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Postoperative ambulation in thoracic surgery patients: standard versus modern ambulation methods

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ABSTRACT

Aim: A single-subject study of two methods of postoperative ambulation of patients recovering from thoracic surgery.

Background: During the postoperative setting, patients are often burdened by their condition that reduces their ability to ambulate. This problem is compounded by the addition of devices that make walking more cumbersome. To simplify the process of ambulation during the postoperative period, an intravenous pole/walker (IVPW) was specifically designed to allow all patient devices and attachments to accompany the patient during ambulation, without the need for supplemental caregiver assistance.

Methods: The IVPW method of ambulation was compared with standard method of ambulation (SMA) in a single-subject clinical trial. Thirty-nine consecutive thoracic surgery patients with at least an IV and chest tube were ambulated using alternatively either the IVPW or the SMA. Immediately following the ambulation periods, the patient and patient's health care worker assessed both methods using satisfaction surveys consisting of several questions about the episodes of ambulation and the number of health care workers needed to assist during ambulation.

Results: Patient satisfaction was significantly higher in the ability of the IVPW to provide support and assist in ambulation in comparison with the SMA ($p < 0{\cdot}001$). Nurses felt the IVPW both facilitated and provided a safer method for ambulation compared with the SMA ($p < 0{\cdot}001$). On average, one less employee was required during ambulation with the IVPW ($p < 0{\cdot}001$).

Conclusion: The IVPW provided better support and was perceived as a safer method for ambulation compared with the SMA. The IVPW also required one less person to assist with ambulation.

Relevance to clinical practice: Facilitation of ambulation in the postoperative setting can impact nursing care and patient satisfaction.

Key words: Adult intensive care • Advanced nursing roles • Critical care nursing • Intensive care • Postoperative care • Quality improvement

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BACKGROUND

Ambulation has long been considered part of the routine regimen for patients recovering from surgery. In general, the sooner a patient can resume normal activity, the shorter the recovery period. Evidence has shown that mobilization, particularly mobilization early following surgery, improves patient outcomes and reduces length of stay (LOS) (Oldmeadow *et al*., 2006; Kaneda *et al*., 2007; Santry, 2010). Recovery methodologies that include ambulation as a key element of the management scheme can significantly reduce costs (Santry, 2010). Kaneda *et al*. (2007) and Oldmeadow *et al*. (2006) showed that aggressive approaches to early postoperative ambulation accelerated recovery and shortened LOS for patients having a lobectomy or hip surgery, respectively. Fast track methodologies that include a regimen of early ambulation following surgery provide improved outcomes

(Cerfolio *et al*., 2001; Delaney *et al*., 2001; Das-Neves-Pereira *et al*., 2009; Feo *et al*., 2009; Jiang *et al*., 2009; Lin *et al*., 2009; Mohn *et al*., 2009; Baird *et al*., 2010). In addition, aggressive mobilization of patients in a critically ill setting has been shown to be safe and effective in improving outcomes (Kress, 2009; O'Connor and Walsham, 2009; Needham *et al*., 2009).

The simple task of walking can be challenging during the postoperative period. Commonly, patients are burdened by their condition that reduces their capacity to ambulate. The addition of supplemental medical delivery systems that are required to provide essential care (intravenous fluids, catheters, drainage tubes and cardiac monitoring equipment) further complicates the act of walking and limits a patient's mobility.

Our thoracic surgery service strives to have our patients ambulate on the ward at least three times each day, beginning on the first postoperative day. Despite best attempts, however, frequently our patients walk only once or twice each day. In a survey of our entire nursing and health care workforce corps, the most common barriers to ambulation on the thoracic surgery service were determined (Table 1). Our nurses also noted that the immediate postoperative period is more difficult to walk a patient than the late postoperative period because more monitoring and critical care devices are likely to be attached. During this time, as opposed to the late postoperative period, patients are more infirmed by pain, weakness and fatigue.

Our leadership team determined that an episode of hallway ambulation commonly lasts from 25 to 40 min from the time the health care worker enters the room and walks with the patient to the time the health care worker leaves the room to continue other duties. This period of time is dedicated to the one patient and takes away time from other responsibilities. In some circumstances, health care workers cannot devote the time to ambulate a patient because of insufficient time and the need to perform other tasks.

The standard method for ambulation (SMA) employs the use of existing equipment that is gathered and utilized to meet the needs of a patient's ambulation episode. Typically, such equipment includes an intravenous (IV) pole on wheels, a portable oxygen tank and a walker if needed. If a patient has a Foley catheter or chest tube, the collection devices are carried by assisting personnel (Figure 1A). Usually, 1–2 health care workers are necessary to walk with a patient using the SMA.

Table 1 Common barriers to ambulation

1	The patient is too sick or too weak
2	The patient refuses to walk
3	There is not enough help to ambulate the patient or the physical therapy service is unavailable
4	There is insufficient time to ambulate the patient during the course of the shift

In an effort to facilitate and simplify ambulation during the postoperative period, a walker that interchangeably functions as an IV pole (IV pole/walker – IVPW®, US patent 7,935,030 B1) was specifically designed (Figure 1B). All equipment can be attached to the device including monitors and two oxygen tanks for oxygen delivery and suction. In addition, a folding seat specially designed for the IVPW can be attached if there is need for the patient to rest while walking.

We performed an extensive search and could not identify literature that compares different aids or methods for ambulation, particularly in the postoperative setting. Our study presented heretofore compares two methods for ambulation and provides an original publication to the literature.

Figure 1 Patients with multiple attachments (intravenous, epidural, telemetry, chest tube, Foley catheter and oxygen) use the standard method of ambulation (A and B). Multiple health care workers are required to assist patient A.

Research aim

A single-subject study to explore the use of two methods of postoperative ambulation of patients recovering from thoracic surgery.

Research objective

- Ambulate and observe patients using both the SMA and the IVPW.
- Learn patient and caregiver self-reported satisfaction and perception of safety of the two methods of ambulation.
- Determine number of health care workers required to walk with patients using both methods of ambulation.

DESIGN AND METHODS

This study was reviewed, outlined and approved by the Vanderbilt University Medical Center Internal Review Board. Inclusion criteria for study patients were as follows: (1) patients were postoperative and on the thoracic surgery service and (2) patients had at least an IV and an indwelling chest tube attached to a portable collection container. Many patients had additional equipment such as portable oxygen, a nasogastric tube, a feeding tube, a bladder catheter and a telemetry unit. This study was completely voluntary and was discussed with potential candidates following their thoracic procedure. Consent from the patient and primary health care worker was obtained after explanation of this study by nurses on the thoracic surgery team. The patients ambulated once in the hallway using either the SMA or the IVPW. During the next episode of ambulation, the other method of ambulation was used. Random sequencing was used and patients walked the same distances each time. There was no preset walking distance. Each patient determined his or her ambulation duration and distance that was the same, for the individual patient, when walking with both methods. The primary health care worker and other health care workers accompanied patients, as needed.

Immediately following each ambulation period, the patient and primary health care worker noted their observations by completing the assessment forms that were composed of 3 and 4 Likert scale questions (Figure 2). The few times that a family member assisted with the questionnaires, the questions were answered by the patient who instructed the family member to transcribe the answer. Data forms were collected and securely housed in the Department of Thoracic Surgery. Data were entered and analysed by one person, SAD, a masters trained analyst, using Wilcoxon sign-rank testing for ordinal data and paired t testing for continuous data. These data were further reviewed by the primary author for consistency and appropriateness. The forms were compiled and assessed in a secure database using Stata (College Station, TX, USA). Power calculation was based on detecting a difference in the number of health care workers necessary to perform ambulation. In a paired $t-$test, assuming 90% power, 0·05% significance, between participant standard deviation of 1 and a reported difference of 1 health care worker between the two methods, 24 participants are necessary. Additional participants were recruited because of uncertainty regarding likely standard deviation.

FINDINGS

Thirty-nine patients and 36 nurses were consented and participated in this study. The results are shown in graphic form later (Figures 3–5). The findings specifically reported in this article are those factors considered by the authors to be most relevant and of greatest importance to the audience. The results of the remaining questions had p values and confidence intervals similar to those specifically reported without significant changes in results with regard to the superiority of the IVPW compared with the SMA.

Patient satisfaction scores showed significant ($p < 0{\cdot}001$) differences in the ability of the IVPW to facilitate ambulation and to provide support while ambulating in comparison with the SMA (Figure 3). When asked if the method 'very well' provided support and assistance, 65% of patients (25 of 38 patients) responded affirmatively following use of the IVPW versus 15% (6 of 39 patients) after use of the SMA.

Nurses noted that the IVPW better facilitated ambulation and was safer compared with SMA (Figures 4 and 5). When queried regarding the system's ability to facilitate ambulation, only the IVPW was noted to accomplish this 'very well'. When asked if the system facilitated ambulation 'not so well', only 1 nurse answered yes for the IVPW versus 19 for the SMA ($p < 0{\cdot}001$). Twenty-six nurses felt the IVPW was 'always' a safe system for ambulation versus two for the SMA.

A paired t-test was used to analyse the number of people required to ambulate with the patient using each method (Table 2). A 1·94 (95% confidence interval [CI] 1·17–2·2) people were required to accompany patients during the SMA versus 1·06 (95% CI 0·94–1·18) people during IVPW ambulation ($p < 0{\cdot}001$). Of 35 nurses, 7 reported needing three people to walk with patients during SMA. No patients using the IVPW required three people. In essence, one less person was required to assist during ambulation with the IVPW.

Questionnaires

Questions for patient/family member about the 'current system for ambulation' (SMA or IVPW)

How well does the current system provide support for you and assist you when you walk?
Very well *well* *not so well* *poorly*

How well does the current system facilitate movement in the room?
Very well *well* *not so well* *poorly*

How well does the current system facilitate movement in the hallway?
Very well *well* *not so well* *poorly*

How well does the current system facilitate the ability to move from the bed to the chair?
Very well *well* *not so well* *poorly*

How well does the current system allow tubes, wires, collection devices, and so forth to move with you when you walk?
Very well *well* *not so well* *poorly*

How well does the RP walker streamline efforts to walk?
Very well *well* *not so well* *poorly*

How difficult is it to walk with all of the tubes, wires, containers, and so forth?
Not difficult *somewhat difficult* *difficult*

Do you feel that you need to wait for a hospital employee to assist you with walking before you can walk?
Always *Sometimes* *Never*

Are you prevented from walking because of your tubes, and so forth?
Always *Sometimes* *Never*

Are you reluctant to walk or get out of bed because of the tubes, and so forth?
Always *Sometimes* *Never*

How many people must walk with you when you are ambulating in the hallway?
1 *2* *3*

Questions for nurses (SMA or IVPW)

How many people are required to ambulate with the patient?
1 *2* *3*

Must a hospital health care worker walk with the patient or can a family member/friend suffice?
Always *Sometimes* *Never*

Is it easy for the patient to transition from the bed to ambulating in the hallway and back to bed?
Always *Sometimes* *Never*

Does the current system appear safe, i.e. does it help to prevent falls, allow safe ambulation, prevent inadvertent removal of tubes and intravenous', and so forth?
Always *Sometimes* *Never*

Does the current system prevent ambulation?
Always *Sometimes* *Never*

How well does the current system facilitate movement in the room, i.e. from bed to chair, from bed to bathroom, from chair to bathroom?
Very well *well* *not so well* *poorly*

How well does the current system facilitate ambulation?
Very well *well* *not so well* *poorly*

Figure 2 Questionnaires used for the patient and health care worker satisfaction surveys.

RELEVANCE TO CLINICAL PRACTICE

The importance of postoperative ambulation has been recognized and reported since 1899 when Ries (1899) was the first to report on the benefit of 'early rising' following celiotomy. Although not frequently used in the early twentieth century in the USA, postoperative ambulation became increasingly utilized as reports of its benefits were reported in the 1940s. Leithauser and Bergo (1941) noted the benefits of early rising and ambulation following surgery. Leithauser *et al*. (1951) further reported reduced venous thrombosis and embolic complications with the use of early

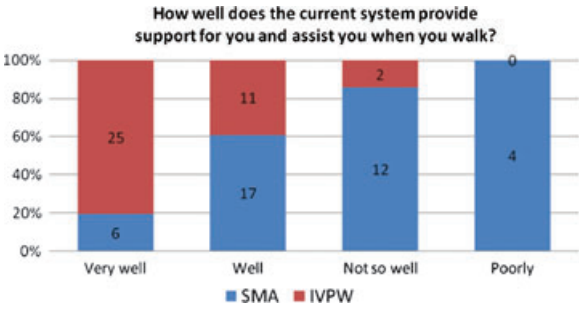

Figure 3 The graphs show patient satisfaction scores for the two systems in providing support and assistance during ambulation ($p < 0{\cdot}001$). One patient did not complete an evaluation for the intravenous pole/walker.

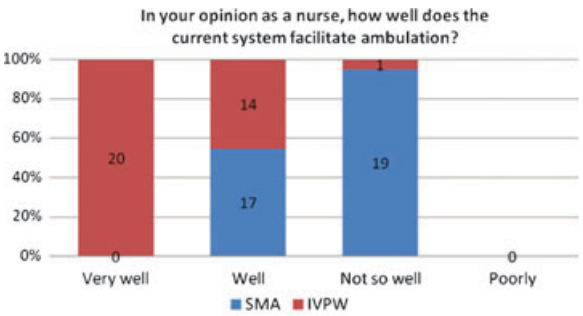

Figure 4 The graphs show health care workforce opinions regarding the two systems' ability to facilitate ambulation ($p < 0{\cdot}001$). One health care worker did not complete an evaluation for the intravenous pole/walker.

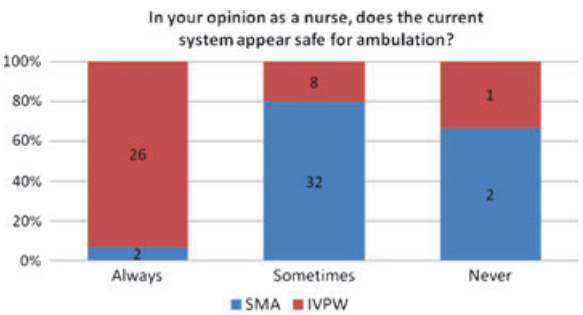

Figure 5 The graphs show health care workforce opinions regarding the safety of each system during ambulation ($p < 0{\cdot}001$). One health care worker did not complete an evaluation for the intravenous pole/walker.

ambulation after surgery. Blodgett (1949) defined early postoperative ambulation as 'walking 2 or 3 times each day on the day of surgery or the following 2 days'. He observed 'the most striking benefits of early ambulation. The early rising patients have a definitely more rapid return to normal strength and activity. Their outlook and morale are better .... They are less impressed with how sick they are ... are more willing to move about in bed and to assist with their own care ... (have) a lower incidence of urinary retention.

Table 2 A paired *t*-test reports the number of people needed to walk with the patients using the different ambulation methods

	Number of patients	Health care workers needed to ambulate with patients	95% confidence interval	*P* value
Standard method for ambulation	34	1·94	1·71–2·2	
Intravenous pole/walker	34	1·06	0·94–1·18	<0·001

One gains a distinct impression that wound pain is reduced at an earlier time among the early rising patients'. Canavarro (1946) reviewed and compared two similar groups of 500 postoperative patients. She found that early ambulation: (1) reduced postoperative complications; (2) was associated with a more rapid return to normal bodily function; (3) required less nursing care; (4) required less medication and rectal care; and (5) improved morale. Since that time, early ambulation has become accepted standard of care in postoperative patients.

Hospitals and the health care workforce are continually investigating methods to enhance care and improve outcomes (Kehlet and Wilmore, 2002, 2008; Kehlet, 2006; Kress, 2009). More recent strategies in postoperative care have incorporated a host of measures termed 'fast tracking' to improve postoperative outcomes. Fast track care elements frequently include: aggressive pain management, early removal of nasogastric or chest tubes, early initiation of enteral intake and vigorous pulmonary physiotherapy. Early and aggressive ambulation measures within the initial 24 h postoperative are key components in this strategy. Postoperative management strategies that include fast track methods incorporating early ambulation have been shown to be successful in multiple surgical specialties including colorectal surgery (Delaney *et al*., 2001; Feo *et al*., 2009; Lin *et al*., 2009; Mohn *et al*., 2009; Baird *et al*., 2010), oesophageal surgery (Jiang *et al*., 2009; Cerfolio *et al*., 2004; Orringer *et al*., 2007), urology (Magheli *et al*., 2011) and orthopaedics (Oldmeadow *et al*., 2006; Pearse *et al*., 2007). When implemented for patients following pulmonary resection, fast tracking has been shown to reduce complications, shorten hospital LOS and lessen costs (Cerfolio *et al*., 2001; Das-Neves-Pereira *et al*., 2009; Muehling *et al*., 2008; Sugarbaker *et al*., 2004). Cerfolio *et al*. (2001) used a fast track protocol that included an aggressive ambulation scheme that was cost effective and achieved a significantly reduced hospital LOS (median of 4 days) in pulmonary resection patients which compares favourably to the national average of 7·5 days. Muehling *et al*.

(2008) performed a randomized controlled study of conservative versus fast tracking of patients post lung resection. They found a significant decrease in the rate of pulmonary complications using the fast track clinical pathway that included an aggressive ambulation programme. Sugarbaker *et al*. (2004) also showed the utility of algorithms that included early ambulation in prevention of complications following extrapleural pneumonectomy.

Within the intensive care setting, ambulation has been shown to improve outcomes. Kress (2009) reviewed studies of early mobilization of critically ill patients who require mechanical ventilation. The investigators showed improved functional outcomes with shortened LOS. O'Connor and Walsham (2009) noting neuromuscular weakness as a frequent complication of prolonged bed rest and critical illness, reviewed the literature to evaluate the worldwide availability and role of mobilization therapy in the critical care setting. While routine mobilization was least likely to be available in the USA, data in support of mobilization was substantial in reducing hospital stay, intensive care unit LOS, mechanical ventilation, muscle weakness and functional independent scores. Kehlet, in a review of multimodal evidence-based surgical care and the evolution of fast track methodology, found that ambulation, in both a postoperative and critical care environment, improves LOS and outcomes (Kehlet and Wilmore, 2002, 2008; Kehlet, 2006). Despite these facts, however, Kehlet notes that patient care with aggressive ambulation measures is slow to change across the country. Part of the problem is the challenge of ambulation in an intensive care setting. Patients are more ill and debilitated, often have respiratory compromise, may be ventilator dependent and require ancillary support to carry equipment that the patient requires.

Innovative ways to facilitate ambulation in such a setting are sparse. Very little has been described in the literature. Needham *et al*. (2009) at Johns Hopkins University reported the use of custom-designed technological aids to assist patients on mechanical ventilation. They found that their patients were able to walk safely and effectively with their device with the potential reduction of human resource requirements.

The conundrum with critically ill patients remains the fact that it is troublesome to move such patients from the confinement of a bed to a standing, ambulatory state. This task usually falls on the nurse who is the direct care provider. To accomplish such an undertaking, time, equipment and lifting help are often required, particularly when a patient has multiple attachments. Such time consuming efforts detract from other critical nursing duties.

In recognition of the facts that ambulation improves outcomes and that specific encumbrances hinder postoperative ambulation, we developed the IVPW. The IVPW was also created in an effort to simplify the process of ambulation that, in turn, might result in more frequent periods of ambulation. If the health care workforce can more quickly prepare and walk a patient and if fewer people are needed to accompany the patient, more nursing time can be given to other patient needs. With all devices already attached to the IVPW, the preparatory time is minimized and the work for the health care workforce is reduced. The net gain appears favourable.

The IVPW is equipped with two oxygen tank holders for suction and oxygen delivery. Monitoring equipment and fluid delivery systems are attached to the IV pole. Fluid collection canisters and drainage systems hang from the lower aspect of the IVPW unit. A basket/tray can be attached to the front portion of the device to hold monitoring equipment. A detachable seat is also available for patients to rest during ambulation periods. In essence, all critical devices are consolidated onto one mobile unit, and the low profile unit can reside next to the patient's bedside at all times. There is no need for a patient to wait for: (1) a health care worker to transfer equipment to a mobile device; (2) a walker if needed for ambulation; or (3) an additional health care worker to assist with carrying oxygen and other equipment.

This study had several limitations. It was very confined in its scope to observe and assess satisfaction. A more in depth study of impact on quality of care and outcomes was not performed to delve into the true impact of the IVPW's usage. As well a cost analysis was not performed to determine its cost effectiveness. There could be a perceived bias by the health care workforce because the IVPW was evaluated only at Vanderbilt University Medical Center. To avoid unintended bias, the identity of the patients and the health care workforce participating in this study were anonymous. The results also show comparable answers for both patients and health care workforce answers, a fact that argues against bias. This study was also limited by the small population observed, although the numbers of participants provided an adequate number for statistical evaluation.

In our observational study, the results showed improved patient and health care worker satisfaction with the IVPW in comparison with SMA. Further evaluation of the device is planned to assess its impact on overall quality of care in a more universal setting.

CONCLUSION

We developed the IVPW to facilitate postoperative ambulation. We believed that we could improve the current universal methodology of ambulation, to make it easier for our patients to ambulate as well as to reduce the number of health care workers required to assist the ambulating patient. The observations of our patients and the health care workforce confirm the utility of the IVPW in comparison with the SMA. Patients believe the IVPW system provides better support and assistance than the SMA. Furthermore, nurses feel that the IVPW better facilitates ambulation and is safer. Last, fewer personnel are needed when the IVPW is used. Although outcomes measures and costs were not evaluated in this study, follow-up research is planned.

WHAT IS KNOWN ABOUT THIS TOPIC

- Ambulation following surgery enhances recovery.
- Barriers exist that hinder a patient's ability to ambulate in the postoperative period.

WHAT THIS PAPER ADDS

- The use of a novel walking device facilitates ambulation.
- Patient and nurse satisfaction are higher with use of the device and one less person is needed to assist with ambulation.

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