



MIDDLE BLACK SEA JOURNAL OF

HEALTH SCIENCE

MAY 2025

VOLUME 11

ISSUE 2

ISSN 2149-7796



**MIDDLE BLACK SEA JOURNAL OF
HEALTH SCIENCE
(MBSJHS)**



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The Middle Black Sea Journal of Health Science, which is international journal, is published by Ordu University Institute of Health Sciences on behalf of the Middle Black Sea Universities Collaboration Platform

e-ISSN 2149-7796

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Sort of Publication: Periodically

Publication Date and Place: 31 /058/ 20245, ORDU, TURKEY

Publishing Kind: Online

Indexing: *Turkey Citation Index, SOBIAD, Rootindexing, Academic Resource index, Fatcat index, Researcgate, EuroPub, Gooogle Scholar, Turk Medline, Index Copernicus*

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Aims and Scope

Middle Black Sea Journal of Health Science is an international journal that publishes original clinical and scientific research. Middle Black Sea Journal of Health Science, published by Ordu University, publishes basic innovations in health education, case reports, reviews, letters to the editor, case reports and research articles.

The aim of the journal is to contribute to the international literature with clinical and experimental research articles, case reports, reviews and letters to the editor in the field of health sciences.

The target audience of the journal is all scientists working in the field of health, graduate students and researchers in this field.

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Structure

Title

Abstract should be structured with subheadings (Objective, Methods, Results, and Conclusion) (average 200-400 word)

Key words

Introduction

Methods

Results

Discussion

Conclusion

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b) Short papers: Prospective, retrospective and all kinds of experimental studies

Structure

Title

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Key Words

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Methods

Results

Discussion

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Abstract (average 200-400 word)

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Introduction

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EDITORIAL**Dear Readers**

It is with great pleasure that we present the third issue of our journal, which continues to shed light on current developments in the field of health through an interdisciplinary perspective. This issue features a rich collection of original articles from diverse fields such as dentistry, pediatrics, neurosurgery, nursing, internal medicine, and family medicine.

The main themes of this issue include the impact of hygiene practices, wound healing processes, the management of neurological conditions such as aneurysms, the clinical course and care of dementia, and a comprehensive outlook on the future of healthcare systems. We believe that these meticulously prepared articles by experts in their fields will contribute significantly to academic knowledge and serve as a guide for clinical practice.

With a strong belief in the power of scientific production and sharing, we are excited to present this publication to you, our valued readers, which encourages interdisciplinary collaboration. We extend our sincere thanks to our authors, reviewers, and editorial board members for their contributions, and we hope that this issue will inspire and inform your work.

Sincerely,

Prof. Dr. Ülkü KARAMAN

Editor

Comparison of the Removability of Different Niti Rotary File Systems from Root Canals

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Received: 01 August 2024, Accepted: 20 February 2025, Published online: 31 May 2025
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Abstract

Objective: This study aimed to compare the removability of fractured nickel-titanium rotary instruments with different working principles in the middle and coronal thirds of the canal using ultrasonic tips and the BTR pen.

Method: Thirty-two mandibular molars were selected from recently extracted teeth that met the inclusion criteria. Teeth had to have a closed apex, no root caries, anomalies, fractures, cracks, or signs of internal or external resorption. The mesiobuccal roots were intentionally fractured, and the root inclination was confirmed to be $\leq 20^\circ$ using Schneider's method. Teeth with a higher inclination angle were excluded. Access cavities were opened traditionally to allow direct canal access, and apical patency was verified with #10 K files. Canal lengths were measured, and teeth were embedded in acrylic blocks for easier handling. The teeth were divided into four study groups (n=8) based on the working principle of the instrument and the location of the fractured instrument (coronal or middle third). NiTi instruments with the same taper (0.6) and heat treatment (blue) were selected. A 4 mm mark was made on each file, and files were thinned to half their thickness at the designated breaking point using a diamond bur. A stage platform was created with Gates Glidden burs to improve the visibility of the broken instruments. After creating the platform, dentin around the broken files was removed by 2 mm with ultrasonic tips, and the broken pieces were extracted using a BTR Pen with a 0.3 mm thin wire loop.

Results: When analyzed by working principle, the removal time for fractured instruments in the middle third was significantly higher (p=0.0001). Within the coronal third, the removal time for reciprocal files was significantly longer (p=0.021). Similarly, in the middle third, the removal time for reciprocal files was statistically longer (p=0.004).

Conclusion: The BTR Pen was effective for both rotary file systems. The location of the fractured instrument influenced the removal time, with faster results in the coronal third due to better access and visibility. Additionally, the type of fractured NiTi rotary instrument also impacted the time required for successful removal, with rotary instruments in the middle third taking significantly longer.

Keyword: Broken file, Broken file removal, BTR Pen, NiTi rotary instruments, ultrasonic.

Suggested Citation Gulgu B, Ayranci LB, Odabasi D, Tok S. Comparison of the Removability of Different Niti Rotary File Systems from Root Canals. Mid Blac Sea Journal of Health Sci, 2025;11(2):83-96.

**Address for correspondence/reprints:**

Bengi Gülgü

Telephone number: +90 (533) 026 20 02**E-mail:** bengigulgu@gmail.com**INTRODUCTION**

Instrument breakage during root canal treatment is an obstacle to effective cleaning of the canal. As a result of inadequate cleaning, the success rate of root canal treatment may decrease. Therefore, the best way to manage this complication is to remove the broken fragment from the canal and continue cleaning and shaping procedures (1).

Based on the evidence provided by endodontic follow-up radiographs, Kerekes and Torstad reported that the probability of a fragment remaining in a root canal treated tooth is between 2% and 6% (2). In a similar study, Iqbal et al. reported this incidence between 1% and 5.1% (3, 4).

According to Grossman (5) and Crump & Natkin (6), the prognosis of teeth with fractured instruments is mainly based on the preoperative condition of the tooth and periapical tissues. The prognosis was found to be better in cases where vital pulp extirpation was performed.

In teeth which diagnosed with periapical lesions before root canal treatment, half of the improvement was observed. In addition, in

almost all cases where no pathologic changes were observed in the periapical tissues before root canal treatment, the teeth remained asymptomatic despite incomplete expansion and filling due to the broken instrument (7). Ingle & Beveridge (8) found that 1% of the observed failures after endodontic treatment were due to broken instruments.

Although removal of the broken instrument is the most desirable method of maintenance, it has been reported that a complete bypass can also result in a good prognosis by clearing the entire working length of the root canal (9).

Canal anatomy and the location of the fractured instrument can make instrument removal stressful and time-consuming. On the other hand, broken instrument removal techniques may cause a number of complications such as excessive loss of dentin tissue, decreased root fracture resistance, perforations, pushing the broken fragment out of the root, and increased temperature on the root surface (10, 11). Successful removal of the broken instrument does not always guarantee that root canal treatment will result in a good prognosis. Therefore, the clinician must balance the successful removal of the broken instrument with the preservation of the existing tooth structure with minimal loss of material. Various devices and techniques have been developed to remove broken instruments during root canal

treatment (12). With the use of ultrasonic devices and tips in combination with dental microscopes, it is possible to remove the dentin surrounding the broken fragment (12, 13).

The Broken Tool removal (BTR Pen) system (Cerkamed Medical Company, Poland) is recently introduced broken tool removal system (Figure 1). The use of an ultra-thin working tip terminated with a high elasticity nitinol loop allows the broken tool to be captured within the canal. Its shape memory, which allows it to be placed in narrow and inclined root canals, prevents the loss of excess material from the tooth to remove the fractured instrument. Our knowledge of the BTR Pen is based on a very limited body of information, mostly clinical experience (1).

The aim of this study is to evaluate and compare the effectiveness of the BTR Pen in combination with ultrasonic tips on rotary instruments with different working principles and different cross-sectional areas on a time basis in the light of the above-mentioned information.

In this study, in which we compared the removability of 4mm files with different working principles (reciprocation and rotation) broken in the mesiobuccal canal of the lower molar teeth with ultrasonic and BTR Pen on the basis of time; the main aim was to evaluate the maintenance of this common complication.

The main objective was to evaluate the effect of magnification and endodontic wire loop (BTR Pen) on the removal of broken files based on the working principle of the files.

The null hypothesis of this study is that when the removal time of files with different working principles broken in the canal is compared, rotary files will take less time to be removed from the canal than reciprocal files.

It is planned that the data to be obtained in this study will give a basic idea about the removability of the files with different working principle and cross-sectional area broken in the canal in terms of time with the use of ultrasonic and BTR Pen.



Figure 1. BTR Pen Device

METHODS

A total of 32 lower molars collected with consent from patients who were decided to be extracted during routine treatment were used in the study. The molars to be used were selected from teeth with closed apex, no root caries, no anomalies, fractures or cracks, no previous root

canal treatment, and no signs of internal or external resorption.

Teeth with open apex, caries on the root surface, anomalies, fractures or cracks in the root, previous root canal treatment, root inclination calculated higher than 20° according to Schneider's method, excessive crown destruction (teeth with only one wall left in the crown) and teeth with perforation in the root canal during instrument extraction were excluded from the study.

Forty-eight eligible lower molars were embedded in acrylic blocks and traditional access cavities were opened to provide direct access to all canals. The apical patency of the mesiobuccal root of all teeth was checked with #10 K files. The length of the mesiobuccal canals was measured and noted.

The NiTi reciprocal (EasyinSmile XtwoS Blue R25, horizontal section S-shaped) and rotary (Fanta, AF Blue Rotary File, horizontal section convex triangular) instruments to be broken in the teeth were selected with the same taper (0.6) and heat treatment (blue). A 4 mm marking was made on the files to be broken and all files were thinned with a diamond bur at half their thickness at the point to be broken. (Figure 2)

These teeth, whose access cavities were opened conventionally, were divided into 4 groups (n=8) according to the working principle of the root canal shaping instruments used and

according to the intra-canal location where the root canal instrument would break.

In the 1st study group (RecipC) (n=8), the reciprocal files were broken 4 mm coronally.

In the 2nd study group (RecipM) (n=8), the reciprocal files were broken 4 mm in the middle third.

In the 3rd study group (RotaryC) (n=8) rotary files fractured 4 mm coronally.

In the 4th study group (RotaryM)(n=8) rotary files fractured 4 mm in the middle third.

The fracture locations of the broken files were checked by digital radiography (Figure 4A, 4C). Specimens with broken instruments that could not be broken in the planned direction were excluded from the study. The total time of the expansion and broken instrument removal stages after the control was measured with a stopwatch and recorded.

For the removal of broken instruments, an stage platform was created by working in a controlled manner with Gates Glidden milling cutters numbered 2 and 3 to provide full access to the instrument. After the fractured fragment was visualized with a 3x magnification Zumax loupe, DTE ultrasonic tips (E88) were used in the G3 mode of the DTE ultrasonic device to free the 2 mm dentin in the coronal part of the fractured fragment. The mobility of fractured instruments was checked with a 20 hand

plugger. The mobilized fractured fragment was grasped with the finest 0.3 mm wire loop tip of the BTR Pen and removed from the canal (Figure 2 and Figure 3). The tooth from which the instrument was removed was checked again by radiograph (Figure 4B, 4D)



Figure 2. Broken File



Figure 3. Broken File Extracted With BTR Pen



Figure 4. A: Control Radiograph for Coronally Located Fractured Instrument
B: Control Radiograph Taken After Removal of The Coronally Located Fractured Instrument
C: Control Radiograph for Middle Third Located Fractured Instrument
D: Control Radiograph Taken After Removal of The Middle Third Located Fractured Instrument

Statistical analysis

The sample size required for this study was calculated using G*Power version 2. Statistical analyses were performed with NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA) package program. In addition to descriptive statistical methods (mean, standard deviation), the distribution of variables was examined with the Shapiro-Wilk normality test, and two-way analysis of variance (Two-Way ANOVA) was used for intergroup comparisons of normally distributed variables. The results were evaluated at a significance level of $p < 0.05$.

RESULTS

When the reciprocal files were compared within themselves, the mean removal time (min) of the coronally positioned fractured files in the RecipM group ($50:09 \pm 2:45$) was statistically significantly higher than the fractured files in the RecipC group ($13:07 \pm 2:07$) ($p = 0.0001$).

When the rotational files were compared among themselves according to their position in the canal, the results were similar. The mean time (min) for removal of broken files in the RotaryM group ($37:01 \pm 9:02$) positioned in the middle third was statistically significantly higher than in the RotaryC group ($9:02 \pm 2:34$) positioned in the coronal third ($p = 0.0001$).

When the study groups in the coronal third were compared according to the working principle of

the files, the mean time ($13:07 \pm 2:07$) (min) required to remove the broken files in the RecipC group working with reciprocal motion was statistically significantly higher than the RotaryC group working with rotation ($9:02 \pm 2:34$) ($p = 0.021$).

When the study groups in the middle triad were compared according to the working principle of the files; the mean removal time ($50:09 \pm 2:45$) (min) of the broken files working with reciprocal motion in the RecipM group was statistically significantly higher than the files working with rotational motion ($37:01 \pm 9:02$) in the RotaryM group ($p = 0.004$).

The mean time to remove the broken instrument ($31:01 \pm 19:26$) (min) of the reciprocation group was statistically significantly higher than the rotation group ($23:02 \pm 15:01$) ($p = 0.0001$). This result confirms the null hypothesis of our study.

The mean time to remove the broken instrument ($43:02 \pm 9:44$) (min) in the medial section was statistically significantly higher than in the coronal section ($11:52 \pm 2:02$) ($p = 0.0001$) (Table 1, Graph 1).

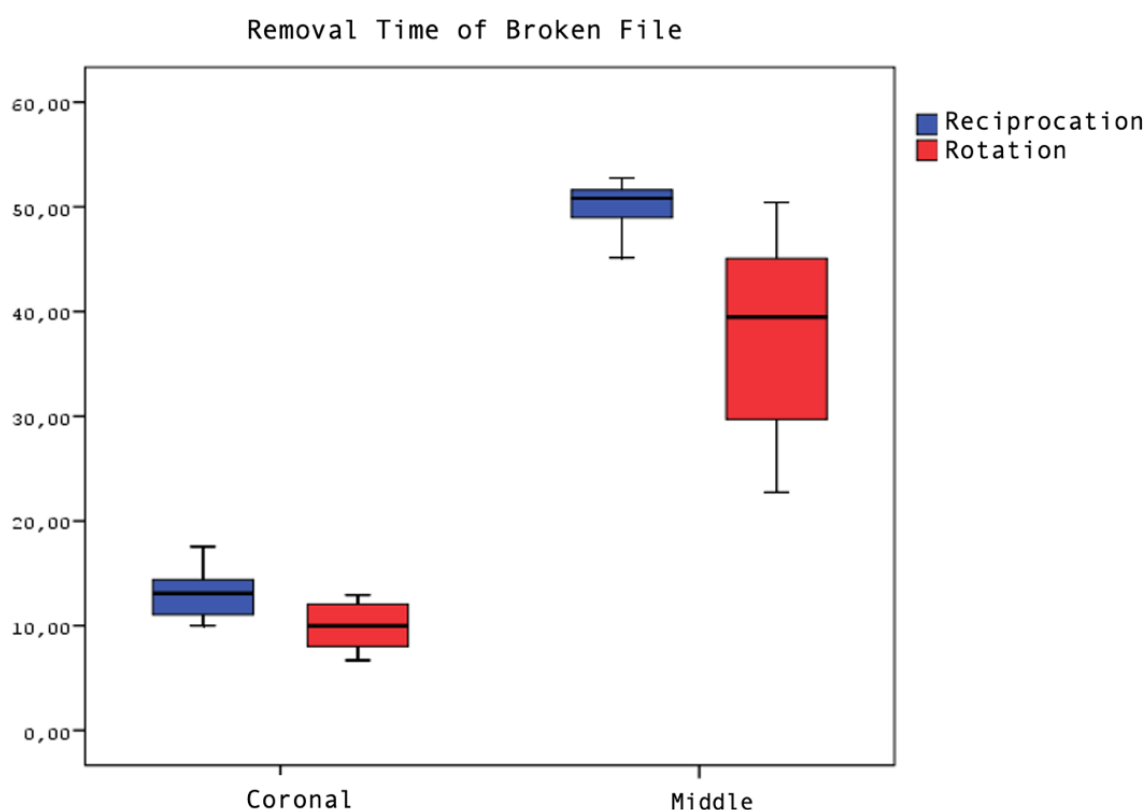
A statistically significant difference was observed between the mean duration of removal of the fractured instrument (min) when the Movement*Location groups were compared within themselves ($p = 0.021$) (Table 2)

Table 1. Specification Of Movement Types And Fracture Instrument Placement Over Time

	Coronal	Middle	Total
Reciprocation	13:07±2:07	50:09±2:45	31:01±19:26
Rotation	9:02±2:34	37:01±9:02	23:02±15:01
Total	11:52±2:02	43:02±9:44	27:01±17:01

Table 2. spesification of sum of squares, df, mean square, F and p for motion and location

	Type III Sum of Squares	df	Mean Square	F	P
Motion	480,37	1	480,37	16,72	0,0001
Location	8388,90	1	8388,90	292,05	0,0001
Motion*Location	171,82	1	171,82	5.98	0,021

**Graph 1.** Boxplot of groups and removal time

DISCUSSION

The separation of the instruments used during endodontic treatment in the canal is a problem encountered by all clinicians performing root canal treatment. The frequency of broken instruments in molars was significantly higher than in premolars, canines or incisors.

Especially the mesiobuccal canals of molars are the most frequently fractured canals due to the curvature of the canal anatomy (3, 14) Therefore, the present study was carried out on broken files in the mesiobuccal roots of lower molars.

The introduction of Nickel-Titanium (NiTi) alloy in endodontics has led to the production of more durable and flexible instruments (15). Since the first hand files, the use of this alloy has led to more reliable preparation (16). Today, NiTi rotary instruments have found a wide place in endodontics with a wide variety of instruments including different horizontal sections, taper and new variations of NiTi alloy (17).

Rotary tools, which often show no evidence of plastic deformation, are seven times more likely to fracture than hand tools (3, 18). Fractures in NiTi rotary tools are usually caused by flexural fatigue, torsional fatigue, or an interaction of both (19, 20). The cause of fracture of stainless steel hand tools is high torque (21).

Recent studies have investigated the fracture frequency of NiTi tools operating in reciprocal or rotational kinematics. In these studies, controversial results have been presented depending on the number of uses of the tools, the experience of the user and the operating system of the current file (22, 23, 24). In recent studies, the effect of different cross-sectional areas on fatigue strength is also a frequently investigated topic with controversial results. Cheung and Darvell, in a study of 4 rotary files with different cross-sectional shapes, concluded that cross-sectional area has no significant effect on cyclic fatigue induced fractures (25).

In vitro studies have shown that changes in the operating principle increase fracture resistance to cyclic fatigue when a larger cutting angle than the relief area is presented in the reciprocal motion (26). During the periodic change of the angle, the positions of the critical stress fields gradually change, so that the stress fields are effectively distributed to various points of the file, distributing the damage to the file and prolonging the life of the tool.

A recent study concluded that Reciproc files with overlapping cross-sectional areas have a longer service life than Mtwo files. The findings of the study support the view that increased flexibility and reciprocal motion during the use of files in curved grooves increases the cyclic fatigue life of NiTi files (27).

Although there are many studies that correlate the cross-sectional area and working principle of the file with the frequency of fracture, there is limited literature that attempts to establish a relationship between the working principle and the removability of the file. For this reason, in our study, we wanted to compare two different rotary files with different cross-sectional areas and different rotation and reciprocation working principles in terms of removability.

Three orthograde methods are utilized in the maintenance of broken instruments. In the first two, the fractured fragment maintains its position in the canal by filling the rest of the canal or bypassing the apical canal and filling

it. The third option is to remove the existing fragment from the canal, continue the washout shaping procedures and finish the canal treatment (28).

Various methods have been developed to remove the broken instrument in the canal. Ruddle (29) reported a case of ultrasonic trephine burs removing the dentin coronal to the broken instrument after creating an entry platform. The combination of the dental microscope and ultrasonics has been reported to increase the success rate and reliability of broken instrument removal (30). Broken instrument removal methods from the root canal must include equipment that can achieve high success rates in a short time with minimal dentin removal (31). The BTR Pen system is a newly introduced system developed to provide easy access to narrow and curved canals.

Successful removal of a broken instrument depends on the type of material, its location and length. The shorter the broken instrument, the more difficult it is to remove.

Success rates have been found to be higher for instruments of 5 mm or more. This may be due to the fact that the long fragments are attached to the root dentin at the ends and there is enough space in the coronal portion to allow bypassing and thus some loosening and movement of the instrument within the canal (e.g. with ultrasonic devices) (32).

One of the possible success factors in the removal of the broken instrument is the type of root canal. It has been observed that broken fragments can be removed more easily in teeth with wide root canals such as canines. In the distal canals of mandibular molars and palatal canals of maxillary molars, success rates were found to be 67% and 60%, respectively, in a study by Hülsmann. The mesial canals of mandibular molars are often curved. The isthmus, which is frequently observed between the mesiobuccal and mesiolingual canals, has been recorded to allow bypassing the broken instrument with a rate of 58%. Considering the curvature of the canal, it would not be a surprise that the success of canal instrument extraction is higher in straight or slightly to moderately curved canals. It is also predictable that instruments located apical to the curvature have a lower removal rate than instruments located coronal to the curvature. It should be kept in mind that two-dimensional images can be misleading when the only data we have are radiographs (7). Considering all these findings and the limited magnification and illumination we will use in our study, the coronal and middle triads of the mesiobuccal canals of the lower molars were preferred for the placement of broken instruments.

When compared between leaving the instrument in the canal and removing it from the canal, removal from the canal is the more preferred option if it is feasible (33). A

standardized procedure that gives definitive results for this is still under investigation. Ormiga et al. (34) tried to remove the broken instrument from the canal by electrochemical thawing, but they did not achieve the expected result. In a study by Shahabinejad et al. ultrasonics was utilized and the success rate was found to be 80% as a result of the removal of the broken instrument by ultrasonics on 70 extracted teeth (28). The success of the ultrasonic technique has been investigated in many studies in vivo and in vitro. Terauchi et al. (31) achieved a success rate of 83.3% with apically located broken files in 30 extracted mandibular incisors. Souter et al. (11) reported success in 91.1% of the mandibular molars in an invitro study. Again, Souter et al. reported a success rate of 70% in an in vivo study on mandibular molars. Considering that the use of ultrasonics will remove less material from the root canal after the creation of an entry platform that will provide direct access to the fractured instrument, ultrasonic tips (DTE; E88) were used in our study to remove the surrounding dentin 2 mm coronal to the fractured fragment and to mobilize the fractured fragment.

The BTR Pen is a relatively new technique used in broken instrument maintenance. Its purpose is to make it easier to access the fractured instrument fragment in locations that are difficult to reach with a simple wire loop. According to the manufacturer's statement; it provides a significant advantage in terms of

time and experience in removing difficultly located, long and high elasticity fracture fragments. According to the information obtained from the manufacturer's website, the BTR Pen can be used successfully in curved root canals and canals with wide apical openings without causing the fracture fragment to be pushed apically. Among the 0.3, 0.4 and 0.5 mm thin wire loops, 0.3 mm thin wire loops were preferred for the mesiobuccal canal of molar teeth, taking into account the manufacturer's recommendation.

The BTR-Pen system also suggests that a longer broken instrument fragment is easier to remove. Further studies and more results are needed to check the accuracy of this proposition. In our study, the size of the fragment to be fractured was determined as 4 mm.

In the present study, some complications and difficulties were encountered while using the BTR Pen and ultrasonic tips. It was observed that contact of the ultrasonic tip with the fractured file fragment caused shortening of the file length and abrasion. A similar finding was reported by Terauchi et al. (31) and Hülsmann and Schinkel (7). Due to the abrasion of the fracture fragment, it was necessary to remove more dentin around the fracture fragment before placing the BTR pen. In addition, if the fracture fragment was too stuck in the canal, dentin removal was continued until it was seen to be mobilized. Even when insufficiently

mobilized fragments were captured in the canal with the BTR Pen, the force applied for removal caused the 0.3 mm thin wire to break.

Among the groups in our study, the shortening of the file length by breaking at the contact between the ultrasonic tip and the broken file was more frequent in the reciprocating files than in the rotation group. This was thought to be one of the factors that may have led to a significantly longer removal time of the fractured fragments in the reciprocating groups in the comparison of the working time.

It is obvious that dentin loss will occur regardless of the method to be used to reach the broken fragment and remove the fragment from the canal. For this reason, no matter which technique is used in broken instrument removal, utmost care is required to remove the broken instrument from the canal. In our study, teeth with perforation in the root canal during broken instrument removal were excluded from the study.

Another limitation of our study was to ensure that the fragment was broken in the planned location. It is known that instrument fractures are frequently seen in the apical third of the root (28). In our study, fractures in the apical triangle were excluded due to limited magnification and illumination possibilities. In order to position the fractured fragment in the desired position (coronal or middle third), the EasyinSmile and Fanta files were thinned to half the thickness of the file with a diamond

fissure cutter at the desired working length of 4 mm and inserted into the canal under pressure. This resulted in an inability to replicate clinical conditions..

CONCLUSION

As a result of the findings of our study, it can be said that the working principle and cross-sectional area of the file fractured in the canal also have an effect on the removal time of the fractured fragment. Files with rotational motion were found to be easier to remove from the canal than those with reciprocal motion. At the same time, the removal of fracture fragments located coronal to the canal was realized in a shorter time than the middle triad. Further in vitro and in vivo studies are needed to determine the effect of the working principle on removability.

Acknowledgements: Many thanks to Ordu University Scientific Research Projects Coordination Unit for their support of the research conducted under the code A2123.

Ethics Committee Approval: Approval for this study was obtained from the Ordu University Non-Interventional Research Ethics Committee (Date: 26/07/2024 Number: 95).

We state that the parents have given their written informed consent to be involved in the

study, in accordance with the Declaration of Helsinki.

Peer-review: Externally peer-reviewed

Author Contributions: Concept: LBA, DO, ST, Design: LBA, DO, ST, BG, Data Collection and Processing: LBA, DO, ST, BG, Analysis and Interpretation: LBA, DO, ST, Writing: LBA, BG

Conflict of Interest: The authors declared no conflict of interest.

Financial Disclosure: Ordu University BAP A2123

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Knowledge Levels of Physicians, Nurses, and Health Technicians Working in A Children's Hospital Regarding Anaphylaxis and Adrenaline Auto-Injectors

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Received: 16 September 2024, Accepted: 20 February 2025, Published online: 31 May 2025

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Abstract

Objective: Anaphylaxis should be recognized and treated by physicians and healthcare workers. In our study, we aimed to determine the knowledge and education levels regarding anaphylaxis and the attitudes towards adrenaline auto-injector use among doctors, nurses, and health technicians working in the Women's and Children's Annex of Ordu University Training and Research Hospital, a tertiary healthcare institution.

Method: A 15-item questionnaire designed to assess demographic data, employment status, and knowledge level about anaphylaxis and its management was administered to the participants.

Results: The study was completed with 136 participants, including 66 physicians, 58 nurses, and 12 technicians. It was found that 75 participants had knowledge about adrenaline auto-injectors, with 9.3% having previously issued a report on auto-injectors. Physicians showed greater knowledge in correctly administering adrenaline during anaphylaxis compared to other professional groups. Healthcare workers in the emergency department demonstrated higher levels of knowledge in adrenaline administration compared to those in other units. While no significant relationship was found between professional experience and the selection of correct treatment methods in anaphylaxis, those with longer professional lives were found to have better knowledge about adrenaline administration proportionally. Another finding from our study is that participants who received training within less than 3 years had more accurate knowledge about adrenaline administration compared to others.

Conclusion: The repetition of essential training and keeping knowledge up-to-date are crucial for correct application and treatment in anaphylaxis. There is a need for organizing training sessions to increase knowledge levels and awareness, particularly among healthcare workers, including physicians.

Keyword: Anaphylaxis, Adrenaline, Auto-injector

Suggested Citation Altınok EI, Yapar Gumus C. Knowledge Levels of Physicians, Nurses, and Health Technicians Working in A Children's Hospital Regarding Anaphylaxis and Adrenaline Auto-Injectors. Mid Blac Sea Journal of Health Sci, 2025;11(2):97-106.

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INTRODUCTION

Allergy refers to an exaggerated reaction of the immune system to substances or agents that usually do not cause any reaction in most individuals. These substances, known as allergens, can enter the body through the mouth, skin, or respiratory tract. For an allergic reaction to develop, the individual must have been previously exposed to the allergen (1).

Common allergic diseases include atopic dermatitis, allergic rhinitis, asthma, allergic conjunctivitis, angioedema, and food, insect, and drug allergies. It is known that the prevalence of these diseases has significantly increased in recent years, supported by studies conducted in various countries (2). Food, insect, and drug allergies often present with urticaria, which are raised, red, itchy welts that blanch with pressure. Another type of allergic reaction is angioedema, which is localized swelling in the subcutaneous tissue, most commonly affecting the extremities, face, genital organs, airways, and gastrointestinal system. Anaphylaxis is a severe allergic reaction with a rapid onset that can be fatal (3).

Anaphylaxis is an IgE-mediated immunological reaction leading to the rapid release of mediators from mast cells and basophils. However, IgG (only in animal models) and immune complex/complement-mediated immunological reactions can also cause anaphylaxis. The most common triggers are known to be foods, with a prevalence reported between 0.05-2% (4). Exercise, cold, contrast agents, and various drugs can also trigger mediator release through non-immunologic pathways, termed anaphylactoid reactions.

The diagnosis of anaphylaxis is made based on clinical signs, history, and physical examination findings. When taking a history, details such as when and how the event occurred, its duration, any treatments applied, and potential and probable triggers should be thoroughly investigated. Anaphylaxis should be considered in the presence of sudden onset of symptoms involving two or more systems, such as the skin, respiratory, circulatory, and digestive systems (5). While symptoms typically appear within the first two hours after exposure, late-onset cases should not be overlooked, and information about medications taken and foods consumed in the last 4-6 hours should be obtained. Skin findings are often present but may not always accompany anaphylaxis.

The first choice and life-saving medication in the event of anaphylaxis is intramuscular

adrenaline. Despite the potential risk of death, this risk can be minimized with correct and prompt treatment approaches (6).

The treatment dose is 0.01 mg/kg (maximum 0.3 mg) in children and 0.5 mg in adults. There are no contraindications, and the dose can be repeated at 5-minute intervals if clinically necessary. All patients who have experienced anaphylaxis should be prescribed an adrenaline auto-injector, and the patient and their relatives should be practically informed on its use. If an adrenaline auto-injector is to be used, 0.15 mg/dose should be applied for children weighing between 7.5-25 kg, and 0.3 mg/dose for those over 25 kg (7). Moreover, patients should be referred to allergy clinics for follow-up and, if necessary, for planning immunotherapy.

Recognizing and treating anaphylaxis, which can be fatal but is treatable with rapid intervention, is essential for both physicians and healthcare workers. Various studies conducted in our country indicate a lack of knowledge on this subject (8, 9).

This study aims to assess the knowledge and education levels regarding anaphylaxis and attitudes towards using adrenaline auto-injectors among doctors, nurses, and health technicians working in the Obstetrics and Pediatrics annex of the Ordu University Training and Research Hospital, a tertiary healthcare institution.

METHODS

The study was designed to include physicians, nurses, and anesthesia technicians working in the Obstetrics and Pediatrics annex of Ordu University Training and Research Hospital. The current total number of these individuals was obtained from the personnel department of our hospital (155 individuals). Using epi info 7, the sample size was calculated as 128, assuming a 66% prevalence, with a 5% margin of error, a 95% confidence interval, and a 20% non-response rate (10). The improbable sample technique was used. A 15-question survey was administered to evaluate demographic data, work assessments, and knowledge levels regarding anaphylaxis and its management. Participants who could not be contacted face-to-face during the study and those who did not want to fill out the consent form were excluded.

Statistical analysis

The data were analyzed using the SPSS 26.0 software package. For categorical variables, the data are presented as frequencies and percentages, while for numerical variables, the mean and standard deviation values are provided. A 95% confidence level was typically used when calculating the confidence interval. The chi-square test was used to examine the relationship between the method of adrenaline administration and other independent variables. The significance level was set at $p < 0.05$.

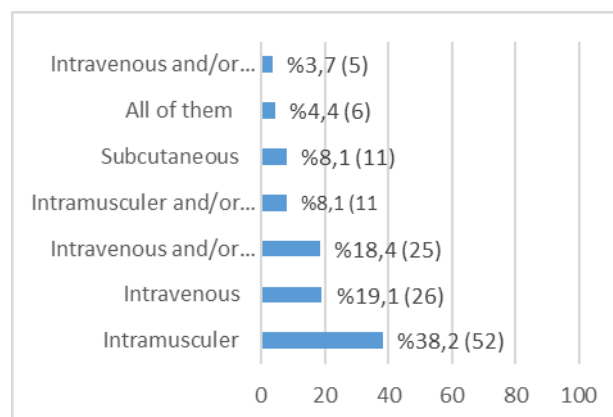
RESULTS

The study was completed with 136 participants, including 66 doctors (48.5%), 58 nurses (42.6%), and 12 technicians (8.9%). The physicians in the study specialized in Pediatrics, Obstetrics and Gynecology, Pediatric Surgery, Anesthesia, Family Medicine, and Emergency Medicine. In total, 103 (75.7%) participants were female, and 33 (24.3%) were male. The mean age was calculated as 34.11 ± 8.99 years. The distribution and work statuses of the participants are shown in Table 1.

Of the participants, 99 (72.8%) reported having received training on anaphylaxis, with most of this training (62.6%) occurring outside their current institution. Among the participants, 88 (64.7%) had previously encountered an anaphylaxis case, with 51.1% of them being physicians. The most common causes of anaphylaxis in encountered cases were drugs (33%), bee stings (27.3%), and food allergies (5.7%). Thirteen participants (15.2%) reported that adrenaline was not administered in the anaphylaxis cases they encountered, and 9 (10.5%) stated that only adrenaline was used. The majority (51, 59.3%) indicated that adrenaline, steroid, and antihistamine were used together (Table 2).

Questions regarding the method of adrenaline administration and knowledge of adrenaline auto-injectors were directed to measure knowledge levels. Among the participants, 52

(38.2%) knew that adrenaline should be administered intramuscularly in anaphylaxis cases. Twenty-six participants (19.1%) stated it should be administered intravenously, and 25 participants (18.4%) indicated it could be administered intravenously and/or intramuscularly (Graph 1).



Graph 1. Routes of Adrenaline Administration in Anaphylaxis According to Participants (Percentage and Frequency)

It was found that 75 participants (55%) had knowledge of adrenaline auto-injectors, and 9.3% of them had previously issued an auto-injector prescription.

Physicians were more knowledgeable than other occupational groups regarding the correct administration of adrenaline in anaphylaxis ($p < 0.001$). Participants working in emergency services had higher knowledge levels about adrenaline administration compared to those working in other units ($p < 0.001$). Another finding was that participants who had received anaphylaxis training within the past three years had more accurate knowledge about adrenaline administration compared to other participants ($p = 0.03$) (Table 3).

Table 1. Demographic Characteristics and Employment Status of Participants

Gender	Number (n)	Percent (%)
Female	103	75.7
Male	33	24.3
Age (mean \pm standard deviation = 34.11 \pm 8.99)		
≤ 34	77	56.6
> 34	59	42.4
Occupation		
Doctor	66	48.5
Nurse	58	42.6
Technician	12	8.9
Years of practice		
< 5	50	36.8
5-10	21	15.4
> 10	65	47.8
Work unit		
Emergency department	30	22.1
Operating room	21	15.4
Outpatient clinic	22	16.2
Ward	30	22.1
Intensive care unit	14	10.3
Other	19	14

Table 2. Treatments administered in encountered cases

	Number (n=88)	Percent (%)
Adrenaline	9	10.5
Adrenaline+Antihistamine	7	8.1
Adrenaline+Steroid	6	7
Steroid	1	1.2
Steroid+Antihistamine	12	14
Adrenaline+Steroid+Antihistamine	51	59.3

Table 3. Characteristics of healthcare professionals according to the method of adrenaline administration in anaphylaxis.

	Method Of Adrenaline Administration		P
	Intramuscular	Others	
Frequency (Percentage)			
Gender			
Female	36 (69.2)	67 (79.8)	0.16
Male	16 (30.8)	17 (20.2)	
Age (mean ± standard deviation = 34.11 ± 8.99)			
≤34	31 (59.6)	46 (54.8)	0.57
>34	21 (40.4)	38 (45.2)	
Occupation			
Doctor	36 (69.2)	30 (35.7)	<0.001
Nurse	15 (28.8)	43 (51.2)	
Technician	1 (1.9)	11 (13.1)	
Years of practice			
<5	19 (36.5)	31 (36.9)	0.96

≥5	33 (63.5)	53 (63.1)	
Work unit			
Emergency department	20 (38.5)	10 (11.9)	<i><0.001</i>
Other	32 (61.5)	74 (88.1)	
History of allergic disease			
Yes	18 (34.6)	33 (39.3)	0.58
No	34 (65.4)	51 (60.7)	
Anaphylaxis training			
Yes	41 (78.8)	58 (69)	0.21
No	11 (21.2)	26 (31)	
Currently receiving training at the institution			
Yes	12 (29.3)	25 (43.1)	0.16
No	29 (70.7)	33 (56.9)	
≤3 years	25 (61)	24 (40.7)	<i>0.03</i>
>3 years	16 (39)	35 (59.3)	
Previous encounter with anaphylaxis case			
Yes	37 (71.2)	51 (60.7)	0.21
No	15 (28.8)	33 (39.3)	
Causative agent of anaphylaxis in encountered case			
Drug	14 (37.8)	15 (29.4)	0.38
Food	3 (8.1)	2 (3.9)	
Bee sting	11 (29.7)	13 (25.5)	
Other	9 (24.3)	21 (41.2)	
Treatment administered in encountered case			
Adrenaline only	5 (13.9)	4 (8)	<i>0.02</i>
Adrenaline + Antihistamine and/or steroid	30 (83.3)	34 (68)	
Non-adrenaline	1 (2.8)	12 (24)	
Knowledge about adrenaline auto-injector			
Yes	33 (63.5)	42 (50)	0.12
No	19 (36.5)	42 (50)	
Issuance of adrenaline auto-injector prescription			
Yes	5 (9.6)	2 (2.4)	0.07
No	47 (90.4)	82 (97.6)	

DISCUSSION

Anaphylaxis, a sudden onset condition that can result in death, must be well recognized and

managed by healthcare professionals. The incidence of anaphylaxis in the general population is 49.8 per 100,000 person-years, whereas it is 70 per 100,000 person-years in

children (11). Therefore, it is crucial for pediatricians and other healthcare providers working with children to be equipped with the knowledge and skills to manage anaphylaxis when encountered. This study aimed to evaluate the knowledge levels of healthcare professionals working in our institution, which provides services in emergency, intensive care, operating rooms, outpatient clinics, and inpatient services, in the field of pediatric and women's health.

Although food-related anaphylaxis is expected to be more common compared to other triggers (4), our findings identified drug-induced and bee sting-related anaphylaxis as the most frequent cases encountered.

Among the participants, 68.2% of the physicians reported previous encounters with anaphylaxis. Physicians constituted the group with the highest encounter rate of anaphylaxis at 51.1% among all participants. In a study by Çimen et al. (12) involving 301 participants, 64% reported previous encounters with anaphylaxis, with physicians having the highest rate, although other healthcare workers also reported experiences with anaphylaxis at a rate of 54%. Significant differences were noted in the knowledge of adrenaline administration between those who had previous experience with anaphylaxis and those who did not. However, in our study, while participants with longer professional experience (>5 years) had more encounters with anaphylaxis, there was no

significant difference in correct adrenaline administration between those who had encountered anaphylaxis and those who had not ($p=0.96$).

Among all participants, the group with the highest correct response rate regarding the intramuscular route of administration was physicians, at 69.2% ($p<0.001$). Furthermore, 54.5% of physicians knew that intramuscular adrenaline is the first-line treatment for anaphylaxis. According to Akova et al. (13), a study involving 30 pediatric residents, all residents chose adrenaline as the first-line medication, and 97% of them knew that the intramuscular route was the preferred method of administration. Another study involving family physicians reported a 90% preference for adrenaline as the first-line treatment for anaphylaxis (14). While there was no significant difference ($p=0.3$) in knowledge about adrenaline being the first-line treatment between experienced family physicians (over 10 years of experience) and other groups, experienced physicians showed significantly better knowledge about administration routes ($p=0.004$). In our study, although there was no significant relationship between professional experience and choice of correct treatment method for anaphylaxis ($p=0.96$), participants with longer work experience had a better knowledge level regarding adrenaline administration (63.5%).

Our study also found that only 1.9% of technicians and 28.8% of nurses knew that adrenaline should be administered via the intramuscular route. Baççioğlu et al. (9) reported higher knowledge levels regarding correct anaphylaxis treatment among nurses compared to other medical auxiliary staff. However, they emphasized a significant decrease in knowledge levels among specialist doctors, medical students, nurses, and technicians. We believe that the limited number of anesthesia and emergency technicians in our study might have created constraints.

In our study, 72.8% of participants had received training on anaphylaxis, with approximately half of them having received training within the last 3 years. There was no significant difference in correct application between those who received training and those who did not. However, proportionally, 78.8% of those who had correct knowledge about adrenaline administration had received previous training. Among the total 84 participants who administered adrenaline via non-intramuscular routes for anaphylaxis, 69% had received training on anaphylaxis before. According to Çimen et al. (12), there was a significant difference ($p < 0.001$) in having correct knowledge about adrenaline treatment between those who received anaphylaxis training and those who did not. Another finding from our study was that individuals who received training within less than 3 years had better

knowledge about adrenaline administration compared to others ($p = 0.03$), highlighting the importance of regular training and keeping knowledge updated for correct application and treatment of anaphylaxis.

Only 29.3% of participants who received training on anaphylaxis did so within their current institution, and most of them had received training more than 3 years ago. This result suggests a need for planning new training sessions.

In managing anaphylaxis in the long term by patients and/or their families, recognizing the clinical signs of anaphylaxis, avoiding triggers, prescribing and teaching the use of adrenaline auto-injectors by doctors are life-saving practices (15). In our study, 55% of participants knew about adrenaline auto-injectors. Among them, 49 were physicians, and only 7 of them reported having issued an auto-injector prescription before. In a study conducted with family physicians in our country, 75.6% of physicians were found to be aware of adrenaline auto-injectors (16).

The limitations of our study include its single-center design and the imbalance in the distribution among groups, which may affect the statistical analysis. Additionally, the absence of probability sampling is another limitation, as it may reduce the generalizability of the findings to the broader population.

CONCLUSION

There is a need for organizing educational programs to increase knowledge and awareness about anaphylaxis among healthcare professionals, especially among physicians. It is essential to educate healthcare professionals about adrenaline use and prescription of auto-injectors to enhance awareness among patients and families dealing with anaphylaxis. Providing anaphylaxis training to healthcare professionals who encounter anaphylaxis for the first time and keeping this training updated are crucial.

Acknowledgements: The authors would like to appreciate the patients participation in this study.

Ethics Committee Approval: Approval for this study was obtained from the Ordu University Non-Interventional Research Ethics Committee (date 29.09.2023 and number 2023/246)

We state that the parents have given their written informed consent to be involved in the study, in accordance with the Declaration of Helsinki.

Peer-review: Externally peer-reviewed

Author Contributions: Concept: EIA, Design: EIA, Data Collection and Processing: EIA,

CYG, Analysis and Interpretation: EIA, Writing: EIA, CYG,

Conflict of Interest: The authors declared no conflict of interest.

Financial Disclosure: The authors declared that this study has not received no financial support.

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The Relationship Between the Amount of Radiological Bleeding and The Development of Vasospasm in Aneurysm Hemorrhage: A 100-Case Retrospective Study

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Received: 12 November 2024, Accepted: 27 March 2025, Published online: 31 May 2025

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Abstract

Objective: Intracranial aneurysms are pathological dilations of the intracranial arterial wall. The rupture of an aneurysm and the subsequent hemorrhage into the subarachnoid, intraventricular, or subdural spaces constitute a significant clinical condition associated with high morbidity and mortality. Aneurysmal subarachnoid hemorrhage (SAH) can lead to various severe complications, one of the most critical being ischemia due to cerebral vasospasm. In this study, we aim to analyze the relationship between the amount of hemorrhage and vasospasm.

Method: This study was conducted on patients admitted to the Neurosurgery Clinic of the Ministry of Health Ankara Training and Research Hospital with a diagnosis of spontaneous subarachnoid hemorrhage (SAH). The diagnosis of SAH was established based on computed tomography (CT) imaging and lumbar puncture (LP) findings. To diagnose aneurysms, all patients underwent four-vessel cerebral digital subtraction angiography (DSA). The CT images obtained at the time of admission were evaluated using the Fisher grading system. Additionally, angiographic vasospasm was assessed. For the statistical evaluation of the obtained results, the Z-test and chi-square (X^2) test were used to analyze proportions.

Results: The mean age of the patients was calculated as 49 years. The age distribution of the cases was as follows: 36% were in the 40-49 age group, 27% in the 50-59 age group, and 15% in the 60-69 age group. In terms of gender distribution, female predominance was observed, with 64% of the 100 cases being female and 36% male. According to the Fisher grading system, the highest incidence of subarachnoid hemorrhage on brain CT was observed in grade 3. The percentage of patients classified as Fisher grade 3 was 36%, followed by 33% in grade 4, 23% in grade 2, and 8% in grade 1. Angiographic vasospasm was defined as a contrast-narrowing phenomenon in the main cerebral arteries, which could be either focal or, in some cases, diffuse. Clinical vasospasm was detected in 23% of cases, whereas angiographic vasospasm was identified in 59% of cases. The

highest incidence of angiographic vasospasm was observed in Fisher grade 3, at a rate of 42.4%. This was followed by 32.2% in grade 4, 18.6% in grade 2, and 6.8% in grade 1. The high incidence in Fisher grade 3 was found to be statistically significant ($p<0.05$).

Conclusion: Our study highlights both the advantages and limitations of the Fisher grading system. A statistically significant relationship was found between Fisher grade 3 and cerebral vasospasm.

Keyword: Bipolar disorder, stigmatization, emotional expression, loneliness, stress, depression, and anxiety

Suggested Citation Sahin O, Bayar MA, Tekiner A, Gokcek C, Nurullah E, Erdem Y, Celik H, Karatay M. The Relationship Between the Amount of Radiological Bleeding and The Development of Vasospasm in Aneurysm Hemorrhage: A 100-Case Retrospective Study. Mid Blac Sea Journal of Health Sci, 2025;11(2):107-115.

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INTRODUCTION

Intracranial aneurysms are pathological dilations of the intracranial arterial wall. The rupture of an aneurysm and the subsequent hemorrhage into the subarachnoid, intraventricular, or subdural spaces constitute a serious clinical condition associated with high morbidity and mortality rates. Various studies have reported that the annual incidence of aneurysmal subarachnoid hemorrhage (SAH) is approximately 10-11 cases per 100,000 individuals. However, this incidence varies by region, with rates as low as 2 per 100,000 in China and as high as 16.8 to 18.33 per 100,000 in Japan and Finland (1).

Approximately 80% of patients with aneurysmal subarachnoid hemorrhage (SAH)

experience a sudden and severe headache that is unresponsive to analgesics. In addition, symptoms suggestive of aneurysmal SAH include nausea, vomiting, altered consciousness, meningeal irritation signs, and focal neurological deficits (1).

Aneurysmal SAH can lead to serious complications, one of the most significant being cerebral ischemia, with cerebral vasospasm being one of its most critical clinical consequences (1,2). Vasospasm is defined as the focal or diffuse narrowing of arteries and can be detected using both radiological imaging techniques and clinical evaluation. Patients who develop vasospasm are at high risk for delayed ischemic neurological deficits due to reduced cerebral blood flow (3).

Various methods exist for classifying and predicting the development of vasospasm, one of the most commonly used being the Fisher Grading System. This system is considered one of the most effective tools for assessing the extent of subarachnoid hemorrhage on

computed tomography (CT) images. Additionally, it has a high predictive value for determining the timing and severity of cerebral vasospasm (4).

In this study, 100 patients who were admitted to the Neurosurgery Clinic of the Ministry of Health Ankara Training and Research Hospital with a diagnosis of spontaneous SAH between January 1993 and January 2005 were retrospectively analyzed both clinically and radiologically, and the findings were discussed in the context of the existing literature.

The aim of this study is to determine the incidence of vasospasm in aneurysmal subarachnoid hemorrhage patients using the Fisher Grading System and to evaluate the relationship between vasospasm and Fisher Grades. Furthermore, by retrospectively analyzing the clinical and radiological characteristics of the patients, this study seeks to examine the correlation between the severity of subarachnoid hemorrhage and the development of vasospasm in line with literature. In this regard, we aim for our study to contribute to the management of subarachnoid hemorrhage and to provide insight for future research.

METHODS

In this study, 100 patients who were admitted to the Neurosurgery Clinic of the Ministry of Health Ankara Training and Research Hospital with a diagnosis of spontaneous subarachnoid

hemorrhage (SAH) between 1993 and 2005 and were found to have an intracranial aneurysm on angiography were retrospectively analyzed. Both surgically treated and untreated cases were included in the study. However, patients who died before undergoing angiography and patients with an aneurysm but without hemorrhage were excluded from the study.

Patient data were obtained by reviewing medical records. The diagnosis of SAH was established based on computed tomography (CT) imaging and lumbar puncture (LP) findings. To confirm aneurysm diagnosis, four-vessel cerebral digital subtraction angiography (DSA) was performed in all patients. In this study, CT images obtained at the time of admission were evaluated using the Fisher Grading System, and angiographic vasospasm analysis was conducted.

Statistical analysis

For the statistical analysis of the obtained data, the Z-test and chi-square (X^2) test were used.

RESULTS

The patients' ages ranged from 5 to 80 years, with a mean age of 49 years. The most common age distribution was observed in the 40-49 age group (36%), followed by the 50-59 age group (27%) and the 60-69 age group (15%) (Table 1).

There was a female predominance in the gender of the cases. Out of 100 cases, 64% were females and 36% were males. (Table 2)

Table.1 Distribution of Aneurysms by Age

Age	Number Of Cases	Rate (%)
0-10	2	2
11-20	2	2
21-30	3	3
31-40	10	10
41-50	36	36
51-60	27	27
61-70	15	15
71-80	5	5
TOTAL	100	100

Table.2 Distribution of Aneurysms According to Gender

	Female	Male
Number Of Cases	64	36
Rate(%)	64	36
Total	100	100

According to Fisher grading system, subarachnoid haemorrhage rate was higher at grade 3 in brain tomographs. The rate of grade 3 was 36%. This was followed by 33% grade 4, 23% grade 2 and 8% grade 1 (Table 3).

Table.3 Distribution of Cases According to Fisher Grading

Grade	Number of Cases	Rate (%)
Grade 1	8	8
Grade 2	23	23
Grade 3	36	36
Grade 4	33	33
TOTAL	100	100

Angiographic vasospasm was defined as a contrast narrowing of the main cerebral arteries, which was usually focal but could also be diffuse. We detected clinical vasospasm in 23% and angiographic vasospasm in 59% of the cases (Table 4).

Table.4 Clinical and Angiographic Vasospasm Case Distribution

Vasospasm	Number of Cases	Rate (%)
Clinical Vasospasm	23	23
Angiographic Vasospasm	59	59

DISCUSSION

Although subarachnoid hemorrhages (SAH) account for less than 5% of all stroke cases, they pose a high risk of morbidity and mortality. This condition can lead to long-term cognitive impairment, a significant decline in quality of life, and death. Since aneurysmal hemorrhages constitute 85% of non-traumatic subarachnoid hemorrhages, early detection and effective treatment of aneurysms are crucial in preventing such hemorrhagic strokes (5).

Literature reviews on aneurysmal subarachnoid hemorrhages indicate that these hemorrhages are most commonly observed in individuals aged 40 to 60 years (6). Bozkuş et al. reported that the incidence of aneurysmal SAH increases with age, being particularly more frequent in individuals in their 70s and 80s (7). In our study, the mean patient age was calculated as 49 years, and the obtained data were largely consistent with the age ranges reported in the literature. Furthermore, patients aged 70 years and older were also included in our study. Although our results do not completely overlap with those of Bozkuş et al., they exhibit similar trends.

In our study, female predominance was observed in the gender distribution of patients.

Literature reviews indicate that there are gender-related differences in the incidence of intracranial aneurysms. Turan et al., in a study on aneurysm formation and rupture based on gender, reported that the incidence of incidentally detected intracranial aneurysms was significantly higher in females compared to males (8). This finding has also been supported by a large-scale analysis involving more than 14,000 adults, which examined predictors of intracranial aneurysm presence (9).

The Fisher Grading System was developed in 1980 to predict the degree of cerebral vasospasm following subarachnoid hemorrhage. This hypothesis was validated in 1983 through a small sample group of 41 patients (10). However, a larger cohort study reported a relationship between subarachnoid hemorrhage and cerebral vasospasm but noted that this association was not statistically significant (11).

One of the major limitations of the Fisher Grading System is its inability to classify all types of intracranial hemorrhages occurring after aneurysm rupture. In particular, the classification of small focal subarachnoid hemorrhages, as well as intraparenchymal and intraventricular hemorrhages, remains unclear. Fisher Grade 4 includes only extensive subarachnoid hemorrhages and is used to describe cases where subarachnoid hemorrhage occurs without other types of bleeding. Additionally, it is not clearly defined how

patients with both subarachnoid hemorrhage and subdural hematoma should be categorized within this system (12).

The Fisher Grading System was developed at a time when imaging technology had a resolution nearly ten times lower than today. With advancements in computed tomography (CT) technology, the quantification of subarachnoid blood volume can now be performed with significantly greater precision. Notably, even when the subarachnoid hemorrhage is less than 1 mm thick, modern CT scans can detect this minimal amount of blood in almost every section. To overcome the limitations of the Fisher classification system, ongoing research continues to focus on new measurement methods and classification systems, including three-dimensional imaging-assisted programs and advanced computational techniques (13).

The incidence of vasospasm in subarachnoid hemorrhage (SAH) patients varies between 9% and 93%, and it has been reported to account for approximately half of the mortality in the period following the initial hemorrhage and aneurysm treatment (14, 15). In approximately 67% of patients with aneurysmal SAH, angiographically detectable vasospasm has been observed, with severity exceeding mild levels (16).

Vasospasm is considered one of the most critical complications of subarachnoid hemorrhage, making early recognition and management essential (17,18). Although the

underlying mechanisms of vasospasm are not yet fully understood, literature reports indicate that the extent of clot dispersion within the subarachnoid space is associated with this risk. Additionally, young age, smoking, substance use, and hypertension have been identified as risk factors for vasospasm. Moreover, the amount of hemorrhage classified by the Fisher Grading System has also been shown to be a significant risk factor. The hemorrhagic burden following subarachnoid hemorrhage may serve as an important predictor of delayed cerebral ischemia, poor functional outcomes, and increased mortality and morbidity (14, 19).

In the literature, higher Fisher, WFNS, and Hunt & Hess (HH) scores have been reported to be associated with cerebral vasospasm. In a study conducted by Varol et al., a significant correlation between cerebral vasospasm and these three classification systems was found, with Fisher ($p=0.005$), WFNS ($p=0.002$), and HH ($p=0.02$) scores demonstrating statistical significance (17,20,21).

Our study evaluates the prognostic significance of the Fisher Grading System in aneurysmal subarachnoid hemorrhage and its relationship with vasospasm. Our findings are largely consistent with previously reported age and gender distributions in the literature. Additionally, our results indicate that Fisher Grade 3 is associated with the highest incidence of subarachnoid hemorrhage and a significantly increased rate of angiographic vasospasm.

However, although a positive correlation was identified between Fisher grade and vasospasm severity in our study, this relationship was not found to be statistically significant.

In our study, patients were categorized according to the Fisher Grading System. Patients with intracranial hemorrhage extending into the subdural space were classified as Fisher Grade 4, regardless of the amount of subarachnoid hemorrhage. According to CT findings, the highest incidence of subarachnoid hemorrhage was observed in Fisher Grade 3 (36%), followed by Fisher Grade 4 (33%), Fisher Grade 2 (23%), and Fisher Grade 1 (8%). Clinical vasospasm was detected in 23% of cases, whereas angiographic vasospasm was identified in 59%. The highest incidence of angiographic vasospasm was found in Fisher Grade 3 (42.4%), followed by Fisher Grade 4 (32.2%), Fisher Grade 2 (18.6%), and Fisher Grade 1 (6.8%). The increased incidence in Fisher Grade 3 was found to be statistically significant.

The amount and distribution of subarachnoid hemorrhage are among the key factors that can influence the clinical course and prognosis of patients. Although the Fisher Grading System remains one of the most frequently used classification methods, advancements in imaging technology have highlighted the ongoing need for more precise and comprehensive classification systems.

LIMITATIONS

This study has certain limitations. First, due to its retrospective design, there is a possibility of missing or incomplete patient data. Second, the relatively small sample size may limit the statistical power of the findings. Finally, all imaging evaluations were conducted at a single center, which may affect the generalizability of the results when compared to studies conducted in multiple centers.

Future prospective studies with larger patient populations are needed to provide a more comprehensive evaluation of the prognostic value of the Fisher Grading System.

CONCLUSION

In conclusion, aneurysmal hemorrhage should always be considered in patients in their fifties presenting with spontaneous subarachnoid hemorrhage. Given that this condition can lead to serious complications such as vasospasm and stroke, rapid clinical and radiological evaluation is essential, and the most appropriate treatment should be planned in a timely manner.

Our study highlights both the advantages and limitations of the Fisher Grading System. Our findings indicate that Fisher Grade 3 is significantly associated with cerebral vasospasm.

The diagnosis of subarachnoid hemorrhage can be established quickly and effectively using computed tomography (CT). In cases where CT

findings are inconclusive, lumbar puncture (LP) may serve as a diagnostic alternative.

Acknowledgements : The authors would like to appreciate the patients participation in this study.

Ethics Committee Approval: Since the study was a retrospective thesis study conducted in 2005, Ethics Committee approval was not obtained.

We state that the parents have given their written informed consent to be involved in the study, in accordance with the Declaration of Helsinki.

Peer-review: Externally peer-reviewed

Author Contributions: Concept: ÖŞ, MAB, AT, Design: ÖŞ, CG, AT, Data Collection and Processing: ÖŞ, HÇ, MK, YE, Analysis and Interpretation: ÖŞ, MAB, AT, Writing: ÖŞ, HÇ, MK, YE, AT, HÇ, MK, YE, MAB

Conflict of Interest: The authors declared no conflict of interest.

Financial Disclosure: The authors declared that this study has not received no financial support.

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The Effect of Video-Supported Hand-washing Training on Hand-washing Knowledge and Skills in Children in Need of Protection

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Received: 19 November 2024, Accepted: 01 May 2025, Published online: 31 May 2025

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Abstract

Objective: Proper hand hygiene knowledge and skills in children are among the most basic practices in preventing infectious diseases. This study aims to evaluate the effect of video-supported hand-washing training given to children in need of protection on hand-washing knowledge and skills.

Method: The study was conducted with 85 children between the ages of 7-14 living in a child welfare institution in a province in Turkey. Hand-washing knowledge and correct hand-washing skills were assessed with a pre-test. Hand-washing knowledge and skills were re-evaluated immediately after the slide and video-supported training and three months later. Data were analyzed with statistical methods.

Results: When the children's hand-washing knowledge and correct hand-washing skills were compared after the training compared to before the training, a statistically significant difference was found compared to before the training ($p<.001$). Although a decrease was observed compared to the measurements immediately after the training in the three-month follow-up, the increase in knowledge and skills before the training continued positively.

Conclusion: It has been found that visual, auditory, and practical hand-washing training for children increases their success targets. Starting hand-washing training for children early and continuing with periodic monitoring will contribute to developing positive behavior and preventing infectious diseases.

Keyword: Hand-washing, Hand hygiene knowledge, Children, Video-supported training, Child Welfare Institution

Suggested Citation Akpolat R, Yavuz ZS, Birkan EB, Yesil C. The Effect of Video-Supported Hand-washing Training on Hand-washing Knowledge and Skills in Children in Need of Protection. Mid Blac Sea Journal of Health Sci, 2025;11(2):116-127.

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INTRODUCTION

Hand hygiene is an effective and inexpensive method for the protection and prevention of infectious diseases. Instilling hygiene habits in children is fundamental to establishing a healthy society. Children often have difficulty in maintaining basic hygiene practices. This can increase the risk of infection and lead to health problems. In addition to preventing many infectious diseases by gaining effective hand-washing habits and turning them into behaviors, it also reduces school absenteeism and the incidence of diseases transmitted through the digestive and respiratory systems. Studies show that correct implementation of hand-washing and gaining habits protect children from infectious diseases. (1–6)

Since hand hygiene education starts within the family, is reinforced in schools, and turns into behavior, this information and education must be accurate. Children are affected by many reasons such as family breakdown, increased mental problems within the family, alcohol and substance addiction, poverty, and unemployment, and the number of children in need of protection in our country is growing. In this case, the education of these children and their acquisition of good behaviors are often ignored.

Correcting incorrect hygiene practices that have become behaviors in adolescence or adulthood can be difficult. Therefore, children in need of protection who live in orphanages are generally

disadvantaged and at-risk groups and hand-washing education is essential for these children. Studies show that the frequency of infection is related to hygiene habits (4).

The World Health Organization (WHO) stated that hygiene education and hand-washing development reduced diarrhea cases by up to 45%. At the same time, a study indicated that it caused a decrease of 6% - 44% in respiratory tract infections. As a result, it is stated that hygiene and hand-washing development studies are simple and cost-effective practices in terms of infectious diseases (7).

Providing planned education to protect and improve the health of individuals, families, and society is among the basic duties of nurses (8,9).

Since proper hand-washing is a behavior that children should exhibit throughout their lives, children should gain the skills to wash their hands properly by using educational materials that they can easily understand and that will increase their interest and desire, and by providing them with interactive applications (3,10).

In line with this information, the study aimed to determine the knowledge and correct hand-washing skills of children in need of protection in the age group of 7-14 and to evaluate the effectiveness of video-supported hand-washing training.

Research Hypotheses:

H0_1: Video-supported hand-washing education given to children in need of protection increases children's knowledge of correct hand-washing.

H0_2: Video-supported hand-washing education given to children in need of protection increases children's correct hand-washing skills.

METHODS

Research Type: Pretest-posttest, intervention and follow-up study

The Universe and Sample of the Research:

The universe of this intervention-type research conducted in a Child Welfare Institution affiliated with the Family and Social Services Directorate in a province in Turkey between June and September 2023 consisted of 96 children between the ages of 7 and 14 living in a dormitory. The research consisted of three parts and 89 children participated in the first and second parts (survey, observation, education, and re-observation). The children were not participating because they went on leave with their volunteer families and relatives and did not volunteer. 85 children participated in the third part of the research (survey and re-observation). Four children did not participate in these parts of the research because they were “on leave” with their volunteer families. Four children who could not participate in the second part of the research were excluded to ensure the

consistency of the comparative data before and after the training. The total sample of the study consisted of 85 children.

Inclusion Criteria for the Study

- Participants must be between the ages of 7-14
- Participants must be willing to participate in the study
- The Participant must not have any speech, hearing, perception, or vision problems
- Full-time residence and volunteer participation in the study.

Data Collection

The study's data was collected by face-to-face interviews and observations with the children in the dormitory where the children lived. Before starting the data collection, written institutional permissions were obtained from the Family and Social Policies Directorate and the children's dormitory, and verbal permissions were obtained from the teachers responsible for the children.

The data collection process consisted of three parts, and in the first part, a survey, observation, and training were conducted. The first part of the data collection included a survey form (3 min) including socio-demographic characteristics, information about hand-washing, and observation (3 min). Each student washed their hands in the sinks in the children's dormitory under the necessary environment, and the 'skill checklist' where their behaviors

were evaluated before the training was marked as "did" or "did not".

After the pre-test and hand-washing skills were evaluated, a PowerPoint presentation (8 min) was given for hand hygiene training and a video of correct hand-washing (5 min). Then, the children were taken to the sink individually and observed again by the same researcher who evaluated their hand-washing skills before the training.

Four people in the research team gave the training on gaining hand-washing skills.

In the third part of the data collection, after three months, a questionnaire form was filled out again regarding hand hygiene, and hand-washing skills were assessed using the "skill checklist". The aim was to ensure they could apply the hand-washing skills following the steps.

Data Collection and Education Tools:

Survey Form: A form that includes sociodemographic information about children (age, gender, how many years they have stayed in a dormitory, whether they have received hand-washing training), questions about when and in what situations to wash hands.

Skill Checklist: A 10-item list containing the Proper Handwashing steps of the Republic of Turkey Ministry of Health.

Hand Hygiene Education: A PowerPoint presentation (8 minutes) prepared by

researchers for children, including information on hand hygiene, when and how it should be done, etc.

Hand-washing Video: This video was prepared by researchers and lasted 5 minutes. It included the steps for proper hand-washing by the Republic of Turkey Ministry of Health.

Statistical Analysis of Data

The data obtained in the research was analyzed using the SPSS (Statistical Package for Social Sciences) for Windows 22.0 program. Descriptive statistical methods were used to evaluate the data: number, percentage, mean, and standard deviation. Parametric methods were used in the analysis of the data. Repeated measures ANOVA test and complementary Bonferroni test were used to compare the repeated measurements. Kurtosis (Kurtosis) and Skewness (Skewness) values were examined to determine whether the research variables showed a normal distribution.

Ethical Aspect of Research

For the implementation of the research conducted within the scope of the TUBITAK Student Project (2209/A No:1919B012217443), an ethics committee permit dated/numbered (23.03.2023-14/05) was obtained from the ethics committee of a university for non-interventional studies and an institutional permit from the Provincial Directorate of Family and Social Policies of the province where the study was conducted.

Verbal permission was obtained from the teachers and children in the dormitory before starting the survey. Students who were not volunteers were not included in the study.

RESULTS

According to gender, children were male 57.6%, the average “age” of the children was 8.880 ± 2.078 (Min=7; Max=14), the average “years spent in a dormitory” was 3.470 ± 2.229 (Min=1; Max=12), children who received hand-washing training were 64.7%, and according to where children received hand-washing training, 38.2% were families, 27.3% were daycare centers, and 34.5% were schools (Table 1).

The increase in the score of hand washing knowledge and skills is significant in the second and third measurements compared to the score in the first measurement ($p < 0.05$) (Table 2, Fig 1).

When the hand-washing status scores of the children before and after the training were compared, it was found that there was a statistically significant difference in all items including hand-washing times compared to before the training ($p < .001$). Before the training, 96.5% of the children stated that they should wash their hands before eating, 97.6% after eating, 92.9% before and after using the toilet, 95.3% after coming home from outside, and 92.8% after touching garbage. In comparison, 68.2% responded correctly to washing their

hands after touching money, newspapers, etc. After the training, 97.6% responded correctly to washing their hands before eating, 100% after eating, 98.8% before and after using the toilet, 98.8% after coming home from outside, 95.3% after touching garbage, and 91.8% after touching money, newspapers, etc. In the 3rd month follow-up, it was determined that the correct response rates were still high compared to before the training (Table 3).

In the observations of the children's hand-washing skills before the training, it was seen that 87.1% of the children applied the steps of "wet the hands and wrists with water", 91.8% of the children applied the steps of "sufficient soap is taken into the palm", 92.9% of the children applied the steps of "rinse the hands with plenty of water", 94.1% of the children applied the steps of "rub the backs of the hands with the palm of the other hand", "comb the palms and clean between the fingers", "clasp the hands and rub the fingertips", "rub the thumb in the palm of the other hand", "rub the fingertips in the palm of the other hand". It was seen that the scores displaying positive behaviors regarding the hand-washing situation increased after the hand-washing training. In the follow-up three months later, although there was a slight decrease in correct hand-washing skills, it was seen that a high rate of positive behaviors continued (Table 4.)

Table 1. Distribution of Children According to Descriptive Characteristics

Variable	Frequency(n)	Percentage (%)
Gender		
Male	49	57.6
Female	36	42.4
Hand-washing Education Status		
Yes	55	64.7
No	30	35.3
Where Did You Get Hand-washing Education		
Family	21	38.2
Dorm	15	27.3
School	19	34.5
	Mean	SD
Age	8.880	2.078
How Many Years Did You Stay in Dormitory	3.470	2.229

SD: Standard Deviation**Table 2.** Hand-washing Knowledge and Hand-washing Skill Scores

	Hand-washing Knowledge Scores		Hand-washing Skills Scores	
	Mean	Sd	Mean	Sd
1. Measurement (Before training)	10.588	1.917	6.553	1.816
2. Measurement (After training)	11.600	1.125	9.106	1.423
3. Measurement (After 3 months)	11.412	1.147	8.741	1.698
F^b	23.931		75.645	
p*	0.000		0.000	
Bonferroni	1<2.3		1<2.3	
Etakare	0.222		0.474	

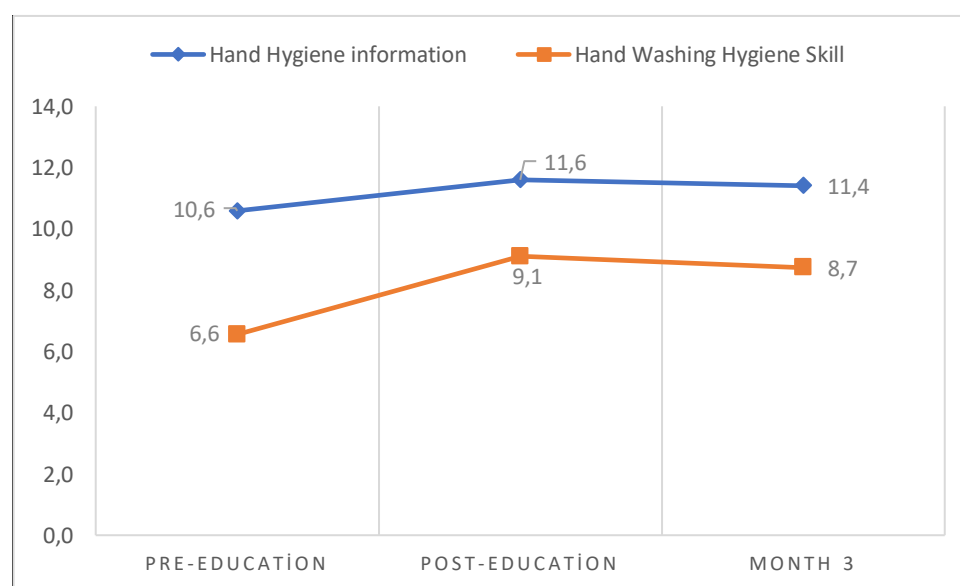
***p<0,001****Figure 1.** Hand-washing Knowledge and Hand-washing Skill Scores

Table 3. Distribution of Correct Answers for Hand-Washing Knowledge

	1. Measurement		2. Measurement		3. Month Later	
	n	%	n	%	n	%
Before eating	82	96.5	83	97.6	84	98.8
After eating	83	97.6	85	100	84	98.8
As soon as we wake up in the morning	75	88.2	84	98.8	84	98.8
Before going to bed at night	67	78.8	81	95.3	81	95.3
Before and after using the toilet	79	92.9	84	98.8	85	100
When we come from outside	81	95.3	84	98.8	85	100
After touching garbage	79	92.9	81	95.3	81	95.3
After sneezing and coughing	78	91.8	83	97.6	80	94.1
After touching wounds, pimples, etc.	69	81.2	80	94.1	76	89.4
After touching money, newspapers, etc.	58	68.2	78	91.8	69	81.2
After touching dirty items	75	88.2	81	95.3	78	91.8
After cleaning	74	87.1	82	96.5	83	97.6

Table 4. Hand-washing Skills Scores

	1. Measurement		2. Measurement		3. Month Later	
	n	%	n	%	n	%
Wet the hands and wrists with water	74	87.1	83	97.6	81	95.3
Take enough soap into the palm	78	91.8	83	97.6	81	95.3
Distribute the soap to all surfaces of the hands and lather thoroughly	69	81.2	80	94.1	81	95.3
Rub the backs of the hands with the palm of the other hand	59	69.4	78	91.8	76	89.4
Palms are brought together and the spaces between the fingers are cleaned	36	42.4	76	89.4	72	84.7
Clasp the hands and rub the fingertips	16	18.8	66	77.6	62	72.9
Rub the thumb in the palm of the other hand	34	40.0	69	81.2	57	67.1
Rub the fingertips in the palm of the other hand	32	37.6	70	82.4	65	76.5
Rinse the hands with plenty of water	79	92.9	85	100	83	97.6
Dry the hands with a clean towel or paper towel	80	94.1	84	98.8	85	100

DISCUSSION

Early childhood is an advantageous time to start education and develop correct behaviors before habits are established (4,11).

Using a competency-based education approach, the study was conducted with orphanage children. The “skill checklist” used in the study is a requirement of the approach above. When the hand-washing skills of the children were compared before, after and three months after the training, it was determined that most of the steps changed positively, it may be thought that the change in some steps was not “sufficient”. For example; “Hands are clasped and fingertips are rubbed”, “Thumb is rubbed in the palm of

the other hand”, and “Fingertips are rubbed in the palm of the other hand” (Table 4). Although an increase was detected after the training, this progress may be considered insufficient. However, there is still a high positive increase compared to the pre-training rates.

While hand hygiene training in children aims to increase knowledge, it is also aimed to improve skills, and it is recommended that various methods such as interactive and applied teaching methods be used in skill training for knowledge and skills to turn into behavior (1,12–14).

Hand-washing education studies conducted with different methods and visual tools such as

slides, videos, and games have increased students' hand-washing knowledge and skills. (12,15–18).

In a study where hand-washing training was given to children under institutional supervision and protection through video presentation and demonstration methods, an increase in the student's knowledge and skill practices was achieved (1).

In the study, children's hand-washing knowledge levels increased after the training compared to before the training, and the H1 hypothesis was accepted (Table 2, Fig 1). In the study by Shrestha and Angolkar (2015), it was seen that the hand hygiene training given to the students effectively increased their level of hand-washing knowledge (19).

When the children's hand-washing information was examined before the training, it was seen that they washed their hands the most before eating (96.5%), after eating (97.5%), and when they came from outside (95.3%). The lowest responses before the training were after touching wounds and pimples (81.2%), after touching money, newspapers, etc. (68.2%), and after touching dirty objects (88.2%). When some studies in the literature were examined, it was stated that children washed their hands the most after using the toilet before the training (1,8,12,13,20).

The hand-washing skills of the children after the training increased compared to the pre-

training period and the H2 hypothesis was accepted (Table 2, Figure 1). The most frequently applied hand-washing steps before the training in the study were; to wet the hands and wrists with water (87.1%), take enough soap in the palm (91.8%), rinse the hands with plenty of water (92.9%) and dry the hands with a clean towel or paper towel (94.1%). The least frequently applied steps by the students before the training were; bringing the palms together and cleaning the spaces between the fingers (42.4%), clasping the hands and rubbing the fingertips (18.8%), rubbing the thumb in the palm of the other hand (40%), rub the fingertips in the palm of the other hand (37.6%) (Table 4). The literature has different results on applying the hand-washing steps before the training (8,13,21).

Studies conducted on children in need of protection and cared for in institutions have shown that separation from family at a young age, institutionalization, the absence of a permanent caregiver, and the inability to establish a secure attachment relationship contribute significantly to the development of mental disorders in these children (22,23).

Yektaş and Tufan found major depression in 24.6% of the children in a study they conducted in a child protection institution in Turkey (24).

The World Health Organization (WHO) has emphasized that depression can significantly impair an individual's ability to function at work or school and cope with daily life (25).

It is observed that children living in orphanages may have inadequate hand-washing behaviors due to their tendency to depression and that their rates of contracting and transmitting infectious diseases will increase. Slekiene and Mosler (2018) stated in their study that depression negatively affects individuals' work, school, and daily behaviors and stated that hand-washing habits are inadequate in children with depression (26).

Proper hand hygiene has been recommended as the most effective method in preventing global epidemics in recent years. It is thought that being more careful, especially for children in need of protection staying in orphanages and developing the right knowledge and skills will reduce the risk of infection.

Time is needed for an individual to turn a practice into a behavior. In our study, even if there is an increase in knowledge and skill levels after the training, observation-based research can be conducted again after six months to monitor whether this turns into a behavior.

The participation rate is 88.5%. The limited number of participants in the study is a restrictive factor for the analysis. Studies with more participants can be conducted to eliminate this limitation..

CONCLUSION

was determined with the knowledge and skills teaching. Providing early hand-washing

knowledge and skills training is appropriate, especially for children in public places. Health professionals should implement hygiene training, which is sufficient for children to acquire knowledge about hand hygiene and to develop positive behaviors, and this training should be repeated regularly at certain intervals. It will be supportive to provide skill training to children during learning behaviors and to provide techniques such as video presentation and demonstration at this stage.

Acknowledgements: The authors would like to thank TUBITAK and the participants and the teachers responsible for the children in the dormitory for their contributions to the research.

Ethics Committee Approval: Ethics committee approval was received for this study from 23.03.2023-14/05 Clinical Research Ethics Committee of Kocaeli Health and Tecnology University.

We state that the parents have given their written informed consent to be involved in the study, in accordance with the Declaration of Helsinki.

Peer-review: Externally peer-reviewed

Author Contributions: Concept: RA, Design: RA, ZŞY, EEB, CY, Data Collection and Processing: ZŞY, EEB, CY, Analysis and

Interpretation: RA, Writing: RA, ZŞY, EEB, CY

Conflict of Interest: The authors declared no conflict of interest.

Financial Disclosure: TUBITAK 2209-A Student Project supports it

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CASE REPORT

DOI: 10.19127/mbsjohs.1655774

Vascular Dementia Beyond Conventional Treatment: The Role of Neuroprotective Agents and Personalized Antiplatelet Therapy

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Received: 11 March 2025, Accepted: 25 March 2025, Published online: 31 May 2025

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Abstract

Vascular dementia is a neurocognitive disorder caused by impaired cerebral blood flow due to vascular pathologies. Conventional pharmacological treatments often yield limited efficacy, necessitating adjunctive therapeutic strategies.

We report the case of a 75-year-old male patient with a history of hypertension and hyperlipidemia, presenting with progressive cognitive decline and psychiatric symptoms over four years. Initially misdiagnosed with a primary psychiatric disorder, the patient underwent various psychiatric treatments without significant improvement. Neurological evaluation revealed ischemic gliotic changes on magnetic resonance imaging (MRI), leading to a diagnosis of early-stage vascular dementia. Standard dementia treatment with donepezil and memantine was supplemented with citicoline, omega-3-6-9 fatty acids, and magnesium L-threonate. Furthermore, aspirin resistance testing revealed total resistance, prompting a switch to clopidogrel therapy. After four months, the patient showed cognitive improvement, with his Mini-Mental State Examination (MMSE) score increasing from 24 to 26.

This case highlights the importance of a comprehensive neurological and psychiatric evaluation in patients with cognitive decline. The integration of neuroprotective agents such as citicoline, omega fatty acids, and magnesium L-threonate may offer additional cognitive benefits in vascular dementia. Moreover, aspirin resistance should be considered in patients receiving antiplatelet therapy to optimize cerebrovascular protection.

Vascular dementia requires a multidisciplinary approach, including cognitive, psychiatric, and vascular risk management. Adjunctive neuroprotective therapies and personalized antiplatelet strategies may improve patient outcomes. Further research is needed to establish standardized protocols for managing vascular dementia with emerging therapeutic agents.

Keyword: Vascular dementia, Mini-Mental State Examination (MMSE), citicoline, magnesium L-threonate, aspirin resistance

Suggested Citation: Kaygısız S. Vascular Dementia Beyond Conventional Treatment: The Role of Neuroprotective Agents and Personalized Antiplatelet Therapy. Mid Blac Sea Journal of Health Sci, 2025;11(2):128-135.

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Telephone number: +90 (505) 925 39 04**E-mail:** skrnkygsz52@gmail.com**INTRODUCTION**

Vascular dementia arises from blockages in cerebral blood vessels and impaired cerebral blood flow. Vascular risk factors, notably hypertension and hyperlipidemia, are pivotal in its pathogenesis. These factors can lead to cerebrovascular damage, directly triggering vascular dementia. Moreover, they may elevate the risk of neurodegenerative diseases like Alzheimer's disease by promoting the accumulation of neurotoxic proteins in the brain (1).

Conventional pharmacological treatments for dementia often yield limited efficacy in vascular dementia cases. Consequently, adjunctive therapies such as citicoline, omega-3 fatty acids, and magnesium L-threonate—which effectively crosses the blood-brain barrier—are employed to enhance treatment outcomes.

In neurodegenerative diseases, psychiatric symptoms can precede radiological findings due to underlying organic causes. Therefore, a comprehensive evaluation is essential before diagnosing psychiatric disorders, ensuring that organic etiologies are excluded.

Aspirin resistance denotes the failure of acetylsalicylic acid to exert its intended antiplatelet effect. The prevalence of aspirin resistance varies widely, ranging from 5.5% to 60%, depending on the testing method used (2). Given this variability, routine testing for aspirin resistance is not universally recommended before initiating therapy. Instead, clinicians should be aware of factors that may impair aspirin function, ensure appropriate dosing, and optimize patient compliance (2).

This case involves a male patient with a history of hypertension and hyperlipidemia who has exhibited cognitive and psychiatric symptoms in recent years. These vascular risk factors likely contribute to his cognitive decline, underscoring the importance of managing such modifiable risks to potentially prevent or slow the progression of dementia.

CASE 1

A 75-year-old male patient, a graduate of an educational institute, operated a bagel bakery for eight years but had to close it due to financial difficulties five years ago. Over the past four years, he has experienced episodes of staring spells, social withdrawal, reduced communication with family members, and a preference for solitude. While he can still perform basic arithmetic, he struggles with

more complex calculations. He has become increasingly emotional and forgetful.

He frequently engages in verbal disputes with others and experiences sudden explosive anger episodes, followed by immediate remorse, in the mosque setting, which is typically a congested area. Previously, he enjoyed reading novels, daily newspapers, and solving puzzles; however, he stopped reading two years ago due to comprehension difficulties. Over the past year, he has also experienced difficulties with spatial orientation.

A brain MRI performed at an external center four years ago reported: "Millimetric ischemic gliotic foci observed in bilateral centrum semiovale regions." These ischemic gliotic foci were attributed to the patient's history of hypertension and hyperlipidemia. Consequently, he was prescribed antihypertensive medication and 80 mg of acetylsalicylic acid, along with dietary and exercise recommendations for hyperlipidemia management.

His symptoms of forgetfulness, anxiety, and heightened emotionality were initially considered psychological, and antidepressant treatment was initiated. However, as his complaints progressively worsened, more aggressive psychiatric treatments were administered. Recently, he became unable to find his way home after visiting a local market, prompting another hospital visit. A psychiatric

specialist referred him to the neurology department for further evaluation.

The patient has a medical history of hypertension and hyperlipidemia, with stable blood pressure around 100/60 mmHg under 10 mg of perindopril. He is not on any medication for hyperlipidemia. One year ago, he underwent surgery for urethral stricture. He has no history of smoking, alcohol consumption, or other known medical conditions.

Neurological Examination and Imaging Findings

Neurological examination revealed a diminished left nasolabial fold. Muscle strength was assessed as +4/5 in the left upper extremity and -5/5 in the left lower extremity. Deep tendon reflexes were normoactive in the bilateral upper extremities but hyperactive in the bilateral lower extremities. The MMSE score was 25. The patient was unable to perform serial subtraction by sevens, failed to draw a cube, and inaccurately reproduced the intersecting pentagon figure, drawing only four sides in one of the pentagons. His recall ability was partial.

Brain MRI showed hyperintense areas in the FLAIR sequence within both lateral ventricles, anterior horn regions, bilateral centrum semiovale, and internal watershed areas. T2-weighted imaging revealed widespread Virchow-Robin spaces in the bilateral centrum semiovale, thalamus, and basal ganglia. Carotid

MR angiography and cervical MRI were evaluated as normal.

Laboratory tests indicated an LDL level of 147 mg/dL (normal range: <100 mg/dL) and an HbA1c level of 6.1% (normal range: <5.7%). The vasculitis panel and other blood tests were within normal limits. Given the clinical presentation, the patient was diagnosed with early-stage vascular dementia. His acetylsalicylic acid dose was increased to 150 mg; however, aspirin resistance testing later revealed total resistance. Consequently, he was switched to clopidogrel therapy. Cardiological evaluation found no pathological abnormalities. The patient was consulted with psychiatry, and his psychiatric medications were discontinued. Instead, he was started on fluoxetine (20 mg), donepezil, memantine, and Ginkgo biloba, with gradual dose adjustments over three months. At follow-up, his MMSE score was 24. Consequently, fluoxetine was increased to 40 mg in the morning, and magnesium L-threonate (1x1) and a citicoline + omega-3-6-9 complex were introduced. After four months of follow-up, the patient's MMSE score improved to 26, and he was able to correctly draw both the cube and intersecting pentagons. The patient continues his current treatment and remains under follow-up at the neurology outpatient clinic.

DISCUSSION

Vascular dementia is a progressive neurological disorder characterized by cognitive decline

resulting from cerebrovascular disease. It is closely associated with vascular risk factors such as hypertension, hyperlipidemia, and diabetes mellitus (3). While current pharmacological treatments aim to slow disease progression and manage symptoms, their overall effectiveness remains limited. Consequently, research into novel therapeutic approaches, particularly neuroprotective strategies, has gained increasing attention.

The Need for Neuroprotective Approaches

Traditional treatments for vascular dementia, including cholinesterase inhibitors (e.g., donepezil) and N-methyl-D-aspartate (NMDA) receptor antagonists (e.g., memantine), primarily focus on symptomatic relief rather than addressing the underlying vascular pathology (4). However, emerging evidence suggests that neuroprotective agents such as citicoline, omega 3 fatty acids, and magnesium L threonate may offer additional benefits by promoting neuronal repair, enhancing synaptic plasticity, and improving cerebral blood flow (4). Citicoline (CDP choline), a precursor of phosphatidylcholine (a key component of cell membranes) has been shown to enhance acetylcholine production. It supports neuronal repair mechanisms and increases neurotransmitter availability, which can improve cognitive function. Recent studies have demonstrated that citicoline supplementation leads to improvements in memory, attention, and overall cognitive

performance in individuals with vascular dementia and mild cognitive impairment (4).

Similarly, omega 3 fatty acids (particularly docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA)) are essential for maintaining neuronal integrity and reducing neuroinflammation. These fatty acids have been linked to improved cognitive function and a lower risk of dementia (5). In addition to their neuroprotective properties, omega 3 fatty acids have been found to alleviate psychiatric symptoms, such as depression and anxiety, which are frequently observed in vascular dementia patients. Given that psychiatric symptoms often precede cognitive impairment, integrating omega 3 supplementation into treatment plans may help improve both neurological and psychiatric outcomes.

Magnesium L threonate is another promising neuroprotective agent due to its ability to effectively cross the blood brain barrier. Magnesium plays a vital role in neurotransmission, synaptic plasticity, and neuroprotection. Studies have suggested that magnesium L threonate supplementation can improve learning, working memory, and overall cognitive function (6). Given that magnesium deficiency has been implicated in the progression of neurodegenerative disorders, targeted magnesium supplementation may be beneficial in the management of vascular dementia.

The Role of Psychiatric Symptoms in Vascular Dementia

One of the critical aspects of vascular dementia that is often overlooked is the presence of psychiatric symptoms. Depression, anxiety, irritability, emotional dysregulation, and even psychotic features can emerge in the early stages of the disease, sometimes preceding cognitive decline (7). These symptoms can complicate diagnosis, as they are frequently misattributed to primary psychiatric disorders. In the case discussed, the patient initially received multiple psychiatric treatments before being referred for neurological evaluation, which underscores the need for a thorough assessment of psychiatric symptoms in older adults. Underlying organic causes should be ruled out before diagnosing a primary psychiatric disorder.

Fluoxetine, a selective serotonin reuptake inhibitor (SSRI), was included in this patient's treatment regimen due to its role in neuroregeneration and axonal sprouting. SSRIs have been found to exert neuroprotective effects by enhancing brain derived neurotrophic factor (BDNF) levels, which may support cognitive function in dementia patients (8). The combination of fluoxetine, donepezil, memantine, and Ginkgo biloba contributed to improved cognitive function, as evidenced by the patient's increasing MMSE score over time. This case underscores the importance of

addressing both cognitive and psychiatric symptoms in vascular dementia management.

Aspirin Resistance and Its Clinical Implications

Aspirin resistance presents a significant challenge in the management of vascular dementia, given that antiplatelet therapy plays a crucial role in preventing further cerebrovascular events. Aspirin works by irreversibly inhibiting cyclooxygenase 1 (COX 1), thereby reducing platelet aggregation. However, some patients exhibit resistance to aspirin—meaning that it fails to achieve the expected antiplatelet effect—which can increase the risk of recurrent ischemic events (9).

In the discussed case, aspirin resistance testing revealed complete resistance, necessitating a switch to clopidogrel therapy. Clopidogrel, a P2Y₁₂ receptor antagonist, inhibits platelet activation through a different mechanism and is thus an effective alternative for patients with aspirin resistance. Given the clinical implications of aspirin resistance, routine screening may be beneficial in high risk patients to ensure that antiplatelet therapy is tailored to individual needs. Several factors contribute to aspirin resistance, including genetic polymorphisms, drug interactions, and metabolic differences. Genetic variations in cyclooxygenase enzymes or platelet receptors can alter aspirin's effectiveness, while the concomitant use of nonsteroidal anti-

inflammatory drugs (NSAIDs) may interfere with its mechanism of action. Identifying these factors through genetic and pharmacokinetic testing could help optimize treatment strategies for vascular dementia patients.

The Importance of a Multidisciplinary Approach

The management of vascular dementia necessitates a multidisciplinary approach that integrates neurology, psychiatry, cardiology, and geriatric medicine. This case highlights the need for comprehensive diagnostic workups (including neuroimaging, cognitive assessments, psychiatric evaluations, and pharmacogenetic testing) to develop personalized treatment strategies. In addition to pharmacological interventions, lifestyle modifications such as dietary changes, physical exercise, and cognitive rehabilitation should be emphasized. Regular physical activity has been shown to enhance cerebral blood flow, reduce vascular risk factors, and improve cognitive function. Similarly, a Mediterranean diet rich in omega 3 fatty acids, antioxidants, and polyphenols may help slow cognitive decline in patients with vascular dementia (5).

Future Directions in Vascular Dementia Treatment

Despite recent advances in vascular dementia research, there remains a need for more targeted therapies that address the underlying vascular pathology and neurodegenerative processes (4).

Future studies should explore the potential of combination therapies that incorporate neuroprotective agents, anti-inflammatory compounds, and personalized antiplatelet strategies (6). Additionally, investigating biomarkers for early diagnosis and treatment response could help refine therapeutic approaches (9). Emerging treatments—such as stem cell therapy, neurostimulation techniques (e.g., transcranial magnetic stimulation), and novel pharmacological agents targeting neuroinflammation and oxidative stress—may provide new avenues for managing vascular dementia (5). As research progresses, a more personalized approach to treatment is likely to emerge, ultimately improving patient outcomes and quality of life (8).

CONCLUSION

In summary, this case highlights the complexity of vascular dementia management and the importance of a multidisciplinary approach. While conventional treatments provide limited benefits, integrating neuroprotective agents such as citicoline, omega-3 fatty acids, and magnesium L-threonate may enhance cognitive function and slow disease progression. Psychiatric symptoms should not be overlooked, as they can significantly impact disease course and treatment outcomes. Additionally, aspirin resistance testing may help optimize antiplatelet therapy, reducing the risk of further cerebrovascular events. Future research should focus on personalized

treatment strategies that address both the vascular and neurodegenerative aspects of the disease.

Ethics Committee Approval: The presented study is qualitative and consent was obtained by giving information about the study by one-to-one interviews with the subjects who agreed to participate. The study was carried out by paying attention to the Declaration of Helsinki.
reviewed

Author Contributions: Concept: SK, Design: SK, Data Collection and Processing: SK, Analysis and Interpretation: SK, Writing: SK

Conflict of Interest: The authors declared no conflict of interest.

Financial Disclosure: The authors declared that this study has not received no financial support.

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CASE REPORT

DOI: 10.19127/mbsjohs.1665455

Detection of Mushroom Extract Use in Patients Coming to the Family Medicine Outpatient Clinic for Routine Check-up and the Relationship Between Changes in Their Clinics

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Received: 25 March 2025, Accepted: 29 May 2025, Published online: 31 May 2025

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Abstract

This study focuses on cancer types with high mortality rates, such as stomach and pancreatic cancer, by examining the clinical effects of using the ethyl acetate extract of the lichen species *Usnea longissima*. The study includes a patient with gastric intestinal metaplasia (GIM), a patient with pancreatic cancer, and a patient with stomach cancer.

A 40-year-old woman diagnosed with gastric intestinal metaplasia was positive for *Helicobacter pylori* and had undergone eradication therapy, which she could not complete. She used mushroom extract for 2 months, and a subsequent stomach biopsy showed that intestinal metaplasia was negative.

An 80-year-old woman diagnosed with pancreatic cancer had undergone Whipple surgery and chemotherapy. Afterward, she began using mushroom extract. Imaging reports showed tumor regression, and cancer observed no signs of progression.

A 78-year-old man diagnosed with stomach cancer received six cycles of chemotherapy and used mushroom extract concurrently. Control PET-CT examinations showed a decrease in FDG uptake related to stomach cancer, indicating a positive response to treatment.

Usnea longissima is known for its potent antioxidant effects. This study evaluated the potential anticancer properties of the lichen extract by presenting three patient examples. Notably, the patient with gastric intestinal metaplasia showed improvement after using the mushroom extract despite incomplete *H. pylori* eradication therapy. Similar positive responses to treatment and tumor regression were observed in the pancreatic and stomach cancer cases.

Literature reviews indicate that the anticancer effects of *Usnea longissima* are supported by preclinical studies, but more research is needed for clinical use. Therefore, we believe that the anticancer potential of *Usnea longissima* should be investigated more comprehensively through clinical studies.

Keyword: Gastric intestinal metaplasia, *Usnea longissima*, Ethyl acetate extract

Suggested Citation: Enginyurt O, Karabulut Ozer M, Cpruh Akyol B, Suleyman H. Detection of Mushroom Extract Use in Patients Coming to the Family Medicine Outpatient Clinic for Routine Check-up and the Relationship Between Changes in Their Clinics. Mid Blac Sea Journal of Health Sci, 2025;11(2):136-142.

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Stomach cancer is the third leading cause of cancer-related deaths worldwide. The ability to identify early-stage lesions in stomach biopsies has increased interest in developing screening and surveillance strategies to diagnose and prevent stomach cancer early (1).

Gastric Intestinal Metaplasia (GIM) is an early mucosal change with the potential to transform into gastric adenocarcinoma (NCGA). GIM can be easily identified endoscopically and histologically and is an important indicator of stomach cancer risk. Managing modifiable risk factors, such as chronic *Helicobacter pylori* infection, and classifying patients' risks who need endoscopic surveillance play a significant role in reducing stomach cancer mortality (2).

Surgery, chemotherapy, and radiotherapy are commonly used methods in the treatment of stomach cancer. In early-stage stomach cancer, complete tumor removal through surgery is considered the most effective treatment, while in advanced or metastatic cases, chemotherapy

and radiotherapy are used to prolong patients' survival and alleviate symptoms (3).

During follow-up, patients undergo regular endoscopic and radiological evaluations. Especially after surgical intervention, control endoscopies and imaging tests are performed at specific intervals to detect and manage recurrences early. Additionally, evaluating patients' general health status and applying supportive treatments when necessary are important (4).

Pancreatic cancer ranks 14th in incidence but 7th in mortality among global cancers. Due to its aggressive nature, it spreads quickly and has mortal outcomes. Early diagnosis is the most critical factor for effective treatment. Although there is no effective medical treatment for pancreatic cancer, curative treatment may be possible with surgical resection in patients diagnosed early. However, recurrences are also possible (5).

CASE 1

A 40-year-old female patient visited the family medicine outpatient clinic with complaints of a burning sensation in the stomach. The patient reported that the burning sensation in her stomach had been ongoing for the past few weeks, and she had previously experienced similar complaints nine years ago. At the time of admission, the patient's vital

signs were within normal limits. Nine years ago, she had visited an external center with complaints of stomach pain and abdominal cramps, and an endoscopy-colonoscopy was planned. The pathology results from the endoscopic samples showed gastritis and *Helicobacter pylori* positivity. The patient was started on *H. pylori* eradication therapy but could not tolerate the antibiotic treatment and did not complete it. A follow-up endoscopy three years later, in the low-risk group, showed intestinal metaplasia.

There was no other significant medical history besides gastritis and intestinal metaplasia. Her physical examination was normal. The patient's family history included hypertension and diabetes mellitus in her father and hypertension in her mother.

Upon questioning her current medication use, it was discovered that the patient had been using a dietary supplement called mushroom extract for the past two months, which she had obtained from an acquaintance on the recommendation that it was beneficial against cancer. Further investigation revealed that the extract was produced from a lichen called *Usnea longissima*.

The blood tests performed upon her visit were within normal ranges. The patient's full abdominal ultrasound evaluation was normal. She was advised to stop using the mushroom extract and was referred to general surgery for a follow-up. General surgery planned an

endoscopy, and the pathology results of the samples taken showed positive inflammation, negative *H. pylori*, negative intestinal metaplasia, and negative atrophy.

CASE 2

An 80-year-old female patient visited our family medicine clinic to get a prescription for her hypothyroidism medication with no active complaints. Upon reviewing the patient's medical history, it was found that she had presented to the emergency department in July 2021 with abdominal pain, and subsequent examinations revealed gallstones for which she underwent surgery. During her follow-up, a mass was detected in her pancreas via abdominal tomography, diagnosed as pancreatic cancer, and a Whipple procedure was performed. The patient underwent chemotherapy for a year and started using mushroom extract in October 2022.

We examined the imaging reports from the E-nabiz database during her pancreatic cancer follow-up. The upper abdominal contrast-enhanced MR imaging dated 08/10/2021 described: "A nodular mass lesion consistent with liver metastasis, the largest measuring 17 mm in diameter in segment 8, appearing T1 hypointense and T2 hyperintense with heterogeneous enhancement following intravenous contrast material (IVCM). Several contiguous recurrent-residual mass lesions with the largest measuring 48 mm in diameter demonstrating invasion into the portal

confluence at the Whipple operation site. Additionally, a 2.5 cm nodular mass lesion in the tail of the pancreas (recurrent-residual tumor?). Infiltrative soft tissue increments in the mesenteric fat tissue primarily favoring post-operative changes, along with an incision scar line on the anterior abdominal wall related to the previous surgery. Follow-up MR for peritonitis carcinomatosis is recommended."

The abdomen contrast-enhanced MR imaging dated 20/12/2021 described: "A metastatic nodular mass lesion in the liver, the largest measuring 1 cm in diameter in segment 8, appearing T1 hypo, T2 hyperintense with heterogeneous enhancement following IVCN. Several recurrent, residual mass lesions at the portal confluence level, the largest measuring 39 mm in diameter. Compared with the MR examination dated 08.10.2021, findings are evaluated in favor of mild regression with no progression detected."

The abdomen contrast-enhanced MR imaging dated 10/03/2022 described: "A nodular lesion in segment 8 of the liver measuring 8 mm in diameter, appearing T1 hypo, T2 hyperintense with no enhancement following IVCN (inactive metastasis?). Post-operative changes related to the previous Whipple operation and asymmetric soft tissue thickening obliterating the mesenteric fat tissue around the operation site (post-operative fibrotic soft tissue?). Compared with the MR examination dated

20.12.2021, findings are evaluated in favor of regression, with no progression detected."

We noted the regression observed in the abdominal magnetic resonance imaging during the patient's follow-up and the absence of progression.

CASE 3

A 78-year-old male patient visited the family medicine outpatient clinic for routine blood tests. Upon arrival, he had no active complaints. When we inquired about his medical history, we found out that he was diagnosed with stomach cancer in May 2024 and had undergone six cycles of chemotherapy. Additionally, he started using mushroom extract. When we requested the diagnostic tests related to his diagnosis, we were unable to obtain the biopsy result, but there were PET-CT scan results available.

The first PET-CT report dated 19/04/2024 indicated: "FDG uptake consistent with primary malignancy in the stomach (SUVmax: 7.7). Pathological FDG uptake observed in multiple lymph nodes including celiac, gastric, aortocaval, and para-aortic lymph nodes (lymph node metastasis). Suspected invasion in the left lobe of the liver."

The PET-CT report dated 04/09/2024, when compared with the April 2024 PET-CT study, noted: "Nearly complete regression of the previously described stomach uptake, disappearance of the FDG uptake in the lesion

observed in the gastrohepatic area. The lymph nodes observed in the previous study have regressed in number and size, and no FDG uptake was noted. Findings are interpreted in favor of a complete metabolic response to treatment."

In the control PET-CT of our third case, a positive response to treatment was observed.

DISCUSSION

Usnea longissima is a lichen species found in the rain forests of Europe, Asia and North America and is formed by the symbiotic relationship of fungi and algae. It has been used among humans for its antimicrobial, painkiller and antipyretic properties (6).

Usnea longissima extracts have been reported to have strong antioxidant effects. Various free radical scavenging tests revealed that *Usnea longissima* showed excellent reducing power and free radical scavenging capacities in a dose-dependent manner. Sharma and Bhat reported that *Usnea longissima* showed anti-lipid peroxidation effects with scavenging effects on superoxide anion and hydroxyl free radicals. In addition, usnic acid, a metabolite of *Usnea longissima*, has been shown to inhibit inflammation in laboratory and living organisms (6).

It is known that reactive oxygen radicals cause lipid peroxidation (LPO) and produce MDA, the end product of LPO. Odabasoglu et al. reported that usnic acid extract obtained

from *Usnea longissima* showed gastroprotective effect by decreasing LPO and increasing GSH (Glutathione - a powerful antioxidant) levels in ulcers (6).

Antioxidants are substances that, when present in low concentration, significantly reduce the oxidation of the substrate. These antioxidants protect the body from harmful oxidation reactions by reacting with free radicals and other reactive oxygen species. Therefore, free radical-related diseases can be prevented by antioxidant therapy. Recent research has been specifically aimed at finding natural antioxidants of plant origin. Although synthetic antioxidants are currently available, it is thought that some synthetic antioxidants may cause adverse health effects. Therefore, new antioxidants that can be derived from plants are still under investigation. The antioxidant activity of plants is usually due to their phenolic compounds. Flavonoids are polyphenolic compounds with various antioxidant properties. The discovery of antioxidant properties of plants is based on traditional medicine and plants provide a potential source for the development of new drugs (7).

In the study conducted by Mammadov and colleagues in our country, the anticancer effects of the ethyl acetate extract of *Usnea longissima* were investigated in rat models of N-methyl-N-nitrosoguanidine (MNNG)-induced esophagogastric adenocarcinoma. In the study, *Usnea longissima* was administered daily for

six months using oral doses of 50 and 100 mg/kg. The findings showed that the ethyl acetate extract prevented gastric and esophageal cancer and that these doses were non-toxic. Furthermore, no lethal effects were found even at high doses (2000 mg/kg). These results reveal the potential of ethyl acetate extract of *Usnea longissima* to be used in clinical applications in the future (8).

Among the patients we presented in our study, the patient with gastric intestinal metaplasia had interrupted H.Pylori eradication treatment and then used mushroom extract for 2 months and no metaplasia was detected in the control gastric biopsy.

The patient diagnosed with pancreatic cancer received surgical treatment and chemotherapy for her cancer, and the patient diagnosed with gastric cancer received chemotherapy. These two patients received the treatments deemed appropriate by their physicians and started to use mushroom extract as a supplement. Regressions were observed in their follow-up.

The regression in patients diagnosed with gastric cancer and pancreatic cancer with the recovery of the patient with gastric intestinal metaplasia that we have observed suggests that it is primarily due to the effect of medical

treatments, but also suggests that mushroom extract may also contribute to the treatment.

CONCLUSION

When we looked at the literature, it was seen that the investigation of the effect of *Usnea longissima* on cancer was limited to preclinical studies. We think that studies on the effects of *Usnea longissima* should move to the next stage and be tested on humans, and we believe that this may be a promising new treatment option for cancer treatment. Based on the findings of our study, *Usnea longissima* appears to have promising biological activity that warrants further investigation. While our observations are limited to a small number of cases, these preliminary results suggest that this lichen species may have potential for future therapeutic applications. However, larger-scale, controlled studies are needed before any clinical recommendations can be made.

Ethics Committee Approval: Ethics committee approval was received for this study from Non-Interventional Scientific Clinical Research Ethics Committee of Ordu University. (Date: 07.03.2025 and number: 78). The study was carried out by paying attention to the Declaration of Helsinki.

Peer-review: Externally peer- reviewed

Author Contributions: Concept: OE, MKO, Design: OE, MKO, Data Collection and Processing: OE, MKO, Analysis and

Interpretation: OE, MKO, BCA, HS, Writing: OE, MKO, BCA, HS

Conflict of Interest: The author declared no conflict of interest.

Financial Disclosure: The authors declared that this study has not received no financial support.

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REVIEW

DOI: 10.19127/mbsjohs.1527654

Artificial Intelligence in Health: Transforming Health in the Future

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Received: 03 August 2024, Accepted: 21 January 2025, Published online: 31 May 2025

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Abstract

Artificial intelligence (AI) is a rapidly developing technology that has the potential to revolutionise healthcare in recent years. AI is known to have various applications that can be used to improve the diagnosis of diseases, treatments and patient care. In addition, by analysing large data sets that will form the basis of diagnosis and treatment, it is aimed to capture details that may escape the human eye and reveal new information. AI enables physicians to make faster, more accurate diagnoses and select the most suitable treatments for patients. Administrative and clinical operations in the healthcare sector are undergoing a radical change under the influence of the digital transformation process. In this context, innovative steps towards process automation are being implemented at an increasing pace. Artificial intelligence technologies, in particular, have demonstrated remarkable adaptation by being integrated into both administrative and medical applications in the healthcare field. These technologies increase the efficiency of patient management systems along with the optimization of diagnosis and treatment processes, thus providing a significant reduction in both operational and clinical costs. Artificial intelligence-supported solutions reshape the organizational structure of healthcare services, optimize resource use and increase service quality. This transformation has a wide range of effects from patient care to institutional operations and contributes to the sustainability of healthcare systems.

Keyword: Health , artificial intelligence, future

Suggested Citation: Uyanık E. Artificial Intelligence in Health: Transforming Health in the Future. Mid Blac Sea Journal of Health Sci, 2025;11(2):143-150

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INTRODUCTION

Artificial Intelligence in Health

Medical imaging techniques are one of the most important tools that reveal the clinical findings of the patient. Artificial intelligence, together with medical imaging methods, supports the doctor by providing information on detecting lesions, deciding on the diagnosis and prescribing the treatment procedure. The success of the treatment procedure applied to the patient is with the correct diagnosis. Evolved neural networks are successfully used in the medical field, especially in image processing and disease prediction to determine the correct diagnosis. For example, it has been reported that artificial intelligence-supported systems perform at least as well as radiologists in mammography and breast cancer screening, have lower diagnostic error rates than radiologists, and significantly reduce the workload of radiologists (1). An artificial intelligence-assisted diagnosis system has been developed to classify malignant and benign lung nodules based on computed tomography (CT) data and has been shown to accurately differentiate lung nodules (2). One of these is computer-aided diagnosis system. Today, computer-aided diagnosis (CAD) has become one of the most important research topics in diagnostic radiology and medical imaging. CAD methods offer tremendous advantages to physicians in diagnosing disease more effectively and avoiding unnecessary biopsy

procedures, while reducing test time and cost. CAD acts as an intermediate layer between medical imaging and radiologists. It is important to note here that the CAD product is not considered a medical record or report. Only the results should be considered as a support reference for the relevant examination and diagnosis (3). AI models often require large amounts of data, so you first need to collect relevant data. For example, if you want to train an image recognition model, it's important to collect thousands of images. It is important to clean and organize the data and reveal important features.

Another area where artificial intelligence plays a role is dermatology. In recent years, artificial intelligence and technological developments have become a component of health. Artificial intelligence is achieving better results in object recognition day by day. According to studies conducted in 2019 and 2020, artificial intelligence achieved better results than humans for the first time with an error rate of less than 5%. Skin Cancer is a disease that patients or doctors usually notice as a lesion during physical examination, but experts try to make a diagnosis by performing biopsy and histopathological examinations after dermatoscopy and examination. The initial detection of disease foci creates a disease classification algorithm and artificial

intelligence plays a guiding role in diagnosis and treatment (4,5).

Diabetic Retinopathy (DR) is one of the major reasons behind the overall increase in the number of people experiencing vision loss. This is due to the worldwide spread of diabetes and the increasing incidence of DR among people with diabetes. People diagnosed with DR have about a 90 per cent chance of avoiding permanent vision loss if early detection is done correctly and effectively. AI algorithms have been shown to be more accurate than the human eye in the early diagnosis of diabetic retinopathy. For example, in one study, AI algorithms achieved an accuracy of 90% in the early diagnosis of diabetic retinopathy, while the accuracy of the human eye was 80%. This suggests that AI can help prevent vision loss from diabetic retinopathy (6). There are several reasons why AI algorithms are more accurate than the human eye in the early diagnosis of diabetic retinopathy. Using image processing and machine learning techniques, AI algorithms can detect details that the human eye cannot see. In addition, AI algorithms can be trained on very large amounts of data, an advantage that doctors do not have.

Cancer is the unpredictable growth of cells that have the potential to invade other parts of the body or spread. Cancer remains one of the world's most common causes of death. AI algorithms have been used to predict how cancerous cells spread. This suggests that it

could help develop more effective treatments for cancer patients. For example, in one study, AI algorithms were able to determine the most effective treatment for patients 10% more accurately by predicting how cancerous cells spread (7). The place of AI in pathology is one of the most promising areas in medicine; it can improve the quality and efficiency of detecting lesions, determining their spread, classification (e.g. tumour subtype), prognosis (in terms of combining clinical and genomic information) and other predictions. Integration of digital pathology with other imaging modalities and clinical data is thought to increase efficiency in terms of diagnosis and prognosis (8). AI algorithms enable early diagnosis by quickly and precisely detecting cancerous areas. This is especially important for cancer types where treatment success largely depends on early diagnosis. This developing technology also offers great potential in the diagnosis of various urological cancers such as prostate cancer, bladder cancer and kidney cancer.

Heart disease is also one of the world's most common causes of death. Artificial intelligence algorithms have started to be used to predict the risk of heart disease. This can help identify people at high risk of heart disease and develop prevention strategies for them. For example, in one study, AI algorithms were able to identify people at high risk of heart disease 20% more accurately by predicting the risk of heart disease. There are several reasons why AI

algorithms predict the risk of heart disease. AI algorithms can predict the risk of heart disease by using demographic information, lifestyle and health history of patients. In addition, AI algorithms can be trained on very large amounts of data, which is an advantage that tissues do not have.

AI applications that are actively available and under development are also used to support specialists. DeepRhythmAI (DRAI) software is used to detect arrhythmias and automatically analyse electrocardiograms (ECG). DRAI is a cloud-based artificial intelligence algorithm that analyses all heartbeats in the processed ECG signal and classifies them as correct or arrhythmic based on this . In addition, the Rothman Index (RI) is used to monitor and visualise patients in a hospital setting. The RI uses the sum of vital signs, laboratory values and nursing assessments to produce a single score reflecting the patient's risk of death (9). In another study, all incoming patients including patients without murmurs, patients with innocent murmurs and patients with pathological murmurs (106 patients) were followed up. These patients who underwent ECHO, the gold standard for diagnosis, were compared with the new algorithm. The computerised algorithm tested showed 87% sensitivity and 100% specificity, 100% positive predictive value, 90% negative predictive value and 94% accuracy. The computerised algorithm has been shown to detect

pathological murmurs with high sensitivity, specificity and accuracy comparable to the published results of paediatric cardiologists and neonatologists (10).

AI algorithms have been used to predict the success of surgery. This has been shown to help us better understand the risks and benefits of surgery and help patients make better decisions. For example, in one study, AI algorithms were able to identify patients at high risk of surgery failure 15% more accurately by predicting the success of the surgery (11). Significant progress has been made with the use of artificial intelligence-based technologies in the perioperative process, which covers the stages before, during and after surgical intervention. Artificial intelligence learns by using the data obtained from surgical operations and makes the surgical programme compatible with the artificial intelligence system by using this information. In this way, it is said that it is possible to determine the limits of surgical intervention, preserve the remaining organ volume after surgery and predict possible metastasised lymph nodes (12). Accurate measurement of intraoperative blood loss is an important clinical variable in managing fluid resuscitation and preventing unnecessary transfusion of blood products. In this study, the blood lost in laparotomy sponges in surgical cases is an example of an application programmed with a unique algorithm modelled on face recognition technology(13) . However,

it is thought that studies should continue to make these algorithms more appropriate.

Research on the combined use of AI and endoscopy in the diagnosis and classification of different diseases is increasing day by day and the future is promising in this field (14). It is thought that AI can help to obtain more accurate and faster results in the diagnosis of diseases in organs such as oesophagus, stomach and colon (15). For example, in a study in which small intestinal capsule endoscopy images were analysed with the AI neural network algorithm, diseased tissues and their locations could be determined more precisely and accurately than traditional methods (16,17).

Medical education is a field that requires intensive and complex professional knowledge. Therefore, only reading medical books and notes may limit the development of medical students. Diversified applications of artificial intelligence (AI) technology have contributed to the solution of this problem by making the learning model of medical students richer and more colourful (18). AI offers medical students a more immersive and interactive learning experience through tools such as virtual reality, augmented reality and interactive simulations. In this way, students have the opportunity to concretise theoretical knowledge and improve their practical skills. By analysing the individual learning style and needs of each student, AI is able to provide the most appropriate learning materials and resources. In

this way, students will be able to learn more efficiently and effectively. AI can help medical students develop their clinical skills through tools such as virtual patients and robotic mannequins. In this way, students will be able to practice in a risk-free environment before intervening in real patients (19). However, some ethical and legal regulations are required for the widespread use of AI technology in medical education.

As is known, the drug development process is a long and labourious process. In this process, which includes target identification, drug design, tests, clinical trials and approval stages, there is also the risk that the expected result may not always be achieved. With the development of artificial intelligence, the pharmaceutical industry is also transforming. New drug discovery and design are becoming easier, and the quality of drugs is also increasing. AI enables us to better understand diseases and the functioning of drugs by analysing medical data. In this way, it becomes possible to develop more accurate and effective drugs. The role of AI in the drug development process is said to have the potential to offer new treatment options to patients faster and safer by saving time and cost. The role of artificial intelligence (AI) in drug development is increasing day by day. Especially deep learning technology enables the discovery of drugs targeting proteins that were once impossible to reach. It has also been observed that cancer

drugs designed and produced thanks to the powerful logical inference and automatic learning capabilities of AI show better therapeutic performance compared to drugs developed by traditional methods. These developments indicate that AI will radically change the drug development paradigm in the near future (20).

CONCLUSION

Artificial intelligence has begun to revolutionise the healthcare sector, offering innovations in every field from diagnosis and treatment to patient care and drug development. By analysing medical images and patient data, it helps doctors make faster and more accurate diagnoses and can be used to create personalised treatment plans. AI plays an important role in remote patient monitoring and chronic disease management. It also accelerates the development of new drugs and treatments. Faster and more accurate diagnoses and treatments, personalised medicine, improved patient care, new drugs and treatments, and lower healthcare costs are expected in the future with the use of AI. The use of AI in healthcare has many benefits. It will provide better patient outcomes, fewer medical errors, lower healthcare costs and greater access. However, there are also some ethical and legal concerns about the use of AI in healthcare. Addressing concerns such as the privacy and security of patient data, the freedom of AI algorithms from bias, and who will be responsible for the

mistakes of AI is important for the widespread adoption of AI in healthcare. In conclusion, AI has great potential for the future of healthcare. When utilised properly, the quality of healthcare services, patient satisfaction and overall health status can be significantly improved.

Peer-review: Externally peer-reviewed

Author Contributions: Concept: EU, Design: EU, Data Collection and Processing: EU, Analysis and Interpretation: EU, Writing: EU

Conflict of Interest: The author declared no conflict of interest.

Financial Disclosure: The author declared that this study has not received no financial support.

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