Effect of Preoperative Incentive Spirometry Patient Education on Patient Outcomes in the Knee and Hip Joint Replacement Population

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Purpose: *This study examined the effects of preoperative incentive spirometry (IS) education (POISE) on postoperative outcomes for knee and hip total joint replacement patients.*
Design: *In this prospective study, 140 patients were randomized to Group 1 (POISE intervention = 50 completing) or Group 2 (no intervention = 56 completing) (34 dropped).*
Methods: *The Group 1 intervention consisted of formal instruction preoperatively for IS home use, postoperative use, and IS volumes documentation. Group 2 patients received no intervention. Patients recorded postoperative IS volumes, which were used to determine return to baseline volume.*
Findings: *One hundred six patients completed the study. Most were Caucasian females averaging 64 years. Although IS return to baseline volume time was not significantly different between groups, POISE patients had fewer postoperative complications, hospital days, and charges. POISE patients ranked the intervention as helpful.*
Conclusions: *Although IS volumes were not significantly different between groups, POISE patients had better outcomes and ranked the intervention as helpful.*

Keywords: *incentive spirometry, postoperative complications, pulmonary complications, physical therapy, PPCs, preoperative care, patient education.*

POSTOPERATIVE PULMONARY COMPLICATIONS (PPCs) are a leading cause of morbidity and mortality, affecting 25% to 50% of patients.[1,2] These complications, often severe in nature, include pneumonia, massive lobar collapse associated with central airway mucous plugging, pneumo-

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Conflict of interest: None to report related directly or indirectly to the patients in this article.

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1089-9472/$36.00
http://dx.doi.org/10.1016/j.jopan.2013.01.009

nitis, atelectasis, and respiratory insufficiency. Incentive spirometry (IS) hand-held devices are used postoperatively by surgical patients to achieve effective inspiration. They are designed to mimic natural sighing or yawning by encouraging patients to take long, slow, deep breaths. The IS provides patients with visual or other positive feedback when they inhale at a predetermined flow rate or volume and sustain the inflation for a minimum of 3 seconds.[3]

A review of the literature regarding preoperative teaching of IS use was conducted in CINAHL and MEDLINE databases for the years 2005 to 2012, using the search terms of IS, postoperative complications, physical therapy, PPCs, preoperative care, and patient education. This review was conducted to evaluate prior research on the effect of the use of preoperative IS education (POISE) on surgical patient outcomes, including postoperative IS return to baseline volumes, PPCs, and length of stay (LOS). For purposes of this study, postoperative IS return to baseline volume is defined as the time when IS volumes recorded by hospitalized patients postoperatively are at or above the preoperative IS volume. Few research studies conducted the POISE intervention preoperatively or analyzed the outcomes of postoperative IS return to baseline volumes, PPCs, and LOS.

One prospective randomized study of 60 obese adults in a post-anesthesia care unit (PACU) compared respiratory physiotherapy with routine treatment during the PACU stay. Early IS intervention significantly improved oxygenation and lung function the first 24 hours of the patient stay. During the PACU stay, pulmonary function in the physiotherapy group was significantly better than the routine treatment group ($P < .0001$). They concluded that short-term respiratory physiotherapy during the PACU stay promotes more rapid recovery of postoperative lung function in the obese during the first 24 hours.[4]

In a prospective, observational, non-randomized study of 263 patients having major abdominal surgery who received intensive physiotherapy, researchers concluded that the addition of IS as part of an intensive postoperative physiotherapy program significantly decreased the occurrence of PPCs (6% for the physiotherapy group vs 17% for the control group, $P = .01$). Also, hospital LOS on the surgical high dependency unit was significantly shorter for the physiotherapy group (3.1 vs 4 days, $P = .03$).[5]

Studies of elective coronary artery bypass graft (CABG) patients at high risk for pulmonary complications evaluated preoperative inspiratory muscle training (IMT).[6,7] In a pilot study, 14 CABG patients were randomized to either preoperative IMT or to a control group (usual care). The IMT group received preoperative IMT as well as usual care. The IMT intervention included 20 minutes of inspiratory threshold-loading device training daily for a minimum of 2 weeks and up to 4 weeks preoperatively. Results demonstrated improved postoperative outcomes for the IMT group with fewer cases of postoperative atelectasis ($_x{}^2{}_{DF1}$-3.85; $P = .05$) and shorter LOS (intervention = 7.93; control = 9.92, $P = .24$).[6] In a second study of CABG patients, 279 were also randomized to either preoperative IMT or to a control group (usual care). Patients were educated on active cycle of breathing and forced expiration techniques. Researchers reported PPCs in 18% of the IMT group versus 35% of the control group (odds ratio, 0.52; 95% confidence interval [CI], 0.30 to 0.92). The IMT group also had a shorter LOS (IMT = 7 days; control = 8; $P = .02$).[7]

In a prospective study of laparoscopic cholecystectomy patients, 50 were randomized to a preoperative IS group or to a control group. The IS group patients were instructed to use IS for 7 days before surgery, 15 times every 4 hours for 1 week. For control group patients, IS was carried out postoperatively only. Lung function values for both groups were documented at 6, 24, and 48 hours, and at discharge. The results showed that the preoperative IS group had significantly better lung function than the control group who had no preoperative training ($P < .05$). Also, the IS group had a shorter LOS than the control group (4.19 vs 5.12 days). While the authors reported no PPCs in either group, they did note it takes several days for a patient's lung function to recover even after a minimally invasive laparoscopic cholecystectomy.[8]

In a study employing both survey research and retrospective review, 150 total hip or total knee replacement patients who did and who did not attend a hospital-based preoperative education