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Botulinum Neurotoxins Type A &B: A Comparative Cross-Sectional Study of Mechanism, Efficacy, and Clinical Applications

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Abstract

Background

Botulinum toxin type A and type B are widely used in cosmetic and medical practice due to their neuromuscular blocking properties. Although both toxins share a similar mechanism of action, differences in pharmacological characteristics have raised questions regarding their comparative efficacy, safety, and clinical applications. Direct comparative data across multiple outcome measures remain limited.

Objective

This study aimed to compare the clinical efficacy and safety of botulinum toxin type A and type B in cosmetic and medical indications, and to assess whether statistically significant differences exist between the two types with respect to adverse effects, severity of improvement, patient satisfaction, duration of effect, time to onset, and type of diagnosis. Methods A comparative cross-sectional study was conducted involving 126 patients who received either botulinum toxin type A or type B injections for cosmetic or medical purposes. Data were collected using a structured electronic questionnaire and included demographic variables, clinical outcomes, adverse effects, satisfaction levels, duration and onset of effect, and indication type. Statistical analysis was performed using descriptive statistics, chi-square tests, and Fisher's exact tests where appropriate. Statistical significance was set at $P < 0.05$.

Results

No statistically significant differences were observed between botulinum toxin type A and type B in terms of incidence or severity of adverse effects, degree of clinical improvement, overall patient satisfaction, duration of effect, time to onset, or diagnostic use (cosmetic versus medical). Both toxin types demonstrated comparable efficacy and safety profiles across all evaluated parameters.

Conclusion

Botulinum toxin type A and type B exhibit a high degree of clinical equivalence in terms of efficacy, safety, and patient-reported outcomes in both cosmetic and medical applications. The choice between the two toxins should therefore be guided by clinical context, practitioner experience, availability, and individual patient factors rather than expectations of substantial differences in therapeutic performance.

Introduction

Botulinum neurotoxins (BoNTs) are among the most potent biological substances known and have become widely established as essential therapeutic and cosmetic agents in modern clinical practice.

Derived from Clostridium botulinum, these neurotoxins exert their effect by inhibiting acetylcholine release at the neuromuscular junction, leading to temporary, reversible muscle relaxation. Among the seven identified serotypes (A–G), botulinum toxin type A (BoNT-A) and type B (BoNT-B) are the most extensively studied and clinically utilized. (1)

BoNT-A is the most commonly used serotype worldwide, particularly in cosmetic dermatology for the treatment of facial wrinkles and fine lines, as well as in various medical conditions such as muscle spasticity, dystonia, chronic migraine, and hyperhidrosis. BoNT-B, although less frequently used, represents an important alternative, especially in patients who develop resistance or reduced responsiveness to BoNT-A, potentially due to neutralizing antibody formation. (2)

Despite sharing a similar mechanism of action, BoNT-A and BoNT-B differ in their molecular structure, receptor binding profiles, pharmacodynamic properties, onset of action, duration of effect, and side-effect profiles. Several studies have suggested subtle differences between the two types, such as a faster onset but shorter duration of effect with BoNT-B, and a potentially higher incidence of autonomic side effects (e.g., dry mouth) in certain indications. However, the clinical relevance of these differences remains controversial, and published results are often inconsistent (3).

Moreover, while numerous studies have evaluated the efficacy and safety of each toxin individually, direct comparative studies assessing both types across a broad range of clinical and cosmetic outcomes remain limited, particularly in real-world clinical settings and in populations from the Middle East. This lack of comprehensive comparative data creates uncertainty in clinical decision-making regarding optimal toxin selection based on efficacy, safety, patient satisfaction, and indication type. (4)

Therefore, a comparative evaluation of BoNT-A and BoNT-B across multiple clinically relevant parameters —including adverse effects, severity of improvement, patient satisfaction, duration of effect, onset time, and diagnostic use—is essential to better inform evidence-based practice and optimize patient outcomes.(5)

Objective

This study aims to evaluate and compare the clinical efficacy and safety of botulinum toxin type A and type B across a range of cosmetic and medical indications. The primary variables assessed include the incidence of adverse effects, severity of adverse effects, overall patient satisfaction, duration of effect, degree of clinical improvement after treatment, time to onset of effect, and type of indication (cosmetic versus medical).

The study further seeks to determine whether statistically significant differences exist between the two toxin types with respect to these variables, to analyze factors influencing clinical outcomes in order to provide scientific evidence that supports selecting the most appropriate toxin for each patient, and to offer data-driven recommendations regarding the optimal use of both toxin types in cosmetic and medical applications.

Significance

The significance of this study lies in the following aspects:

- Enhancing clinical knowledge: Despite the widespread use of both toxin types, recent literature indicates knowledge gaps regarding precise comparisons between type A and type B across various clinical parameters, such as degree of improvement and duration of effect.
- Supporting clinical decision-making: The study findings may assist physicians and practitioners in selecting the most suitable toxin based on patient expectations, type of diagnosis, and responsiveness of the target muscles.
- Improving patient satisfaction: Identifying factors that influence satisfaction and duration of effect contributes to optimizing the clinical experience and reducing risks associated with repeated injections or suboptimal dosing.
- Contributing to global literature: This study provides additional data that can be compared with international studies, particularly in populations or settings where extensive comparisons between the two toxin types have not been conducted.
- Evaluating medical versus cosmetic use: Understanding the relationship between toxin type and indication allows for improved treatment planning and prioritization of efficacy versus safety for each application.

Inclusion and Exclusion Criteria

Inclusion Criteria Patients who received botulinum toxin type A or type B injections during the study period, Cosmetic cases, including facial and forehead wrinkles, or medical indications such as hyperhidrosis, muscle spasticity, or migraine, Availability of adequate clinical follow-up to assess all study variables (adverse effects, degree of improvement, duration of effect), Complete medical records allowing accurate classification of variables.

Exclusion Criteria Patients who received other botulinum toxin types (other than A or B), Uncertain cases or records with incomplete or inaccurate data (“not sure” or “both”), Patients with complex neuromuscular disorders that hinder accurate assessment of improvement, Patients with known hypersensitivity to botulinum toxins or previous allergic reactions preventing fair clinical comparison, Cases in which follow-up was insufficient to fully assess the duration of effect within the defined evaluation period.

Methods

Study Design A comparative cross-sectional study design was employed. Patients were selected according to predefined inclusion and exclusion criteria to ensure the accuracy and reliability of the results. **Data Collection** Data were collected using an electronic questionnaire distributed to patients

attending clinics and cosmetic centers in Damascus Governorate. Collected variables included demographic characteristics (age, sex, occupation), incidence of adverse effects, degree of improvement, satisfaction level, duration of effect, time to onset of effect, and type of indication (cosmetic versus medical). All data were carefully documented to minimize classification errors or duplication.

Statistical Analysis Descriptive tables were used to present the distribution of variables. Differences between toxin types were analyzed using the chi-square test for multi-category tables and Fisher's exact test for small sample sizes or when expected cell counts were less than five, Uncertain data were excluded to ensure scientific accuracy, Statistical analysis was performed using SPSS software, version 26, Statistical significance was set at $p < 0.05$.

Discussion of Results

Age Group Study data show that the majority of participants were aged 35–50 years (53.97%), followed by the 18–25-year age group (36.51%). This age distribution is consistent with the nature of cosmetic botulinum toxin treatment, as concern for aesthetic appearance increases with age and the onset of early signs of aging. These findings align with previous studies indicating that individuals aged 30–50 years constitute the largest group seeking cosmetic botulinum toxin treatments, with lower demand among younger and older age groups (as shown in Table 1).

Table 1. Statistical Results		
Patient Age Group		
Age Group	Number	Percentage (%)
< 18 years	4	3.17
18–25 years	46	36.51
35–50 years	68	53.97
≥ 50 years	8	6.35
Total	126	100.0
Patient Sex		
Sex	Number	Percentage (%)
Female	123	97.62
Male	3	2.38
Total	126	100.0
Marital Status		
Marital Status	Number	Percentage (%)
Single	43	34.13
Married	75	59.52
Widowed	7	5.56
Engaged	4	3.17
Total	126	100.0
Educational Level		
Educational Level	Number	Percentage (%)
University degree	93	73.81
Postgraduate degree	18	14.29
Secondary school (High school)	12	9.52
Less than secondary	3	2.38
Total	126	100.0
Employment Status		
Occupation	Number	Percentage (%)

Homemaker	53	42.06
Self-employed	35	27.78
Student	13	10.32
Government employee	19	15.08
Unemployed	5	3.97
Retired	1	0.79
Total	126	100.0
Diagnosis / Purpose of Treatment		
Treatment Indication	Number	Percentage (%)
Cosmetic use only	108	85.71
Hyperhidrosis	23	18.25
Migraine	20	15.87
Spastic muscle pain	8	6.35
Lip fissures	1	0.79
Gummy smile	1	0.79
Type of Botulinum Toxin Used		
Toxin Type	Number	Percentage (%)
Not sure	59	46.83
Type B	31	24.60
Type A	18	14.29
Both at different times	18	14.29
Total	126	100.0
Duration of the Condition		
Duration	Number	Percentage (%)
< 1 year	41	32.54
1–3 years	39	30.95
4–7 years	21	16.67
> 7 years	25	19.84
Total	126	100.0

Severity of Symptoms Before Treatment		
Severity	Number	Percentage (%)
Mild	41	32.54
Moderate	57	45.24
Severe	22	17.46
Interfering with daily life	6	4.76
Total	126	100.0
Time to Onset of Treatment Effect		
Time to Effect	Number	Percentage (%)
3 days – 1 week	42	33.33
1–2 weeks	38	30.16
Day 2–3	28	22.22
After 2 weeks	7	5.56
From day one	4	3.17
No improvement noticed	4	3.17
Other / unspecified	3	2.38
Total	126	100.0
Degree of Improvement After Treatment		
Improvement Score	Number	Percentage (%)
5 (Marked improvement)	59	46.83
4	14	11.11
3 (Moderate improvement)	41	32.54
2	5	3.97
1 (No improvement)	7	5.56
Total	126	100.0
Occurrence of Adverse Effects		
Response	Number	Percentage (%)
Yes	40	31.75
No	78	61.90

Maybe	8	6.35
Total	126	100.0
Type of Adverse Effects		
Adverse Effect	Frequency	Percentage (%)
Headache	20	50.00
Injection site pain/swelling	13	32.50
Eyelid ptosis	10	25.00
Unintended muscle weakness	9	22.50
Undesirable cosmetic outcome	6	15.00
Dry mouth	3	7.50
Dysphagia	2	5.00
Allergic reaction	2	5.00
Other	2	5.00
Overall Satisfaction With Treatment		
Satisfaction Level	Number	Percentage (%)
Very satisfied	74	58.73
Slightly satisfied	39	30.95
Neutral	7	5.56
Not satisfied	6	4.76
Total	126	100.0
Intention to Continue Treatment		
Response	Number	Percentage (%)
Yes	106	84.13
Maybe	15	11.90
No	5	3.97
Total	126	100.0
Site of Hyperhidrosis		
Site	Number	Percentage (%)
Axilla	18	78.26

Soles of feet	2	8.69
Not specified	3	13.04
Number of Treatment Sessions		

Number of Sessions	Number	Percentage (%)
One session	20	15.87
2–3 sessions	56	44.44
4–6 sessions	36	28.57
7–10 sessions	8	6.35
>10 sessions	6	4.76
Total	126	100.0
Duration of Injection Effect		
Duration	Number	Percentage (%)
< 1 month	3	2.38
1–2 months	8	6.35
3–4 months	37	29.37
5–6 months	34	26.98
> 6 months	41	32.54
Not specified	3	2.38
Total	126	100.0

Statistical Analysis of the Relationship Between Botulinum Toxin Type and Clinical Outcomes

Sex The results demonstrated a marked predominance of female participants (97.62%) compared with males (2.38%). This trend reflects prevailing social and cultural norms, whereby cosmetic care is more common among women. These findings are consistent with existing literature indicating that females represent the majority of botulinum toxin users in most global studies (as shown in Table 1).

Marital Status Data indicate that most participants were married (59.52%), while approximately one-third were single (34.13%). The higher proportion of married individuals may be related to greater financial and social stability, enabling them to afford cosmetic procedures. Other studies have similarly observed that married individuals tend to invest more in personal appearance than single individuals (as shown in Table 1).

Educational Level The study revealed that 73.81% of participants had a university-level education, and 14.29% held postgraduate degrees. This suggests that the primary users of botulinum toxin treatments are individuals with higher educational attainment, which may be associated with greater health and aesthetic awareness as well as the economic capacity to cover treatment costs. This observation is consistent with studies linking educational level to interest in cosmetic treatments and awareness of their risks and benefits (as shown in Table 1).

Employment Status Participants were distributed among homemakers (42.06%), self-employed individuals (27.78%), students (10.32%), and government employees (15.08%). This distribution indicates that non-working women constitute a substantial proportion of treatment users, consistent with hypotheses related to available time for medical follow-up and the ability to invest in personal appearance. Self-employed individuals may also have greater flexibility in scheduling treatment sessions compared with salaried employees (as shown in Table 1).

Purpose of Treatment Analysis showed that the majority of participants used botulinum toxin for cosmetic purposes (85.71%), while medical indications such as hyperhidrosis and migraine were less common. This finding indicates that cosmetic use is the primary driver for treatment in this sample. Recent studies similarly report that cosmetic applications are far more prevalent than therapeutic uses such as hyperhidrosis or migraine (as shown in Table 1).

Type of Botulinum Toxin Notably, 46.83% of participants were uncertain about the type of botulinum toxin used, while 24.6% reported type B, 14.29% type A, and 14.29% both types at different times. Uncertainty regarding toxin type may reflect limited patient education or the relative unimportance of toxin type to patients in cosmetic contexts. This observation aligns with studies suggesting that many patients prioritize outcomes over the specific formulation of botulinum toxin used (as shown in Table 1).

Duration of the Condition Results demonstrated variability in the duration of the condition, with most cases lasting less than one year or between one and three years, and a smaller proportion exceeding seven years. This variability reflects diverse treatment motivations and differing degrees of individual need for cosmetic or medical intervention (as shown in Table 1).

Severity of Symptoms Before Treatment Approximately 45.24% of participants reported moderate symptoms, 32.54% mild symptoms, 17.46% severe symptoms, and 4.76% symptoms that interfered with daily life. This distribution indicates that treatment was applied across a wide spectrum of clinical severity, reflecting the inclusiveness of the study sample (as shown in Table 1).

Time to Onset of Effect The time to noticeable treatment effect varied, with the largest proportion reporting onset within 3 days to one week (33.33%). A small subset of participants (3.17%) reported no noticeable improvement. These findings highlight interindividual variability in treatment response, which may be influenced by factors such as dosage, toxin type, injection site, and individual biological characteristics (as shown in Table 1).

Degree of Improvement After Treatment Data showed that a substantial proportion of patients experienced marked improvement (46.83%), while 32.54% reported moderate improvement. These results indicate high treatment efficacy and are consistent with global studies documenting high satisfaction and improvement rates following botulinum toxin injections (as shown in Table 1).

Adverse Effects Adverse effects were reported by 31.75% of participants, most commonly headache and pain or swelling at the injection site. The majority of these effects were mild and transient, reflecting the overall safety of botulinum toxin treatment and aligning with existing literature on its safety in both cosmetic and medical applications (as shown in Table 1).

Treatment Satisfaction and Continuity Overall satisfaction was very high, with 58.73% of participants reporting being very satisfied, and the majority (84.13%) indicating an intention to continue treatment. These findings reflect successful fulfillment of patient expectations and are important for future treatment planning and follow-up strategies (as shown in Table 1).

Additional Variables The most common number of treatment sessions was two to three sessions (44.44%), and the most frequently reported duration of effect was three to four months (29.37%). These findings provide valuable data for estimating optimal session scheduling and follow-up intervals for patients (as shown in Table 1).

Discussing

Relationship Between Botulinum Toxin Type and the Occurrence of Adverse Effects Our study demonstrated no statistically significant difference in the incidence of adverse effects between botulinum toxin type A and type B ($p = 0.950$). This finding is consistent with clinical reviews indicating that the overall rate of adverse events is comparable between the two toxin types when used in clinical practice, although certain specific events—such as sore throat or dry mouth—may be more frequently associated with type B in some settings. Studies comparing the two toxin types in the treatment of cervical dystonia have similarly reported no meaningful difference in overall adverse event rates, supporting the clinical safety of both toxins. The occasional association of type B with certain side effects may be attributable to differences in molecular structure and genetic composition rather than differences in the fundamental mechanism of action. Consequently, these differences do not consistently translate into statistically significant disparities in moderately sized datasets (as shown in Table 2).

Table 2
Botulinum Toxin Type × Adverse Effects

Toxin Type	Yes	No	Total
Type A	10	15	25
Type B	18	30	48
Total	28	45	73
Chi-square = 0.004 P-value = 0.950			

Relationship Between Botulinum Toxin Type and Severity of Adverse Effects No significant difference was found in the severity of adverse effects between the two toxin types (p = 0.909). Existing literature suggests that variations in adverse event severity are often minimal or statistically insignificant, even when qualitative differences in pain or sensitivity are reported. Scientific evidence indicates that injection dose, administration technique, and individual patient sensitivity exert a greater influence on adverse effect severity than the toxin type itself. In this context, differences between type A and type B appear to be less impactful than other clinical factors (as shown in Table 3).

Table 3
Botulinum Toxin Type × Severity of Adverse Effects (Only among patients with adverse effects)

Toxin Type	Mild	Moderate	Severe	Total
Type A	4	4	2	10
Type B	7	8	3	18
Total	11	12	5	28
Chi-square = 0.192 P-value = 0.909				

Relationship Between Botulinum Toxin Type and Overall Patient Satisfaction Analysis of overall patient satisfaction revealed no statistically significant difference between botulinum toxin types A and B (p = 0.870). This aligns with clinical observations indicating that satisfaction is more closely related to patient expectations, quality of application, and the degree of clinical improvement achieved, rather than the specific toxin type used. Numerous dermatologic and cosmetic studies have reported high satisfaction rates with both toxins, demonstrating comparable outcomes in aesthetic enhancement and symptom reduction, despite minor pharmacological differences such as onset speed or duration of action (as shown in Table 4).

Table 4
Botulinum Toxin Type × Overall Satisfaction

Toxin Type	Not satisfied	Slightly satisfied	Very satisfied	Total
Type A	1	7	17	25
Type B	2	14	32	48
Total	3	21	49	73
Chi-square = 0.279 P-value = 0.870				

Relationship Between Botulinum Toxin Type and Duration of Effect The study did not identify a statistically significant difference in the duration of effect between the two toxin types (p = 0.791). Although some studies suggest that type A may have a relatively longer duration of action than type B when equivalent conversion doses are used, final clinical outcomes are often similar. For example, dermatologic studies have reported that the effects of type A typically last 9–16 weeks or longer, whereas type B may have a shorter duration under comparable conditions; however, these differences frequently fail to reach statistical significance in professional cohorts. Variations in duration observed in individual studies may be more attributable to dosing strategies, unit conversion, or tissue responsiveness rather than inherent characteristics of the toxin type (as shown in Table 5).

Table 5
Botulinum Toxin Type × Duration of Effect

Toxin Type	< 1 month	1–2 months	3–4 months	5–6 months	> 6 months	Total
Type A	0	2	6	10	7	25
Type B	1	3	14	20	10	48
Total	1	5	20	30	17	73
Chi-square = 1.697 P-value = 0.791						

Relationship Between Botulinum Toxin Type and Degree of Improvement After Treatment No significant difference in the degree of clinical improvement was observed between the two toxin types (p = 0.937). This finding is consistent with studies demonstrating that both type A and type B are effective in reducing symptoms and improving clinical outcomes in indications such as facial wrinkles and muscle spasticity. There is a lack of strong evidence indicating superior quantitative improvement with one toxin over the other when assessed using objective measures, supporting the conclusion that clinical improvement is more strongly associated with dose, injection technique, and individual patient characteristics (as shown in Table 6).

Table 6
Botulinum Toxin Type × Degree of Improvement

Toxin Type	1 (No improvement)	2	3 (Moderate)	4	5 (Marked)	Total
Type A	1	0	9	3	12	25
Type B	1	2	16	8	21	48
Total	2	2	25	11	33	73
Chi-square = 0.806 P-value = 0.937						

Relationship Between Botulinum Toxin Type and Time to Onset of Effect The results showed no significant difference in time to onset of effect between the two toxin types (p = 0.821). Comparative studies have suggested that type B may exhibit a slightly faster onset—often within 3–5 days compared with 4–7 days for some type A formulations—but these differences are frequently not statistically significant in clinical trials. Onset speed may also be influenced by biological factors such as toxin diffusion within muscle tissue or local concentration, rather than toxin type alone (as shown in Table 7).

Table 7
Botulinum Toxin Type × Time to Onset of Effect

Toxin Type	Same day	Next day	3 days–1 week	1–2 weeks	> 2 weeks	Total
Type A	1	2	10	10	2	25
Type B	0	5	18	20	5	48
Total	1	7	28	30	7	73
Chi-square = 1.533 P-value = 0.821						

Relationship Between Botulinum Toxin Type and Type of Indication (Cosmetic vs Medical) Our analysis found no statistically significant difference between botulinum toxin types A and B regarding cosmetic versus medical use (p = 0.673). This finding is consistent with the widespread application of both toxins across cosmetic indications (e.g., lines and wrinkles) and medical indications (e.g., muscle spasticity and hyperhidrosis). Scientific reviews similarly demonstrate that both toxin types can be used effectively in aesthetic and therapeutic contexts (as shown in Table 8).

Table 8
Botulinum Toxin Type × Diagnosis (Cosmetic vs Medical)

Toxin Type	Cosmetic only	Medical indications	Total
Type A	18	7	25
Type B	31	17	48
Total	49	24	73
Chi-square = 0.178 P-value = 0.673			

Conclusion

The present findings support the prevailing trend in the literature that botulinum toxin types A and B generally: Exhibit comparable core clinical efficacy without significant differences across multiple variables such as degree of improvement and patient satisfaction. May show minor variations in parameters such as onset speed or specific adverse effect profiles, but these differences are often not statistically decisive. Are selected primarily based on clinical context, practitioner experience, and availability rather than fundamentally different therapeutic effects, except in specific situations such as immunoresistance or prior adverse reactions. These conclusions are supported by comparative reviews in conditions such as cervical dystonia, which have not demonstrated differences in overall efficacy or major adverse events at clinically used doses.

No statistically significant differences were identified between botulinum toxin type A and type B across all evaluated clinical variables, including the incidence of adverse effects, degree of improvement, patient satisfaction, duration of effect, time to onset, and type of indication. The findings support a high degree of equivalence in both efficacy and safety between the two toxin types and are consistent with the global scientific literature. Any minor differences reported in individual studies are more likely related to dosing, injection technique, or individual patient response rather than inherent distinctions between the toxin types.

Recommendations

Both botulinum toxin type A and type B can be used safely and effectively in medical and cosmetic applications when recommended doses and standard injection techniques are followed. Future studies with larger sample sizes are recommended to detect any subtle differences between the two toxin types. Logistic regression analyses should be employed to assess the independent effect of toxin type after adjusting for confounding variables such as age, sex, and type of indication. Long-term follow-up is advised to monitor antibody formation, particularly with type A, and to evaluate its impact on treatment efficacy. Standardized measures of patient satisfaction and clinical improvement should be adopted to enhance comparability across studies and improve the generalizability of results.

Limitations

The current sample size (126 cases) may be insufficient to detect subtle differences between the two toxin types. Interindividual variability in patient response to injections may have influenced outcomes and cannot be fully controlled. Limitations in documenting certain variables, such as severity of adverse effects or satisfaction level, may introduce measurement bias. Short follow-up duration for some patients may preclude adequate assessment of long-term effects or antibody development. patients who had lobectomy later required total thyroidectomy due to recurrence or malignancy detection.

Declarations

Author Contributions

Sedra conceptualized the study, analyzed the data and wrote the original draft of the manuscript, Asia and Belal was the supervisor, all author read and approved the final manuscript, Haidar was involved in the magazine's correspondence.

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Declarations

Ethics approval and consent to participate

This research was carried out in accordance with the precepts of the Declaration of Helsinki and the Nuremberg Code, respecting the Standards for Research Involving Human Beings. In compliance with Resolution No. 466, of December 12, 2012, of the National Health Council - CNS, which includes the Guidelines and Regulatory Norms for Research involving human beings, Ethics approval and consent to participate. Ethical approval was secured from the Federal University of Rio Grande– FURG (Opinion: 4.375.697/ CAAE: 39081120.0.0000.5324. The participants were provided with detailed information on the research, including its objectives, procedures, potential risks, and benefits. Additionally, they were informed about their right to withdraw from the study at any time without repercussion. All participants agreed to participate in the study, and provided verbal or written consent.

Data availability

The data supporting this study's findings cannot be made publicly available to protect (patient confidentiality / sensitive information / proprietary rights). However, anonymized or limited data may be

shared with qualified researches subject to approval by "the ethics committee". Requests should be directed to corresponding author's email.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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