Research Article

Effect of Evidence-based Postoperative Pain Guidelines via Web for Patients undergoing Abdominal Surgery in South Korea

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SUMMARY

Purpose: The purpose of this study was to develop evidence-based guidelines on postoperative pain management via the web and to examine the effects in terms of pain level of patients undergoing abdominal surgery and nurses’ knowledge of postoperative pain management.

Methods: First, evidence-based pain guidelines were developed via the web in a tertiary hospital. Second, a special educational program on evidence-based pain guidelines for nurses was developed after validation of content by experts. Third, diverse strategies were adopted in order to facilitate incorporation of evidence-based pain guidelines in practice. Fourth, nurses in the study units were educated on evidence-based guidelines using the developed educational program for 3 weeks before their implementation of evidence-based pain guidelines to patients. Patients were assigned to the control group (from July 29 to August 20, 2011) and the experimental group (from September 24 to October 25, 2011) according to interrupted time interval. The data were analyzed using chi-square test, analysis of variance test with Scheffé’s test as a post hoc and repeated measure of analysis of variance.

Results: Patients in the experimental group showed a significantly lower level of pain. Nurses’ knowledge of management of postoperative pain showed a significant increase after installation of evidence-based guidelines.

Conclusion: Evidence-based pain guidelines were effective in reducing the pain level of patients as well as improving nurses’ knowledge of pain management.

Introduction

In recent years, an increase in the number of patients with gastrointestinal problems and remarkable technological progress in abdominal surgery have led to an increase in the numbers of patients undergoing abdominal surgery (Jeong et al., 2009). According to the National Health Insurance Corporation (2009), 66% of patients in Korea who underwent surgery underwent abdominal surgery; these numbers were expected to continue to increase in the future (National Cancer Information Center, 2008).

However, according to research findings, approximative 80% of patients experienced acute pain, and among these, 86% had more to extreme pain after surgery (Apfelbaum, Chen, Mehta, & Gan, 2003). In addition to the suffering caused by pain, postoperative pain also leads to occurrence of adverse events, such as difficulty in sleeping, decreased mobility, and atelectasis (Lee & Lee, 2006; Rudolph & Marcantonio, 2011). These adverse events result in increased health care cost through delayed hospital discharge (Hughes, 2008). Thus, appropriate management of postoperative pain for abdominal surgery patients has been seen as an important nursing intervention (Hutchinson, 2007).

Evidence-based practice (EBP) is the conscientious and judicious use of current best evidence, including research results, expert opinion, in conjunction with patient preference to guide health care decisions (Sackett, Straus, Richardson, Rosenberg, & Haynes, 2000). There are strong incentives to making health care much more evidence-based and cost effective (Majid et al., 2011) in every healthcare setting. However, EBP is still not well adapted in nursing practice worldwide.

According to previous research (Olade, 2004; Ross, 2010; Upton & Upton, 2006), nurses are challenged to integrate research-based evidence into clinical practice. Olade reported that only 20.8% of nurses incorporate research-based evidence into their practice, while 76.4% of nurses responded that they would utilize research...
results in their practice in the future, if they were provided the opportunity and support. According to Ross, 33% of nurses did not use research findings in clinical practice at all and only 17% of nurses used research findings more than three times per year. Therefore, development and testing of various strategies is needed in order to increase application of EBP by nurses in clinical practice.

One easy way to increase applicability of evidence in clinical practice may be the utilization of EBP guidelines (Specht, 2013; Tolson, Bennett, Currie, Mohammed, & Middleton, 2009), which are comprehensive and allow nurses easy access to the latest evidence, making it possible to improve patient outcomes. In addition, discovery and development of evidence that can be applied to match the needs of each patient by individual nurses in their practice is not easy. According to previous studies, when EBP guidelines were applied to clinical practice, not only did the nurses’ knowledge and skills show improvement, but patients’ satisfaction with nursing services also showed an increase and the patients showed rapid recovery from their illnesses (Specht; Newhouse, Dearholt, Poe, Pugh, & White, 2005). However, in paper format, the EBP guidelines contain many algorithms that are not easily accessible whenever nurses need them, making their application to clinical practice difficult (Doebbeling, Chou & Tierney, 2006; Jha et al., 2006).

To overcome these limitations, an electronic system that includes EBP guidelines should be developed and utilized in order to increase utilization in clinical practice. According to previous studies, when EBP guidelines were computerized, their rate of utilization, as well as positive patient outcomes showed an increase (Wensing, Wollersheim, & Grol, 2006). Implementation of EBP guidelines in an electronic system would provide easy and low-cost accessibility to evidence anytime and anywhere (Titler, 2006), allowing nurses to easily obtain assistance with complicated clinical problems and to readily apply scientific evidence to clinical practice.

Therefore, the purpose of this study was to evaluate the effectiveness of EBP guidelines in terms of pain level of patients who underwent abdominal surgery and level of knowledge on pain management of nurses caring for patients undergoing abdominal surgery.

**Method**

**Study design**

Two different study designs were used to determine the effect of use of EBP for management of pain in patients who underwent abdominal surgery. A simple interrupted time series design was used for nurses in order to test their level of knowledge of pain management. A posttest-only control group design was used for patients.

**Setting and sample**

The study included two types of participants: nurses and patients. First, nurses who have worked for more than 1 year in a perioperative anesthesia care unit (PACU) or two surgical units in a tertiary hospital were asked to participate in the study. Nurses who were willing to participate in the study were recruited. Second, patients who underwent abdominal surgery under general anesthesia in the same hospital were recruited. Patients who met the inclusion criteria were asked to participate in the study. The specific criteria for selection of patients were as follows, that they (a) understood the purpose of the study, and agreed to participate in it; (b) were aged over 19 years; (c) their surgery took at least more than 1 hour; (d) fell under the body grade classification 1 or 2 of the American Society of Anesthesiologists, that means normal healthy patients and patients with mild systemic disease (American Society of Anesthesiologists Task Force on Acute Pain Management, 2003); (e) were conscious, able to communicate, and oriented to person, place, and time and (f) their vital signs were within normal limits before the operation.

Before data collection, in order to obtain an appropriate power of analysis, the number of participants was calculated using G-power analysis. For the repeated analysis of variance (ANOVA) test, alpha at .05, effect size of .25, power (1–β) at .80, numbers of measurement at 5, and correlation among repeated measure at .70 were adopted and the total number of patient subjects needed was 123 for three groups. For nurses, alpha at .05, effect size of .25, power (1–β) at .80, and numbers of measurements at 3 were adopted for repeated measure of ANOVA and the total number of nurses needed was 28. Of a total of 35 eligible nurses working in the PACU and surgical units, 27 (77%) nurses were willing to participate in the study, which was considered appropriate for the study.

**Ethical consideration**

All procedures were approved by the institutional review board of the Kyungpook National University hospital with which the author was affiliated. As clearly stated in the written consent form, subjects could freely decide to participate in the study and were not compelled to do so in any way or by anyone. The participants were informed of their right to withdraw from the research at any time. The final sample reflected those who went on to complete the study materials.

**Instruments**

**Postoperative pain level of patients**

To test the effects of the EBP guidelines, pain level of patients who underwent abdominal surgery was measured. Postoperative pain level was measured using a numerical rating score, from 0 (no pain) to 10 (maximum pain). Postoperative pain level was measured at 1 hour, 6 hours, 12 hours, 18 hours, and 24 hours after abdominal surgery in both the control and experimental groups.

In order to increase inter-rater reliability among nurses measuring the pain level of patients, before measuring the postoperative pain level of patients, each nurse received instruction on how to assess the pain level of patients. Each nurse was trained to use the same question for all patients who participated in the research “How would you describe the level of pain you are currently experiencing on a 10 point scale, 0 means no pain and 10 means extreme pain which is not bearable?” Only 27 nurses who were trained in interpretation of clinically relevant indicators of pain intensity of patients performed measurements of patients’ postoperative pain.

**Nurses’ knowledge of postoperative pain management**

To measure nurses’ knowledge of pain management of postoperative patients, the questionnaire originally developed by Watt-Watson (1987) and then revised and supplemented by Hyun and Park (2000) into Korean was used after minor revision. Of a total of 49 items on the questionnaire, 24 items are on knowledge of pain and 25 items are on use of analgesics. These items were answered with “yes,” “no,” or “don’t know”. One point was given for a correct answer and 0 for a wrong or “don’t know” answer, thus, the higher the score, the higher the level of knowledge of postoperative pain management. The range of scores was 0–49. In a previous study conducted by Hyun and Park, reliability as measured by Cronbach’s alpha was .87, while, in this study, Cronbach’s alpha was .85. Nurses’ knowledge of postoperative pain management was measured three
consecutive times, before implementation of EBP guidelines, 2 weeks after implementation of EBP guidelines, and 4 weeks after implementation of EBP guidelines.

Data collection

Translation of EBP guidelines

The guidelines adapted in this study were the guidelines for pain assessment and management developed in 2002 and revised in 2007 based on the results of monitoring by the Registered Nurses’ Association of Ontario (2007) during a 3-year period. It was made up of two areas, assessment and management. The recommendations on assessment were classified according to pain assessment, assessment elements, general pain assessment, reassessment, recording, and communication. The recommendations on management include pharmacologic management, non-pharmacologic management, and educational and organizational policies.

Before development of the web-based system, which includes EBP acute pain management guidelines, the guidelines were translated into Korean. Two researchers with a high command of English and Korean translated the guidelines into Korean. First, both researchers translated the guidelines separately into Korean and then compared each item of the translated guidelines. If there was a discordance in the terms used in translated items of the EBP guidelines, these items were selected and re-translated into Korean. Re-translation continued until nearly 100% consistency of meaning and words was achieved; a total of seven re-retranslation cycles were performed. Then, the Korean version was sent to a bilingual Korean-American faculty member who was born in the US and had lived in Korea for more than 10 years. The guidelines translated by a Korean were retranslated into English. The back translated version was compared with the original English version and finalized by two anesthesiologists who had adequate knowledge on pain management.

After approval of the guidelines by two anesthesiologists, 30 staff members (4 nurse managers, 23 nurses, 3 physicians) were then asked to evaluate content validity of the EBP guidelines in terms of the appropriateness and applicability of the EBP guidelines using the 9-point Likert scale from the RAND (research and development) Corporation (Sachs, Pritz, Kahn, Carpenter, & Docherty, 2000). They were also required to answer a question regarding whether the recommendation items of the guidelines were currently used in their clinical practice with a “Yes” or “No”. After the analysis, we found that all of the recommendation items received more than 7.0 points, with a mean of 7.44 for appropriateness and 6.91 for applicability. Approximately 68% of recommendation items were currently used in practice. Therefore, we decided to include all of the recommendation items in the web-based system. However, based on staff feedback, indicating that items referring to organizational policy (item no. 67 through 75) were not culturally appropriate to hospitals in Korea, these items were excluded. Although organizational support was a necessary and important factor facilitating use of EBP, this exclusion was accepted because this research was initiated without organizational support and was implemented only by staff nurses working in a hospital. In addition, only nurses who voluntarily accepted EBP and were willing to participate in the study were recruited. The process for validation of EBP guidelines in Korean hospitals has been published in another journal.

An educational session on EBP was prepared for nurses

In the pilot study, developed for assessment of the level of nurses’ knowledge of EBP, 5 of the 27 nurses answered that they “do not know at all about EBP” or “do not know about EBP”. Therefore, an educational session on EBP and its guidelines was developed and provided to the nurses in the designated study units. The contents of each educational session were prepared based on feedback from nurses, expert opinions, and literature search of the internet.

Educational material was evaluated and validated by a research team and other experts who had knowledge of EBP. Educational sessions were composed of five parts; sessions were conducted for 80 minutes, totaling 320 minutes, once per week. Information on the contents of education on evidence-based guidelines and EBP is provided in Table 1 and a brief summary of EBP guidelines adopted in the study and traditional practices in postoperative pain management is provided in Table 2.

Other strategies used to stimulate utilization of EBP guidelines

The web-based EBP guidelines were developed separately from the nursing information system in the hospital using the JSP/Servlet (Sun Microsystems, Inc, Stanford, California, USA) and stored by the Database Access Object. However, for easy accessibility, icon on the web based EBP guidelines was prepared on the computer screen in the nursing station. Each nurse who participated in the study was asked to log into the designated web page in order to access the EBP guidelines. After login, nurses were also asked to check every recommendation item of the EBP with regard to whether they had read the recommendation item by clicking the “yes” or “no” button next to the recommendation items. In addition, whenever nurses were connected to the EBP guidelines, they were asked to click on whether they had implemented each recommendation item of the EBP guidelines.

To stimulate use of EBP guidelines and to enhance adoption of EBP guidelines in practice, the number of contacts with EBP guidelines through the web by nurses in the research study was monitored by a member of the research team. Even though there was no penalty to nurses who did not access EBP guidelines for a while, the number of contacts with EBP guidelines was noted, and, from time to time, each nurse was contacted by e-mail and encouraged to access EBP guidelines.

In addition, the bulletin board on the web page was developed in order to increase understanding of the guidelines; nurses who had questions regarding guidelines as well as EBP could post questions on the bulletin board. Individualized feedback was provided directly either by e-mail or phone call. In addition, a nurse in the designated unit was assigned as a change champion in order to enhance adoption of evidence-based guidelines to patients. These change champion nurses had close contact with other nurses working in the units as well as members of the research team.

Pain level

Postoperative pain level was measured using a numerical rating score at 1 hour, 6 hours, 12 hours, 18 hours, and 24 hours after abdominal surgery in both the control and experimental groups. In order to prevent influence of the EBP guidelines on the pain intensity of patients, measurements of pain level were performed for the control group and then for the experimental groups. After implementation of EBP guidelines, pain level of patients in the experimental groups was assessed. Allocation of the control group and experimental groups 1 and 2 was performed according to a time schedule. Thus, pain level of patients in experimental group 1 was assessed from the first day to 14 days after implementation of EBP, and then on the 15th day to 28 days after implementation of EBP in experimental group 2. To assure the reliability of pain intensity score, measurements of pain level of patients in both the control and experimental groups was performed only by trained nurses working in the PACU and surgical units.
Table 1 Contents of Educational Session

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<thead>
<tr>
<th>Session</th>
<th>Subject</th>
<th>Content</th>
<th>Methods</th>
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<tbody>
<tr>
<td>Session 1</td>
<td>What is evidence-based nursing?</td>
<td>1. Background of evidence-based health care</td>
<td>Lecture</td>
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<td>2. Development process of evidence-based health care</td>
<td>Discussion</td>
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<td>3. Definition, stages, and strengths of evidence-based nursing</td>
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<td>4. Challenges of evidence-based nursing</td>
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<td>1. Preparation and evaluation of the clinical question</td>
<td>Lecture</td>
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<td>2. Method of source searching</td>
<td>Presentation</td>
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<tr>
<td>Session 2</td>
<td>What are the stages of evidence-based nursing?</td>
<td>1. Definition of evidence-based nursing practice guidelines</td>
<td>Discussion</td>
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<td>2. Characteristics of the evidence-based nursing practice guidelines</td>
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<td>3. Development process of the evidence-based nursing practice guidelines</td>
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<td>4. Strengths and weaknesses of the guidelines</td>
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<td>5. Trends and challenges of the evidence-based nursing practice guidelines</td>
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<td>Session 3</td>
<td>What are the evidence-based nursing practice guidelines?</td>
<td>1. Essential factors contributing to the practical application of the evidence-based nursing practice guidelines</td>
<td>Lecture</td>
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<td>2. Analysis of the barriers to the practical application of the evidence-based nursing practice guidelines</td>
<td>Presentation</td>
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<td>3. Process of applying the evidence-based nursing practice guidelines to clinical practice</td>
<td>Discussion</td>
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<td>4. Use and evaluation of the effects of the practical application of the evidence-based nursing practice guidelines</td>
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<td>Session 4</td>
<td>Application and evaluation of the evidence-based nursing practice guidelines</td>
<td>1. Web program user guide education</td>
<td>Lecture</td>
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<td>2. Introduction to and how to use the postoperative pain, postoperative nausea and vomiting, and body temperature management evidence-based nursing practice guidelines</td>
<td>Demonstration</td>
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Nurses' knowledge of postoperative pain management

Knowledge of postoperative pain management was assessed in order to determine the impact of EBP guidelines on management of patients' pain by nurses. The level of nurses' knowledge of postoperative pain management was measured just before implementation of EBP guidelines and 14 days and 28 days after implementation of EBP guidelines, consecutively.

Data analysis

SPSS 17.0 for Windows (IBM SPSS Inc., Chicago, IL, USA) was used for analysis of collected data, and statistical analysis was performed as follows: (a) to test homogeneity of surgery-related characteristics of each group of patients, chi-square test was applied (b) to test the pain levels at each time point of surgery in each group, ANOVA

<table>
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<tr>
<th>Phase</th>
<th>EBP</th>
<th>Traditional practice</th>
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<tr>
<td>Perioperative pain</td>
<td>Institutional policies</td>
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<tr>
<td>management</td>
<td>- Anesthesiologists participated in developing standardized institutional policies and procedures</td>
<td>- Anesthesiologists should be available at all times to consult with unit nurses, surgeons, or other involved physicians.</td>
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<td></td>
<td>- Anesthesiologists should be available at all times to consult with unit nurses, surgeons, or other involved physicians.</td>
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<td>- Healthcare professionals were all educated on pain assessment, pain management techniques (PCA, pain analgesics), and non-pharmacologic techniques (relaxation, imagery, inhalation therapy, and music therapy)</td>
<td>- Nonpharmacologic therapy (imagery, aroma oil inhalation with oxygen, relaxation technique)</td>
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<td>- Adapted standardized, validated instrument for pain assessment</td>
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<td></td>
<td>- Documentation of pain intensity, the effects of pain therapy, and side effects caused by the therapy</td>
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<td>Education to patient and caregivers</td>
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<td></td>
<td>- Misbeliefs on pain</td>
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<td></td>
<td>- Side effects induced by analgesia</td>
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<tr>
<td></td>
<td>- Use of PCA machine (patient and caregivers)</td>
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<td>- Use of self-reporting pain tool</td>
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<td>Preoperative pain</td>
<td>Assessment</td>
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<tr>
<td>management</td>
<td>- Data collection and assessments pain history, physical examination, and development of pain management plan</td>
<td>- No assessment on pain history of patient</td>
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<tr>
<td></td>
<td>Intervention</td>
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<td></td>
<td>- Education on pain management</td>
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<td></td>
<td>- Pain assessment every 2 hours</td>
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<tr>
<td></td>
<td>- Pharmacologic therapy (PCA, NSAIDs, acetaminophen)</td>
<td>- Only pharmacological therapy (PCA, NSAIDs, acetaminophen side effects monitoring)</td>
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<td></td>
<td>- Monitoring of side effects</td>
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<td></td>
<td>- Nonpharmacologic therapy (imagery, aroma oil inhalation with oxygen, relaxation technique)</td>
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<td>- Anesthesiologists directly evaluate patients who are experiencing pain</td>
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Note. EBP — evidence-based practice; PCA — patient-controlled analgesia; NSAIDS — nonsteroidal anti-inflammatory drugs.
was performed using Scheffé’s test as a post hoc. Repeated measure of ANOVA was applied for testing of nurses’ knowledge of pain management.

**Results**

**Demographics of participants**

**Nurses’ general characteristics**

Of the 27 nurses who participated in the study, 7.4% were male and 92.6% were female. The average age was 29.96 years, with 40.7% in the 20–29 age group, and 59.3% in the 30–39 age group. Regarding their civil status, 48.1% were married and 51.9% were single. Regarding education, most (66.7%) were bachelor degree holders, and most (70.4%) had 4–7 years of work experience in the ward.

**Patients’ general characteristics and homogeneity test on the variables**

Of a total of 124 abdominal-surgery patient subjects, 58.1% were male, 94.3% were married, 61.3% had undergone surgery, and 41.1% had undergone total gastrectomy. Among the 124 participants, 47 were included in the control group, 36 in experimental group 1, and 41 in experimental group 2. Regarding their general characteristics (Table 3), no significant differences in any aspects were observed among the three groups. In the control group, 68.1% of patients were male and 31.9% were female; in experimental group 1, 44.4% of them were male and 55.6% were female; and in experimental group 2, 58.5% of them were male and 41.5% were female. The average age was 56.56 for the control group, 54.5 for experimental group 1, and 59.20 (12.2) for experimental group 2. Therefore, significant differences were observed among the three groups. In the control group, 6.49 points in the control group, 6.19 points in experimental group 1, and 5.77 points in experimental group 2 had a signifi cant increase with significant differences within 4 weeks after surgery was 6.79 points in the control group, 6.28 points in experimental group 1, and 5.61 points in experimental group 2 (p < .001). The score for pain felt at 18 hours after surgery was 6.49 points in the control group, 6.19 points in experimental group 1, and 5.02 points in experimental group 2 (p < .001); and the score for pain felt at 24 hours after surgery was 6.08 points in the control group, 5.77 points in experimental group 1, and 4.80 points in experimental group 2. Thus, significant differences were observed among the three groups (p < .001) (Table 5, Figure 1).

**Effect of implementation of EBP guidelines on nurses and patients**

**Nurses’ knowledge of pain management**

The nurses’ score for knowledge regarding postoperative pain management was 31.96 points before application of the Web-based EBP guidelines, 32.50 points after application of the guidelines for 2 weeks, and 37.93 points (p < .001) after application for four weeks (Table 4).

**Postoperative pain level of patients**

The group (F = 13.74, p < .001), time elapsed since implementation of web EBP (F = 113.81, p < .001), and the group and time interaction (F = 7.00, p < .001) all had significant effects on pain level of patients. With respect to the patients’ postoperative pain before and after application of EBP guidelines, the score for pain felt by the patients 1 hour after surgery was 8.30 points in the control group, 7.39 points in experimental group 1, and 6.44 points in experimental group 2 (p = .007). The score for pain felt by patient subjects at 6 hours after surgery was 7.40 points in the control group, 6.33 points in experimental group 1, and 6.10 points in experimental group 2.

**Discussion**

The ability to implement evidence into practice is fundamental to assuring the quality of nursing care. Despite substantial research devoted to development of knowledge in the nursing discipline, there are persistent challenges in implementation of new research evidence in patient care. Many researchers have pointed out that much of nursing care does not meet recommended clinical guidelines and this pattern is prevalent regardless of clinical setting, such as preventive, acute, and chronic care (Cooley, Nix, & Clancy, 2006). This study was conducted in order to determine effectiveness of web based EBP guidelines in terms of pain level of patients who have undergone abdominal surgery and knowledge of postoperative pain management of nurses caring for abdominal surgery patients.

In this study, nurses’ knowledge on management of postoperative pain before and after application of the web-based EBP guidelines showed an increase with significant differences within 4 weeks. Michaud et al. (2007) and Moghabghab et al. (2003) reported that health providers’ knowledge on dementia care showed a significant increase after application of EBP guidelines for 4–12 weeks. In a study reported by Lee and Lee (2006), nurses’ knowledge of pain management and pain assessment of children showed...
a significant increase after application of EBP guidelines for 3 weeks. However, in the study reported by Habich et al. (2012), no difference in nurses’ knowledge of pediatric pain management was observed after application of EBP guidelines for 3 weeks, except for the analgesic ladder and pharmacologic properties. Thus, previous studies have reported that the length of time taken to increase the knowledge of nurses on EBP guidelines varied from 3 weeks to 8 months (Considine & Brennan, 2007; Lee & Lee; Richardson, 2001). Quantification of the time required to increase nurses’ knowledge of EBP guidelines, and the question of which factors inhibit acquisition of knowledge by nurses should be investigated in future research.

Postoperative pain levels of patients at each time point showed a significant decrease after implementation of web-based EBP guidelines in this study. Reimer-Kent (2003) also reported that use of EBP guidelines is an effective method for management of postoperative pain after cardiac surgery. They defined EBP guidelines as not only a proactive, low-tech, low-risk, well-tolerated approach to pain management, but also cost-effective, simple, and feasible to use. Merbooth and Barnason (2000) also reported that the pain level of patients decreased, and patient satisfaction with pain management increased after application of EBP guidelines to patients who underwent thoracic surgery. In a study reported by Bédard, Purden, Sauvè-Larose, Certosini, and Schein (2006), in which EBP guidelines were applied to patients who underwent different types of surgery (orthopedic, obstetric, thoracic, vein graft, orthopedic, general surgery, and cardiac), pain level and worst pain in the past 24 hours showed a significant decrease after implementation of EBP guidelines with increased general activity and sleep of the patients. Results of their research also demonstrated that patients’ belief regarding pain management improved after implementation of evidence-based guidelines.

Effective translation of research evidence into clinical practice is not a simple process and often requires substantial organizational support and extensive coordination across organizations. Therefore, there are many challenges in adoption of evidence into practice. According to Brooks, Titler, Ardery, and Herr (2009), use of evidence-based pain management guidelines resulted in cost saving per inpatient stay of more than $1,500 for elderly patients with hip fracture. Thus, hospitals would benefit financially from promotion of evidence-based pain management practice; however, more importantly, the vulnerable population of older adults would benefit from better management of acute pain.

This study employed diverse strategies in order to comply with EBP guidelines on postoperative pain management. First, a more structured educational program on pain management, which includes pharmacologic and nonpharmacologic interventions, was prepared for each patient before surgery. Second, patients were informed of the advantages of using a self-reporting pain assessment tool after surgery and its use by nurses was recommended. It was highly recommendable because patients using it were more knowledgeable with regard to their pain and pain management. Third, an interdisciplinary approach was used in management of postoperative pain and more diverse interventions were performed, including music therapy, relaxation therapy, and aromatherapy with oxygen inhalation according to the recommendations of EBP guidelines by nurses compared to the traditional predominantly used pharmacologic interventions prescribed by physicians.

Nurses who participated in the study were very motivated to implementation of EBP with their patients. They also felt pride in use of EBP in their practice because use of EBP was first attempted in the designated hospital. In addition, throughout the study, anesthesiologists and surgeons were very supportive and encouraged adoption of EBP in the practice. They were very active in encouraging use of EBP in the hospital. As another strategy, from time to time, e-mail alerts were sent to the participating nurses, informing them of the number of connections they had made to the web EBP guidelines even though nurses were informed that there was no penalty at all for less connection to web-based EBP guidelines. In analysis, the number of contacts with web-based guidelines per nurse was between 2–3 times per shift. Nurses’ opportunity to become acquainted with pain management will be enhanced each time as the number of connections to the web-based guidelines increases. All of these strategies may have a positive influence on management of patients’ pain.

The contribution of the study will be to decrease the gap between research and translation of research into clinical practice that has existed (Bradley, Schlesinger, Webster, Baker, & Inouye, 2004; Brancato, 2006; Davis et al., 2007) in the nursing discipline. This study developed web-based EBP guidelines instead of the existing paper-based guidelines, and enhanced the applicability of guidelines so that nurses can have easy access to them. Currently, no results from research to test the effectiveness of web-based EBP guidelines in Korea, or web-based EBP guidelines on postoperative pain management, have been reported. Web based EBP guidelines have allowed nurses easy access to the latest evidence, making it possible to improve patient outcomes on pain management. In future studies, there will be a need to provide more diverse EBP guidelines through the web or hospital information system, and development of strategies for active utilization of such guidelines by nurses in their clinical practice will also be needed.

As a limitation, this study was only conducted in a hospital located in Korea; therefore, the ability to generalize the study findings is limited. In addition, the question of which interventions or combination of interventions performed by nurses contributed
to the decrease in postoperative pain level of patients was not investigated. Further investigation regarding which portion of EBP guidelines influenced the change in pain intensity, compared with other portions of the EBP guidelines, is needed. Further, after implementation of EBP guidelines, the pain level of patients was still relatively high; this might be a result of the traditionally rooted Korean culture or perception of pain management. Asian culture traditionally places emphasis on “virtue of patience”. This might seem illogical according to Western culture, but is still true in Korea. Therefore, conduct of further research is needed in order to improve pain management practice in Korea.

Adoption of evidence-based guidelines for pain management using the web was an effective strategy for decreasing the pain level of postoperative patients in order to improve knowledge of nurses on pain management. However, more research is needed with regard to which elements of evidence-based guidelines are more effective than others on patient outcomes, and what combination of guidelines produces greater effectiveness. In addition, because the explosion in information technology and the growing number of research articles published annually can make keeping up to date extremely challenging, especially in Korea, strategies that are sensitive to Korean culture of clinical practice should be investigated in order to help nurses to more easily integrate evidence-based guidelines in their practice.

Conclusion

After examining the applicability of the guidelines developed outside of Korea, we developed web oriented evidence based pain management guidelines after minor revision for the purpose of enhancing the quality of pain management practice by nurses. After implementation of evidence-based guidelines, postoperative pain level of patients who underwent abdominal surgery showed a decrease, and nurses’ knowledge of pain management showed a significant increase.

Implementation and maintenance of changes of EBP in practice in health care organizations can be complex and time-consuming. In addition, conflicting evidence from research and lack of accessibility to evidence were important barriers to effective adoption of EBP. Various strategies or combination of different strategies will be recommended in order to increase adoption of EBP and sustainable utilization of EBP in clinical practice.

Conflict of interest

The authors declare no conflict of interest.

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References


Table 5 Comparison of Postoperative Pain Levels among Groups

<table>
<thead>
<tr>
<th>Time of measurement</th>
<th>Postop 1 hour</th>
<th>Postop 6 hours</th>
<th>Postop 12 hours</th>
<th>Postop 18 hours</th>
<th>Postop 24 hours</th>
<th>Source</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG (n = 47)</td>
<td>8.30 ± 1.83</td>
<td>7.40 ± 1.94</td>
<td>6.79 ± 2.02</td>
<td>6.49 ± 1.92</td>
<td>6.08 ± 0.93</td>
<td>Group</td>
<td>13.74</td>
<td>.001</td>
</tr>
<tr>
<td>EG1 (n = 36)</td>
<td>7.39 ± 0.85</td>
<td>6.33 ± 1.04</td>
<td>6.28 ± 0.91</td>
<td>6.19 ± 0.86</td>
<td>5.77 ± 1.94</td>
<td>Time</td>
<td>113.81</td>
<td>.001</td>
</tr>
<tr>
<td>EG2 (n = 41)</td>
<td>6.44 ± 0.70</td>
<td>6.10 ± 1.02</td>
<td>5.61 ± 0.86</td>
<td>5.02 ± 1.19</td>
<td>4.80 ± 1.19</td>
<td>Group x time</td>
<td>7.00</td>
<td>.001</td>
</tr>
<tr>
<td>F</td>
<td>5.10</td>
<td>10.87</td>
<td>7.56</td>
<td>11.87</td>
<td>5.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>.007</td>
<td>&lt;.001</td>
<td>.001</td>
<td>&lt;.001</td>
<td>.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scheffe*</td>
<td>a &gt; b &gt; c</td>
<td>a &gt; b &gt; c</td>
<td>a &gt; b &gt; c</td>
<td>a &gt; b &gt; c</td>
<td>a &gt; b &gt; c</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. CG = control group (before implementation of EBP guidelines); EG = experimental group (EG1 = 1–14 days after implementation of EBP guidelines; EG2 = 15–28 days after implementation of EBP guidelines); EBP = evidence-based practice.

* For Scheffe’s test, a denotes CG, b denotes EG1 and c denotes EG2.


