

Scientific publications in anesthesiology journals from East Asia: a 10-year survey of the literature

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Abstract The scientific publications in anesthesiology research from East Asian authors have not been reported yet. The present study was designed to analyze the contribution of articles from East Asia to anesthesiology research. Articles published in 17 journals in anesthesiology originating from Japan, China, and South Korea from 2000 to 2009 were retrieved from the PubMed database and Web of Science. From 2000 to 2009, there were 3,076 articles published from East Asia. During this period, there were a notable decrease in publications from Japan and modest increases in publications from both China and South Korea. The average 5-year impact factor of the published articles was similar among the three regions, and China had the highest average number of citations to each article. *Anesthesia & Analgesia* published more articles than any other journal from all three regions. Our analysis showed that Japan was the most productive region in East Asia, but there was a notable decrease in publications from Japan in 2000–2009. The impact factor of the articles suggests similar levels of scholarship. *Anesthesia & Analgesia* was the most popular journal in East Asia.

Keywords Japan · China · South Korea · Anesthesia · Bibliometric analysis

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Introduction

In recent decades, significant growth has been seen in the field of anesthesiology, along with progress in other branches of biomedical research. The number of original articles published by an institution or country is one indicator of its contribution toward the creation of new knowledge in anesthesiology [1]. Because of the rapid progress of Internet technology, communication in scientific information of biomedical research is much more convenient and more expedient than before, especially after the widespread use of some databases, including the Medline and Web of Science. Based on the available search tools, a large-size bibliometric analysis is now feasible.

East Asia is a subregion of Asia, including Japan, North Korea, South Korea, Mongolia, and China, containing the Mainland (ML), Hong Kong (HK), Taiwan (TW), and Macau. This is an important region in the world because Japan is one of the leading developed countries of the world; Mainland China has the largest population and the most rapid economic growth worldwide; and three of Asia's four dragons lie in East Asia (Hong Kong, Taiwan, and South Korea). However, scientific publications in anesthesiology research from East Asian authors have not yet been reported. We therefore analyzed the contributions of articles from East Asia to anesthesiology research.

Methods

Search strategy

A total of 25 journals related to anesthesiology were selected from the 'anesthesiology' category in 2009 Journal Citation Reports (JCR) established by the Institute for

Scientific Information (ISI) [2]. We only included the journals published in English, and therefore 6 non-English-language journals were excluded. Because this analysis was a 10-year literature survey, the journals that have been cited by JCR only in recent years, not including the full 10 years of our survey, were excluded also. Finally, 17 journals were included in this study, as listed in Table 1.

A computerized literature search was conducted in the Web of Science database and PubMed database during 10 September 2010 to 30 September 2010. Articles published in the 17 journals from January 2000 to December 2009 were elicited, respectively. The titles of the journals were used to perform searches in Web of Science, and the document types of the articles were restricted to article, review, and proceedings paper according to Web of Science. Because there were no articles from Mongolia, North Korea, and Macau published in the selected 17 journals during 2000 and 2009, the search was restricted to Japan, China (containing Mainland China, Hong Kong, and Taiwan), and South Korea.

The ISSN (print) of the journals was used to perform searches in PubMed. The search terms used were ‘0304-3959 OR 0003-3022 OR 1090-3801 OR 0007-0912 OR 0749-8047 OR 0003-2999 OR 0898-4921 OR 0003-2409 OR 1098-7339 OR 0832-610X OR 0001-5172 OR 0959-289X OR 0265-0215 OR 1155-5645 OR 0952-8180 OR 1053-0770 OR 0310-057X’ AND ‘Japan [AD]’, ‘Korea [AD]’, and ‘China [AD] OR Hong Kong [AD] OR Taiwan [AD]’. The numbers of articles in the fields of clinical trial and randomized controlled trial (RCT) were generated, respectively, according to the publication type in PubMed.

To compare the quality of the research articles, three methods were used. First, the accumulated and average 5-year impact factors (5y-IF) were generated according to 2009 JCR established by the ISI. Second, citation reports of articles were conducted. Articles were extracted first independently and subsequently in consensus if a disagreement existed between the reviewers (Z. Li and L.X. Qiu) by viewing the titles, abstract, and full text if necessary. Articles published in the high-impact anesthesiology journals (5y-IF >2) were also generated. Further, we determined the five most popular anesthesiology journals (the journals with the most articles published from a country) of the three regions according to the published article numbers.

Statistical analysis

As our only goal is to describe trends, and not to test hypotheses about the relative contributions of Japan, China, and South Korea, only simple descriptive statistics (e.g., sum, average) are used.

Results

Total number of articles

A total number of 27,371 articles were published in the selected 17 journals from 2000 to 2009 worldwide. The United States (USA) published the most articles from 2000 to 2009 (6,717/27,371; 24.54%), followed by the United

Table 1 Anesthesiology journals included in search

Journal name	Abbreviation	Impact factor (IF)	Five-year IF (5y-IF)
<i>Pain</i>	<i>Pain</i>	5.371	6.125
<i>Anesthesiology</i>	<i>Ane</i>	5.354	4.891
<i>Regional Anesthesia and Pain Medicine</i>	<i>RAPM</i>	4.157	3.309
<i>British Journal of Anaesthesia</i>	<i>BJA</i>	3.827	3.487
<i>European Journal of Pain</i>	<i>EJP</i>	3.371	4.019
<i>Anesthesia and Analgesia</i>	<i>A&A</i>	3.083	2.650
<i>Clinical Journal of Pain</i>	<i>CJP</i>	3.005	3.423
<i>Anaesthesia</i>	<i>Ana</i>	2.855	2.675
<i>Journal of Neurosurgical Anesthesiology</i>	<i>JNA</i>	2.412	1.990
<i>Canadian Journal of Anesthesia</i>	<i>CJA</i>	2.306	2.150
<i>Acta Anaesthesiologica Scandinavica</i>	<i>AAS</i>	2.260	2.081
<i>Pediatric Anesthesia</i>	<i>PA</i>	2.149	1.861
<i>European Journal of Anaesthesiology</i>	<i>EJA</i>	1.859	1.649
<i>International Journal of Obstetric Anesthesia</i>	<i>IJOA</i>	1.847	1.682
<i>Journal of Clinical Anesthesia</i>	<i>JCA</i>	1.324	1.508
<i>Anaesthesia and Intensive Care</i>	<i>AIC</i>	1.108	1.159
<i>Journal of Cardiothoracic and Vascular Anesthesia</i>	<i>JCVA</i>	1.062	1.090

Kingdom (2,996), Germany (2,160), Japan (1,922), Canada (1,524), France (1,203), and Australia (1,195). Over the 10 years analyzed there were 3,076 articles (3,076/27,371; 11.24%) from Japan, China, and South Korea. Japan published more articles (1,922/3,076; 62.48%) than South Korea (405/3,076; 13.17%) and China (749/3,076, 24.35%; ML 256, HK 190, and TW 303).

Figure 1 shows the published articles from Japan, China, and South Korea. Several trends are evident. During this period, a notable decrease in publications from Japan was indicated (from 265 in 2000 to 131 in 2009). There were modest increases in publications both from China and South Korea (China: 49 in 2000 to 105 in 2009; South Korea: 14 in 2000 to 85 in 2009).

Impact factor

As seen in Table 1, the 17 included journals all have IF and 5y-IF. The accumulated 5y-IF of the articles from Japan (5,639.90) was markedly higher than those of the articles from China (2,161.57) and South Korea (1,141.16)

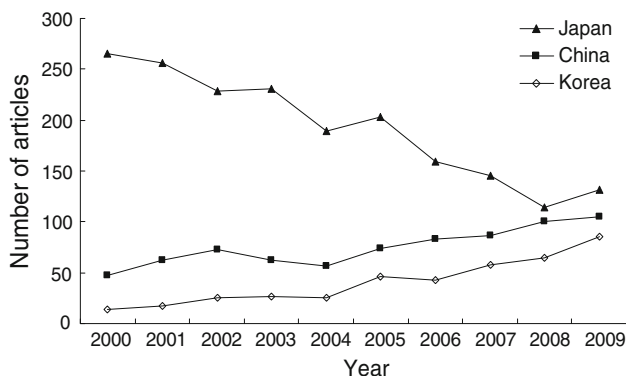


Fig. 1 Number of articles from Japan, China, and South Korea in 2000–2009

Table 2 Accumulated 5y-IF of the articles from Japan, South Korea, and China

Year	Japan	South Korea	China			Total
			Mainland (ML)	Hong Kong (HK)	Taiwan (TW)	
2000	768.84	38.87	14.88	43.77	80.61	139.26
2001	754.91	55.92	47.57	71.20	64.12	182.89
2002	660.26	64.03	38.84	82.62	82.33	203.79
2003	670.12	77.47	55.44	39.89	83.99	179.32
2004	571.65	65.44	31.58	48.22	82.68	162.48
2005	597.80	127.60	62.46	56.99	91.67	211.12
2006	466.11	121.61	97.91	34.45	110.16	242.52
2007	414.57	162.25	93.15	42.79	109.82	245.76
2008	357.84	188.35	167.35	31.32	85.79	284.46
2009	377.79	239.62	180.95	47.46	81.58	309.99
Total	5,639.90	1,141.16	790.13	498.70	872.74	2,161.57

(Table 2). The average 5y-IF of the published articles was similar across the three regions: Japan (2.83), China (2.89), and South Korea (2.73) (Table 3). Among the three regions of China, ML had the highest average 5y-IF (3.09), followed by TW (2.88), and HK (2.62) (Table 3).

Citations

The total citations to the published articles from 2000 to 2009 in Japan (15,679) were higher than China (6,576) and South Korea (2,208) (Table 4). China had the highest average number of citations to each article (8.78), followed by Japan (8.16) and South Korea (5.45) (Table 5). Among the three regions of China, HK had the highest average number of citations to each article (10.23), followed by TW (8.87) and ML (7.56) (Table 5).

Clinical trials and RCT

There were 8,811 clinical trials and 6,700 RCTs published during 2000 to 2009, including 1,006 clinical trials (11.42%) and 793 RCTs (11.84%) from East Asia. Japan published the most clinical trials (607) and RCTs (439) in the 10 years examined, as compared with China (208 clinical trials and 191 RCTs) and South Korea (191 clinical trials and 163 RCTs) (Fig. 2).

High-impact anesthesiology journals

In the 2009 JCR, ten journals had 5y-IF >2 (see Table 1): 2,506 articles were published in these ten journals from Japan, China, and South Korea in 2000–2009, of which 59.74% (1,497 of 2,506) were in *Anesthesia & Analgesia*, *Anesthesiology*, and *British Journal of Anaesthesia*. Japan published 1,581 articles in the ten high-impact journals, whereas China and South Korea had 592 and 333 articles, respectively (Table 6).

Table 3 Average 5y-IF of the articles from Japan, South Korea, and China

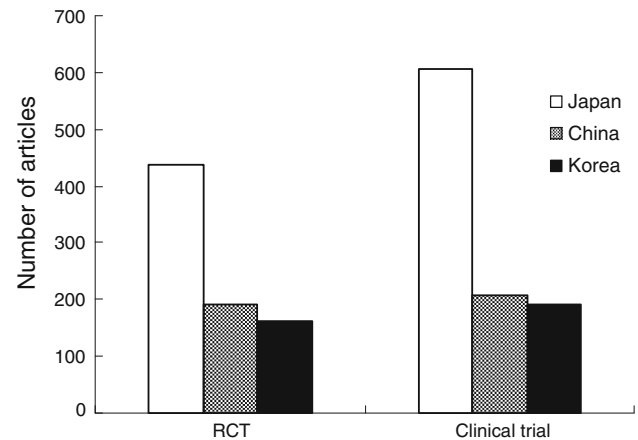
Year	Japan	South Korea	China			Total
			ML	HK	TW	
2000	2.90	2.78	3.72	2.43	3.22	2.96
2001	2.95	3.29	3.66	2.54	3.05	2.95
2002	2.88	2.56	3.88	2.50	2.74	2.79
2003	2.90	2.87	4.26	2.10	2.80	2.89
2004	3.02	2.62	3.51	2.68	2.76	2.85
2005	2.92	2.71	2.97	3.17	2.62	2.85
2006	2.77	2.76	2.97	2.65	2.98	2.92
2007	2.59	2.58	2.66	2.85	3.05	2.86
2008	2.73	2.58	3.04	2.61	2.60	2.84
2009	2.64	2.58	2.87	2.97	3.14	2.95
Total	2.83	2.73	3.09	2.62	2.88	2.89

Table 4 Total citations per article from Japan, South Korea, and China

Year	Japan	South Korea	China			Total
			ML	HK	TW	
2000	3,273	197	48	215	444	717
2001	2,447	300	165	321	245	730
2002	2,379	237	251	550	412	1,213
2003	2,084	197	263	137	240	644
2004	1,486	151	146	208	272	635
2005	1,611	260	197	164	286	649
2006	939	261	294	112	354	759
2007	666	262	197	156	202	559
2008	527	229	255	60	92	440
2009	267	114	123	59	67	248
Total	15,679	2,208	1,934	1,944	2,688	6,576

Table 5 Average citations per article from Japan, South Korea, and China

Year	Japan	South Korea	China			Total
			ML	HK	TW	
2000	12.35	14.07	12.00	11.94	17.77	15.25
2001	9.56	17.64	12.71	11.47	11.66	11.78
2002	10.39	9.46	25.08	16.67	13.72	16.61
2003	9.02	7.3	20.20	7.20	8.00	10.39
2004	7.86	6.05	16.17	11.55	9.06	11.14
2005	7.86	5.66	9.38	9.12	8.16	8.77
2006	5.59	6.07	8.92	8.61	9.57	9.14
2007	4.16	4.51	5.62	10.38	5.62	6.50
2008	4.02	3.53	4.64	5.00	2.78	4.40
2009	1.87	1.34	1.96	3.71	2.58	2.36
Total	8.16	5.45	7.56	10.23	8.87	8.78

**Fig. 2** Number of clinical trials and randomized controlled trials (RCTs) from Japan, China, and South Korea in 2000–2009**Table 6** Articles published in the high-impact journals from Japan, South Korea, and China

Rank	Journal	Japan	South Korea	China			Total	
				ML	HK	TW		
1	<i>Pain</i>	94	21	35	0	19	54	169
2	<i>Ane</i>	257	28	22	15	20	57	342
3	<i>Ejpp</i>	17	7	9	2	3	14	38
4	<i>Bja</i>	163	47	14	29	30	73	283
5	<i>CJP</i>	23	7	5	4	12	21	51
6	<i>RAPM</i>	54	14	1	5	9	15	83
7	<i>Ana</i>	47	31	12	30	12	54	132
8	<i>A&A</i>	595	93	54	43	87	184	872
9	<i>CJA</i>	153	26	13	12	33	58	237
10	<i>AAS</i>	139	53	29	2	31	62	254
Total		1,581	333	194	142	256	592	2,506

Popular anesthesiology journals

The most popular journals for the authors in the three regions are listed in Table 7. *Anesthesia & Analgesia* published more articles than any other journal for authors from all three regions. Also, *British Journal of Anaesthesia* and *Acta Anaesthesiologica Scandinavica* also appeared in all top five journals in the three regions. *Anesthesiology*, *Anaesthesia*, and *Canadian Journal of Anesthesia* were found in the top five journal list in two regions.

Discussion

East Asia is an important area in the world, both in the field of economy and in scientific research. However, the scientific publications in anesthesiology research from East Asia have not yet been reported. To the best of our knowledge, this is the first report to reveal the contribution

Table 7 The five most popular anesthesiology journals in Japan, South Korea, and China

Rank	Japan	N	South Korea	N	China						Total	N
					ML	N	HK	N	TW	N		
1	A&A	595	A&A	93	A&A	54	A&A	43	A&A	87	A&A	184
2	Ane	257	AAS	53	Pain	35	AIC	35	CJA	33	BJA	73
3	BJA	163	BJA	47	AAS	29	Ana	30	AAS	31	AAS	62
4	CJA	153	Ana	31	Ane	22	BJA	29	BJA	30	CJA	58
5	AAS	139	Ane	28	EJA	21	Ane	15	JCA	27	Ane	57

of the authors in the major regions of East Asia—Japan, China, and South Korea—to research in the field of anesthesiology.

Historically, scientific and medical research from Japan, South Korea, and two parts of China (Hong Kong and Taiwan) has been advanced for several decades. Indeed, investigations from these regions have contributed some of the best scientific articles in anesthesiology research. Although Japan ranked fourth in anesthesiology research between 2000 and 2009, a marked decrease trend was found, whereas the publications from China and South Korea increased. There may be several reasons: first, the economic stagnation in the past two decades in Japan might have reduced the support of medical research and resulted in the decrease of publications; second, the compulsory training for medical residents, which started in 2004, has weakened research power in the medical universities in Japan; third, economic development in China and South Korea has been still rapid in the past 10 years, especially in Mainland China. In our previous study, we found that there was a substantial increase in the number of articles published from Mainland China, which mainly led to the increase of publications of China between 2000 and 2009 [3]. In a way, scientific publications might suggest a reflection of the economy.

In 2008, the Thomson Institute for Scientific Information first introduced the 5y-IF, besides the conventional 2-year impact factor (2y-IF). The 2y-IF usually varies widely, because it only reflects the mean citations per article in the previous 2 years. Instead of a 2-year window, now a 5-year window is used. More precisely, the numerator is the number of citations in the current year to all items published in a journal in the previous 5 years [4]. Thus, the 5y-IF may better reflect the quality of a journal in the past decade than the 2y-IF, and therefore we applied the 5y-IF in this study to assess East Asia's contribution to anesthesiology research. However, the impact factor was intended only to assess the quality of a journal but not the quality of an individual article [3]. For these reasons, one should not read too much into the impact factor analysis, other than to note that the differences among Japan, China, and South Korea are

modest and probably reflect similar levels of scholarship in the publications from the three regions.

Although China did not publish as many clinical trials and RCTs as Japan during the 10 years examined, the number of trials from China in the past 3 years has increased rapidly and approached the number of trials from Japan. There may be several reasons: first, China, with a population of 1.3 billion persons, has a large number of subjects. Second, trials in China are much less expensive to conduct [5]. Third, clinical research in anesthesiology has been an academic focus of many academic Chinese anesthesiologists in recent years [6]. Nevertheless, considering the population size, it is clear that Mainland China still has far to go to equal the per capita academic productivity of Japan and South Korea.

Anesthesia & Analgesia has been the most popular journal for authors from Japan, China, and South Korea. *Anesthesia & Analgesia* was founded in 1922 and is the oldest publication for the specialty of anesthesiology, which leads to a popular international impact. In addition, *Anesthesia & Analgesia* is the largest scale journal among the 17 selected ones, with more than 500 articles published each year.

This study only includes publications in English because it is well known that English is the international scientific language [7]. ISI and PubMed databases mainly include journals in this language, which renders it difficult for journals in other languages to attain high impact [8]. Accordingly, we excluded six journals published in Germany and French because of their lower international impact compared with English-language journals.

There are some limitations in our study. Although the journals were selected from the anesthesiology category of the JCR, a few journals cover disciplines beyond anesthesiology and perioperative medicine. Additionally, some general medicine journals might also publish a few articles related to anesthesiology research. Nevertheless, the 17 journals included in this analysis are the major international journals devoted to anesthesiology research.

In conclusion, Japan published the largest number of articles, clinical trials, and RCTs among the main three

regions in East Asia in 2000–2009, but there was a notable decrease in publications from Japan. Concurrently, there were modest increases in publications from China and South Korea. The impact factor of the articles suggests similar levels of scholarship. *Anesthesia & Analgesia* was the most popular journal in the three regions.

Conflict of interest None.

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