

Comparison of international medical costs for interventional pain treatment: a focus on Korea and Japan

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ABSTRACT

Background: The rise in national health care costs has emerged as a global problem given the ever-aging population and rapid development of medical technology. The utilization of interventional pain management has, similarly, shown a continued rise worldwide. This study evaluates the differences in the medical costs in the field of interventional pain treatment (IPT) between two countries: Korea and Japan.

Methods: Korean medical insurance costs for 2019 related to pain management focused on IPT were compared to those of Japan. Purchasing power parity (PPP) was used to adjust the exchange rate differences and to compare prices in consideration of the respective societies' economic power.

Results: The cost of trigger point injections in Japan was 1.06 times higher than that of Korea, whereas the perineural and intraarticular injection prices were lower in Japan. The cost of epidural blocks was higher in Japan compared to Korea in both cervical/thoracic and lumbar regions. As for blocks of peripheral branches of spinal nerves, the cost of scapular nerve blocks in Japan was lower than that in Korea, given a PPP ratio 0.09. For nerve blocks in which fluoroscopy guidance is mandatory, the costs of epidurography in Japan were greater than those in Korea, given a PPP ratio 1.04.

Conclusions: This is the first comparative study focusing on the medical costs related to IPT between Korea and Japan, which reveals that the costs differed along various categories. Further comparisons reflecting more diverse countries and socio-economic aspects will be required.

Keywords: Health Care Costs; Injections, Intra-articular; Japan; Lumbosacral Region; Nerve Block; Pain Management; Republic of Korea; Socioeconomic Factors; Spinal Nerves.

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INTRODUCTION

The rise in national health care costs—and the accompanying difficulties—has emerged as a global problem in light of the aging population and rapid development of medical technology. Financial burdens placed on individuals and families have become a common social problem, with the total amount of national medical expenses in Korea increasing since the implementation of the national health insurance system [1]. As such, the calculation of medical expenses is made for the purpose of ensuring the provision of and access to quality medical services, to minimize the financial burden on the health care system, and to promote the efficient production and distribution of medical aid. The healthcare cost reimbursement system is a critical component in maintaining the healthcare system. In economic terms, it is essential that consumers can purchase appropriately according to their needs, while healthcare providers are compensated at a level that enables them to provide healthcare services continuously and progressively [2].

All Koreans have been mandatorily required to subscribe to the National Health Insurance Service (NHIS) since 1989. The NHIS is the only public and state-run medical insurance system in Korea, and the number of subscribers is estimated to be nearly the same as the number of Korean nationals [3]. However, health care costs in Korea are recognized as being set relatively low for health care providers, as they are focused on quality and reduction in the cost of medical care [4].

Rapid advancements in medical technology—especially in the field of pain management—may have an effect on increased medical costs. The existence of physicians with diverse training backgrounds—in their utilization of interventional pain procedures ranging from peripheral nerve blocks to minimally invasive surgery—has, nonetheless, become a factor in rising medical costs [5]. The explosion of interventional pain management-associated health care costs is not only a major concern in Korea but also globally [6–11]. Therefore, it is necessary to reveal the level of compensation provided for medical expenses in Korea and examine how such prices compare to other countries with similar medical environments, so as to guide policy concerning pain management. The purpose of this study is to evaluate the difference in the medical costs in the field of interventional pain treatment (IPT) between the two countries, Korea and Japan.

MATERIALS AND METHODS

1. Data on medical costs

Medical insurance costs in Korea related to pain management *via* interventional treatment for 2019 were compared to that of Japan. The cost of medical insurance in Korea was based on the data published by the Health Insurance Review and Assessment Service in 2019, with data concerning Japan sourced from the Japanese Ministry of Health, Labor, and Welfare. This study is an analytical study accomplished by utilizing booklets containing numerical or legal information as well as internet resource without any participation of humans or experimental animals. Thus, this study does not require ethical committee approval since the investigated data are publicly accessible.

2. Selecting comparisons and analysis

Comparisons were selected and classified based on IPT after careful discussion with experts from the Korean Pain Society's committee on insurance. The selected comparisons were reviewed for validity after further consultation with members of the insurance committee for the Japanese Society of Anesthesiologists.

3. Cost analysis

In order to compare medical fees by country, the market exchange rate, as it exists at a specific time, was applied to the costs surveyed in the currency of each country and converted into Korean Won (KRW). The exchange rate was based on the average cost of Japanese Yen (YEN) across 2019, with the exchange rate applied in this study set at 1,070.63 KRW/100 YEN. As the simple exchange rate comparison does not reflect the relative purchasing power, purchasing power parity (PPP) was used to adjust the exchange rate differences and to compare reasonable prices in consideration of differing levels of economic power between the two countries. This economic theory states that the exchange rate between the two currencies is equal to the ratio of the currencies' respective purchasing power. PPP provides an opportunity and means for comparing countries that have different standards of living by recalculating the value of a country's goods and services as if they were being sold at U.S. prices. The database concerning PPP was sourced from the Organization for Economic Cooperation and Development (OECD) for 2019. The value applied to this study was 860 KRW in Ko-

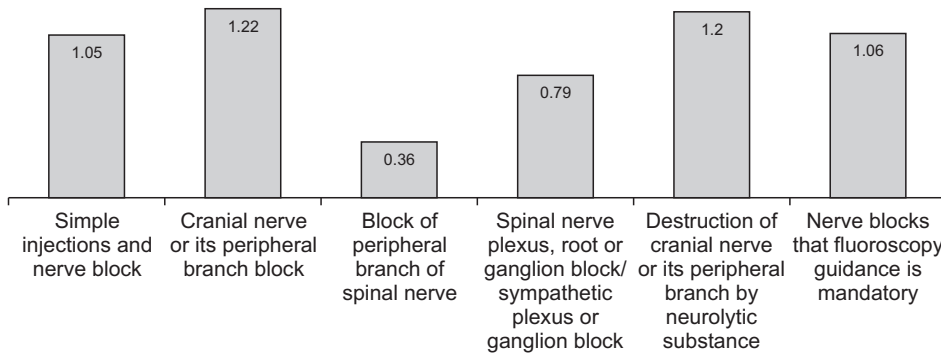


Fig. 1. A comparison of the average prices (using PPP) for interventional pain treatment. PPP: purchasing power parity.

Table 1. Comparison cost of simple injections and nerve block

Injections/nerve blocks	Converted into Korean Won			PPP ratio Japan/Korea
	Korea (₩)	Japan (₩)	PPP (₩)	
Trigger point injections	6,420	8,565	6,782	1.06
Perineural injections	8,860	2,677	2,119	0.24
Intra-articular injections	13,830	8,565	6,782	0.49
Cervical, thoracic epidural blocks	64,330	160,595	127,158	1.98
Lumbar epidural blocks	38,040	85,650	67,817	1.78
Caudal epidural blocks	38,040	36,401	28,822	0.76

PPP: purchasing power parity.

Table 2. Comparison cost of cranial nerve or its peripheral branch block

Nerve block	Converted into Korean Won			PPP ratio Japan/Korea
	Korea (₩)	Japan (₩)	PPP (₩)	
Trigeminal peripheral nerve branch blocks	45,160	18,201	14,411	0.32
Facial nerve blocks	26,370	36,401	28,822	1.09
Glossopharyngeal nerve blocks	26,370	85,650	67,817	2.57
Sphenopalatine ganglion blocks	74,700	85,650	67,817	0.91

PPP: purchasing power parity.

rea and 101 YEN in Japan.

4. Classification of interventional pain treatment

For ease of comparison, six categories were designated based on the medical insurance costs in both countries. Overlapping medical terms in certain items were shown in the categories, because these items were based on the inclusion of insurance codes in both countries.

- I. Simple injections and nerve blocks
- II. Cranial nerve or its peripheral branch blocks
- III. Blocks of the peripheral branch of the spinal nerve
- IV. Spinal nerve plexus, root, or ganglion blocks and sympathetic plexus blocks

V. Destruction of the cranial nerve, or its peripheral branch, via neurolytic substance

VI. Nerve blocks in which fluoroscopy guidance is mandatory

As there is no separate regulation regarding nerve blocks using fluoroscopy in Japan, category VI was selected as per the Korean guidelines.

RESULTS

There were no regulations for physicians performing IPT in either country. However, certification criteria for permitting payment related to the specific nerve block under

Table 3. Comparison cost of blocks of peripheral branches of spinal nerves

Nerve block	Converted into Korean Won			PPP ratio Japan/Korea
	Korea (₩)	Japan (₩)	PPP (₩)	
Greater or lesser occipital nerve blocks	23,010	9,636	7,629	0.33
Superior laryngeal nerve blocks	20,920	9,636	7,629	0.36
Laryngeal nerve blocks	20,920	2,677	2,119	0.10
Phrenic nerve blocks	21,240	2,677	2,119	0.10
Spinal accessory nerve blocks	21,230	9,636	7,629	0.36
Axillary nerve blocks	23,370	9,636	7,629	0.33
Median, ulnar, radial nerve blocks	20,930	9,636	7,629	0.36
Scapular nerve blocks	23,680	2,677	2,119	0.09
Intercostal nerve blocks	23,040	9,636	7,629	0.33
Ilioinguinal nerve blocks	21,030	9,636	7,629	0.36
Iliohypogastric nerve blocks	21,030	9,636	7,629	0.36
Pudendal nerve blocks	20,140	9,636	7,629	0.38
Sciatic nerve blocks	23,910	9,636	7,629	0.32
Obturator nerve blocks	21,050	18,201	14,411	0.68
Femoral nerve blocks	23,490	9,636	7,629	0.32
Lateral cutaneous femoral nerve blocks	22,040	18,201	14,411	0.65
Brachial plexus blocks	23,910	18,201	14,411	0.60

PPP: purchasing power parity.

Table 4. Comparison costs of spinal nerve plexus, root, ganglion blocks and sympathetic plexus blocks

Nerve block	Converted into Korean Won			PPP Ratio Japan/Korea
	Korea (₩)	Japan (₩)	PPP (₩)	
Superficial cervical plexus blocks	31,480	18,201	14,411	0.46
Coccygeal nerve blocks	56,940	18,201	14,411	0.25
Lumbar or sacral plexus blocks	62,850	61,026	48,320	0.77
Gray rami communicans nerve blocks	62,850	160,595	127,158	2.02
Posterior division of spinal nerve blocks	48,470	9,636	7,629	0.16
Stellate ganglion blocks	24,480	36,401	28,822	1.18
Blockades of the ganglion impar	92,610	160,595	127,158	1.37

PPP: purchasing power parity.

Table 5. Comparison cost of destruction of cranial nerves or its peripheral branches by neurolytic substances

Description of service	Converted into Korean Won			PPP Ratio Japan/Korea
	Korea (₩)	Japan (₩)	PPP (₩)	
Trigeminal ganglion	171,150	321,189	254,316	1.49
Trigeminal nerve branch	145,060	192,713	152,589	1.05
Facial nerves	125,840	192,713	152,589	1.21
Glossopharyngeal nerve	124,010	192,713	152,589	1.23
Sphenopalatine ganglion	151,850	192,713	152,589	1.00

PPP: purchasing power parity.

Table 6. Comparison cost of nerve blocks in which fluoroscopy guidance is mandatory

Description of service	Converted into Korean Won			PPP Ratio Japan/Korea
	Korea (₩)	Japan (₩)	PPP (₩)	
Epidurography	122,120	160,595	127,158	1.04
Trigeminal ganglion blocks	76,650	160,595	127,158	1.66
Maxillary, mandibular nerve blocks	76,650	85,650	67,817	0.88
Facet joint blocks	65,330	9,636	7,629	0.12
Paravertebral nerve blocks	62,850	9,636	7,629	0.12
Dorsal root ganglion blocks	62,850	160,595	127,158	2.02
Posterior medial branch blocks	62,850	9,636	7,629	0.12
Selective spinal nerve root blocks	62,850	160,595	127,158	2.02
Thoracic sympathetic ganglion blocks	95,330	160,595	127,158	1.33
Lumbar sympathetic ganglion blocks	92,650	61,026	48,320	0.52
Celiac plexus blocks	127,590	160,595	127,158	1.00
Inferior mesenteric plexus blocks	121,760	160,595	127,158	1.04
Superior hypogastric plexus blocks	127,350	160,595	127,158	1.00

PPP: purchasing power parity.

fluoroscopy guidance were only documented in Korea. A comparison of the average costs using PPP for each of the six categories are shown in **Fig. 1**.

The cost comparisons for the detail of each category are shown in **Tables 1–6**. **Table 1** shows the comparison between the two nations of simple injections and nerve blocks. The PPP ratio indicated a factor of 1.06 regarding trigger point injections, which means that the cost of the procedure in Japan is 1.06 times higher than in Korea; the data similarly showed ratios of 0.24 and 0.49 for perineural and intraarticular injections, respectively, which means that the cost of these procedures are lower in Japan than in Korea. The costs of epidural blocks in the cervical/thoracic and lumbar regions were much higher in Japan, but the cost of injections in the caudal region was higher in Korea. Results of the cranial nerve or its peripheral branch blocks are shown in the **Table 2**. It shows a relatively low cost for procedures involving the trigeminal peripheral branch in Japan (with a PPP ratio of 0.32), however glossopharyngeal nerve blocks in Japan were recorded as costing 2.57 times more than in Korea. Results are shown in **Table 3** for blocks of the peripheral branches of spinal nerves—which are commonly performed with blind techniques in both countries. Based on a comparative analysis of the data, the results indicate that the general price of IPTs performed in Korea is much higher than in Japan, as indicated via the respective PPP ratios ranging from 0.09 (scapular nerve blocks) to 0.65 (lateral cutaneous femoral nerve). **Table 4** shows the results of the comparison between spinal nerve plexus,

root, or ganglion blocks and sympathetic plexus or ganglion blocks. For IPTs concerning the spinal nerve, the PPP ratio ranged from 0.16 to 0.77, indicating a high cost in Korea; however, sympathetic ganglion blocks cost more in Japan. The gray rami communicans nerve block in Japan has a PPP ratio of 2.02, with a higher cost than that in Korea. The comparison of the destruction of the cranial nerve or its peripheral branch using a neurolytic substance is shown in **Table 5**. After comparing each detail, the results show that overall medical costs in Japan are higher, with PPP ratios ranging from 1.00 to 1.49. Cost comparison regarding the regulation related to nerve blocks which require fluoroscopy guidance in Korea is shown in **Table 6**. When transforaminal epidural blocks are performed in Korea, it is processed under the term “epidurography.” However, the treatment is applied as a spinal nerve root block in Japan, which differs from Korea. The cost of epidurography is recorded at a relatively high ratio of 1.04 in Japan. The PPP ratio with other nerve blocks that are frequently performed in the treatment of spinal pain show various differences ranging from 0.12 (facet joint blocks) to 2.02 (selective spinal nerve root blocks).

DISCUSSION

Numerous previous studies have attempted to compare health insurance costs between Korea and other countries across different clinical fields, such as gastric

endoscopy, C-sections, cataracts, appendectomy surgeries, and so on [12,13]. Based on the results of those studies, overall costs of medical procedures in Korea were revealed as being significantly lower than those of other countries. However, real cost differences between Korea and other countries could not be definitively identified in terms of interventional pain management. This study is the first report that focuses on comparison costs between Korea and Japan. The reasons for highlighting this theme are several. The medical insurance system of Korea was created by referring to the system(s) used in Japan [14], which resulted in the insurance systems of Korea and Japan being most similar compared to other systems in the world. Moreover, when medical insurance was created in Korea, interested parties followed and implemented all of the Japanese systems (and their features) without distinguishing their strengths and weaknesses. For these reasons, Korea and Japan started facing similar problems related to their medical insurance systems. Particularly, there has been a problem with low price compensation for health care providers in both countries.

IPT is defined as the discipline of medicine devoted to the diagnosis and treatment of pain and related disorders by the application of interventional techniques to manage subacute, chronic, persistent, and intractable pain, independently or in conjunction with other modalities of treatments [15]. On the basis of advances in imaging, anatomic findings, medication, and the development of precision diagnostic and therapeutic injection techniques, the importance of interventional pain management techniques has been refined and continues to evolve with reviews of clinical evidence [16,17]. However, interventional techniques are performed by physicians across multiple specialties and settings globally, with a growing number taking place in Korea [18]. In addition, the frequency with which these procedures are performed depends on the nature of the procedures and providers [19]. For economic compensation based on circumstances with low prices, the data show a rapid increase in the resource utilization related to IPT. However, this resulting cost increase has become a major cause of social and financial burden in Korea because there is no certification for pain management in the medical system.

The rationale of nerve blocks with diagnostic value in treating painful conditions is due to the presence of multiple challenges arising from diverse clinical situations, which includes the purely subjective nature of pain and the undetermined or uncertain pathophysiology of most pain-inducing conditions [20]. Among interventional pain management techniques, a blockade for the

structure contributing to pain has been adaptable for certain diagnoses or treatments through the proof of the hypothesis related to the exact cause of pain [21]. Precise injections targeting the specific pathologies are potentially powerful tools for management of pain, but are often technically challenging. The knowledge required for practicing interventional pain medicine, thus, is unique and highly skilled [22]. With this understanding, further in-depth education and training is required [15]. Based on the authors' research, a documented certification meeting this kind of demand does not yet seem to exist in either country. Thus, it is also essential to establish guidelines for properly certifying physicians who are appropriately trained in interventional techniques to manage pain, taking into consideration cost-effectiveness and patient safety. Formal approval as a clinically-skilled expert is required to solve the ever-increasing problem of growing medical costs—particularly in the area of IPT—and sufficient compensation is needed along with specific guidelines for effective pain treatment.

In the present study, the costs of peripheral branch blocks, such as scapular and occipital nerve blocks using a blind technique, were higher in Korea, even though those kinds of blocks were easier than diverse image-guided techniques. Whereas, in the case of nerve blocks (which are more difficult to perform), the cost was higher in Japan; these include selective spinal nerve root blocks and sympathetic plexus blocks, among others. Additionally, in Japan, lumbar epidural block is divided into two types of procedures: caudal epidural block and interlaminar epidural block. Although it may vary depending on the patients, there is generally an obvious difference in the technical difficulty between these two methods [23,24]. Thus, there is a need to introduce a fee structure reflecting this discrepancy in Korea.

In considering the nature of IPT, more appropriate compensation for neuraxial blockades is needed in comparison with other simple peripheral blocks. In order to achieve accurate needle placement, various image guidance techniques were employed for IPT, with fluoroscopy guidance being the most frequently utilized method, notwithstanding its inherent radiation risk [25]. During a nerve block, risk of radiation exposure conducted simultaneously should also be reflected in pricing. Awareness and adherence to radiation safety protocols among healthcare personnel play a crucial role in mitigating the potential hazards associated with radiation exposure and its possible adverse physiological consequences [25]. For these efforts towards safety, an investment of cost or time should be met with appropriate rewards to enable

concrete execution. Based on these results, guidelines for interventional procedures, risk assessments reflecting the procedural difficulty, documented certification for performing physicians, and quality control for procedures and procedure-related equipment all remain elements in both countries' medical costs.

In light of these results, this study has some limitations. Most of all, it should be noted that the prices of individual goods in different countries and regions may vary. In general, the prices of goods are determined by various factors, such as the income level of the consumer, labor costs, structure of industry, transportation and exchange rates. Thus, it is difficult to make uniform comparisons given that medical costs also differ between countries or regions for the same reason [26]. Although the results are corrected using PPP, they should be interpreted in consideration of various factors present in each country, such as the respective national medical insurance system, the number of available medical resources, and the training courses for medical personnel. Additionally, since a comparative analysis was conducted using insurance system codes that are similar only in two countries, there is a possibility of overlap or confusion in the medical category of the present study.

In conclusion, the significance of this study lies in its presentation of concrete figures and objective comparative methods focused on IPT, which demonstrates that medical fees in Korea are relatively lower compared to Japan. The current empirical assessment of the level of medical fees could have significant policy implications in either Korea or Japan given that the respective national health insurances play crucial roles in setting healthcare prices as a single insurer, which can be utilized in future fee negotiations. Thus, future continuous studies emphasizing the significance of policy will be required for constantly maintaining the level of medical fees, and future studies reflecting improved comparative analyses will also be necessary to consider more diverse countries and socio-economic aspects, in addition to the findings of the present results.

DATA AVAILABILITY

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

CONFLICT OF INTEREST

Yeon-Dong Kim is a section editor of the Korean Journal of Pain; however, he has not been involved in the peer reviewer selection, evaluation, or decision process of this article. No other potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

Eun Young Lee: Investigation; Hyung-Sun Won: Writing/manuscript preparation; Miyoung Yang: Data curation; Hyungtae Kim: Supervision; Yeon-Dong Kim: Project administration.

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