Perioperative physiotherapy

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Purpose of review
Physiotherapy in the perioperative period is emerging as an important component of postoperative recovery. This review highlights recent advances in the implementation of physiotherapy in the perioperative period and its enhancement of postsurgical outcomes.

Recent findings
Physical therapy in the preoperative period can improve physical deconditioning and potentially affect subsequent postsurgical outcomes. Fast-track surgical programs have highlighted the importance of early ambulation in the postoperative period. Incorporation of this multimodal, evidenced-based approach has been shown to reduce postoperative pulmonary complications and shorten hospital length of stay. Physiotherapy is feasible and well tolerated in patients who remain intubated and mechanically ventilated in the postoperative period. This approach also improves duration of mechanical ventilation and return to functional independence at hospital discharge.

Summary
Timely and early physiotherapy in the perioperative period improves surgical recovery and reduces postoperative complications.

Keywords
early ambulation, early mobilization, fast-track surgery

INTRODUCTION

Traditionally bed rest had been prescribed in the convalescence from surgery as well as medical illness. However by the mid 20th century, there was growing recognition of the deleterious effects of immobilization that are 'potentiat[ed] by anesthesia, narcotics, or the original illness' [1]. Initial reports of the benefits and safety of early postoperative ambulation began the paradigm shift toward 'prompt restoration of surgical patients to normal life' [2] as an essential feature of postoperative recovery. Recently, a systematic review of 39 trials of bed rest in a variety of conditions demonstrated no therapeutic benefit and instead suggested potential harm [3]. The consequences of immobilization include increased risk of thromboembolism, pulmonary complications, orthostatic intolerance [4], ileus, and muscle atrophy/weakness. Further, ICU acquired neuromuscular weakness can have residual effects even years after survival from critical illness [5].

Perioperative physiotherapy has emerged as an important intervention in preventing these complications. Prior retrospective studies have suggested that early physical therapy was protective against postoperative complications [6] and associated with improved outcomes in patients with acute respiratory failure [7]. Recent prospective studies have similarly suggested the benefits of mobilization in the preoperative care, with use of multidisciplinary fast-track surgery programs, and in the management of critically ill patients (Table 1). This review will summarize the role of perioperative physical therapy in improving patient outcomes in each of these contexts.

PREOPERATIVE PHYSIOTHERAPY

Pre-existing physical deconditioning can adversely affect surgical outcomes [26]. As such, preoperative rehabilitation has become an attractive option to potentially improve postoperative recovery, although definitive data supporting this notion are somewhat elusive. Herdy *et al.* [8] performed a

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Curr Opin Anesthesiol 2013, 26:152–156

DOI:10.1097/ACO.0b013e32835e8b34

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KEY POINTS

- Immobilization in the perioperative period is associated with poor outcomes.
- Timely mobilization early in the postoperative period is key to improving patient recovery.
- Incorporation of early ambulation in fast-track surgery programs has improved postoperative outcomes including shortened hospital stay, less pulmonary complications, and shorter time to analgesic-free states.
- Early physical and occupational therapy is well tolerated and feasible in mechanically ventilated patients and improves return to functional independence at hospital discharge.

randomized controlled trial of hospitalized patients awaiting coronary bypass graft surgery (CABG) to receive standard care or preoperative cardiopulmonary rehabilitation for at least 5 days prior to surgery. Patients who received physical therapy had shortened time to extubation, less postoperative pulmonary complications, and shorter hospital length of stay. The role of pulmonary rehabilitation in the preoperative period for patients undergoing lobectomy may improve physiologic parameters and exercise capacity, but its effect on postoperative pulmonary complications remains uncertain [9]. The disparate outcomes in the CABG versus lobectomy patient populations may be more related to the prevention of the complications of in-hospital immobilization rather than benefits of preoperative physical therapy, given that these populations differ significantly in their ability to continue with mobilization strategies in the postoperative period.

Mitigating the effects of preoperative immobilization with physical therapy in extremes of illness has been described in pediatric patients awaiting

Table 1. Effects of perioperative physical therapy

Preoperative physiotherapy	
Cardiopulmonary rehabilitation prior to coronary bypass graft surgery [8]	Less ventilator days; Less PPC; Shorter hospital length of stay
Pulmonary rehabilitation prior to lobectomy [9]	Improved exercise capacity; No difference in PPC
Fast-track surgery programs	
Colorectal surgery	Reduced need for ICU admission [10]
Gastric surgery [12,13]	Faster recovery of gastrointestinal function [10]
	Less postoperative pulmonary complications [10]
Pancreatic surgery	Reduced hospital length of stay [10,11]
	Faster recovery of gastrointestinal function
Hepatic surgery [16,17]	Reduced hospital length of stay
	Trend for less postsurgical complications
	Less postsurgical complications [14]
	Reduced hospital length of stay [14,15]
	Reduced hospital costs [15]
	Reduced hospital length of stay
Abdominal aortic surgery	Reduced time to extubation [18]
	Reduced hospital length of stay [18–20]
Esophageal surgery	Earlier extubation and discharge from ICU [21]
Total knee arthroplasty [22]	Reduced need for analgesic drugs
	Reduced hospital length of stay
Mechanically ventilated patients	
Critically ill medicine patients [23]	Improved return to functional independence at hospital discharge; shorter duration of delirium; reduced duration of mechanical ventilation
Surgical ICU patients	
Bedside bicycle ergometer [24]	Improved walk distance, quadriceps strength; trend toward discharge to home
Stepwise mobilization to ambulation[25▪▪]	Feasible and safe in surgical ICU patients; more effective if implemented by physical/occupational therapists

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lung transplant on extracorporeal membrane oxygenation (ECMO). In a small case series of three patients Turner *et al.* [27▪] demonstrated the feasibility of preoperative physiotherapy while on ECMO and a reduction of post-transplant hospital length of stay by about 50 days. Further study of the role of preoperative physiotherapy in pretransplant patients is warranted.

FAST-TRACK PROGRAMS

The essence of surgical fast-track programs is the employment of evidence-based practice to enhance postoperative recovery and reduce morbidity. This multimodal approach incorporates surgeons, anesthesiologists, physical therapists and nursing into the care team [28]. Fast-track programs employ preoperative assessment and education, evidence-based practice in anesthesia, minimally invasive procedures, analgesia, early feeding and ambulation to enhance and accelerate postoperative recovery. Early physiotherapy has not been standardized among all programs but generally involves early extubation, sitting in a chair for more than 1 h on the postoperative day, and ambulation by post-operative day one.

The evidence supporting the success of fast-track programs is robust in the colorectal surgical literature [29,30]. Benefits of this multimodal approach include reduced need for ICU stay, faster recovery of normal gastrointestinal function, reduction of postoperative pulmonary complications and shortened hospital stay [10]. A recent meta-analysis of four randomized controlled trials and seven case-controlled studies comparing fast-track surgery to standard care demonstrated a reduced hospital stay by 2.35 days and less morbidity without increase in readmission rates or mortality [11]. Further, Lee *et al.* [31] investigated the contribution of early feeding and mobilization to the benefits of fast-track surgical programs in a randomized control trial. Patients who received early ambulation and feeding had shorter times to recovery, more analgesic-free states, and had a trend toward shorter hospital stay when compared with the patients with late nutrition and bed rest. Fast-track programs with intensive mobilization have been implemented in other surgical procedures including gastric [12,13], pancreatic [14,15,32], hepatic [16,17], abdominal aortic [18–20], esophageal [21,33,34], and total knee replacement surgery [22] with similar enhancement of postoperative outcomes.

The timeliness of mobilization appears important in achieving these beneficial effects on recovery. A case–control study compared 36 patients who underwent lobectomy by axillolateral thoracotomy approach with ambulation at 4 h after surgery versus controls who ambulated on postoperative day one. Patients with late ambulation were twice more likely to require oxygen for more than 2 days. Also, no patients in the early ambulation group had P/F (partial pressure of oxygen/fraction of inspired oxygen) ratios of less than 300 on postoperative day 3, whereas control patients did [35▪].

There often are barriers to immediate mobilization in the postoperative period. Concerns over adequate analgesia for postoperative pain especially may thwart early ambulation. However, narcotics may also impede immediate ambulation by causing orthostatic instability. In fact, one retrospective study of patients undergoing laparoscopic gynecologic surgery, described that delayed ambulation [adjusted odds ratio (95% confidence interval), 8.37 (1.23–72.15)] and orthostatic intolerance [adjusted odds ratio (95% confidence interval), 34.78 (11.12–131.72)] was strongly associated with continuous fentanyl infusion [36]. Therefore, a careful balance of adequate analgesia without the associated side-effects is necessary for patients to benefit from enhanced recovery seen with early physiotherapy implemented within fast-track surgery programs. One attractive possibility is to extend the use of postoperative regional anesthetic techniques whenever possible to avoid the undesirable systemic effects of opioids.

EARLY MOBILIZATION OF MECHANICALLY VENTILATED CRITICALLY ILL PATIENTS

In fast-track surgery programs, timely extubation is considered the rate-limiting step for initiation of early mobility. However, this rationale is being questioned by the growing recognition of ICU-acquired weakness, characterized by symmetric limb and axial muscle weakness that afflicts many patients surviving critical illness [37]. A quarter of patients mechanically ventilated for at least 7 days suffer ICU-acquired weakness [38], but the incidence can reach nearly 100% in patients with sepsis and multiorgan failure [39]. Time on mechanical ventilation is a critical factor as diaphragm muscle atrophy can be seen as early as 18 h after the institution of mechanical ventilation in patients who are passive on the ventilator [40]. Once established, this weakness may persist years after recovery from the original process precipitating critical illness and ICU admission. Accordingly, this process appears to be common, to develop early in the course for many patients, and to confound their recovery for a protracted period of time.

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Early mobilization of intubated mechanically ventilated patients has been recently demonstrated as well tolerated, feasible, and beneficial for patients and can prevent or ameliorate ICU-acquired weakness in many patients [23,24,25▪▪,41,42]. Bailey *et al.* [41] were the first to describe early mobilization of mechanically ventilated patients who required more than 4 days of mechanical ventilation. Physical therapy was started after physiologic stabilization and almost 70% of patients were able to walk 100 ft by ICU discharge. The main criticisms of this prospective cohort study were that patients were less ill at the time of mobilization and that physiotherapy typically occurred after more than 10 days of admission to the ICU. Schweickert *et al.* [23] published a prospective randomized controlled trial of very early mobility in patients intubated for less than 72 h. Therapy began on average within 36 h of intubation with 89% of sessions occurring during acute lung injury, delirium, renal replacement therapy or vasoactive administration [43]. Patients who underwent early mobilization had more ventilator free days, more delirium free days, and were functionally independent to a greater degree on hospital discharge.

The studies cited above had a predominance of patients admitted to the ICU with medical disorders. Implementation of early mobilization in the surgical ICU may be hindered by unique considerations, such as wound healing, postoperative pain, weight-bearing limitations, and surgical drains [44]. However, there are limited data on the safety and feasibility of early mobilization in the surgical population. Burtin *et al.* [24] performed a randomized controlled trial of early exercise using a bedside bicycle ergometer in patients with expected prolonged stays in the medical and surgical ICUs. A majority of the patients were surgical patients with 84% being intubated during physical therapy. Intervention patients had a higher 6 min walk distance, improved quadriceps strength, and a trend to hospital discharge to home. Garzon-Serrano *et al.* [25▪▪] performed a prospective observational study on the implementation of physical therapy in a surgical ICU. Patients underwent stepwise mobilization with a passive range of motion in bed, followed by sitting on the edge of the bed, transferring to a chair, standing, and ambulating. Interestingly, physical therapists mobilized patients to higher levels than nurses. This highlights the need for a multidisciplinary team of physical/occupational therapists, nursing, respiratory staff, and physicians to champion early mobilization.

CONCLUSION

Bed rest in the postoperative period can be detrimental to patient recovery. Preoperative physiotherapy in some cases can prime patients for enhanced recovery in the postoperative period. Fast-track surgery methodology that incorporates intensive mobilization has been shown to improve outcomes. Timeliness of mobilization occurring immediately after surgery or early after institution of mechanical ventilation in cases of respiratory failure can be beneficial in preventing weakness and returning patients to functional independence at time of discharge.

Acknowledgements

None.

Conflicts of interest

There are no conflicts of interest.

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Papers of particular interest, published within the annual period of review, have been highlighted as:

- ▪ of special interest
- ▪▪ of outstanding interest

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