



Reasons for article retraction in anesthesiology: a comprehensive analysis

Raisons justifiant la rétractation d'un article en anesthésiologie: une analyse exhaustive

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Abstract

Background Increasing awareness of scientific misconduct has prompted various fields of medicine, including orthopedic surgery, neurosurgery, and dentistry to characterize the reasons for article retraction. The purpose of this review was to evaluate the reasons for and the rate of article retraction in the field of anesthesia within the last 30 years.

Methods Based on a reproducible search strategy, two independent reviewers searched MEDLINE, EMBASE, and the Retraction Watch website to identify retracted anesthesiology articles. Extracted data included: author names, year of publication, year of the retracted article, journal name, journal five-year impact factor, research type (clinical, basic science, or review), reason for article retraction, number of citations, and presence of a watermark indicating article retraction.

Results Three hundred and fifty articles were included for data extraction. Reasons for article retraction could be grouped into six broad categories. The most common reason for retraction was fraud (data fabrication or manipulation), which accounted for nearly half (49.4%) of all retractions, followed by lack of appropriate ethical approval (28%). Other reasons for retraction included publication issues (e.g., duplicate publications), plagiarism, and studies with methodologic or other non-

fraud data issues. Four authors were associated with most of the retracted articles (59%). The majority (69%) of publications utilized a watermark on the original article to indicate that the article was retracted. Journal Citation Reports journal impact factors ranged from 0.9 to 48.1 (median [interquartile range (IQR)], 3.6 [2.5–4.0]), and the most cited article was referenced 197 times (median [IQR], 13 [5–26]). Most retracted articles (66%) were cited at least once by other journal articles after having been withdrawn.

Conclusions Most retracted articles in anesthesiology literature were retracted because of research misconduct. Limited information is available in the retraction notices, unless explicitly stated, so it is challenging to distinguish between an honest error and research misconduct. Therefore, a standardized reporting process with structured retraction notices is desired.

Résumé

Contexte L'augmentation de la prise de conscience face à l'inconduite scientifique a poussé plusieurs domaines de la médecine, notamment la chirurgie orthopédique, la neurochirurgie et la dentisterie, à rendre explicites les raisons justifiant la rétractation d'un article. L'objectif de ce compte-rendu était d'évaluer les raisons justifiant la rétractation d'un article et le taux de rétractation dans le domaine de l'anesthésie au cours des 30 dernières années.

Méthode À l'aide d'une stratégie de recherche reproductible, deux réviseurs indépendants ont effectué des recherches dans les bases de données MEDLINE et EMBASE ainsi que sur le site internet Retraction Watch afin d'identifier les articles rétractés en anesthésiologie. Les données extraites comprenaient : les noms des auteurs, l'année de publication, l'année de l'article rétracté, le nom de la revue, le facteur d'impact sur cinq ans de la revue, le

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type de recherche (clinique, science fondamentale, ou compte-rendu), la raison de la rétractation, le nombre de citations, et la présence d'un filigrane indiquant la rétractation.

Résultats Trois cent cinquante articles ont été retenus pour l'extraction de données. Les raisons de la rétractation ont été réparties en six grandes catégories. La raison la plus fréquente de rétractation était la fraude (fabrication ou manipulation de données), qui représentait près de la moitié (49,4 %) de toutes les rétractations, suivie de l'absence d'un consentement éthique approprié (28 %). Les autres raisons ayant justifié une rétractation étaient des problèmes au niveau de la publication (par ex. publication en double), le plagiat, et les études présentant des problèmes méthodologiques ou autres au niveau des données mais non frauduleuses. Quatre auteurs étaient associés à la plupart des articles rétractés (59 %). La majorité (69 %) des publications avaient apposé un filigrane sur l'article original afin d'indiquer que l'article avait été rétracté. Les facteurs d'impact des revues, selon le *Journal Citation Reports*, allaient de 0,9 à 48,1 (médiane [écart interquartile (ÉIQ)], 3,6 [2,5-4,0]), et l'article le plus cité était mentionné 197 fois dans les références (médiane [ÉIQ], 13 [5-26]). La plupart des articles rétractés (66 %) ont été cités au moins une fois par d'autres articles de revue après avoir été retirés.

Conclusion La plupart des articles rétractés dans la littérature de l'anesthésiologie l'ont été en raison d'inconduite scientifique. Les informations présentées dans les avis de rétractation sont limitées sauf mention explicite, c'est pourquoi il est difficile de faire la part des choses entre une erreur commise en toute bonne foi et une véritable inconduite scientifique. Ainsi, un processus de signalement standardisé comportant des avis de rétractation structurés serait souhaitable.

The Committee on Publication Ethics (COPE) defines article retraction as a mechanism for correcting the academic literature by alerting readers to publications that contain flawed or erroneous data.¹ Articles are retracted for a myriad of reasons, and while there has been an overall increase in the number of retracted publications since the 1950s, there was an upsurge between 1990 and 2006.² Whether this recent increase can be attributed to a decline in the integrity of science, an increase in the visibility and accessibility of published papers, or advances in computing power and statistical methods is not entirely clear.^{2,3} Nonetheless, invalid conclusions can perpetuate faulty research and potentially misguide patient management leading to harm. The COPE

created extensive guidelines on which types of publications should be issued retracted article statements and how notices of retraction should be conveyed. These guidelines include identifying an article as retracted, making retracted articles publicly available (not behind paywalls), publishing retracted articles promptly, and stating the reason for the article retraction.¹ It appears that aligning the management of retracted articles with these COPE guidelines can be improved in the field of anesthesiology.⁴

To heighten awareness and educate the public about retracted articles, representatives from various fields of medicine have increased efforts to draw attention to this issue. Specialties such as orthopedics, neurosurgery, emergency medicine, and dentistry have published systematic reviews examining retracted publications in their respective fields.⁵⁻⁹ In the same vein, "Retraction Watch," a public website (www.retractionwatch.com) started in 2010 by two medical journalists, focuses on retracted articles and their authors.¹⁰ Retraction Watch's unofficial "leaderboard" of authors includes three anesthesiologists, corresponding to the recent increase in the number of retracted articles related to scientific misconduct in the specialty.¹¹ It is possible that anesthesiology research is particularly vulnerable to this phenomenon, as there may be greater opportunities to utilize and manipulate large clinical data sets relative to other fields.¹² The purpose of this review was to evaluate the reasons for and the rate of article retraction in the field of anesthesia within the last 30 years.

Methods

Search parameters

In this comprehensive review of retracted anesthesia literature, we adapted search parameters from other systematic reviews to develop a reproducible strategy for identifying retracted articles in anesthesiology.⁵⁻⁸ The search focused on two major complementary databases, MEDLINE and EMBASE, as well as the Retraction Watch website. On MEDLINE and EMBASE, the search terms used to identify retracted articles were "anesthesia," "anesthesiology," "anesthesiologist," "anesthetic," "analgesia," "pain," "retracted article of study," "retracted study," "notice of retracted article," "retracted article notice," "retracted article of publication," and "retracted publication." Boolean operators "OR" and "AND" connected the anesthesiology keywords with the retracted article keywords and phrases. On the Retraction Watch website, blog entries categorized under "anesthesia retracted articles" were reviewed for additional retracted articles. All identified articles were then imported into

EndNote software (Clarivate Analytics, Philadelphia, PA, USA) to manage articles and remove duplicates for final review.

Data extraction

Two reviewers (C.Y. and J.Y.) independently reviewed titles and abstracts and then selected articles based on the following inclusion criteria: studies that pertain to anesthesiology or pain, studies that involve all research techniques (e.g., human subjects, basic science, animal studies, and reviews/meta-analyses), and articles that were retracted between 1987 and 2017 inclusive. All discrepancies between reviewers were discussed at length until a final consensus could be reached. Extracted data included: author names, year of publication, year of retracted article, time elapsed between publication and retraction, journal name, journal five-year impact factor, research type (clinical, basic science, or review), reason for retraction, number of citations, presence of watermark or other retracted article labelling, and whether the article continued to be cited after its retraction. The journal impact factor was determined using the Journal Citation Reports database. The reasons for article retraction were identified using keywords in the retraction notices rather than an a priori classification of retraction reasons. The number of citations as well as whether the article was cited after its retraction was determined using the Web of Science database. Ten of the retracted articles were independently reviewed for the purpose of cross-validating data collection. Disagreements were resolved through a consensus-based discussion.

Data analysis

We used descriptive statistics to report our analysis. Data are presented as counts and proportions. All analyses were performed using Microsoft Excel.

Results

Study selection

A total of 350 retracted articles were included for data extraction from a total search result of 3,312 articles (Fig. 1). The articles identified were a mixture of human subject clinical research (82%), basic science research involving drugs or animals (15%), and review articles (3%). All retraction notices referenced are available upon request by contacting the corresponding author.

Timing of retracted articles

Retracted articles were published between 1986 and 2017 and retracted between 1993 and 2017, with the latency between publication and retraction ranging from 0 to 29 yr (median [interquartile range (IQR)], 8 [3–14] yr). Figure 2 shows the year of initial publication of the retracted articles and the year they were retracted. Article retractions were concentrated between 2009 and 2017, and most (32%) occurred in 2013.

Authors, countries, and journals

Four individuals were responsible for 59% of retracted articles in anesthesiology. These authors were from Germany (Drs Joachim Boldt and Swen Piper), Japan (Dr. Yoshitaka Fujii), and the United States (Dr. Scott S. Reuben). Four more individuals, listed as second authors, were associated with an additional 30% of retracted articles. The top four journals, publishing 44% of retracted articles, were from the United States, Canada, and the United Kingdom.

Fig. 1 Study selection process

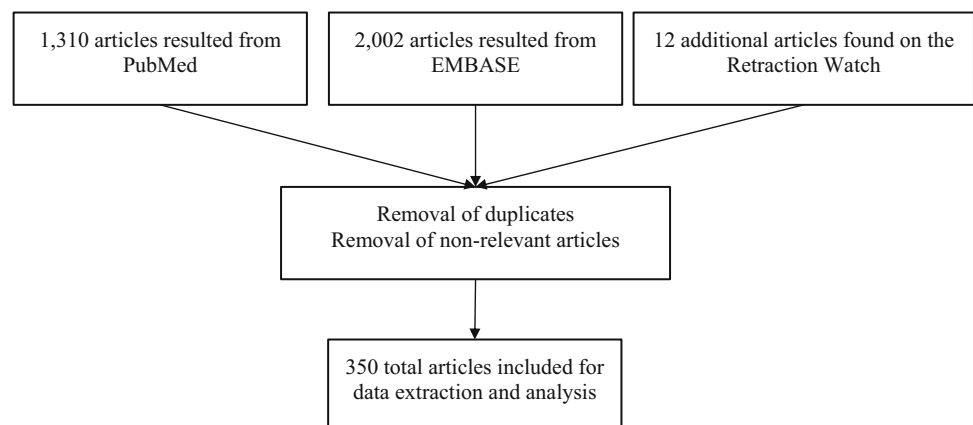
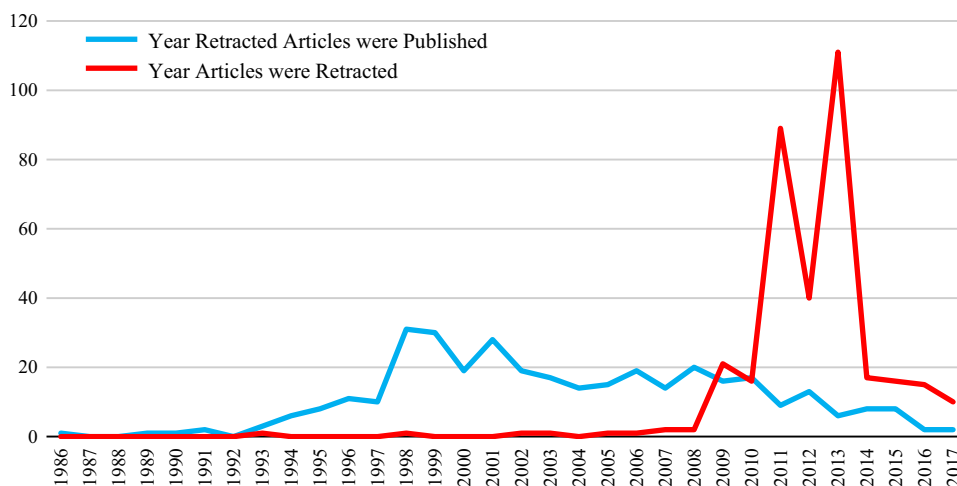


Fig. 2 Count of publications and retractions by year



Reasons for retraction

Reasons for retraction were grouped into six broad categories (Table). The most common reason for article retraction was fraud (data fabrication or manipulation), which accounted for nearly half (49.4%) of all retractions, followed by lack of appropriate ethical approval (28%). Other reasons for retraction included publication issues (e.g., duplicate publications), plagiarism, studies with methodological or other non-fraud data issues, and a miscellaneous category, including inaccessible articles or articles with no stated reason for retraction. Of the 350 retracted articles, only 23 (7%) were retracted by the author. These included studies of the pharmacokinetics and pharmacodynamics of a propofol prodrug; the authors discovered and reported an inaccuracy in the propofol assay, invalidating the results of seven previously published studies.

Retracted article methods

The majority of retracted publications (69%) utilized a watermark on the original article to indicate that the article was retracted. Conversely, 21% were not watermarked, and the original articles could still be accessed unaltered. The remaining 10% of articles could not be accessed. Some retracted articles also included headers (25%) and footers (0.5%) labelling the retracted article.

Impact factor

The Journal Citation Reports journal impact factors ranged from 0.9 to 48.0 (median [IQR], 3.6 [2.5–4.0]), and the most cited article was referenced 197 times (median [IQR], 13 [5–26]). Of the 350 articles, 230 (66%) were cited at least once by other journal articles after having already been retracted.

Discussion

In this comprehensive review of retracted articles in anesthesiology, we found that the majority of retracted articles (76%, 266 of 350) were retracted because of research misconduct, including data fabrication and lack of ethical approval. Furthermore, we found that four authors were associated with a majority of the retracted articles in anesthesiology, three of whom have been discussed extensively within the last decade.^{13–15} Their articles correspond to the large increase in retracted articles between 2009 and 2017, with those attributed to Dr. Yoshitaka Fujii accounting for the large spike of retracted articles in the 2012–2013 period.

Dr. Fujii's research misconduct resulted in over one third (37%, 131 of 350) of the retracted anesthesiology articles. The line of events in Dr. Fujii's paper started with Peter Kranke *et al.* writing a letter to the editor indicating the possibility of an "underlying influence" in the reported data.¹⁶ Subsequently, Dr. John B. Carlisle, a consultant anesthesiologist from the United Kingdom, reported "unusual consistency" in data from 168 randomized-controlled trials published by Fujii between 1991 and 2011.¹³ Carlisle developed a statistical technique using a Chi squared method for identifying aberrant patterns in outcome data by analyzing the distribution of baseline variables, such as height, weight, and age. In collaboration with others, Carlisle further refined this methodology using Monte Carlo simulations, another statistical technique that utilizes repeated random sampling of variables to calculate the probability that means and standard deviations arose from randomization of subjects.¹⁴ This team confirmed the previous theory that Fujii's distribution of data were extremely unlikely to have arisen by chance and showed that the Monte Carlo analysis might be a tool for detecting unreliable data in other studies. In addition to the concerns raised by Kranke and Carlisle, the editors of the affected

journals reached out to the affiliated institutions and requested an investigation to validate the authenticity of Dr. Fujii’s work. A collaborative effort between these editors and institutions confirmed Fujii’s research misconduct. The reasons for retraction were “1) overwhelming evidence of fabrication relating to the fact that the distributions of many variables reported by Dr. Fujii in these studies are exceedingly unlikely, and 2) the inability of Dr. Fujii’s institutions to attest to the integrity of the studies and/or the data conducted under their auspices, as set out in the Joint Editors-in-Chief Request for Determination of April 9, 2012.”¹⁷

Dr. Joachim Boldt was the first author of 33 of the 350 retracted articles in anesthesiology. In 2011, Editors-in-Chief from 18 major anesthesiology and surgery journals signed a joint statement proclaiming retracted articles of 88 of Dr. Boldt’s publications, including those where he was not the first author.^{15,18} The State Medical Association of Rheinland-Pfalz (Germany), which served as the Institutional Review Board (IRB) for Boldt’s research, carried out an investigation into his work and was unable to verify IRB approval for the aforementioned 88 articles.¹⁸

Finally, Dr. Scott S. Reuben accounted for 20 of the 350 retracted articles in anesthesiology. Dr. Reuben was investigated by Bay State Medical Center in 2009 and was found to have fabricated data in 19 peer-reviewed articles and two abstracts.¹⁹ As noted by White *et al.* in a 2011 editorial, the retracted articles had clinical

implications for chronic pain and the use of nonsteroidal anti-inflammatory in the perioperative setting.¹⁹ An impact analysis published in 2016 indicated that nearly half of Reuben’s articles were still being referenced with only a quarter of these articles mentioning his retractions five years after being withdrawn.²⁰

In one of the retraction notices, it was stated that “subsequent to its publication, the authors indicated that the study was not prospectively randomized as stated in the Methods section. Upon independent review as an observational study, it was concluded that the findings were underpowered to allow the conclusions drawn with adequate certainty.”²¹ While this retraction could have been due to falsification/flawed methods, the reported reason was underpowered statistics. If underpowered statistics is to be routinely considered a reason for retraction, numerous published studies would warrant retraction. This illustrates the need for standardization in reporting the reasons for article retraction to eliminate ambiguity.

Identification of retracted articles

Watermarks are an effective method of notifying the public of retracted articles as they are eye-catching and difficult to miss. While the majority of retracted articles contained a watermark of retraction, we found that the quality of these watermarks differed among journals. Some journals

Table Counts and proportions of reasons for retraction

Reasons for retraction	Count	Percentage
Data manipulation/fabrication/fraud	173	49.4%
Scientific misconduct	173	49.4%
Ethical issues	100	28.0%
No ethical approval	100	28.0%
Other data/methodology issues	15	4.2%
Flawed methods or statistics	9	2.5%
Invalid data or data error	5	1.4%
Findings were underpowered to support the conclusions	1	0.3%
Plagiarism	20	5.7%
Plagiarism	20	4.9%
Publication issues	23	6.5%
Previously published in another journal	14	4.0%
Overlap of research findings	3	0.9%
Authors’ request	3	0.9%
Authorship dispute	3	0.9%
Other/uncategorizable	19	5.4%
Cannot access original article	11	3.1%
No explanation is given in retracted article notice	6	1.7%
Theft of intellectual property	1	0.3%
Alternative explanation for research finding	1	0.3%

utilized completely opaque watermarks in a bright red font that made the text difficult to read, and others printed watermarks that were nearly translucent, allowing the text to be read easily. Moreover, 21% of articles did not contain any kind of marking and were fully accessible. The lack of watermarks or other designation makes it possible for retracted articles to be unwittingly cited after they have been retracted. Despite watermarks on 69% of retracted articles, we found that 66% of all retracted articles were cited after the retraction. There are several possible reasons for this. It is conceivable that authors do not carefully recheck or update their list of references before publication. There may also be a latency between when articles are retracted and when retracted article notices are publicly available or accessible.⁴ Furthermore, there may be paywalls or other barriers to accessing retracted article notices.

Reasons for research misconduct

Exploring the reasons for research misconduct was not an explicit goal of this paper, but one of the important motivators could be the “publish or perish” culture.^{22,23} To thrive in the hypercompetitive research environment, there is an imperative to publish in high impact journals and acquire research grants. This competitive pressure could encourage some researches to commit fraud. Additionally, certain personality traits are strongly related to research misconduct.²⁴ The combined effect of personality traits, job pressure, and desire for academic promotion, as well as institutional cultural factors may influence susceptibility to research misconduct. Finally, individual financial interests, including manipulation of the results for favourable outcomes, problematic conflicts of interest, and ghostwriting may also be associated with research misconduct.^{25–27}

Limitations

Our study was limited by the searching capabilities and robustness of the databases utilized. Although there was significant overlap between MEDLINE and EMBASE, there were instances when retracted articles were found in one database but not in the other. Determining whether this was due to differing search algorithms or article indexing capabilities was beyond the scope of this study. Searching other databases may yield additional retracted articles not included in our study. Although our list of anesthesiology keywords was purposely broad to capture the general landscape of anesthesiology, the inclusion of specialty-related keywords may yield a larger set of retracted articles.

Since the reasons for article retraction were collected solely from published retraction notices, an important limitation of our study is the inability to distinguish between an honest error and deliberate research misconduct. To accurately distinguish between honest error and research misconduct, it would be necessary to obtain all communications between the researcher/organization and the editor/publisher. Another limitation is that we have only reported one reason for retraction per study. Many of the studies potentially have more than one reason for retraction. Nevertheless, for clarity and to standardize extracted information from the retraction notices, we decided to record one reason per study. Also, we reported that 66% of retracted articles were cited post-retraction. We acknowledge that some may have been cited for appropriate reasons, but this was not systematically verified in the citing literature. Finally, we reported that 7% of articles were self-retracted by the author, but we also acknowledge that retraction of articles is a collaborative process involving agreement between editors/journal publishers and authors.

Potential to reduce the incidence of retracted articles

While departmental and institutional research policies may play a significant role in preventing research misconduct,²⁸ every investigator is expected to adhere to research integrity by practicing transparency and intellectual honesty in planning, performing, and reporting research.

Conclusion

In summary, during the study period, most retracted articles in anesthesiology literature were retracted because of research misconduct. Because information in the retraction notices was often limited, it is challenging to distinguish between an honest error and research misconduct. This ambiguity often prevents readers from contextualizing the reasons for retraction, so standardized reporting processes with structured retraction notices is needed.

Conflicts of interest None declared.

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article. *Jonathan Leff* and *Ellise Delphin* contributed to study conception and design, interpretation of data, and editing the article. *David Adams* contributed to interpretation of data, drafting the article, and editing and revising the manuscript

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