care services, and socioeconomic disparities contribute to the higher prevalence of cataract-related blindness in these low- and middle-income regions (8). Moreover, the global prevalence of cataracts is expected to rise due to increasing life expectancies and changes in lifestyle factors (8). Understanding the magnitude of the problem and identifying strategies to address the global burden of cataracts are essential for achieving the goal of restoring sight and improving the quality of life for individuals affected by this treatable condition.

Pathophysiology and Classification

Cataracts, a prevalent age-related vision disorder, involve the progressive clouding of the eye's natural lens, leading to impaired vision and potential blindness if left untreated (9). The pathophysiology of cataracts is characterized by the accumulation of protein deposits and oxidative damage within the lens, resulting in its opacity (10). These changes disrupt the lens' transparency and refractive properties, leading to visual disturbances like blurred vision, glare sensitivity, and decreased color perception (10). Cataracts are broadly classified based on their location within the lens: anterior subcapsular cataracts (ASCs), posterior subcapsular cataracts (PSCs), cortical cataracts (CCs), and nuclear cataracts (NCs) (11). ASCs form just beneath the front surface of the lens and may cause significant vision problems, especially with near vision tasks (10). PSCs form just beneath the posterior lens capsule, often causing visual difficulties in bright light conditions (10). CCs develop in the outer edges of the lens, and their growth towards the center interferes with light passage (10). Lastly, NCs occur in the central nucleus of the lens, progressively impacting distance vision and causing a yellowing of vision (10). More than one type of cataract may be present in one patient (10). Prompt diagnosis and appropriate management remain crucial to restore clear vision and enhance the quality of life for affected individuals (10). Figure 1 demonstrates a diagrammatic representation of the eye's lens, and the expected locations of the four aforementioned cataracts (11).

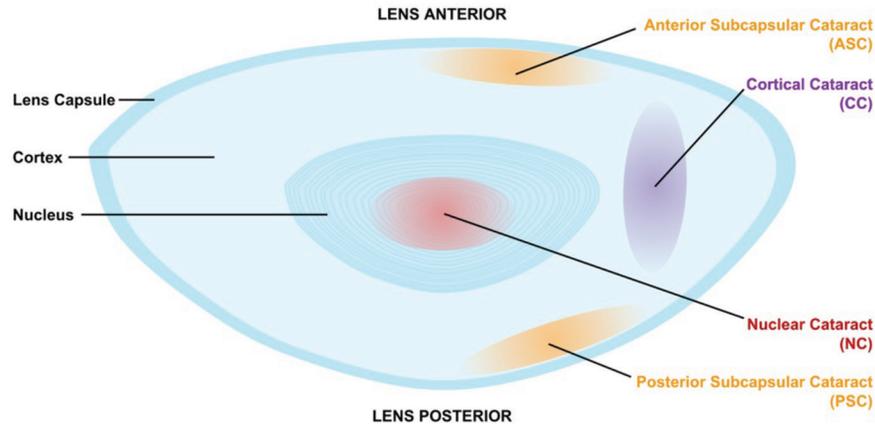


Figure 1: Simplified illustration of a lens and the locations of cataracts.

Symptoms

The symptoms of cataracts can vary depending on the stage and severity of the condition (12). In the early stages, individuals may experience gradual blurring or hazy vision, as if looking through a smudged window (13). As cataracts progress, vision may become increasingly impaired, leading to difficulty in reading, driving, or recognizing faces (13). Sensitivity to light and glare, particularly at night or in bright sunlight, is also common (12). Colors may appear faded or yellowed, and the overall clarity of vision is diminished (12). Some individuals may have frequent changes in their eyeglass prescription without significant improvement in vision (13). Additionally, cataracts can cause double vision in one eye or a halo effect around lights (13). It is important to note that cataracts do not cause pain, redness, or discharge from the eye (12). Recognizing these symptoms and seeking early medical intervention can greatly improve the chances of successful treatment and restoration of visual function (12). The diagnosis of cataracts is typically determined through a slit-lamp examination performed after the dilation of the pupils (12). This examination enables the classification of the opacity patterns based on their anatomical distribution, which can assist in guiding any further investigations related to the underlying causes (12). The Lens Opacities Classification System III is a commonly employed subjective grading system that is widely utilized to evaluate the severity of cataracts (14).

Risk Factors

Understanding the risk factors associated with cataracts is crucial for effective prevention and management strategies (5). Series of both non-modifiable as well as modifiable risk factors that contribute to the development of cataracts have been identified (5).

Non-modifiable Risk Factors

Several non-modifiable risk factors have been identified in association with cataract development (5). Age is the most significant non-modifiable risk factor, as the incidence and severity of cataracts increase substantially with advancing age (5). According to the findings of the Beaver Dam Eye Study, a

population-based cohort examining the incidence of age-related diseases of the eye in around five thousand participants, there was a noticeable rise in the incidence of PSCs, CCs, and NCs with advancing age (15). The study revealed a significant increase in the overall occurrence of NCs, which escalated from 2.9% in individuals between the ages of 43 and 54, to a striking 40% in those aged 75 or above (15). Similar patterns of cumulative incidence were observed with age for CCs and PSCs (15). The incidence of CCs exhibited a notable rise from 1.9% in those aged between 43 and 54 to 21.8% in those aged 75 and above, while PSCs increased from 1.4% to 7.3% (15). Similar findings were observed in the Blue Mountains Eye Study in Australia, confirming an increase in incidence as well as severity of cataracts with advancing age (16). Another non-modifiable risk factor is gender, particularly the decline in estrogen levels during menopause, which has been suggested to contribute to cataract formation (5). There is a hypothesis suggesting that estrogen might possess a safeguarding influence on the development of cataracts (17). It is well known that estrogen has protective effects against cardiovascular as well as neurodegenerative diseases (18). Lower levels of cataract surgery incidence were observed in women with a larger accumulation of reproductive years, and therefore exposure to estrogen, indicating a protective effect of estrogen against cataract formation (19). The Barbados Eye Study consisting of 4,709 participants over five years compared the prevalence of cataracts between men and women among five separate age groups; 40-49, 50-59, 60-69, 70-79, and those above the age of 80 (20). The average age of menopause onset globally is estimated to be 48.8 years as of 2022 (21). The Barbados Eye Study included an age group of 40-49 which provides information on the prevalence of cataracts in women prior to or during the beginning of menopause, where the effects of estrogen deprivation have not yet made themselves apparent (20). In the age group of 40-49, the prevalence of cataracts is reported to be 4.2% in women and 4.3% in men [relative risk (RR) 0.98, 95% confidence interval (CI) 0.58-1.65], indicating that pre-menopausal women or women that recently had menopause onset have a lower prevalence of cataracts than men (20). However, moving to the

age group of 50-59, the prevalence increases drastically, with women showing a rate of 24.2% and men at 18.6% (RR 1.30, 95% CI 1.02-1.65) (20). The most notable increase is observed in the 60-69 age group, with the prevalence of cataracts reaching 55.2% in women and 40.0% in men (RR 1.38, 95% CI 1.20-1.59) (20). This trend continues in the 70-79 age group, with women having a prevalence of 72.4% and men 65.7% (RR 1.10, 95% CI 0.99-1.22) (20). The final increase is observed in the age group of ≥ 80 , where the prevalence of cataracts in women was a staggering 85.3%, in comparison to their male counterparts with a prevalence of 82.9% (RR 1.03, 95% CI 0.91-1.17) (20). The only age group where women had a lower prevalence of cataracts in comparison to their male counterparts was in the 40-49 age group before the onset of menopause, hinting at the protective role of estrogen in preventing cataract formation (20). Consequently, the decline in estrogen levels that occurs during menopause may potentially elevate the susceptibility of women to cataract development (17). Studies have demonstrated the presence of estrogen receptors on the lens epithelium, and *in vitro* experiments conducted on animals have revealed a considerable reduction in lens opacity among rats treated with estradiol (E2) and estrone (E1) (17). Nevertheless, the existing evidence remains inconclusive, and additional investigations are warranted to gain a comprehensive understanding of the precise impact of estrogen on the development of cataracts (17). Additionally, race/ethnicity plays a role, with studies indicating that individuals of African and Asian descent are at higher risk compared to Caucasians (5). In the Salisbury Eye Evaluation Study, a comparison was made between the rates of lens opacity progression and incidence among older African Americans and Caucasians in the United States (22). The findings revealed that African Americans exhibited higher incidence and progression rates of CCs when compared to Caucasians (22). According to the Singapore Epidemiology of Eye Disease Study, a study conducted on more than ten thousand Asian adults including Chinese, Malaysian and Indian participants, cataract occurrence was found to be twice as prevalent among Asians and manifested approximately 10 years earlier compared to Caucasians (23).

Lastly, myopia has been associated with an increased risk of cataracts, although the exact mechanisms underlying this relationship require further investigation (5). In a meta-analysis study, twelve population-based studies involving nearly forty thousand participants were analyzed, and the findings indicated a positive correlation between myopia and the growing prevalence of NCs and PSCs (24). While conflicting data exist on this matter, some studies suggest that the presence of myopia does not seem to predispose individuals to cataracts (25). Instead, it is proposed that the increase in cataract development may lead to refractive changes resulting in myopia (25).

Modifiable Risk Factors

While certain risk factors for cataracts are beyond individual control, there are several modifiable factors that individuals can actively address to reduce their risk (5). Smoking has

consistently been linked to an increased risk of cataract development, and quitting smoking has been shown to decrease the risk over time (5). Researchers from the Beaver Dam Eye Study discovered a significant association between smoking and a heightened occurrence of NCs (26). Notably, this association persisted even after adjusting for age and sex (26). The Korea National Health and Nutrition Examination Survey, a cross-sectional study conducted on more than fifteen thousand participants, yielded similar outcomes, demonstrating that smoking was linked to a heightened risk of NCs among both men and women (27). Cannabis smoking has also been linked to an increased incidence of cataract development, with cannabis users developing cataracts 5 years earlier than individuals that did not smoke cannabis (28). It is not surprising to find a connection between cannabis smoking and the emergence of cataracts (28). Tobacco smoke and cannabis smoke are similar in that they both contain a plethora of organic and inorganic chemical compounds (28). Cannabis tar exhibits chemical similarities to the tar found in tobacco smoke, and more than fifty known carcinogens, such as nitrosamines and reactive aldehydes have been identified in cannabis smoke (28).

Lower-income and education level have also been identified as modifiable risk factors, possibly due to limited access to healthcare and lower health literacy (5). Higher incidences of cataracts are observed in those with lower household incomes as well as lower education levels (27).

Excessive alcohol consumption has been associated with an elevated risk of cataracts, emphasizing the importance of moderation, however the data is not yet conclusive (5). The researchers conducting the Blue Mountain Eye Study found that exceeding a daily consumption of two alcoholic drinks was linked to a higher probability of requiring cataract surgery (29). Notably, they also observed that refraining from alcohol was similarly connected to an increased likelihood of needing cataract surgery, in comparison to consuming one to two drinks per day—indicating that mild alcohol consumption may have a protective effect over cataract development, whereas excessive alcohol consumption may be a causative factor (29). However, a meta-analysis study including nearly one hundred twenty thousand subjects found there to be no association whatsoever between alcohol consumption and the risk for cataract development, indicating that further investigation is warranted (30).

Proper nutrition including a healthy diet made up of vegetables and fruits, as well as multivitamin supplementation may help protect against cataract formation (5). The Antioxidants in Prevention of Cataracts Study, a five-year placebo-controlled clinical trial, concluded that the supplementation of antioxidants such as beta carotene, vitamin C, and vitamin E did not have an impact on the progression of cataracts (31). Another study found that while nutritional supplementation with vitamin C, lutein and zeaxanthin might provide benefits for specific populations such as individuals with inadequate nutrition or heavy smokers, its impact on cataract progression in the

majority of patients is unlikely (32). Despite the differences of opinion with regards to the relationship between nutrition and cataract development, it is suggested that following a nutritious diet that includes fruits and vegetables rich in vitamins A, C and E as well as considering the use of multivitamin supplements might offer some protection against cataracts (33).

Lastly, the role of exposure to ultraviolet (UV) radiation, both from sunlight and artificial sources in cataract development has been implicated, highlighting the need for adequate eye protection and sun avoidance measures (5). It is thought that oxidative stress from UV radiation exposure and the consequent inflammation contribute to the development of cataracts (34). While the lens has the ability to absorb both UV-A and UV-B radiation, research indicates that UV-B radiation is the main culprit responsible for the development of cataracts (35). In a study involving more than eight hundred watermen working on Chesapeake Bay, it was observed that high cumulative levels of UV-B exposure substantially raised the risk of CCs (35). It was found that watermen whose average annual exposure to UV-B radiation in the upper quartile had a 3.3 times greater risk of developing CCs than those whose average annual exposure to UV-B radiation was in the lowest quartile (35). More recent studies have further substantiated this finding by demonstrating a higher prevalence of CCs among individuals working in outdoor occupations (34).

Cataracts are a multifactorial eye condition influenced by a combination of non-modifiable and modifiable risk factors (5). While age, estrogen levels, race/ethnicity, and myopia are non-modifiable risk factors, individuals can take proactive steps to address modifiable risk factors such as smoking, income, education, alcohol consumption, nutrition, and UV radiation exposure (16, 19, 22, 24, 26, 27, 29, 35). Public health efforts should focus on raising awareness about these risk factors, promoting healthy behaviors, and implementing preventive measures to reduce the burden of cataracts and preserve visual health in populations worldwide.

Treatment and the Transformative Power of Cataract Surgery

Cataract surgery has revolutionized the treatment of cataracts and has become one of the most transformative interventions in modern medicine (36). The surgical removal of the clouded lens and its replacement with an artificial intraocular lens (IOL) has proven to be highly effective in restoring vision and improving visual function in individuals with cataracts (36). This procedure is typically performed on an outpatient basis and has a high success rate (36). A procedure that previously necessitated a hospital stay and lengthy visual recovery has now been transformed into a quick day-case procedure, thanks to advancements in technology (36). Advanced techniques such as phacoemulsification, which uses ultrasound waves to break up the cataract for removal, have made the surgery less invasive and facilitated faster recovery times (37). Additionally, the availability of various types of IOLs, including those that correct astigmatism, has further enhanced the outcomes of cataract

surgery (38). The transformative power of cataract surgery extends beyond the restoration of vision, it often brings about a significant improvement in the quality of life for individuals affected by cataracts (39). Reduced visual function, irrespective of its underlying causes, is linked to a decline in quality of life and limitations in everyday functional activities (39). Studies have shown that cataract surgery not only improves visual acuity but also enhances independence, social interaction, and overall well-being (39-41). As cataracts continue to be a leading cause of blindness globally, ensuring access to high-quality cataract surgery and post-operative care remains crucial in the effort to restore vision and alleviate the burden of blindness (36).

There are several different types of cataract surgery techniques, with certain procedures being preferred over others due to factors such as precision, minimally invasive nature, recovery times, risk of complications, lens options, and surgeon expertise and preference (42-44). The choice of technique depends on individual patient factors and desired outcomes that are determined during the preoperative evaluation of the patient (45).

Phacoemulsification

Phacoemulsification, which derives its name from the Greek term for lens "phakos", is a modern surgical technique used to remove a cataract by emulsifying it (46). It is the most common method for cataract surgery and involves using an ultrasonic device to break up the cloudy lens into tiny fragments (46). These fragments are then gently suctioned out of the eye through small corneal incisions that are typically 2 to 3 millimeters in size (47). Once the cataract is removed, an artificial IOL is usually implanted to restore clear vision (48). Phacoemulsification is widely practiced across the globe and is considered the standard technique for cataract surgery in developed countries as well as many developing nations, however its use in developing countries is limited due to higher costs of the procedure (49). The average cost of phacoemulsification surgery can vary depending on factors such as the geographical location, the surgical facility, the surgeon's experience, and the type of IOL chosen (50). The average cost of cataract surgery by phacoemulsification can be as low as 25.55 United States dollar (USD) per eye in developing countries such as India, up to 4,030 USD per eye in developed countries such as the United States (50, 51). Expected outcomes of phacoemulsification surgery are generally positive (52). Patients can experience improved visual acuity and clarity following the removal of the cataract (52). The procedure is known for its rapid recovery time, minimal discomfort, and reduced risk of complications compared to older techniques such as extracapsular cataract extraction (ECCE) (52, 53). Many patients report enhanced quality of life and the ability to resume daily activities with improved vision after undergoing phacoemulsification surgery (54).

Extracapsular Cataract Extraction

Extracapsular cataract extraction is a surgical technique used to remove a cataract where the surgeon removes the cloudy lens

while leaving the posterior capsule intact (43). It is commonly used in developing regions where resources for advanced techniques like phacoemulsification may be limited (49). The average cost of ECCE can range anywhere from 16.25 USD per eye in developing countries such as India, up to 1,500 USD per eye in developed countries such as the United States (50). The expected outcomes include improved vision but with a longer recovery time and a slightly higher risk of complications compared to more modern techniques like phacoemulsification or laser-assisted surgeries (49).

Intracapsular Cataract Extraction

Intracapsular cataract extraction (ICCE) is a surgical technique used to remove a cataract where both the cloudy lens and the surrounding lens capsule are removed together (55). This older technique is now rarely performed due to advancements in cataract surgery (55). Modern techniques like phacoemulsification have largely replaced the use of ICCE as the procedure is associated with higher risks and complications (56).

Laser-assisted Cataract Surgery

Laser-assisted cataract surgery (LACS) is a modern technique where a femtosecond laser is used to assist in various steps of cataract removal, including creating precise incisions, opening the lens capsule, and fragmenting the cataract for removal (57). LACS is commonly used in developed countries where advanced technology is available such as the United States, with the average cost of surgery being 4,365 USD per eye (51). Expected outcomes often include improved visual acuity, faster recovery, reduced risk of complications, and the potential for enhanced precision in creating incisions and positioning the IOL (57-59). This breakthrough technology has shown potential in enhancing cataract surgery outcomes when compared to all other existing surgical methods, leading to its recognition as a significant advancement in the field of cataract surgery (51).

Manual Small Incision Cataract Surgery

Manual small incision cataract surgery (MSICS) is a surgical technique used to remove a cataract through a small incision, typically around 6 to 7 millimeters in size (60). The surgeon manually removes the cataract and implants an IOL to restore vision (60). MSICS has undergone significant improvements in recent decades, resulting in comparable outcomes to phacoemulsification in specific situations (61). This type of surgery is commonly used in developing countries where access to advanced technology like phacoemulsification or laser-assisted surgeries may be limited (62). The cost-effectiveness and efficiency of MSICS make it a crucial approach in the global effort to combat cataract-related blindness (61). The average cost of MSICS can range anywhere from 17.03 USD per eye in developing countries such as India, up to 600 USD per eye in developed countries (50). Expected outcomes include improved vision, but the recovery time may be slightly longer compared

to more advanced techniques, and there is a slightly higher risk of postoperative complications such as astigmatism when compared to phacoemulsification (63). However, MSICS is still considered an effective and cost-efficient alternative for cataract surgery in resource-constrained settings (61-63).

The choice of cataract surgery technique is influenced by several factors including cost of surgery, access to advanced technology, and surgeon preference (36-38). While newer techniques like phacoemulsification and LACS offer advantages such as faster recovery, reduced risk of complications, and precise outcomes, traditional methods like ECCE or MSICS still have a role in specific situations, particularly in resource-constrained settings (49, 52, 57, 63). Understanding the individual patient's needs, available resources, and surgical expertise is crucial in determining the most suitable approach, ensuring optimal outcomes and patient satisfaction in cataract surgery (45).

CONCLUSION

In conclusion, this brief narrative review article has provided a concise yet comprehensive overview of the significance of cataracts as the primary treatable cause of blindness and the various interventions available for restoring sight. Through an exploration of the global prevalence, risk factors, symptoms, and treatment options, we have gained valuable insights into the potential of cataract surgery and its impact on improving visual impairment worldwide. With advancements in surgical techniques and access to quality healthcare, especially in developing countries, millions of individuals globally can be cured of blindness - restoring their vision. By raising awareness about cataracts, its identifiable symptoms and modifiable risk factors, as well as promoting timely interventions, we can work towards eliminating preventable blindness and empowering individuals to regain their sight, leading to a brighter future for all.

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POLYCYSTIC OVARY SYNDROME (PCOS) PATHOGENESIS, DIAGNOSIS, AND COMMON TREATMENT OPTIONS: A LITERATURE REVIEW

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ABSTRACT

Polycystic ovary syndrome stands out among other syndromes in women of reproductive age in terms of prevalence. It can be identified with the presence of at least two of these three key symptoms: irregular cycles, hyperandrogenism, and polycystic ovary morphology. Even though the etiology is uncertain, the syndrome occurs due to both genetic and environmental factors. Additionally, polycystic ovary syndrome comes with other comorbidities such as infertility, thyroid diseases, abdominal obesity, insulin resistance, and diabetes. Its multifactorial nature with different clinical representations, requires various alternatives for treatment and symptom management. This review aims to understand the underlying causes of the syndrome and to correlate this understanding with symptom management approaches.

Keywords: Hyperandrogenism, ovulation, polycystic ovary syndrome

INTRODUCTION

Polycystic ovary syndrome (PCOS) stands out among other syndromes in women of reproductive age in terms of prevalence (1). There are three key symptoms to identify PCOS: irregular cycles, hyperandrogenism, and polycystic ovary morphology (PCOM) (1). In 1935 Stein and Leventhal (2) identified this condition in their paper titled "Amenorrhea Associated with Bilateral Polycystic Ovaries". They found that PCOM is correlated with several other major and minor manifestations. According to their study, these manifestations are amenorrhea, oligomenorrhea, infertility, masculinizing changes such as hirsutism, goiter, and obesity (2). Due to the history and manifestation of the syndrome, PCOS can be named "Stein-Leventhal syndrome" or "hyperandrogenic anovulation". Despite the diagnostic criteria having slight changes and additions, the same characteristics are used for both identification and diagnosis (1, 2). Even though the etiology is not certain, it is known that both environmental factors and genetics play a

role in this manifestation (3, 4). Parallel to PCOS, some other conditions such as infertility, thyroid diseases, abdominal obesity, insulin resistance (IR), and diabetes may occur (4). Due to its multifactorial nature with different clinical presentations, there is a wide range of options for treatment and symptom management (5). This review aims to understand the underlying structure of the syndrome and to correlate this understanding with symptom management approaches.

Epidemiology

Polycystic ovary syndrome is considered a multifactorial and heterogenous syndrome (4, 6). It is known that the diagnosis rate of females who have this syndrome can be 6-20%, depending on the population (4). One study suggests that 35% of the mothers and 40% of the sisters of premenopausal untreated PCOS patients also have the syndrome, proving the effect of genetics (7). It is also mentioned that single nucleotide polymorphism and epigenetic modifications due to exposures are also contributing to the prevalence (8). Lifestyle, socioeconomic status, and



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environmental factors have an impact on this situation as well (7, 9). Prevalence may vary between populations. The severity of symptoms also varies between races (9). Hirsutism can be given as an example of symptoms that differ in severity as it is found that hirsutism is more common and severe in South Asian, Indian, Mediterranean, and Middle Eastern women than in some of the Caucasian races and East Asian women (9).

Diagnosis

Core diagnostic criteria of PCOS are the presence of at least two out of the following three elements: hyperandrogenism, ovulatory dysfunction, and PCOM (1, 10). IR and obesity are common, yet they do not directly indicate the presence of the syndrome (10).

Hyperandrogenism is divided into two main categories: biochemical and clinical (10). Biochemical hyperandrogenism is identified with mild to moderately elevated serum levels of androgenic precursors such as dehydroepiandrosterone sulfate (DHEAS), androstenedione (A4), and proper forms of androgens such as testosterone (T4) (11). Major clinical manifestation of hyperandrogenism is hirsutism, whereas alopecia and acne are the minor clinical manifestations (10, 11). Hirsutism can be assessed by the Ferriman-Gallwey index by scoring the growth of hair from 0 to 4 hair in the chest, chin, upper lip, upper arm, upper and lower back, upper and lower abdomen, and thighs (10). If this index is greater than a total score of 4 to 6, it can be identified as hirsutism (10).

Ovulatory dysfunction clinically represents itself with amenorrhea, which means the absence of menstruation, or oligomenorrhea that is defined as 35 days or more between menstrual cycles or less than 8 cycles a year (1, 10). It is caused by a deficiency of follicle-stimulating hormone (FSH) and overproduction of luteinizing hormone (LH), leading follicles to mature into antral follicles, yet not causing enough stimulation for ovulation (3).

Polycystic ovary morphology context covers ultrasound images with more than 12 follicles per ovary, and/or more than 20 follicles in both ovaries with an ovarian volume greater than 10 cm³ (1). Primordial follicles grow into preantral and antral follicles, causing PCOM (12). LH, FSH, and estradiol levels have additional significance in diagnosis (13). Increased LH to FSH ratio is especially significant due to the increased gonadotropin hormone-releasing hormone (GnRH) pulse frequency, indicating the presence of the syndrome (3, 13). This situation mainly occurs due to excess LH and ovarian androgens or excess LH stimulation (3, 12).

Studies suggest that having PCOM does not imply having PCOS directly likewise, having ovulatory dysfunction and hyperandrogenism could not be evidence alone (1, 12, 13). According to Rotterdam criteria, a patient must possess two of the three main symptoms to be diagnosed with PCOS (1). Due to the combinations of the symptoms, PCOS patients fall under 4 phenotypes (1, 10, 12):

- A. Classic (Complete) PCOS: All symptoms are present,
 - B. Classic PCOS: Hyperandrogenism and oligo-anovulation,
 - C. Ovulatory PCOS: Hyperandrogenism and PCOM,
 - D. Non-hyperandrogenic PCOS: Oligo-anovulation and PCOM.
- When these 4 phenotypes are compared, phenotypes A and B tend to show symptoms more severely (1, 10). Phenotype D is known as the mildest form and phenotype C falls between A-B and D, in terms of severity (1, 10).

Etiology and Pathogenesis

Polycystic ovary syndrome is a syndrome that is composed of multiple hereditary and environmental elements (14). Symptoms occur when inherited factors meet with environmental exposure, including heavy metals, endocrine-disrupting chemicals, and pesticides (3, 14). As an example of many endocrine-disrupting chemicals, Bisphenol A (BPA), a compound utilized in the plastic industry, is detected higher in serum concentration in PCOS patients than in healthy individuals (15). BPA disrupts the endocrine system by interacting with estrogen receptors, correlating with increased T4 and free androgen index (15). Therefore, it can be said that plastic utilization has an impact on PCOS (16). Other examples of endocrine-disrupting chemicals include perfluorooctanoate and perfluorooctane sulfonate (14).

It is also known that lifestyle greatly affects the course of PCOS (14, 16). It is found that smoking or being exposed to smoke has a relationship with oligo-anovulation (3, 16). Mitochondrial dysfunction and oxidative stress resulting from the reduction in glutathione and decreased levels of antioxidants cause the inability to reduce reactive oxygen species or toxins causing early luteinization of primordial follicles (3, 16). Snoring and obstructive sleep apnea also contribute to the condition (17). These sleep disorders are observed in PCOS patients with obesity (17). In rats, it is observed that an over-eating and high-fat diet lowers folliculogenesis and the quality of oocytes (18). It is also proven that high body mass index (BMI) is associated with PCOS, low oocyte quality, and a higher risk of miscarriage (18).

High BMI is a risk factor for both IR and central obesity (19, 20). PCOS can occur with high BMI, not correlating with sex hormone levels (19). High BMI is one of the reasons for IR (21). When IR meets with underlying genetic material for PCOS, it enhances the symptoms (21). Excessive insulin levels cause theca cells to secrete androgens which cause PCOM (3).

Genetic sisters, mothers, and fathers of PCOS patients have a higher prevalence of IR and type II diabetes (22, 23). Since insulin has an impact on the metabolic pathways of carbohydrates, proteins, and lipids, it also imitates the action of LH and causes excessive androgen output by raising GnRH pulse frequency (3, 24). Additionally, IR lowers the synthesis of sex hormone-binding globulin (SHBG) in the liver, resulting in increased free androgen levels in circulation (24).

Androgen exposure enhances the signs of PCOS. Another cause of developing PCOS more frequently is to be exposed to

high levels of prenatal androgens (24). Aromatase deficiency or abnormality is another reason for hyperandrogenism (8). Due to the lack of functioning aromatase, conversion from testosterone to estradiol drops, leading to excess androgens (8). It is important to mention that many other genes related to PCOS can be listed (8).

Anti-Müllerian hormone (AMH) is one of the indicators of PCOS. AMH is responsible for the maturation and development of follicles. Over-secretion of AMH can cause ovary malfunction (25). AMH and its receptor variants which are low functioning, cause 6.7% of PCOS cases (14).

Post-translational modifications are also contributing to the syndrome, yet these mechanisms can be used in therapeutic ways to reduce the symptoms of PCOS (26).

Fertility issues occur due to the changes in the microenvironments of the follicles, resulting in a lack of oocyte quality, and implantation issues due to the changes in the endometrium (4). As it was described, it is an endocrine disorder that can cause fertility issues, and diagnosis and symptom management are fundamental (4). Many options, such as lifestyle changes, weight loss, pharmacotherapy, and procedures such as laparoscopic ovarian surgery and assisted reproduction techniques, can help with conception (27).

Common Treatment Options

There is no cure for PCOS itself (25). Treatment options are considered for each patient individually, due to multiple mechanisms and different phenotypes (3, 25). Also, it is vital to know that lifestyle has a great impact on pathogenesis (3, 16). Modifications in daily life can be helpful for overall symptom management (3, 16). Exercising regularly and having a healthy diet help reduce BMI, which in turn helps with insulin sensitivity and increases metabolic rate, thus decreasing insulin levels (5).

Combined oral contraceptives (OCs) are the first-line drugs that are used in PCOS treatment (3, 28). They consist of estrogens and progesterone. They are primarily used to regulate menstruation and decrease the severity of hyperandrogenism symptoms (28). Another property of combined OCs is triggering the liver for the synthesis of SHBG (14). As a result of increased SHBG concentration, free T4 levels decrease. Combined OCs with progesterone are also helping with the suppression of LH secretion (28).

Antiandrogens are a group of drugs that suppress androgen effects by competitively binding to androgen receptors. Additionally, they are the first-line medication for hirsutism. Cyproterone acetate, spironolactone, and flutamide can be counted in this group (25).

Ovulation inducers are a suitable form of treatment for anovulatory sterility caused by PCOS (3, 27). Clomiphene citrate, a first-line medication for ovulatory dysfunction, competitively binds to estrogen receptors at the hypothalamus and pituitary level, turns down the negative feedback effect of

estrogen, and increases FSH (25). Aromatase inhibitors are also effective for ovulatory dysfunction because they prevent the conversion of T4 to estradiol, causing positive feedback on the hypothalamic-pituitary-ovarian axis (3). This positive feedback results in GnRH secretion, followed by FSH release and follicular stimulation (3).

Insulin-sensitizing drugs are used for IR primarily (3, 5, 25). Metformin, a biguanide drug, is used as first-line and thiazolidinediones as second-line medication (25). When insulin levels normalize, the severity of the symptoms decreases, and the menstruation cycle improves (29). Insulin sensitization reduces insulin levels, reverting the negative effects of insulin on ovaries (3).

Inositol is a carbocyclic sugar that can be used as a dietary supplement with a low risk of adverse effects (5). It works as a secondary messenger in important mechanisms such as thyroid-stimulating hormone or glycogen synthesis (3). Two of many types of inositol are discussed for PCOS. One is myo-inositol, which acts on glucose intake and metabolism while taking part in FSH signaling. The other is D-chiro-inositol, which controls glycogen synthesis and is effective in androgen production caused by hyperinsulinemia (30).

CONCLUSION

Polycystic ovary syndrome is a multifactorial and heterogeneous syndrome affecting women of all age groups (4, 6). It has three main criteria: irregular cycles, hyperandrogenism, and PCOM (1). PCOS is composed of multiple hereditary and environmental elements (14). Due to its multifactorial nature patients come with different phenotypes (1, 3). In addition to infertility, thyroid diseases, abdominal obesity, IR, and diabetes may occur, depending on the patient (4). There is no cure for the syndrome itself and treatment options should be evaluated for each patient individually (3, 25). Lifestyle and habits take a great place in pathogenesis, positive changes in daily life can be beneficial for the individual (3, 16).

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THE EVALUATION OF SURGICAL HAND RUBBING COMPLIANCE WITH THE USE OF FLUORESCENT ALCOHOL BASED HAND ANTISEPTIC ULTRAVIOLET LAMP METHOD

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ABSTRACT

Aims: This study aims to evaluate the knowledge, attitude, and compliance of the students working in the sterile area of the operating room on the surgical hand preparation procedure using the ultraviolet lamp method.

Methods: The study was planned as a cross-sectional research and was carried out at the surgical technology department. This study was conducted with a total of 94 first- and second-year surgical technology students. The data was collected through "the introductory information, hand hygiene, and attitude form", and photographs were taken under a ultraviolet lamp after a surgical hand preparation procedure using fluorescent alcohol-based hand antiseptic. Compliance with surgical hand rubbing was evaluated based on the duration, technique, and efficiency of this procedure.

Results: The study was conducted on a total of 94 first- and second-year surgical technology students. Of the students, 67 (71.3%) were female, 52 (55.3%) were in the first year, and the most preferred surgical hand preparation procedure was surgical hand scrubbing (n=89, 94.7%). Only 19 (20.2%) of the students stated that they fully complied with the surgical hand preparation procedure. The students' knowledge was moderate, and their attitudes were positive. The median value for students' surgical hand preparation duration was 1.5 (1.24-2.51) minutes. The median alcohol-based hand antiseptic uncovered area percentage was larger for the left- and right-hand dorsal surfaces than the palmar surface. In both arms, the median percentage of the uncovered area was higher in the proximal than in the distal regions, whereas alcohol-based hand antiseptic intensity was lower in the proximal regions. The duration of surgical hand preparation was negatively correlated with the percentage of the area and positively correlated with the effectiveness of the procedure.

Conclusion: Students had a lack of knowledge and practice regarding the surgical hand rubbing/scrubbing procedure. Since the duration of surgical hand preparation was closely related to the technique and effectiveness, prolonging this period may improve the correct execution of this procedure. This is the first study to evaluate the effectiveness of UV lamps in surgical hand preparation procedures, and additional studies are needed.

Keywords: Alcohol-based hand rubs, operating room, students, surgical hand preparation, ultraviolet lamp

INTRODUCTION

Surgical site infections (SSIs) are a serious problem that can cause prolonged and repeated hospitalizations, loss of labor, additional surgical procedures, increased treatment costs, and mortality (1, 2). The World Health Organization (WHO) has indicated that the incidence of SSIs is 11.2%, which means one

in three patients who underwent a surgical operation in low and middle-income countries have been affected by SSIs (1). In addition, this condition constitutes the second-most common cause of hospital-related infections in Europe and America (1).

According to the guidelines prepared by the WHO on the prevention of SSIs, preoperative surgical hand preparation takes place among factors that can be controlled (1, 2).



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Each person working in the sterile area of the operating room must perform the surgical hand preparation effectively to prevent contamination caused by medical personnel.

Surgical hand preparation may be carried out as surgical hand scrubbing (SHS) using antibacterial solutions and water or as surgical hand rubbing (SHR) using alcohol-based antiseptics (ABHA). Among these two methods, the preference for SHR is due to its ease of application as well as the absence of complications such as dryness on the hands, skin irritation, and allergic reactions due to SHS (3-6). However, studies carried out with medical personnel indicate that there are deficiencies in their knowledge and implementation of the SHR and SHS (7-9). Although it is stated that, along with medical personnel, students may also increase the risk of infection due to their lack of knowledge and skills, the number of studies evaluating the surgical hand preparation practices of students working in operating rooms is limited (10, 11).

The effectiveness of surgical hand preparation may be monitored using various methods. One of these methods is microbiological evaluation, in which bacteriological samples are taken from the surface of the hand and forearm before and after the procedure. Another one is the evaluation by the ultraviolet (UV) lamp method, which has been used frequently for hand washing control, yet there aren't any studies on its application for surgical hand preparation assessment in the literature. In this method, a disinfectant solution mixed with a fluorescent dye is used for surgical hand preparation, and the coverage of the hands and forearms is checked under a UV light lamp. The quality of the application of surgical hand preparation is suitable if all areas of the hands and forearms are covered homogeneously with the fluorescent hand rub solution (10-12).

In the evaluation of the compliance of the duration of SHR and SHS, the WHO guideline was accepted as a basis, and any duration under three minutes was evaluated as "unsuitable surgical hand rubbing" (1). Effective application of surgical hand preparation can be expected only from qualified and trained staff personnel (11). It is important for the operating room nurses, who are members of the professional staff that play a key role in transferring sufficient knowledge and skills to the students, to know the knowledge and technical application levels of the students on surgical hand preparation in terms of ensuring patient safety and eliminating deficiencies in this regard (13).

This study aims to objectively evaluate the surgical hand preparation performance of the students working in the sterile field in the operating room considering their knowledge, compliance, and attitude by using the UV lamp, which is preferred due to its advantages such as easy application, immediate and well-visible results, and low cost. This is the first study in the literature on the assessment of SHR compliance using the UV lamp method.

MATERIAL AND METHODS

Ethical approval of this study was granted by the Mersin University Clinical Research Ethics Board (decision no: 128,

date: 20.03.2019), institutional permission was granted by the vocational school of health services, and written consent was given by the students.

The study was planned as a cross-sectional research and was carried out at the surgical technology (ST) Department of the Vocational School of Health Services of Mersin University in Türkiye between April 15 and April 30, 2019. Around 60% of the curriculum of the ST department, which lasts four semesters (two years), consists of surgery room practice, with students starting in their first year and working in the sterile area under the of surgery nurses. Students receive a four-hour surgical hand preparation training following WHO standards.

Sample

The study was carried out with the participation of 94 ST students who attend their classes regularly, do not have any dermatological problems on their hands, and agreed to participate in the study among 103 registered students in the ST program during the spring semester of the 2018-2019 academic year.

Measurement Tools

Research data was evaluated through Introductory Information, Hand Hygiene Information, and Attitude Form and "digital photographs" taken after SHR and SHS.

Introductory Information, Hand Hygiene Information, and Attitude Form

The content validity of the form, which was created through a literature review, was evaluated by a nurse who has served on an infection control committee and three instructors (4, 10, 13). The form consisted of 40 questions and four sections (Appendix 1). The first section included four questions about demographic information about the students and five questions about their evaluations of the surgery room in which they practice the surgical hand preparation procedure. In the second section, there were 10 questions regarding the purpose, duration, and steps of surgical hand preparation. Correct answers were given one point, and wrong answers were given zero points.

In the third section, there were 12 attitude statements regarding the necessity, difficulty, and effectiveness of surgical hand preparation (e.g., Following surgical hand preparation implementation steps one by one is annoying, surgical hand preparation is unnecessary when sterile gloves are worn). The responses were collected using a five-point Likert scale (absolutely disagree: one point, strongly agree: five points), and a total score was calculated based on the responses given to all questions. The lowest score that could be obtained was 12, and the highest score was 60. High scores were evaluated as a "positive attitude towards surgical hand preparation".

In the fourth section, there were nine questions about how often they complied with the principles of surgical hand asepsis during the surgery room implementation (e.g., I wash

my hands when entering and leaving the operating room, cut my nails short, and do not wear jewelry). For the evaluation of compliance with SHR and SHS, surgical hand preparation duration was measured, and photographs of the palmar and dorsal surfaces of the right and left hands and forearms were taken after surgical hand preparation under a UV lamp with a 12-megapixel camera (Nikon Digital Camera D3400, Nikon Corporation, Japan) in two shots. Photographs were evaluated in terms of the SHR and SHS technique (ABHA uncovered area) and effectiveness (ABHA intensity).

Study Protocol and Data Collection

Surveys were conducted in a classroom environment. It took about 15 minutes for the students to answer all the questions. The following day, the surgical hand preparation procedure was performed in the application laboratory under the supervision of two researchers. The training set was used to evaluate compliance with SHR and SHS. The set included ABHA with a fluorescent substance [two drops of phosphorous substance (disodium distyrylbiphenyl disulfonate) were added to 500 mL of ABHA] and a black box (76x43x43 cm) with a UV lamp. Students were admitted to the laboratories one by one so that they were not influenced by each other. Each student was asked to perform surgical hand preparation the same way they do during regular practice. The students performed the surgical hand preparation procedure using as much ABHA as they deemed sufficient. Without informing the students, a researcher whom the students did not know kept track of the time between the students taking ABHA and them finishing the implementation and declaring that they were ready.

The photographs were taken in a dark environment created with curtains at the student laboratory. Each student was given a code number, and the dorsal (D) and palmar (P) surfaces of their right (R) and left (L) hands (H) and forearms (FA) were photographed twice. After the photographing process, the areas uncovered by ABHA or where its intensity was low were shown to the student. Reminders were made regarding the steps they missed in the surgical hand preparation technique.

The photographs were evaluated visually on a computer by two independent researchers who were not involved in the photography process, according to the intensity of the areas covered by ABHA (bright blue areas). The evaluation criteria, which were described in our previous study, were used to determine the hand area (10). The surface area of a hand was calculated in cm^2 and converted into a percentage value. The dorsal/palmar area and percentages of a hand were determined as 14.5% for the thumb, 34.5% for the other fingers, 51% for the metacarpal area, and 100% for the total area (10).

A similar method was used for the evaluation of the forearm. The surface area of a forearm (the area between 2 cm above the wrist and elbow) was calculated in cm^2 and converted into a percentage value. Then, the lengths of the distal and

proximal regions were calculated by dividing the length of the forearm into two equal parts. After this calculation, 40% of the total forearm area was found to be the distal part and 60% of the proximal part. To make this evaluation more sensitive, the proximal and distal areas were divided into four equal regions. Each of the dorsal and palmar surfaces of the forearm was evaluated to be 100% in total. (Figure 1).

Fluorescent ABHA intensity was used to evaluate surgical hand preparation effectiveness. The areas with the highest brightness under the UV lamp were considered "three" and the areas that looked completely black and were not bright were evaluated as "zero" on a four-point scale.

Compliance with surgical hand preparation was evaluated under the duration, technique (ABHA uncovered area), and effectiveness (ABHA intensity) of surgical hand preparation sub-headings.

Statistical Analysis

The evaluation of the data was carried out in a computer environment (IBM SPSS Statistics 26.0). The inter-observer agreement (absolute agreement) was evaluated with the intraclass correlation coefficient (ICC) [95% confidence intervals, single measure 0.772 (0.409-0.892), degrees of freedom: 93, $p < 0.001$]. The fact that ICC is between 0.75 and 0.90 has been considered good reliability (14).

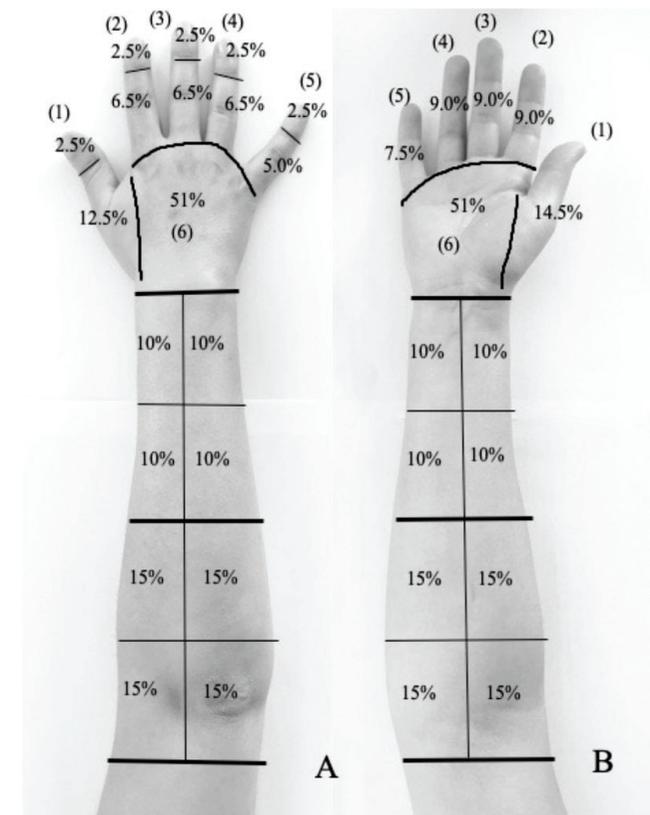


Figure 1: The surface area of a hand and forearm was calculated in cm^2 and converted into a percentage value. The dorsal (A) and palmar (B) areas and percentages of a hand were determined in the figure.

The normal distribution of the data was determined with the kurtosis and skewness coefficient. In descriptive statistics, number (percentage), mean \pm standard deviation, or median (25-75%) was used. Independent samples t-test, or Mann-Whitney U test were used in comparison of numeric variables between groups. The relationship between continuous data was determined by Spearman's rank correlation. The value of $p < 0.05$ was accepted as significant. To calculate the percentage of the uncovered area, the ABHA-covered area score was subtracted from the surface area score and proportioned to the surface area score. For example, the dorsal hand 6th zone uncovered area is calculated as follows: [(51-ABHA covered area of the 6th zone) \times 100 \div 51].

RESULTS

The mean age of students was 20.83 \pm 3.09 (18-38) years. When we look at the participants, 67 (71.3%) were women, 52 (55.3%) were in their first year, and 85 (90.4%) of them were right-handed. In the operating room where they regularly practice, there were 16 (17.0%) people who found inspections of hand preparation insufficient, 91 (96.8%) people who found the areas for surgical hand preparation adequate, and 68 (72.3%) people who thought the materials were often sufficient. While 89 (94.7%) of them preferred SHS and 5 (5.3%) of them preferred SHR for surgical hand preparation, 19 (20.2%) of the students stated that they fully comply with the surgical hand preparation procedure. Students' mean scores for knowledge were 5.03 \pm 1.6 (1-8) and for attitude 47.05 \pm 5.21 (29-60). In addition, the mean frequency of the behavior according to the principles of surgical hand asepsis was found to be 33.50 \pm 3.69 (23-41) (Table 1).

SHR Technique (ABHA Uncovered Area)

The median ABHA uncovered area percentage was larger for the left and right dorsal surfaces than the palmar surface, and the difference between the palmar and dorsal surfaces on the left hand was found to be statistically significant ($z=219$, $p=0.03$) (Figure 2).

There was a difference in the median percentage of ABHA uncovered area between the distal and proximal regions of both the right and left forearms ($p < 0.001$). The median percentage of the uncovered area was higher in proximal areas (Figures 3, 4).

Effectiveness of Surgical Hand Preparation (ABHA Intensity)

When the effectiveness of surgical hand preparation was evaluated according to the intensity level of fluorescent ABHA on areas, it was seen that the effectiveness decreased towards hand dorsal surfaces. However, there were no differences among ABHA intensity score medians. The effectiveness decreases from proximal to distal arm areas. There were differences among ABHA intensity score medians ($p \leq 0.001$) (Figures 3, 4).

Table 1: Introductory features of students and their views on the operating room.

Features	n (%)
Sex	
Female	67 (71.3)
Male	27 (28.7)
Year	
First-year	52 (55.3)
Second-year	42 (44.7)
Dominant hand	
Right	85 (90.4)
Left	9 (9.6)
Surgical hand preparation duration	
Sufficient	16 (17.0)
Insufficient	78 (83.0)
The most preferred surgical hand preparation procedure in the operating room practice	
Surgical hand scrubbing	89 (94.7)
Surgical hand rubbing	5 (5.3)
Evaluation of compliance with the surgical hand preparation procedure in practice (self-evaluation)	
Never	1 (1.1)
Some	7 (7.4)
Highly	67 (71.3)
Fully	19 (20.2)
Opinion on the adequacy of the areas of surgical hand preparation in the operating room	
Adequate	91 (96.8)
Inadequate	3 (3.2)
Opinion on the adequacy of surgical hand preparation materials in the operating room	
Always	3 (3.2)
Mostly	68 (72.3)
Sometimes	20 (21.3)
Rarely	3 (3.2)
Opinion on the adequacy of the compliance controls for surgical hand preparation in the operating room	
Always	21 (22.3)
Mostly	31 (33.0)
Rarely	26 (27.7)
Inadequate	16 (17.0)
Total	94 (100)
Mean \pm SD	
Knowledge of surgical hand rubbing	5.03 \pm 1.6 (1-8)
Attitude for surgical hand rubbing	47.05 \pm 5.21 (29-60)
Behavior in accordance with the principles of surgical hand antisepsis	33.50 \pm 3.69 (23-41)

SD: Standard deviation

Duration of Surgical Hand Preparation

The median duration of surgical hand preparation was 1.5 (1.24-2.51) minutes, and only 16 (17.0%) of the students were suitable to give sufficient time to this preparation. Although there was

no statistical difference compared to gender in terms of the duration of surgical hand preparation median scores, it was higher among the students in their first year compared to those in their second year ($u=662.0, p=0.001$) (Table 2). There was no significant correlation between surgical hand preparation duration and knowledge and attitude scores ($p>0.05$).

Relationship Between Duration, Technique, and Effectiveness of Surgical Hand Preparation

As the SHR and SHS duration decreased, the percentage of the uncovered area increased, whereas the duration of surgical hand preparation increased, and the effectiveness of the implementation increased. While there was no difference between first and second years in terms of knowledge, attitude, score medians, and ABHA intensity on hands and forearms, second years scored higher in terms of frequency of behavior appropriate to the surgical hand asepsis principles median scores ($t=2.99, p=0.004$) (Table 2) and the median of ABHA uncovered area on the right hand (Table 3).

DISCUSSION

In this study, the knowledge, attitude, and compliance of ST students who practice in sterile areas in the operating room were evaluated. It was observed that the students answered approximately half of the knowledge questions regarding surgical hand preparation incorrectly, which shows that they lack information about the matter. It is also indicated that the operating room nurses and surgeons have insufficient knowledge in terms of the technique of surgical hand preparation, and only 3.1% of them correctly know the necessary duration for the surgical hand preparation (7, 15). The wrong examples they saw in implementation may have caused the students to have insufficient knowledge.

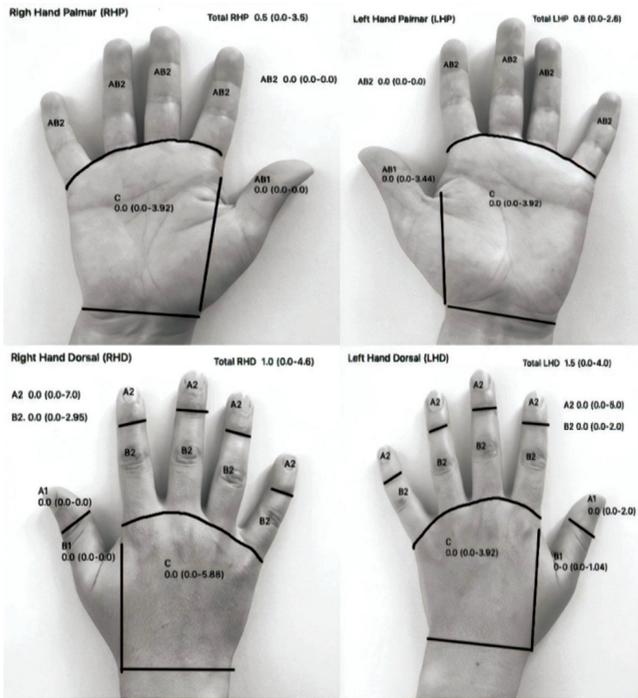
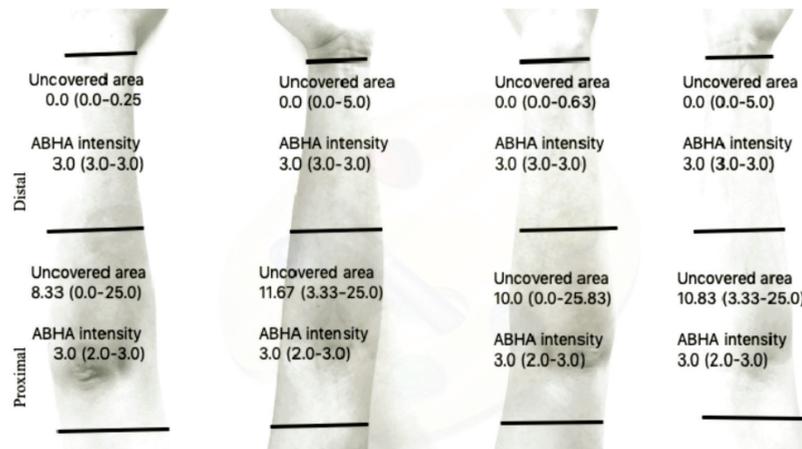


Figure 2: The distribution of median uncovered alcohol-based hand antiseptic area scores on the dorsal and palmar surfaces of hands [(RHP-RHD: $z=1.73, p=0.09$, total right hand 2.0 (0.3-3.6), LHP-LHD: $z=2.19, p=0.03$, total left hand 1.5 (0.3-3.8) ($z=0.51, p=0.61$)]. RHP: Right hand palmar, RHD: Right hand dorsal, LHP: Left hand palmar, LHD: Left hand dorsal



Total left forearm dorsal surface uncovered area: 5.5 (0.0-15.0) Distal-proximal uncovered area: $\leq 0.001/7.02$ ABHA intensity: $\leq 0.001/4.82$	Total left forearm palmar surface uncovered area: 8.5 (2.0-17.0) Distal-proximal uncovered area: $\leq 0.001/6.89$ ABHA intensity: $\leq 0.001/5.38$	Total right forearm dorsal surface uncovered area: 6.0 (0.8-19.0) Distal-proximal uncovered area: $\leq 0.001/6.78$ ABHA intensity: $\leq 0.001/4.95$	Total right forearm palmar surface uncovered area: 7.0 (2.0-19.0) Distal-proximal uncovered area: $\leq 0.001/7.10$ ABHA intensity: $\leq 0.001/4.95$
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Figure 3: The distribution of the median percentage of alcohol-based hand antiseptic uncovered areas on the forearm surfaces. ABHA: Alcohol-based antiseptics

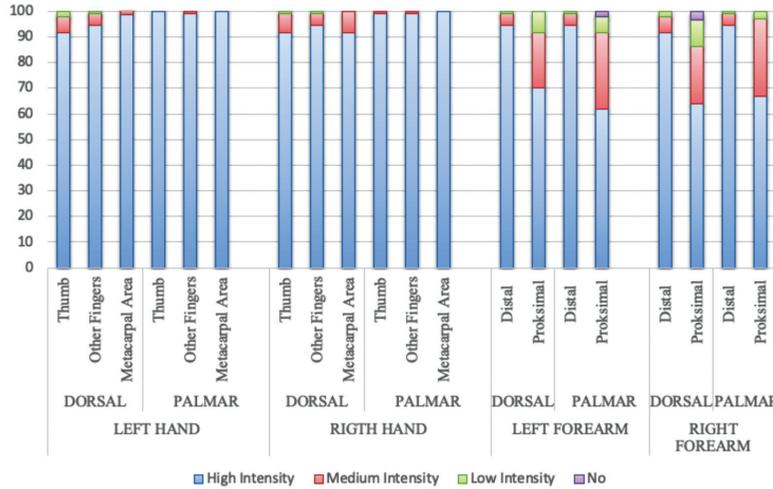


Figure 4: Intensity distribution of alcohol-based hand antiseptic on the hands and forearms.

Table 2: The distribution of median duration, knowledge, attitude, and behavior of surgical hand preparation in accordance with the principles of surgical hand antiseptics according to class and gender.

	Median knowledge scores of surgical hand preparation	Median attitude scores of surgical hand preparation	Median scores of behavior in accordance with the principles of surgical hand antiseptics	Median surgical hand preparation duration
First-year students	5.09±1.46	47.53±4.81	32.51±3.56	2.13 (1.34-3.09)
Second-year students	4.95±1.73	46.45±5.66	34.71±3.50	1.35 (1.162-2.11)
t/df/p	0.44/92/0.66	1.00/92/0.32	2.99/92/ 0.004	U:662.0/ 0.001
Female	5.13±1.58	47.50±4.94	33.71±3.53	1.45 (1.24-2.32)
Male	4.77±1.57	45.92±5.76	32.96±4.07	2.0 (1.24-3.13)
t/df/p	0.99/92/0.33	1.33/92/0.18	0.89/92/0.37	U:768.5/0.25

*t: Student t-test, df: Degrees of freedom, u: Mann-Whiney U test, p: P-value

Table 3: The relationship between surgical hand preparation time, technique and effectiveness and the distribution of exposed areas in the hands according to classes.

		Hand (total)	Forearm (total)	
Right	Uncovered area (Technique of surgical hand preparation)	r: -0.230 p: 0.026	-0.189 0.067	
	ABHA intensity (Effectiveness of surgical hand preparation)	r: -0.029 p: 0.784	0.217 0.036	
	Uncovered area			
	First-year students	Median (25-75%)	0.88 (0.14-3.26)	10.25 (5.0-17.0)
	Second-year students	Median (25-75%)	2.75 (1.67-4.06)	4.25 (0.88-19.13)
	U; p		790; 0.020	896; 0.135
Left	Uncovered area (Technique of surgical hand preparation)	r: -0.235 p: 0.023	-0.211 0.041	
	ABHA intensity (Effectiveness of surgical hand preparation)	r: -0.134 p: 0.199	0.302 0.003	
	Uncovered area			
	First-year students	Median (25-75%)	1.25 (0-2.65)	9.0 (4.5-14.5)
	Second-year students	Median (25-75%)	2.0 (1.0-4.32)	4.5 (0-18.75)
	U;p		866.5; 0.084	902.5; 0.149

U: Mann-Whitney U test, r: Spearman's rank correlation test , p: P-value, ABHA: Alcohol-based antiseptics

Although the students' knowledge about surgical hand preparation was not at the desired level, the fact that they had a positive attitude about surgical hand preparation may be motivating in supporting their development and eliminating their lack of knowledge and practice on the subject.

It is stated that for compliance with surgical hand preparation, in-service training, an appropriate environment for hand preparation, sufficient materials, adequate inspections, and an institutional policy should exist (4). Although almost all the students participating in this study thought that the operating room environment was suitable for surgical hand preparation, three out of ten students stated that the materials were insufficient, and four students stated that there was a lack of supervision. In this context, in-house facilities and supervision can increase students' as well as the surgical team's knowledge of surgical hand preparation and help them apply the technique correctly.

Although direct observation is the gold standard for evaluating the surgical hand preparation technique, checklists were not used in this study to avoid influencing students (13). Instead, they were evaluated on the ABHA-uncovered areas with the help of a UV lamp. The application was strengthened by showing uncovered areas and areas with decreasing intensity to the students. Evaluation of suitability for hand hygiene with the help of a UV lamp does not show purification from pathogens, but it can be used in training as it allows visual inspection (9, 11, 16). Evaluation with UV lamps has been used mostly for hand washing control, but there is no study on surgical hand preparation assessment in the literature. Lehotsky et al. (12) reported that the UV-dye-based hand washing assessment method is a true and reliable indicator of correctly disinfected and pathogen-free areas on the hand surface. We think that the UV test method is easily applicable to and suitable for the evaluation of surgical hand preparation. It was suitable for revealing the errors and demonstrating the development of skills for the education and training of students (10, 11). Also, this method has immediate visual control over the surgical hand preparation. Therefore, direct feedback may support the correction of wrong practices.

While appropriate ABHA, sufficient time, and correct technique are required for effective surgical hand preparation, in the present study, ST students were found to have problems complying with the duration and technique of surgical hand preparation. Although one out of every five students thinks that he or she complies with the surgical hand preparation procedure, only one out of six students has been found to have a suitable duration for surgical hand preparation. Similarly, it has been reported that there are problems with the compliance of the operating room team with the duration of surgical hand preparation (7, 9, 17). Oriol et al. (3) reported that 10% of the personnel had a duration of under one minute for the surgical hand preparation procedure. Similar to this result, Jeyakumar (8) reported that this procedure lasted less than two minutes, and Laurikainen et al. (18) stated that more than half of the personnel did not comply with the three-minute duration.

Although studies are reporting that a 1.5-minute implementation is as effective as a 3-minute implementation in reducing the colonization of microorganisms, in the WHO guideline it is stated that the appropriate time for surgical hand preparation is between 3-5 minutes, and the company recommendation should be followed according to the ABHA content (1, 19, 20). In our study, it was observed that compliance with time was important since the uncovered areas increased when the duration of surgical hand preparation got shorter, and the students were more effective in implementing on their forearms when the duration of surgical hand preparation got longer. Although the of surgical hand preparation is important in order to fully implement the technique and ensure an adequate time of skin contact with ABHA, it has been observed that there are problems complying with the duration. Increasing interventional studies that will increase the compliance of students and health personnel in operating rooms with the duration of surgical hand preparation and ensure their dissemination in the field may contribute to the solution of the problem.

In our study, it was also observed that the duration was important but not solely sufficient. Effective surgical hand preparation was achieved by applying ABHA long enough and with the correct technique on the hands and forearms. The fact that although the SHR and SHS duration of the first-year students was longer, they had more uncovered areas on their forearms compared to second-year students. This result showed that the length of education increased compliance with the surgical hand preparation technique. It was reported that the increase in total employment and the increase in time spent in the operating room increased staff nurses' compliance with surgical hand preparation (7). In a study conducted with medical students, it was observed that surgical hand preparation compliance increased, and the areas uncovered by ABHA decreased in the last weeks of the theoretical and practical training given gradually throughout the term (11). On the contrary, studies are showing that working time in the operating room is not related to surgical hand preparation (8).

In our study, although the time spent in training increased compliance with surgical hand preparation, it was also observed that the students had deficiencies in the correct and effective application of the technique. Likewise, it is stated in the literature that operating room personnel have deficiencies in applying the technique regarding surgical hand preparation (4, 7, 8, 11). In one study, only 4 out of 34 surgical hand preparation procedures were reported to complete all steps correctly (4). In other studies, 48% of the nurses had insufficient surgical hand preparation techniques, and it was reported that the operating room personnel did not follow the forearm implementations adequately (7, 8, 18). In the study conducted by Schwartz et al. (4), it was shown that hand rubbing implementation, which is at the end of the surgical hand preparation implementation steps, was the most frequently skipped step. In another study, it was observed that participants allocated more time to hand rubbing

than they should have, but their forearm implementation duration and total duration were insufficient (8). The inadequacy of the operating room personnel to comply with the surgical hand preparation technique is important in terms of not being suitable role models for the students.

The World Health Organization recommends SHR or SHS methods for surgical hand preparation (1). Although the effectiveness of SHR is shown and its prevalence is increasing, almost all the students stated that they preferred to use SHS (21). The adequacy of the method, environment, and materials used by the surgical team in the practice environment may have been effective in satisfying this preference of the students who learned both methods in theoretical courses.

The fact that hand and forearm photographs could not be evaluated through a computer program in three dimensions is an important limitation of this study. For this reason, detailed guidance on the evaluation of the photographs has been prepared, the observers have been trained before the evaluation, and the inter-observer compliance has been evaluated statistically. However, the dry or moist hands and forearms, skin resistance differences, hairs on the arms, and the fluorescent material may have caused a difference. Also, since it is the only surgical technician school in our region and this study was carried out in that school, the number of people participating in this study was low.

CONCLUSION

The results of this study show that using fluorescence-marked ABHA can be considered a good choice in evaluating compliance with surgical hand preparation. It was observed that ST students have deficiencies in compliance with their knowledge and practice about surgical hand preparation. The duration of surgical hand preparation is closely related to technique and effectiveness, and the time spent in practice can improve the students' application skills. It will be important for the operating room personnel, who are involved in the practical training of the students, to observe the students, give feedback to them, and be appropriate role models to increase compliance with surgical hand preparation and ensure patient safety in order to complete the deficiencies of the students in this regard. In future studies, it is recommended to evaluate the effect of interventional studies that aim to increase collaboration with personnel on student compliance.

Ethics Committee Approval: Ethical approval of this study was granted by the Mersin University Clinical Research Ethics Board (decision no: 128, date: 20.03.2019).

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Appendix 1. Surgical Hand Preparation Evaluation Questionnaire

Section 1.

1. Age.....

2. Sex

Female Male

3. Grade

First year Second year

4. Which is your dominant hand?

Right Left

5. Do you think the inspections regarding surgical hand rubbing in the operating room are sufficient?

Yes Mostly Rarely No

6. Are there sufficient materials for hand rubbing in the operating room?

Yes. If your answer is yes, how often? Always Mostly Sometimes Rarely No, never

7. Are there sufficient areas for hand rubbing in the operating room?

Yes No

8. How much of the recommended surgical hand rubbing procedure do you believe you can perform?

None Some Highly Completely

9. Which one do you mostly prefer for surgical hand hygiene?

Surgical hand washing

Surgical hand rubbing (with alcohol-based antiseptics)

Surgical hand rubbing duration:second

Section 2. Knowledge

Indicate whether each of the following statements is true	True	False	I don't know
1. The amount of antiseptic used for surgical hand rubbing is irrelevant.			
2. Surgical hand rubbing time with hand antiseptic is fixed.			
3. The active ingredient of the antiseptic solution used determines the duration of hand rubbing.			
4. The purpose of surgical hand rubbing is to eliminate only temporary flora.			
5. After surgical hand rubbing, wet areas can be dried with a sterile towel.			
6. In the surgical hand rubbing process, first all surfaces of the hands and then the forearm are rubbed with antiseptic solution.			
7. Surgical gloves prevent contamination even when surgical hand hygiene is not properly performed.			
8. Just rubbing your hands between two surgeries is sufficient.			
9. Surgical hand rubbing may be preferred as long as there is no visible contamination.			
10. Surgical hand rubbing should last at least 3 minutes before the first case of the day.			

Section 3. Attitude

Please read each item and think about yourself and indicate how much you agree with the following statements regarding surgical hand preparation.

There is no right or wrong answer.

I strongly disagree

I disagree

I neither agree nor disagree

I agree

I strongly agree

1. It is very frustrating to have to follow the exact procedures for surgical hand rubbing.
2. It is unnecessary to follow the exact procedures for surgical hand rubbing.
3. It is unnecessary to perform surgical hand scrubbing up to the elbows.
4. It is a waste of time to follow the exact procedures related to surgical hand rubbing.
5. I believe it is a professional responsibility to comply with procedures regarding surgical hand rubbing.
6. Warnings regarding surgical hand hygiene in surgical hand washing areas draw my attention.
7. Surgical hand rubbing with alcohol-based hand antiseptic is more effective than surgical hand washing
8. Surgical hand rubbing with alcohol-based hand antiseptic is safer than surgical hand washing
9. Surgical hand rubbing with alcohol-based hand antiseptic is more comfortable than surgical hand washing
10. Surgical hand rubbing with alcohol-based hand antiseptic is easier than surgical hand washing
11. I don't believe in the effectiveness of surgical hand rubbing with alcohol-based hand antiseptic
12. If sterile gloves are used, I think surgical hand rub unnecessary.

Section 4. Behavior

Please indicate how often you do the following behaviors.

Never

Rarely

Sometimes

Mostly

Always

1. When I enter the operating room from outside, I wash my hands with soap and water.
2. When I enter the operating room from outside, I rub my hands with alcohol-based hand antiseptic.
3. I wash my hands when leaving the operating room
4. I rub my hands with alcohol-based hand antiseptic when leaving the operating room.
5. I rub my hands with antiseptic for a longer time before the first surgery of the day.
6. Between surgeries, I only rub my hands with hand antiseptic.
7. I don't come to the operating room with jewelry such as rings, watches, etc.
8. On days when I will be in the operating room, my nails are always short.
9. I follow the recommended procedures for surgical hand rubbing step by step.

A RARE CAUSE OF HEMOLYTIC ANEMIA: PARANEOPLASTIC SYNDROME

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ABSTRACT

In this article, we investigate the association between testicular cancer and hematological paraneoplastic syndrome, which is seen infrequently among all types of tumors in the literature. This case report provides a comprehensive evaluation of a 28-year-old patient admitted to the emergency department with symptoms of vomiting, nausea, and a medical history of epilepsy. Although the initial presentation did not exhibit specific symptoms or signs associated with anemia, subsequent blood tests were interpreted in favor of hemolytic anemia. Our study provides detailed radiological findings and laboratory tests that provide comprehensive information about the progression of the lesions and the patient's response to our treatment.

Keywords: Hemolytic anemia, neoplasms, testicles

INTRODUCTION

Testicular tumors are the most common solid neoplasms in the male population under 45 years of age, and they comprise 1-2% of all malignant tumors in male patients (1). Depending on the type and stage of testicular cancer, the patient may receive one of several treatments or a combination of them. Testicular malignancy usually presents as a unilateral lump or painless swelling that is found incidentally. Less commonly, testicular cancer presents with pain, with about one-third of the patients having dull pain, whereas acute pain is noted in about 10% of patients (2). Testicular tumors may present themselves asymptotically, but they can also manifest paraneoplastic symptoms, which occur in oncological cases and cannot be attributed to the primary location of the tumor or its metastasis (3). These conditions result from the release of hormones, peptides, cytokines, or immune reactions between cancerous and healthy tissues (3). Paraneoplastic syndrome may affect various systems, mostly the endocrine, neurological, dermatological, rheumatological, and hematological systems

(3). In this article, we present the association between testicular cancer and hematological paraneoplastic syndrome, which is rare in the literature.

CASE REPORT

A 28-year-old male patient was admitted to the Trakya University Hospital with vomiting and nausea symptoms. He also had a history of epilepsy, and his physical examination showed cervical and para-aortic lymphadenopathy, in addition to splenomegaly. The results of his blood tests indicated hemolytic anemia (Table 1). His coombs and paroxysmal nocturnal hemoglobinuria tests were negative, but his antinuclear antibody test was positive (++) . Although folate and vitamin B12 levels were in normal range, the patient's anemia treatment started with 5 mg folate, because active hemolysis can consume folate and cause megaloblastosis. 1000 mcg/mL intramuscular B12 was also administered. The bone marrow biopsy of the patient revealed 90% cellularity, myeloid hypoplasia, erythroid hyperplasia, and grades 1-2 reticular fiber proliferation. His



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computed tomography scanning for the chest, abdomen, and cervix showed a 16-centimeter conglomerated mass-like lymphadenopathy in the para-aortic area and a 15-millimeter nodular lesion in the lower left area of the left lung (Figure 1). Also, his spleen was measured at 23 cm on the long axis, and his liver at 17 cm. Moreover, his scrotal ultrasonography showed 22 millimeters of heterogeneous nodular structure, including vascularization in the left testicle.

After examining the test results, it was concluded that the general condition of the patient might worsen due to severe tumor status and hemolytic anemia. We diagnosed a mixed germ cell testicular tumor clinically and radiologically, without any orchiectomy for tissue fixation, and started bleomycin, etoposide, and cisplatin (BEP) combination treatment. After the first cycle of the treatment, follow-up controls showed improvement in anemia as well as regression of bilirubin and tumor markers. Following four cycles of the BEP treatment, tomography controls showed partial recovery (Figure 2),

however retroperitoneal lymph nodes larger than one centimeter were also spotted. Therefore, we applied consolidation treatment by providing two cycles of the paclitaxel, ifosfamide, and cisplatin (TIP) combination. In the control scanning, a 55-millimeter para-aortic lymph node was detected, and as a result, orchiectomy and retroperitoneal lymph node dissection procedures were performed (Figures 3, 4). The pathology results showed multiple retroperitoneal lymph nodes consisting of necrotic tissue. Furthermore, in the testicular tissue pathology, a mixed germ cell testicular tumor with a diameter of 5 cm, containing 60% yolk sac, 30% choriocarcinoma, and 10% teratoma components was observed. We presented a case report in which the patient's paraneoplastic hemolytic anemia improved after the first cycle of chemotherapy, the patient had tumor shrinkage after continued chemotherapy, and treatment was completed with a successful operation.

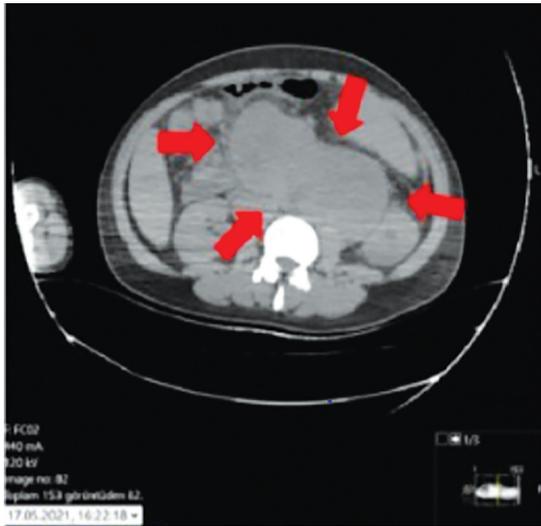


Figure 1: Computerized tomographic image of the patient's retroperitoneal mass at the time of admission.

Table 1: The result of the patient's blood test.

	17.05.2021	21.06.2021
Hb (13.7-17.5)	10.7 g/dL	11.5 g/dL
Leukocyte (4.23-9.07)	7.5x10 ³ /uL	4.09x10 ³ /uL
Hematocrit	31.4%	34.6%
AFP (0-7)	3000 ng/mL	4.78 ng/mL
Total bilirubin (0.3-1.2)	9.0 mg/dL	3.7 mg/dL
Direct bilirubin (0-0.2)	1.1 mg/dL	0.3 mg/dL
LDH (0-247)	633 U/L	228 U/L
Creatinine (0.72-1.25)	0.67 mg/dL	0.59 mg/dL
B-hCG (<2.6)	24759 IU/L	<0.2 mIU/mL
Reticulocyte (0.5-2.5)	11.30	8.5 (08.08.2022)
Haptoglobin (30-200)	<29.5 mg/dL	-

Hb: Hemoglobin, AFP: Alpha-fetoprotein, LDH: Lactate dehydrogenase, B-hCG: Beta-human chorionic gonadotropin



Figure 2: Computerized tomographic imaging of the patient's retroperitoneal mass after chemotherapy.



Figure 3: Uniformly bordered tumor on the testicular cross-sectional face.

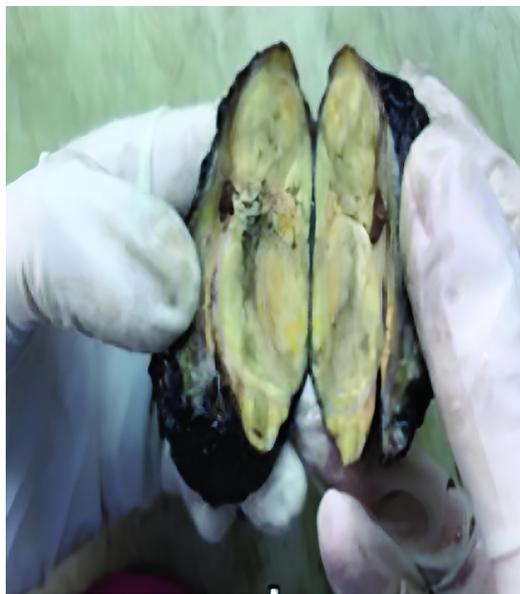


Figure 4: Sectional surface of retroperitoneal mass.

DISCUSSION

Anemia is typically defined as a condition characterized by a reduced number of circulating erythrocytes or a hemoglobin level below the thresholds established by the World Health Organization, which is below 13 g/dL in adult men and below 12 g/dL in non-pregnant adult women (4). Hemolysis is characterized by the destruction of red blood cells, leading to a diverse range of physiological and pathological findings observed in both laboratory and clinical tests. It is also used to address situations where an erythrocyte's lifespan is reduced due to mechanical, chemical, autoimmune, or infectious causes (5).

Between 1945 and 2009, case reports or series involving 52 patients associated with autoimmune hemolytic anemia (AIHA) with solid cancers were examined. The revealed number of cases linked to testicular cancer with AIHA was only 3 (6). However, anemia has been observed in cancer patients, usually secondary to chronic lymphocytic leukemia, some lymphomas, and in some cases, non-lymphoid tumors such as ovarian tumors (7). Hemolytic anemia secondary to germ cell testicular tumors, which has been described in our case report, is rare in literature (7, 8). Since paraneoplastic syndromes often cause increased morbidity, effective treatment can improve the patient's quality of life and prolong life expectancy (3). Treatment of paraneoplastic syndromes includes the process

of assessment and treatment of the underlying malignancy, immunosuppression, and electrolyte and hormone disorders (3). Paraneoplastic syndrome should always be included in the differential diagnosis since malignancies may present with various symptoms, such as nausea and vomiting, in the surrounding or distant tissues other than the involved organ. However, the primary etiology should be revealed and followed up while handling the secondary symptoms during the treatment phase. In our case, the causes of anemia were tried to be treated in the first place. However, following the supplementary examinations such as bone marrow biopsy and computed tomography scanning, the patient received a successful diagnosis which indicated that anemia resulted from the malignancy rather than being the primary ailment. The patient's clinical progress was observed to improve as a result of the main target-oriented treatment.

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FORESTIER SYNDROME CAUSING DYSPHAGIA: A CASE REPORT

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ABSTRACT

Diffuse idiopathic skeletal hyperostosis, or Forestier's disease, is characterised by increased bone mass. Its etiology is currently unknown. The disease predominantly manifests as cervical and back pain. Some patients also present with additional symptoms like dysphagia, neck pain, and dyspnea. Several cases of surgical treatment are reported in the medical literature. Surgical treatment is attached to the specific symptoms or complications and generally involves osteophyctomy through the usual anterior approach. The existence of diffuse idiopathic skeletal hyperostosis has been related to older age, male sex, obesity, hypertension, atherosclerosis, and diabetes mellitus. This case report elucidates our patient-centric approach to managing diffuse idiopathic skeletal hyperostosis and aims to share insights from our experience.

Keywords: Dysphagia, ligaments, ossification, spinal osteophytosis, surgery

INTRODUCTION

Diffuse idiopathic skeletal hyperostosis (DISH), or Forestier's disease, is a perplexing condition characterised by the ossification of paravertebral ligaments and muscles. Notable clinical manifestations include dysphagia, neck pain, and dyspnoea (1-4). According to Childs (5), DISH is assumed to be a different kind of osteoarthritis (OA) without the degenerative intervertebral disc and joint degenerative qualities seen in classic OA. Conversely, Kuperus et al. (4) mentioned in their article that DISH's pathogenesis is occult. The existence of DISH has been related to older age, male sex, obesity, hypertension, atherosclerosis, and diabetes mellitus (4). This report delineates the case of a 66-year-old male who presented with persistent dysphagia over a year, culminating in a significant weight loss of 25 kilograms within six months. An exhaustive literature review was undertaken concurrently with this case study to enhance our comprehension of DISH.

CASE REPORT

A 66-year-old man, a retired counterterrorism officer, was admitted to the neurosurgery department. He had experienced

stinging in his hands and progressive regression in fine motor skills in the upper extremities, such as the inability to button up or hold a spoon. He also complained of dysphagia for the last year, leading to a weight loss of 25 kilograms over six months. His medical and family histories were unremarkable. He had received physical therapy for 15 days, and although the stinging in his hands slightly improved, there was no improvement in motor skills and swallowing difficulties. Upon admission to our facility, he underwent a two-phase surgical intervention: excision of the anterior calcified disc and osteophytes compressing the oesophagus, posterior decompression by laminectomy and posterior stabilisation.

In the preoperative computed tomography (CT), widespread, bridging, osteophytic new bone formations were observed in the anterior left paracentral part of the C2-C7 vertebral body in the anterior longitudinal ligament trace. In addition, the C4-C5-C6-C7 vertebral bodies appeared to be fused anteriorly and posteriorly. The findings were initially compatible with Forestier's disease. At the C4-C6 level, ossifications in the posterior longitudinal ligament trace were causing narrowing in the central canal (Figure 1). A preoperative magnetic resonance imaging was performed and in addition to the above findings,



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there were degenerative changes at the C3-4 C4-5 disc levels and a significant narrowing of the bilateral neural foramen secondary to dorsal osteophytes. At the C3-4 disc level, the spinal canal anterior-posterior diameter was measured as 6.8 mm and was narrowed (Figure 2).

A three-level (C3, 4, 5) anterior decompression involving osteophyte drilling was executed, supplemented by posterior decompression by laminectomy and stabilisation using lateral mass screws. In the postoperative CT, heterogeneity and occasional air densities were observed at the level of posterior elements in C2, 3, and 4 vertebrae. Bilateral screws and fixators were observed at these levels. It was observed that the anterior osteophytes between the C2 lower endplate and the C5 upper endplate were excised (Figures 3, 4). The perioperative phase was uneventful, with no significant bleeding or neurological complications. However, postoperative feeding led to aspiration, necessitating intubation and subsequent transfer to the intensive care unit. Despite a normal neurological examination, the patient's significant weight loss had resulted in

muscular atrophy, prompting a tracheostomy. Due to persistent respiratory and swallowing challenges, he was on a nasogastric tube and eventually discharged in the 2nd postoperative month with appropriate nutrition. At the 6th month follow-up, respiratory and swallowing difficulties were persistent, and the patient still had a tracheostomy and a nasogastric tube.

DISCUSSION

Forestier's disease, or DISH, is a rare ossifying pathology characterised by spinal and peripheral enthesopathy (6). The condition shows a male predilection and an increasing prevalence with age. Its incidence is estimated to be between 8-10% among individuals aged 65 years and over. It is rarely diagnosed in those under 45 years of age (7). Contemporary studies suggest potential risk factors for DISH include high body mass index, insulin-independent diabetes mellitus, acromegaly, obesity, hypervitaminosis A, human leukocyte antigen (HLA)-B27, HLA-B5, HLA-A11, and ankylosing spondylitis (6, 8).

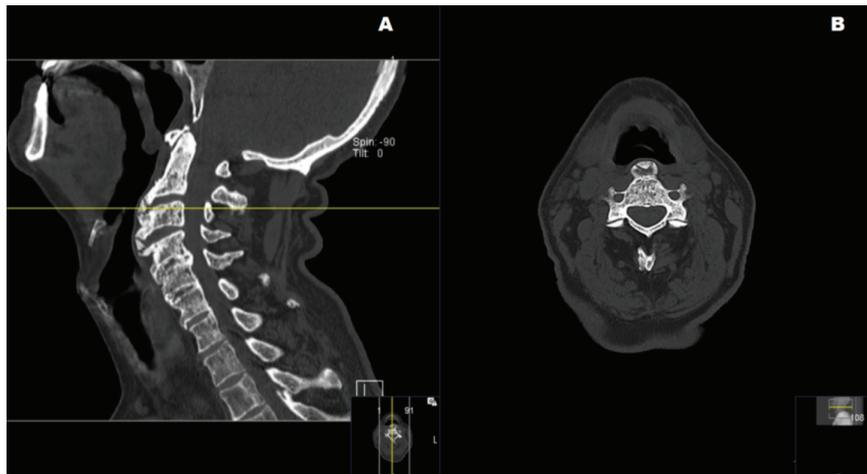


Figure 1: Preoperative CT images, (A) sagittal reconstruction (B) axial scan.

CT: Computed tomography

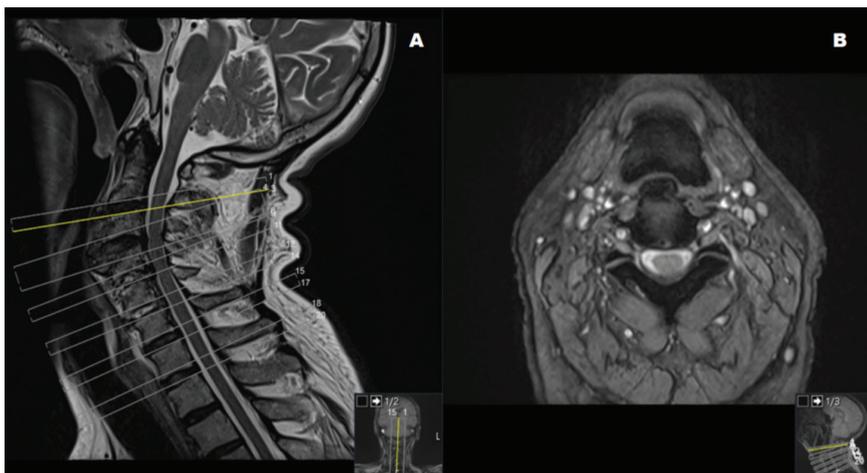


Figure 2: Preoperative MR images (A) sagittal reconstruction (B) axial scan.

MR: Magnetic resonance

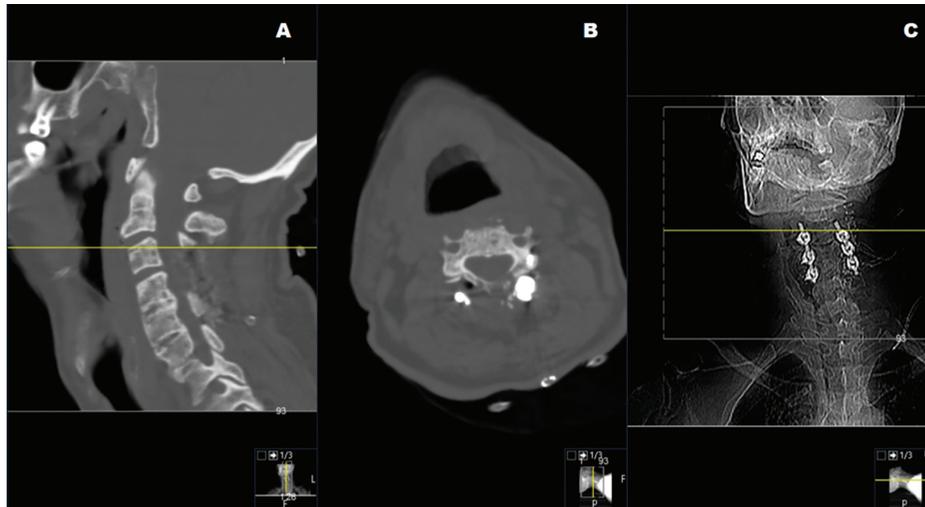


Figure 3: Preoperative CT images, (A) sagittal reconstruction, (B) axial scan, (C) anteroposterior scout view.

CT: Computed tomography

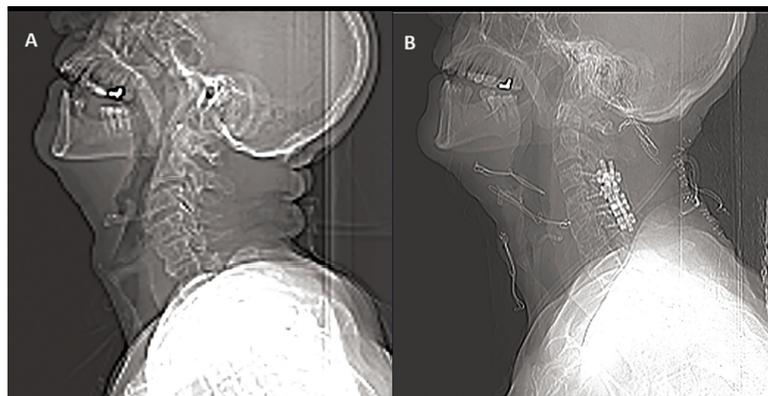


Figure 4: Preoperative (A) and postoperative (B) CT lateral scout views.

CT: Computed tomography

Common sites of DISH involvement are the spine, pelvis, patella, and calcaneus, with the sacroiliac joint being an exception (6). The thoracic region is almost universally affected (96%), while the lumbar (90%) and cervical regions (78%) are involved less frequently (7).

Clinical studies report that 17-28% of individuals with DISH display symptoms of dysphagia attributable to cervical osteophytes (2). Other common symptoms include neurovascular compression, movement restriction, cervicalgia, stridor, and hoarseness (6).

Diagnosis of DISH is typically confirmed through radiological assessments. Three radiological classification criteria exist: (I) Calcification and bone bridge formation in at least two contiguous vertebrae, (II) Preservation of intervertebral disc height, and (III) Absence of ankylosis in interapophyseal joints (4, 6). CT is the diagnostic tool of choice, with sagittal, coronal, and three-dimensional reconstructions providing an elaborate perspective of the osteophytes' relationship with adjacent anatomical structures (6).

Conservative treatment options are typically recommended for symptomatic DISH cases with non-severe clinical findings. These encompass non-steroidal anti-inflammatory drugs, steroids, muscle relaxants, dietary modifications, and anti-reflux treatments. Patients' refractory to conservative treatment may necessitate surgical intervention. Surgical resection of osteophytes has been recognised as an effective treatment modality in severe cases, particularly those presenting with airway obstruction. Anterior cervical, posterolateral, and transpharyngeal approaches are potential surgical methods, depending on individual patient characteristics and disease severity (6, 7).

No early postoperative complication was present in the presented case. Nevertheless, these procedures are prone to some complications, including surgical site hematomas, development of Horner's syndrome, paralysis of recurrent or superior laryngeal nerves, dysphonia, oesophageal rupture, or spinal instability (8). Unfortunately, late complications, such as aspiration, lead to an extended hospital stay along with a late and limited recovery.

Ethics Committee Approval: N/A

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A DECLINE IN EDUCATIONAL ACHIEVEMENT: THE IMPACT OF VIRTUAL LEARNING ON THE PEDIATRIC ROTATION FOR MEDICAL SCHOOL STUDENTS

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During the past few years in Türkiye, an abrupt closure of universities occurred primarily due to the coronavirus disease-2019 pandemic, and then again for the second time after the February 6th 2023 earthquake, as students were sent home to provide shelter for earthquake survivors in student dormitories (1, 2). These shut-downs have ushered in a myriad of challenges, casting a shadow on the traditional education landscape and notably, impacting the realm of pediatric training. With the closure of campuses and the shift to online courses, the adverse effects have affected both academic and professional domains (3).

One of the foremost problems has been the loss of hands-on experience crucial for medical students, particularly in clinical branches like pediatrics. The absence of physical classrooms and in-person clinical rotations has deprived aspiring medical students of valuable interactions with patients, hindering their ability to hone crucial diagnostic and interpersonal skills. Because of the physiological and emotional differences that exist between adults and children, medical students undergo specialized training that equips them to effectively meet the health needs of young patients during their pediatric rotation, which cannot be experienced online. Furthermore, the shift to online education has strained the sense of community and collaboration that is pivotal in medical training. The camaraderie developed through shared experiences in clinics and at patient

bedsides is irreplaceable. Pediatrics, by nature, demands a nuanced understanding of not only the medical aspects but also the intricacies of patient-doctor relationships, often requiring a delicate touch that can only be refined through direct, in-person encounters. A study by Dev et al. (4) looked at the impact of online education on medical students and found that only 13% found this method of education to be effective. Similarly, Sutoi et al. (5) found that the lack of interaction between students and other colleagues, educators, doctors, and patients was the most important disadvantage highlighted by medical students. In this study, over 75% stated that they felt online education had a negative influence on their professional development (5).

In addition to the challenges faced in pediatric training, the transition to long-distance learning has also been accompanied by a concerning decline in academic performance among students. When we evaluated our rates of academic achievements over the past few years, we found that in 2021, 37% of students in the first pediatric rotation group failed their exams. This was the first face-to-face rotation after the lockdown. In 2022, this decreased to 18% but increased again in 2023 to 28% as students had again been employing online education for the past six months due to the earthquake. The shift from traditional classrooms to virtual platforms has posed a steep learning curve for many, as students grapple with technological hurdles, a lack of face-to-face interaction with instructors, and



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potential distractions within their home environments (4, 5). The absence of immediate feedback and the informal support networks found in physical classrooms have contributed to a decline in engagement and understanding. Moreover, the digital divide has exacerbated disparities, with some students facing difficulties accessing necessary resources or maintaining a conducive learning environment.

Equally concerning is the potential impact on mental health and well-being, both for students and educators. The isolation that accompanies prolonged periods of remote learning can contribute to burnout, stress, and a sense of disconnect. In the demanding field of pediatric medicine, where empathy and emotional intelligence are integral, the toll on mental health can compromise the quality of care provided to young patients. As educators, we have all seen the toll on mental health in our students. A study by Aljhani et al. (6) showed that two-thirds of medical students reported generalized anxiety and a shocking 94.4% moderate to high stress levels during the pandemic.

As grades dip and academic motivation wanes, the repercussions are not only felt by individual students but also raise broader concerns about the long-term impact on the quality of education and the preparedness of future professionals across various disciplines, including pediatrics.

In conclusion, the closure of universities and the shift to online education during the pandemic and after the earthquake have cast a pall over the pediatric training of medical students. The loss of hands-on experiences, community collaboration, and the

potential toll on mental health could have lasting repercussions on medical students. As we navigate these challenging times, it becomes imperative to find innovative solutions to mitigate these negative effects and ensure that face-to-face education is not compromised again.

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