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Review article

Research articles published by Korean spine surgeons: Scientific progress and the increase in spine surgery

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ABSTRACT

There has been a marked increase in spine surgery in the 21st century, but there are no reports providing quantitative and qualitative analyses of research by Korean spine surgeons. The study goal was to assess the status of Korean spinal surgery and research.

The number of spine surgeries was obtained from the Korean National Health Insurance Service. Research articles published by Korean spine surgeons were reviewed by using the Medline/PubMed online database.

The number of spine surgeries in Korea increased markedly from 92,390 in 2004 to 164,291 in 2013. During the 2000–2014 period, 1982 articles were published by Korean spine surgeons. The annual number of articles increased from 20 articles in 2000 to 293 articles in 2014. There was a positive correlation between the annual spine surgery and article numbers ($p < 0.001$). There were 1176 original studies published, and there was an annual increase in articles with Oxford levels of evidence 1, 2, and 3. The mean five-year impact factor (IF) for article quality was 1.79. There was no positive correlation between the annual IF and article numbers. Most articles (65.9%) were authored by neurosurgical spine surgeons. But spinal deformity-related topics were dominant among articles authored by orthopedics.

The results show a clear quantitative increase in Korean spinal surgery and research over the last 15 years. The lack of a correlation between annual IF and published article numbers indicate that Korean spine surgeons should endeavor to increase research value.

1. Introduction

Recently, there has been a marked increase in the number of spine surgeries performed around the globe. This increase is resulted to a noticeable expansion in the recently emerging market for spinal implants and a similar expansion in the number of spine-related neurosurgical articles published [1,2]. There was an increase in neurosurgery-related research between 1996 and 2009, and there has been a comparable increase in published articles related to spinal neurosurgery authored by Korean researchers [3]. Notwithstanding the obvious increase in the number of spine surgeries over the last decade in Korea, no studies have been conducted to determine, quantitatively and qualitatively, the status of research articles by Korean spine surgeons. It is important to identify whether the increase in published research articles is associated with the increase in spine surgeries.

Evaluation of the status and trends in spinal research articles can provide useful feedback to Korean spine surgeons. Hence, the purpose of this study was to analyze quantitatively the correlation between the number of spine surgeries performed and the number of spinal research articles published in Korea in the early years of the 21st century. In addition, the quality and main topics of recent spinal articles were evaluated. Prospects for future research to enable further development of spine surgery in Korea are discussed.

Abbreviations: IF, impact factor; NS, neurosurgery; OS, orthopedics; JKNS, journal of Korean neurosurgical society; KJS, Korean journal of spine; ASJ, Asian spine journal; ESJ, European spinal journal; JSDT, journal of spinal disorder and technique; TSJ, the spinal journal; JNS, journal of neurosurgery; SCI, science citation index; SCIE, science citation index expanded.

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2. Materials and methods

The National Health Insurance Service of Korea has published a surgery-related statistical yearbook since 2004 [4]. The yearbook includes the annual number of surgeries for 33 major diseases. The main types of spine surgeries are included in that statistical summary, and the Korean spinal surgical codes are N0444, N0445, N0446, N0447, N0451, N0452, N0453, N0466, N0468, N0469, N0471, N0472, N0473, N0474, N0480, N0500, N0630, N1491, N1492, N1493, N1494, N1495, N1496, N1497, N1498, N1499, N2461, N2462, N2463, N2464, N2464, N2465, N2466, N2467, N2468, N2469, N2470, N2471, N2472, N2491, N2492, and N0303.

By using the Medline/PubMed (http://www.ncbi.nlm.nih.gov/pubmed/) online database, searches of English-written articles on spine-related subjects by Korean spine surgeons were performed. The key search terms used were "Korea" AND ("spine" OR "spinal disease" OR "spinal cord" OR "spinal cord disease" OR "vertebroplasty" OR "arthrodesis" OR "foraminotomy" OR "laminectomy" OR "denervation" OR "back injuries" OR "fusion" OR "nonfusion"). The article search was limited to publication dates between January 2000 and December 2014. Based on title and abstract content, we excluded articles that were not related to spine subjects (Fig. 1). Subsequently, potentially eligible articles were assessed and articles without spine surgeon authorship, articles from other countries, and letters to editors were excluded. Korean spine surgeons were defined as surgeons from departments of neurosurgery (NS) and orthopedics (OS) in Korea. The department of the article's corresponding author was used as the article's representative department when surgeons with different affiliations or from other departments were included in the authorship of the article. Articles with Korean spine surgeon authors for which the corresponding author was affiliated with another country were excluded. Articles that met the inclusion criteria were analyzed based on article theme, main topic, year published, study type, Oxford Centre for Evidence-based Medicine (Oxford) level of evidence, journal impact factor (IF), corresponding author's department, and spine area studied [5,6]. Study type was divided into original study, case report, experimental study, technical note, systemic review, and other. The technical note type was included when the article title included that term. The quality of the journal in which the article was published was evaluated based on the Oxford level of evidence and the 2013 five-year IF obtained from Journal Database. Mean IF was calculated over all articles. Differences in spine areas and topics studied between NS and OS spine surgeons were evaluated.

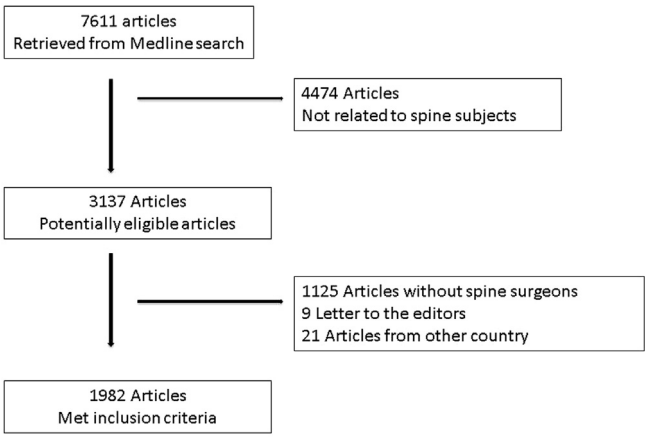

Fig. 1. Research articles authors by Korean spine surgeons. A total of 7611 articles were retrieved from Medline/PubMed online database, and 1982 articles were published by Korean spine surgeons between 2000 and 2014.

2.1. Statistical analysis

Linear-by-linear association test was used to determine the correlation between the annual numbers of spine surgery topics and research articles. Spearman rank coefficient test was conducted to assess qualitative associations among main spine surgery topics, research articles published, Oxford level of evidence, and IF values. Independent Student's *t* test was used for comparisons between NS and OS spine surgeons. Statistical analyses were performed by using SPSS version 22.0.

3. Results

3.1. Annual number of spine surgeries and research articles

Spine surgeries were divided into endoscopic spinal surgery and general spinal surgery. Annual data were available for all years between 2004 and 2013. There were 92,390 spine surgeries reported in 2004. The number of surgeries gradually and significantly increased to 164,291 in 2013 ($p = 0.005$, Fig. 2).

Of the 7611 articles retrieved from the Medline/PubMed searches, most were not authored by spine surgeons and were not related to spine topics; thus, they were excluded from our analyses. After those exclusions, there were 1982 spine articles published by Korean spine surgeons between 2000 and 2014. Total article output significantly increased over the study period from 20 articles in 2000 to 293 articles in 2014 ($p < 0.001$, Fig. 3). Spearman rank coefficient analysis revealed a positive correlation between the reported number of spine surgeries and the number of spine research articles published annually ($r = 0.915$, $p < 0.001$).

3.2. Quality of research articles by Korean spine surgeons

Of the 1982 spine-related articles authored by Korean spine surgeons, 1176 were original studies (59.3%), 558 were case reports (28.1%), 190 were experimental studies (9.5%), 33 were technical reports (1.6%), 17 were systemic reviews (0.8%), and 8 were other study types (0.4%). When stratified by Oxford levels of evidence, there were 32 original studies in level 1b, 5 in level 2a, 61 in level 2b, 5 in level 3a, 235 in level 3b, 830 in level 4, and 8 in level 5 (Fig. 4). The number of articles at Oxford levels 1, 2, and 3 increased annually ($p < 0.001$), and there was a significant positive correlation between Oxford levels of 1, 2, and 3 and the annual number of published articles ($r = 0.956$, $p < 0.001$).

Among the155 journals in which Korean spine surgeons published articles, the commonest was Journal of Korean Neurosurgical Society (JKNS, 395 articles). In descending order, the next nine common journals were Spine (Phila Pa 1976, 285 articles), Korean Journal of Spine (KJS, 172 articles), Asian Spine Journal (ASJ, 145 articles), European Spinal Journal (ESJ, 113 articles), Journal of Spinal Disorder and Technique (JSDT, 100 articles), The Spinal Journal (TSJ, 89 articles), Journal of Neurosurgery: Spine (JNS, 68 articles), Neurosurgery (64 articles), and Acta Neurochirugica, Wein (Acta Neurochir, 41 articles). Thirteen journals had published between 11 and 40 Korean spine articles and 54 journals had published between 2 and 10 such articles. Seventy-eight journals only published one article authored by Korean spine surgeons.

The mean IF of the 1982 Korean spine articles was 1.79 ± 0.98 (range, 0–8.496). Variation in annual IF values is demonstrated in Fig. 5, which indicates a significant tendency toward lower IF values ($p = 0.005$). Moreover, there was a negative correlation