

ORIGINAL ARTICLE

Meta-Analysis of the Ease of Care From the Nurses' Perspective Comparing Fentanyl Iontophoretic Transdermal System (ITS) Vs Morphine Intravenous Patient-Controlled Analgesia (IV PCA) in Postoperative Pain Management

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Purpose: The aim of this meta-analysis was to compare the ease of care (EOC) of fentanyl iontophoretic transdermal system (ITS) vs the morphine intravenous patient-controlled analgesia (IV PCA) as assessed by the nurse.

Design: Meta-analysis of three phase 3B randomized active-comparator trials.

Methods: This meta-analysis according to Cochrane's approach assessed EOC using a validated nurse questionnaire (22 items grouped into three subscales, which include time efficiency, convenience, and satisfaction) in adult patients treated with fentanyl ITS or morphine IV PCA for postoperative pain management. The weighted mean difference (WMD) between treatments was calculated.

Finding: EOC analyses were based on responses to questionnaires from 848 (fentanyl ITS) and 761 (morphine IV PCA) nurses. Fentanyl ITS was reported to provide significant advantages compared with morphine IV PCA in terms of nurses' overall EOC (WMD = -0.57, $P < .0001$) and each of the subscales: time efficiency (WMD = -0.58, $P < .0001$), convenience (WMD = -0.57, $P < .0001$), and satisfaction (WMD = -0.47, $P < .0001$).

Conclusions: In this meta-analysis, fentanyl ITS is associated with a superior EOC profile from the nurses' perspective than morphine IV PCA.

Keywords: fentanyl, iontophoretic transdermal system, morphine, patient-controlled analgesia, ease of care.

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Conflict of interest: Cecile R. Pestano and Pam Lindley have no relevant conflicts of interest to disclose. Li Ding, Hassan

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1089-9472/\$36.00

<http://dx.doi.org/10.1016/j.jopan.2015.11.012>

INTRAVENOUS (IV) PATIENT-CONTROLLED ANALGESIA (PCA) has been shown to provide effective pain relief and become standard practice for postoperative pain management.¹⁻⁵ However, IV PCA requires IV access, can often limit mobility, and an associated risk of medication and pump programming errors.⁶⁻⁹ Some of the safety hazards with IV PCA include use of wrong analgesic or concentration, accidental pump misprogramming, false triggering (eg, PCA button short circuit), unintended dose administration by proxy (eg, activation of PCA pump by nurse/visitors), drug accumulation in IV dead space, runaway fluid column because of siphoning or other means, PCA pump malfunction because of hardware failure or software design error, retrograde flow of PCA analgesic into a second IV set because of catheter blockade, and others.⁹ In 2009, the estimated annual error rates per 10,000 people in the United States were 407 for IV PCA-related errors and 17 for device-related errors.¹⁰ The average cost per error in this analysis ranged between \$552.00 and \$773.00.¹⁰ As expected, harmful errors were much more costly than nonharmful errors. Another concern with traditional IV PCA is that infusion pumps may be at risk for hacking, which could lead to modifications of doses by unauthorized users.¹¹

Fentanyl iontophoretic transdermal system (ITS) is a preprogrammed needle-free PCA approach for the management of moderate-to-severe acute postoperative pain by administering the analgesic via iontophoresis. Iontophoresis allows transdermal delivery of fentanyl through the skin by the application of a low-intensity and nearly imperceptible electric current.¹² The system is pictured in Figure 1. Staff time spent on traditional IV PCA administration such as obtaining supplies to initiate therapy, time required to program the pump, a secondary nurse to confirm the order and programming, and time to deal with malfunctions and refills should be reduced with fentanyl ITS allowing nurses more time for direct patient care.¹³⁻²¹

Fentanyl ITS delivers analgesic doses based on patient control and has demonstrated to have comparable efficacy to morphine IV PCA.¹⁵⁻¹⁸

Ease of care (EOC) for nurses is an important parameter to measure, especially with new tech-



Figure 1. Illustration of the fentanyl iontophoretic transdermal system controller and drug unit and assembled system. The device is approximately the size of a credit card. The controller and drug unit are assembled by the health care professional immediately before the application. This figure is available in color online at www.jopan.org. Reprinted with permission from The Medicines Company (Parsippany, NJ).

nology such as fentanyl ITS. A validated questionnaire has been developed for evaluating EOC for patients receiving PCA from the nurses' perspective.²² We have previously reported results using a simple pooled analysis of two phase 3B active-comparator clinical trials that compared fentanyl ITS with morphine IV PCA and used the nurses' EOC questionnaire.²³ In this article, we use a meta-analysis that compares fentanyl ITS with morphine IV PCA from the three phase 3B active-comparator studies conducted in the development of fentanyl ITS that captured EOC from the nurses' perspective. By using a meta-analysis, we should be able to detect treatment effects with greater power and estimate these effects with greater precision.²⁴ A strength of this analysis is that all the included studies were designed to reflect real-world practice and included many different surgery types. Therefore, the results of this meta-analysis should be generalizable to many types of patients with postoperative pain.

Methods

PubMed, Cochrane Library, and Google Scholar were searched combining the terms fentanyl and iontophoretic and ease of care for the period of 1980 to August 1, 2015. Studies were included if they studied fentanyl ITS and had used the validated nurse EOC questionnaire.²² The

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