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Quantitative and Qualitative Analysis of Clinical Trial Acronyms From Surgical Journals

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ABSTRACT

Introduction: Acronyms, the short form of a word or phrase, are commonly used in medical research to identify studies. However, their usage and quality assessment in surgical journals are unclear. This study aimed to determine the impact of identifying acronyms for clinical studies on the number of citations by comparing studies published in surgical and medical journals.

Methods: Articles were screened from five highly cited journals (*Annals of Surgery*, *British Journal of Surgery*, *JAMA Surgery*, *Journal of the American College of Surgeons*, and *New England Journal of Medicine*, alphabetically). The correlation between acronym use and number of citations was analyzed. In addition, the characteristics and quality of acronyms, in terms of lettering and wording scores, used to identify studies were evaluated for acronymous trials using a developed and self-validated scoring tool.

Results: Of 291 eligible articles, 167 (57.4%) were acronymous studies. Although 70.5% (122/173) of articles in general medical journals used identifying acronyms, only 38.1% (45/118) used them in surgical journals ($P < 0.001$). The median number of citations was higher for acronymous studies (212 *versus* 53; $P < 0.001$). Multivariable analysis revealed that acronymous studies had a 2.5-fold higher possibility of being a highly cited (odds ratio 2.514, $P = 0.004$). The average quality scores of the acronyms were similar for surgical and general medical journals (5.1 ± 1.7 *versus* 5.1 ± 1.6, $P = 0.949$). Surgical journals had lower lettering (2.20 ± 1.14 *versus* 3.02 ± 1.04, $P < 0.001$) but higher wording scores (2.89 ± 1.01 *versus* 2.09 ± 1.14, $P < 0.001$) than general medical journals.

Conclusions: Given the publicity effect of acronyms, a memorable acronym devised using the first or continuous letters for surgical studies may help recognize their clinical impact.

Both Hong-min Ahn and Hyeon Woo Shin share the first authorship on this manuscript.

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Introduction

The word 'acronym', is used to define an abbreviation for a compound of letters pronounced as a single word.[1] Historically, the term 'acronym' is derived from the German word *Akronym:* '*acr*', which means 'height, summit, or tip', and '*onym*', meaning 'name'.[2,3] The use of acronyms may help to identify and memorize content more easily without relying on a long phrase of words.[1]

The use of acronyms as identifiers of clinical studies emerged in the 1970s, and naming groups or trials using acronyms depicted collaboration between researchers and centers.[4-6] Suitable acronyms may have positive effects on communication, including clinical research; however, not all acronyms are considered to be well-devised, thoughtful, orthographically correct, or convincing. Some acronyms sound positive, which might mislead readers to automatically assume that the trials are of good quality despite the contents of the studies.[7-9] The use of undefined acronyms may confuse the scope of a clinical trial.[2,10] Furthermore, other acronyms are created by rearranging words in the title of the trial only to form a famous artist's or scientist's name to increase the awareness of their study, regardless of content.[11] To avoid these negative aspects, recommendations have been proposed on how to construct an acronym, including which letters to use and which words to avoid.[6] Despite these recommendations, abused or misused acronyms are still present in clinical trials. Furthermore, the quality of the acronyms varies across studies using different scoring systems.[12,13]

Previous studies on the use of acronyms in medical trials have examined the purpose and function of acronyms, and these were found to be useful tools for briefly improving and recalling references.[2,4,5] Acronymous studies that used acronyms as their names were more likely to be funded by the industry and authored by industry employees.[12,14] Because acronyms save time and space, they are practical and can facilitate communication with other researchers or groups. By branding clinical research or randomized trials with an acronym for the study name, a study is more likely to be cited than a nonacronymous study.[12,14]

Previous studies have reported the use of acronyms in trials by internal medicine specialists.[12,14] However, the efficiency or quality of acronyms used in surgical trials remains unclear. Therefore, this study aimed to demonstrate the characteristics of trials that had adopted acronyms and the correlation between the use of acronyms and citation rate, particularly by comparing surgical and medical trials.

Methods

Acronym identification

Articles published in 2018 were identified from the following five highly cited journals: *Annals of Surgery*, *British Journal of Surgery* (*BJS*), *Journal of the American Medical Association* (*JAMA*) *Surgery*, *Journal of the American College of Surgeons* (*JACS*), and *New England Journal of Medicine* (*NEJM*). These journals were classified as surgical (*Annals of Surgery*, *BJS*, *JAMA Surgery*, and *JACS*) and general medical (*NEJM*) journals, according to their main interests, which are either general surgery or medical in general. The journals were listed in the Journal Citation Reports in the year 2018. All articles in these journals were extracted from PubMed (https://pubmed.ncbi.nlm.nih.gov/), which contains biomedical and life sciences literature maintained by the National Center for Biotechnology Information. Among the articles from the five most-cited journals, case reports, review articles, editorials, and letters were excluded. Other articles, such as corrections, correspondence, and commentaries, were also excluded; therefore, only original scientific articles, either prospective or retrospective, were included in the analysis. The original articles from each journal were double-checked by filtering the article type as a "Clinical Trial" in PubMed.

Variables

Original articles were divided into two groups according to the use of acronyms: acronymous and nonacronymous. All articles were reviewed to obtain variables for comparison between the two groups. The variables collected from the articles were as follows: characteristics of the study (type of trial, funding, number of participating centers, and number of countries involved in the study), information on the authors (number of authors and medical specialty of the corresponding author), and contents of the study (number of participants, study protocol, intervention methods, and study outcomes). The data were collected based on the word description in the papers rather than by implication or interpretation of the contents.

The number of citations

The number of citations for each article was investigated on the same day using the Web of Science website (http://www.webofknowledge.com, November 22, 2022), which provides access to multiple databases containing reference and citation data from academic journals. According to previous citation analysis studies evaluating citations of electrocardiogram-related articles, the extracted studies were categorized as follows: papers with <100 citations were classified as having 'low citations' and those with ≥ 100 as having 'high citations'.[15,16]

Scoring of the acronym quality

The scoring system for the acronyms was modified to quantify their quality. Previous studies have defined acronym quality with either appropriate usage of the first letter or meaningfulness of words such as real words, meaning, and relation to the study, and these lettering and wording were counted as positive scores.[12,13] To understand the importance of lettering and wording when

creating an acronym, the scoring system used in this study consisted of a 'letter combination' and 'word component' score. In the 'letter combination', the construction of the first letter was scored from 1 to 4; an acronym constructed with only the first letters scored the highest, and an acronym impossible to construct with the first letter alone scored the lowest. In the 'word component', three different parameters of the included words, that is, the relationship with the specialty of the study (related), words with meaningful sounds (meaningfulness), and words used in real life (valid) were considered in the score. The acronyms with all three components had the highest score of 4, and those with none of these components scored the lowest at 1 (Table 1). Finally, the quality score given to each acronym was calculated by adding the scores of the 'letter combination' and 'word component'. Two separate researchers scored the acronym for each study using this quality scoring system. The intraclass correlation coefficient of the quality score was 0.98 (95% confidence interval, 0.97–0.98) indicating an almost perfect agreement of the interrater reliability.

Statistical analyses

To understand the characteristics of articles according to the use of acronyms, differences between acronymous and non-acronymous studies were compared. The mean values of the continuous variables were compared using an independent *t*-test or the Mann–Whitney *U*-test, according to the results of the Kolmogorov–Smirnov test. Chi-square or Fisher's exact test was used to compare categorical variables. Low-and highly cited articles were compared by multivariable analysis using a logistic regression model, with the covariance input criterion set at $P < 0.1$. All statistical analyses were performed using the Statistical Package for Social Science (SPSS) for Windows (version 27.0; SPSS, IBM). Descriptive results for continuous variables were expressed as medians (quartiles 1 and 3). Statistical significance was established at $P < 0.05$. The study protocol for this study was approved by the Institutional Review Board of the Seoul National University Bundang Hospital (X-2403-889-901).

Table 1 – A scoring system for acronyms used as titles of clinical studies.

Letter combination	Score	Word components*	Score
Only first letters	4	3+	4
>50% with first letters	3	2+	3
<50% with first letters	2	1+	2
Impossible to construct	1	None	1

For example, COREAN trial[17] (Comparison of Open *versus* laparoscopic surgery for mid and low REctal cancer After Neoadjuvant chemoradiotherapy): 3 (Letter combination) + 3 (Word components: Meaningful and Valid acronym) = '6'.
* The word component criteria include three parameters: 'Related', 'Meaningful', and 'Valid'.

Results

A total of 3114 articles were identified from the five highly cited journals. Among them, 1565 and 1549 articles were from surgical and general medical journals, respectively. After excluding case reports ($n = 213$), reviews ($n = 137$), editorials ($n = 114$), letters ($n = 781$), and other study types ($n = 1578$), 291 eligible papers were selected. Among the original articles, 118 and 173 were from surgical and general medical journals, respectively (Supplement 1). Papers with more than 100 citations were significantly higher in medical journals than in surgical journals (11.9% *versus* 86.1%, $P < 0.001$, Supplement 2). The acronyms were used in 167 (57.4%) papers, including 122 (73.1%) and 45 (26.9%) in general medical and surgical journals, respectively (Table 2). The use of acronyms was higher when the study was funded (41.1% *versus* 65.9%, $P < 0.001$) or designed according to industrial needs (17.7% *versus* 38.9%, $P < 0.001$). When multiple centers (54.8% *versus* 74.9%, $P < 0.001$) or countries (55.6% *versus* 79.0%, $P < 0.001$) were involved in the study, the use of acronyms was higher. However, the results of the study, whether positive or negative, were not associated with acronym use ($P = 0.224$) (Table 2).

The median number of citations in the study group was 130 (q2 = 34, q3 = 395). The number of citations was higher for studies using acronyms in their research titles (median number of citations, 53 *versus* 212, $P < 0.001$) (Fig. 1). Sponsor-initiated trials (72 *versus* 456, $P < 0.001$) tended to be cited more often than those without any funding association. Furthermore, studies involving multiple or international hospitals tended to be cited by other studies (multicenter studies: 72 *versus* 177, $P = 0.002$; international studies: 35 *versus* 211, $P < 0.001$). The number of citations with surgery as the specialty of the corresponding author was the lowest among all specialties ($P < 0.001$), and the number of citations was the lowest when the intervention method was surgery ($P < 0.001$). Articles from general medical journals were cited more frequently than those from surgical journals (311 *versus* 29, $P < 0.001$) (Table 3).

Among eligible papers, 128 (44.0%) had low citations and 163 (56.0%) had high citations. Univariate analysis revealed that the acronyms were associated with sponsor-initiated trials, funding, multicenter, international, nonsurgical intervention, and that the nonsurgeon corresponding authors were associated with highly cited papers. By adjusting for other factors in a multivariable analysis, the use of an acronym was a factor associated with high citations of more than 2.5-fold (odd ratio 2.514, 95% confidence interval, 1.335–4.734; $P = 0.004$). In addition to acronyms, sponsored trials, funding, and nonsurgeon authors were factors associated with high citation counts (Table 4).

Studies in general medical journals using acronyms showed a higher tendency to be cited than surgical journals (311 *versus* 29, $P < 0.001$). More letters were used in devising the acronymous studies of general medical journal than those of surgical journals (7.4 ± 3.0 *versus* 5.7 ± 1.7, $P < 0.001$), and acronyms with known words such as nouns, adjectives, or verbs that were used in daily life were used more frequently in studies of general medical journal (77.9% *versus* 55.6%, $P = 0.041$). There was no difference in the distribution of total

Table 2 – Comparison of characteristics between acronymous and nonacronymous studies in five highly cited journals ($n = 391$).

Variables	Nonacronymous ($n = 124$)	Acronymous ($n = 167$)	P value
Number of participants*	231 (107, 601)	626 (225, 2251)	0.004
Number of authors*	11 (8, 17)	17 (11, 26)	<0.001
Type of trials			
Investigator-initiated trial	102 (82.3)	102 (61.1)	<0.001
Sponsor-initiated trial	22 (17.7)	65 (38.9)	
Funding			
Industry	51 (41.1)	110 (65.9)	<0.001
Government	36 (29.0)	31 (18.6)	
Combined	8 (6.5)	7 (4.2)	
Academic society	8 (6.5)	9 (5.4)	
Other	21 (16.9)	10 (6.0)	
Number of centers			
Single	56 (45.2)	42 (25.1)	<0.001
Multiple	68 (54.8)	125 (74.9)	
Number of countries			
Domestic	55 (44.4)	35 (21.0)	<0.001
International	69 (55.6)	132 (79.0)	
Specialty of the corresponding author			
Internal medicine	32 (25.8)	81 (48.5)	<0.001
Surgery	65 (52.4)	49 (29.3)	
Others	27 (21.8)	37 (22.2)	
Intervention methods of studies			
Medication	42 (33.9)	98 (58.7)	<0.001
Surgery	40 (32.3)	31 (18.6)	
Others	42 (33.9)	38 (22.8)	
Study protocol			
Retrospective	27 (21.8)	17 (10.2)	<0.001
Prospective	97 (75.2)	150 (89.8)	
Study outcomes			
Positive	76 (61.3)	107 (64.1)	0.224
Negative	23 (18.5)	39 (23.4)	
Inconclusive	20 (16.1)	19 (11.4)	
Others	5 (4.0)	2 (1.2)	
Character of journal			
General medicine	51 (41.1)	122 (73.1)	<0.001
Surgery	73 (58.9)	45 (26.9)	

Values in parentheses indicate *n* (%) unless otherwise indicated.
*Values are medians (q1, q3).

quality scores between general medical and surgical journals ($P = 0.503$) (Table 5). The estimated quality scores of the acronym were 5.1 ± 1.6 for studies from general medical journal and 5.1 ± 1.7 for surgical journals, with no significant difference ($P = 0.949$) (Fig. 2). Stratifying acronyms according to the "letter combination" and "word component," general medical journal with acronyms scored higher when a letter combination was used than surgical journals with acronyms (2.20 ± 1.14 *versus* 3.02 ± 1.04, $P < 0.001$); however, surgical journals with acronyms scored higher in the word component than general medical journal with acronyms (2.89 ± 1.01 *versus* 2.09 ± 1.14, $P < 0.001$) (Fig. 2).

Discussion

Trials identified by an acronym tended to be cited more often than nonacronymous trials. However, surgical journals

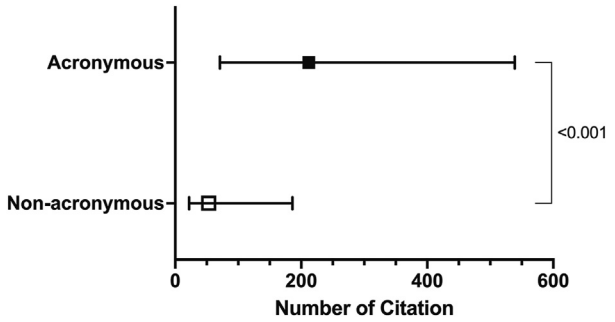

Fig. 1 – Correlation between the use of acronym and number of citations.

publishing papers using acronyms for studies were less likely to be cited than a general medical journal. In addition, there was a 2.5-fold higher possibility of articles being cited when acronyms were used to identify the study. Although there were no differences in the total quality score, surgical journals showed a poor combination of letters but took into consideration meaningful, related, or valid words when constructing the acronym. In other words, having complex acronyms may be less efficient than having simple letter arrangements. This study reports the correlation between the use of acronyms and frequency of citations in the five highly cited journals by analyzing articles published in the year 2018. To the best of our knowledge, this is the first study to determine the correlation between the number of citations 5 ys after publication and quality of an acronym used to identify a study, considering different characteristics of surgical and general medical journals.

The frequent use of acronyms in medical journals, particularly cardiology, has been the subject of in-depth analyses, and the prevalence of identifying acronyms for medical trials has increased with time.[12] The use of acronyms facilitates communication among researchers by saving time and space when speaking and writing about the related research.[1,12,18] Because of this advantage, authors of large-scale studies, such as multicenter or international trials, prefer to use acronyms to name their trials. Furthermore, acronymous studies may more likely be funded by the pharmaceutical industry. This may indicate that medical trials are often initiated by industrial needs, and acronyms are used to take advantage of branding effects. However, surgical randomized controlled trials have gradually increased over the years, and the need to use acronyms to identify surgical trials may also increase.[19]

Due to the increasing trend of using acronyms in the title of trials, greater attention is being paid to the quality of acronyms. Positive sounding acronyms, such as PROMISE, GREAT, and DREAM, may mislead researchers about the results of the trial.[9] Some researchers have warned of the uncertainty and confusion that acronyms may contain various meanings in different areas.[2,20] A study in the United Kingdom reported that acronyms were not considered helpful despite an increase in their usage.[13] In addition to the negative aspects of acronyms, pseudo-acronyms such as the PICASSO or MICHELANGELO trial, constructed to exploit famous artists' names, were used only to gain attention, regardless of the context.[11] It is necessary to create high-quality acronyms that provide definite advantages for communicating research content.[6]

Regarding the quality control of acronyms, a cardiologist in the United States proposed the Ten Commandments of Acronymology as a tool to avoid abuse or misuse.[6,14] Among these commandments, appropriate combination of initial letters is the main criterion for creating an acronym. There are few scoring systems to evaluate the quality of acronyms and

Table 3 – Number of citations with various characteristics.

Variables	Number of citations		*P* value
	Median	(q1, q3)	
Type of trials			
Investigator-initiated trial	72	(23, 185)	<0.001
Sponsor-initiated trial	456	(225, 1039)	
Funding			
Industry	201	(44, 534)	<0.001
Government	172	(80, 338)	
Combined	64	(34, 164)	
Academic society	53	(20, 201)	
Others	32	(20, 52)	
Number of centers			
Single	72	(25, 248)	0.002
Multiple	177	(51, 469)	
Number of countries			
Domestic	35	(18, 111)	<0.001
International	211	(76, 528)	
Specialty of the corresponding author			
Internal medicine	322	(151, 640)	<0.001
Surgery	34	(17, 78)	
Others	170	(60, 443)	
Intervention methods of studies			
Medication	284	(112, 564)	<0.001
Surgery	35	(15, 110)	
Others	71	(25, 222)	
Study protocol			
Retrospective	61	(27, 290)	0.564
Prospective	144	(35, 404)	
Study outcomes			
Positive	136	(40, 501)	<0.001
Negative	119	(22, 277)	
Inconclusive	184	(64, 338)	
Others	26	(15, 33)	
Journal specialty			
General medicine	311	(143, 602)	<0.001
Surgery	29	(15, 47)	

Table 4 — Univariable and multivariable analyses comparing low- and high-cited papers.

Variables	Univariable analysis				Multivariable analysis		
	Low citation* ($n = 128$)	High citation* ($n = 163$)	OR	*P* value	OR	95% CI	*P* value
Acronym (*versus* nonacronymous)	50 (39.1)	117 (71.8)	3.968	<0.001	2.514	1.335-4.734	0.004
Nonpositive outcome (*versus* Positive)	48 (37.5)	60 (36.8)	0.971	0.904			
Sponsor-initiated trial (*versus* IIT)	7 (5.5)	80 (49.1)	16.661	<0.001	7.354	2.887-18.731	<0.001
With funding (*versus* without)	101 (78.9)	106 (98.2)	14.286	<0.001	5.237	1.372-19.992	0.015
Multicenter study (*versus* single)	71 (55.5)	122 (74.8)	2.389	0.001	1.215	0.603-2.447	0.586
International study (*versus* domestic)	64 (50.0)	137 (84.0)	5.269	<0.001	1.711	0.843-3.475	0.137
Nonsurgical intervention (*versus* Surgical)	76 (59.4)	144 (88.3)	5.186	<0.001	1.014	0.434-2.369	0.974
Prospective study (*versus* retrospective)	103 (80.5)	144 (88.3)	1.840	0.063			
Nonsurgeon author (*versus* surgeon)	39 (30.5)	138 (84.7)	12.597	<0.001	6.309	3.019-13.183	<0.001

CI = confidence interval; OR = odds ratio; IIT = investigator-initiated trial.
*Low or high citations were categorized according to 100 citations; <100 citations were categorized as low citations and ≥100 as high citations (15).

the lettering score, using the first initial count as a positive score may be a useful parameter. In addition to lettering, components such as real words, meaning, and acronyms related to the study can also be considered positive scores. Because meaningful acronyms may make trials memorable, the proportion of word components in scoring systems is much higher than that of lettering.[12,13] However, studies assigning scores by adding or subtracting from the total score based on whether the acronyms meet the criteria, make it difficult to estimate the quality of the acronyms.

Table 5 — Characteristics of acronymous articles between surgical and general medical journals ($n = 167$).

Variables	General medicine ($n = 122$)	Surgery ($n = 45$)	*P* value
Number of citations*	386 (184, 663)	27 (15, 55)	<0.001
Acronym: number of letters†	7.4 ± 3.0	5.7 ± 1.7	<0.001
Acronym: parts of speech			
Noun	62 (50.8)	17 (37.8)	0.041
Verb	23 (18.9)	5 (11.1)	
Adjective	10 (8.2)	3 (6.7)	
Others	27 (22.1)	20 (44.4)	
Quality of acronym score			0.503
2	9 (7.4)	6 (13.3)	
3	3 (2.5)	1 (2.2)	
4	34 (27.9)	6 (13.3)	
5	30 (24.6)	13 (28.9)	
6	20 (16.4)	10 (22.2)	
7	18 (14.8)	7 (15.6)	
8	8 (4.8)	2 (1.2)	

Values in parentheses are percentages unless otherwise indicated.
*Values indicate median (q1, q3).
†Values indicate means ± standard deviations.

The scoring system developed in this study to assess the quality of acronyms was assigned 1 to 4 points in both the letter combination criteria and word component criteria, which were then summed to obtain the total score leading points ranging from 2 to 8 for the quality scores. A validation test of the scoring system revealed that each item has a separate impact on the number of citations. Although the total score was not affected by the number of citations, correlations were found for each item, letter combination, and word component. With the tendency for lower scores in letter combinations and higher scores in word components in surgical journals, it is understandable that surgeons spend too much time and energy creating related, meaningful, and valid acronyms instead of simply lettering the title of their trials. In other words, a simple combination of the first letter in the title may be sufficient to attract the attention of other researchers.

This study had some limitations. Firstly, many variables could have confounded the results, including the significant difference in general medical and surgical journals. Because most surgical studies share the same interests as medical studies, inevitable differences may strongly affect the correlation between the use of acronyms and the number of citations. As the difference masked all other confounding effects, exclusion in multivariable analysis to understand the confounding effects of other variables was necessary. To understand the difference between general medical and surgical

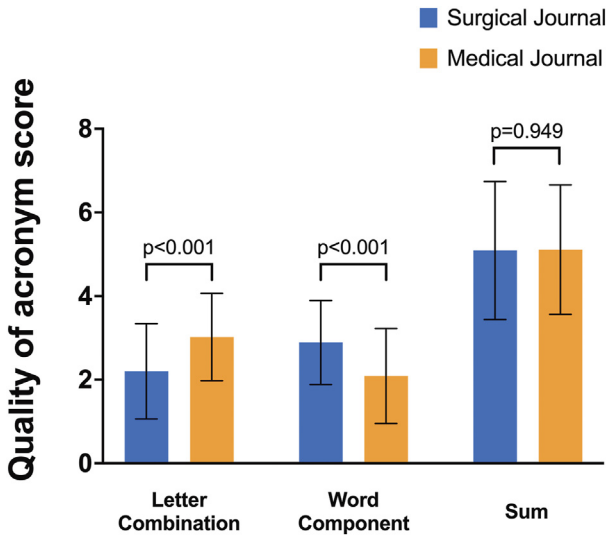

Fig. 2 – Comparison of the quality of acronym scores between papers from surgical and general medical journals.

journals, we conducted a separate multivariable analysis; however, due to the small sample size, the results of the subgroup analyses were less likely to gain statistical power. Despite the statistical insignificance, the use of acronyms tends to lead to more citations in both general medical and surgical journals (odds ratio 1.871 and 1.678, respectively, Supplements 3 and 4).

Other than the difference between general medical and surgical journals, the number of articles analyzed was not large enough to represent all clinical studies. In addition, the number of citations for each article changes on a daily basis. To reduce the effect of this dynamics, the articles published in the year 2018 were selected for analysis, and the citation data for these articles in the 5 ys after their publication was collected on the same day. Lastly, the developed scoring system was not a previously verified and established system. It was established for the purpose of this study to indicate the exact quality of the acronyms; however, it has advantages of understanding the quality of each acronym component. Despite these limitations, this was the first study to determine the correlation between the number of citations 5 ys after publication and the use of acronyms, considering the different characteristics of surgical and general medical journals. Therefore, research with controlled data on the acronymous trials using advanced technology, such as artificial intelligence, would be helpful in processing huge amounts of data in future studies.

In conclusion, despite the various benefits of using acronyms, surgical journals use fewer acronyms to identify a study than medical journals. Given the publicity effect of acronyms, efforts should be made to create memorable acronyms for surgical research. While acronym use should be promoted, simultaneous efforts should be made to prevent deterioration of their quality. Therefore, creating an acronym with the first or continuous letter for surgical research may be helpful to recognize its clinical impact.

Supplementary Materials

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jss.2025.01.009.

CRediT authorship contribution statement

Hong-min Ahn: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Formal analysis. **Hyeon Woo Shin:** Writing – original draft, Visualization, Formal analysis, Data curation. **Heung-Kwon Oh:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Conceptualization. **Yoon Ju Jung:** Visualization, Formal analysis, Data curation. **Anuj Naresh Singhi:** Writing – review & editing, Data curation. **Min Hyeong Jo:** Writing – review & editing, Data curation. **Mi Jeong Choi:** Writing – review & editing, Data curation. **Tae-Gyun Lee:** Writing – review & editing, Data curation. **Hye Rim Shin:** Writing – review & editing, Data curation. **Duck-Woo Kim:** Writing – review & editing, Validation, Resources, Conceptualization. **Sung-Bum Kang:** Writing – review & editing, Validation, Resources, Conceptualization.

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Availability of Data

The data underlying this article will be shared on reasonable request to the corresponding author. The data are not publicly available to compromise the privacy of participants.

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