5-2016

# Walking to Recovery - The Effects of Postsurgical Ambulation on Patient Recovery Times

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Chancellor’s Honors Program Undergraduate Thesis

UNHO 498

29 April 2016

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<u>Introduction</u>

Value is defined in the hospital setting by better outcomes at a reduced cost. Efforts to reduce inpatient care costs ultimately reduce costs on insurance companies and, ultimately, on the patients themselves. Additionally, few (if any) patients wish to elongate their stay in a hospital by any length of time. Across the country, hospitals are trying to develop new methods of postsurgical treatment to expedite the recovery process and save costs.

An interview was conducted with Dr. James McLoughlin, a surgical oncologist at the University of Tennessee Medical Center, to elucidate the principles of surgical preparation. In the past, patients admitted to the hospital underwent abdominal surgery and remained as inpatients for extended periods of time, often exceeding 7-10 days (McLoughlin). Patients traditionally did not have a defined pre- and postoperative diet and recovery plan. Healthcare providers rarely emphasized ambulation in patients who underwent abdominal surgeries, and patients often were not ambulated following abdominal surgery until their first bowel movement – a policy that could leave a recovering patient bedridden for three to four days following surgery (McLoughlin). Other practices included preoperative fasting 12-24 hours prior to surgery and routine mechanical bowel preparation (Melnyk et al, 2011). Evidence suggests these practices extended patient length of stay (LOS) but were considered necessary measures for patients undergoing abdominal surgery (McLoughlin).

However, as healthcare costs increased and reimbursement became more fixed for each episode of care, healthcare professionals came under increasing pressure to discharge patients more rapidly from hospitals (McLoughlin). The creation of Medicare's 1983 Prospective Payment System (PPS) established the current hospital healthcare model. Hospitals receive federal reimbursements based on a "paid fixed sum per case" which is outlined and updated annually in federal diagnosis related groups (Gottlober, 2001). For example, a hospital will receive a set reimbursement for a specific abdominal surgery on a patient. The amount the government dispenses should cover the surgical operation and the operating expenses of the facility (Gottlober, 2001). However, the reimbursement amount does not cover patient complications or extended LOS, which must be paid by the patient or taken on by the hospital (McLoughlin). With these new regulations in place, clinician goals are now to help patients recover efficiently to avoid the loss of allocated federal reimbursement funding.

A relatively new initiative is enhanced recovery after surgery (ERAS). This strategy was pioneered in the 1990s and first found prominence in Europe until now gaining popularity in the American healthcare system (Melnyk et al, 2011) ERAS may be defined as a "fast-track" approach for perioperative management. Through new philosophies in preoperative preparation, postoperative nutrition, and patient mobilization, studies have found that patient LOS can be satisfactorily reduced to benefit all groups in the healthcare process. Hospitals save money by reducing patient LOS and complications, and patients benefit by regaining function and being discharged more quickly.

Two separate studies have tested the efficacy of ERAS techniques on patients. One study was performed at Vanderbilt University Medical Center in which patient outcomes on two colorectal and urologic postsurgical floors were compared (Kibler et al, 2012). One floor engaged in patient ambulation and one control floor did not engage in patient ambulation. The study analyzed more than 3,000 patients. The results supported ERAS protocols. The floor that regularly ambulated patients after surgery noted a 37% decrease in paralytic ileus – a complication in which the colon cannot advance its contents following surgery – compared to control groups. Decreasing rates of paralytic ileus by 37% alone were calculated to represent a "potential annual cost savings of $830,000" (Kibler et al, 2012). This study shows ambulation benefits patients by reducing their risk of postsurgical complications.

Another study was conducted on patients undergoing laparoscopic radical gastrectomy for stomach carcinomas (Abdikarim et al, 2015). Thirty patients were included in the ERAS group and 31 were in the control group. The study reported roughly one less day spent in the hospital for postoperative recovery for the ERAS group ($6.8 \pm 1.1$ days for ERAS versus $7.7 \pm 1.1$ day for conventional group). The study reported no significant difference in postoperative complications between the ERAS and control group (Abdikarim et al, 2015). This study highlights the benefits of ambulation on reducing time spent in the hospital.

At the University of Tennessee Medical Center, a dedicated ambulation team performs daily rounds to encourage patients to ambulate. The purpose of this study was to analyze the efficacy of ambulation technicians on patient LOS. This was accomplished by testing variables such as missed daily ambulation by hospital personnel and patient refusals to ambulation. The goal was to determine the effectiveness of current ERAS protocols at the University of Tennessee Medical Center.

## Methods

This was a pilot study containing 132 patients. The original 132 patients were later narrowed to 69 that received strictly an abdominal surgery. The original 132 patients included some patients whose ambulation would not be considered under "ERAS" protocols because they received non-abdominal surgeries. These non-abdominal surgeries included thoracic and oral surgeries. Analyses were initially run on the full 132 patient group, but further refinement led to analyses on the narrowed 69 abdominal surgery patient cohort for comparison. Thus, two data sets were produced – the 132 patient cohort in Figures 1 & 2 and the 69 patient abdominal surgery cohort in Figures 3 & 4.

Between the dates 1 January 2014, and 30 June 2014, ambulation technicians at UTMCK recorded ambulation with patients. From the combined ambulation technician data, patient names were selected beginning in January and February. Using the hospital's online PowerChart software, detailed patient medical information was gathered from available hospital documents.

The ambulation data was then tallied and recorded. The optimum daily ambulation was three times per day. The three possible tallying scores were an ambulation, a refusal, and a missed opportunity. If a patient was recorded to have ambulated three times in one day, the patient would be tallied to have ambulated three times that day with no refusals or missed opportunities. A refusal was any time an ambulation technician offered to help the patient to ambulate, but the patient refused. Missed opportunities were tallied under three conditions: the patient was absent from his or her room when the ambulation technician arrived, less than three ambulation attempts were recorded for a day, or the patient's ambulation data was not recorded for a day.

Patient data and ambulation data were compiled into Microsoft Excel and analyzed by a biostatistician. The data was divided into discrete and continuous variables. The discrete data was compiled as responses of "yes" or "no" to a set of questions based upon the ambulation technician data. The continuous variables were compiled from the ambulation technician data. All continuous variables consisted of raw data except for the ambulation completion ratio and the percentage of ambulation attempts completed. These were calculated from a ratio of completed ambulation attempts to total ambulation attempts.

Skewness and kurtosis statistics were run on all continuous variables to assess the assumption of normality. Any skewness or kurtosis statistic above an absolute value of 2.0 was assumed non-normal. Levene's Test of Equality of Variances was used to test the assumption of homogeneity of variance. In the event that a statistical assumption of a parametric between-subjects comparison occurred, a non-parametric Mann-Whitney U test was utilized. Spearman's rho correlations were used to establish associations with ambulation. All analyses were conducted using SPSS Version 22 (Armonk, NY: IBM Corp.) and statistical significance was assumed at a Bonferroni corrected alpha value to adjust for multiple comparisons, when appropriate.

## Results

The following are the results from the analyses of the discrete data responses. From the total 132 patient ambulation data, the following questions were answered either as a "no" or a "yes." The results are tabulated as median length of stay (LOS) in hours according to the groups who answered no and yes to each question. Beneath the median LOS in hours are the interquartile ranges.

Figure 1: Between-subject comparisons for 132 patient cohort

| | Median LOS (hours) | | |
|---|---|---|---|
| Discrete variables | No | Yes | p-value |

| | | | |
|---|---|---|---|
| 1. Did the patient ambulate in the hospital? | 36.5 (180) | 101 (169) | .04 |
| 2. Did the patient ambulate with ambulation technician? | 43 (159) | 102 (169) | .04 |
| 3. Did the patient miss a day of ambulation? | 57 (49) | 120 (235) | <.001 |
| 4. Did the patient refuse at least one ambulation attempt? | 41.5 (41) | 151 (222) | <.001 |
| 5. Does the patient have a smoking history? | 84 (154) | 130 (226) | .01 |

The continuous variables listed below were compared against LOS in hours to calculate the correlation coefficients in a regression model. These variables were continuous because they accounted for a range of different sum totals calculated from the ambulation technician data.

Figure 2: Correlations for 132 patient cohort

| Continuous variables | Correlation coefficient (r) | p-value |
|---|---|---|
| 1. Total times ambulated | .451 | <.001 |
| 2. Total ambulation distance (feet) | .335 | <.001 |
| 3. Total refusals | .765 | <.001 |
| 4. Total ambulation visits missed | .846 | <.001 |
| 5. Total possible ambulation attempts | .950 | <.001 |
| 6. Ambulation completion ratio | -.240 | .006 |
| 7. Percentage of ambulation attempts completed | -.240 | .006 |
| 8. Smoking - packs per day | .242 | .005 |
| 9. Smoking - history in years | .188 | .031 |

After running calculations on data for the 132 total patients, the study was narrowed to patients who only underwent abdominal surgeries. Sixty-nine of the original 132 patients (roughly 52%) underwent abdominal surgeries. Only two tests were run in order to compare the most significant variables.

Figure 3: Between-subject comparisons of 69 abdominal surgery patient cohort

| | Median LOS (hours) | | |
|---|---|---|---|
| Discrete variables | No | Yes | p-value |
| 1. Did the patient miss a day of ambulation? | 59 (50) | 104 (179) | .008 |
| 2. Did the patient refuse at least one ambulation attempt? | 37 (27) | 115 (167) | <.001 |

Continuous variables for the 69 abdominal patients of the original 132 were plotted as a regression against length of stay (LOS), as in Figure 2.

Figure 4: Correlations for 69 abdominal surgery patients cohort

| Continuous variables | Correlation coefficient (r) | p-value |
|---|---|---|
| 1. Total refusals | .585 | <.001 |
| 2. Ambulation completion ratio | -.350 | .003 |
| 3. Percentage of ambulation attempts completed | -.350 | .003 |

Analysis

Discrete variables – Figures 1 and 3

In Figure 1, three of the five discrete variables were found to have both statistical and clinical significance: days of missed ambulation, ambulation refusal, and smoking history. Beginning with days of missed ambulation, the results showed that patients who missed at least one full day of ambulation during their hospital stay increased their median LOS from almost 57 hours (2.5 days) to a median of 120 hours (5 days), $p<0.001$. These findings show that a lack of ambulation could potentially double a patient's time in the hospital. Of the 132 total patients, 32 (roughly 24%) did not ambulate at all during their hospital stay.

Results for another patient group proved interesting. Patients who refused at least one ambulation attempt from the ambulation technician increased their median LOS from 1.7 days to 6.3 days ($p<0.001$). Eighty-eight of the 132 (or roughly 67%) refused at least one ambulation.

The presence of smoking history was the final discrete variable with statistical and clinical significance. Patients with a smoking history increased their LOS from a median 3.5 days to a median 5.4 days. Forty-seven of the 132 patients (or roughly 36%) reported a history of smoking.

In Figure 3, two statistical tests were run again on the 69 patient who underwent an abdominal surgery from the original 132. These tests addressed the most significant findings from the original data set. Between the two data sets, the findings were consistent. Median LOS went from 57 to 120 hours (2.4 to 5 days) in Figure 1 for missing a day of ambulation. In Figure 3, the abdominal surgery patients' LOS went from 59 to 104 hours (2.5 to 4.3 days) for missing a day of ambulation. Similarly, in Figure 1 patients that refused at least one ambulation increased their LOS from 41.5 to 151 hours (1.8 to 6.3 days). The abdominal surgery patient results in Figure 3 showed LOS increased from 37 to 115 hours (1.5 to 4.8 days).

The remaining two discrete variables in Figure 1 were found to be nonsignificant. For patients who ambulated in the hospital and ambulated with ambulation technicians, the median LOS increased dramatically from roughly 1.6 days to about 4.2 days. However, this was due to numerous other reasons. Only 16 patients in the 132 sampled (or roughly 12%) did not ambulate. Thus, this group was very small and not well represented in the total sample size. Of those 16 patients who did not ambulate, eight (50%) received relatively routine operations and were discharged from the hospital in thirty hours or less. Many of these patients were not in the hospital long enough to see an ambulation technician. A sample size greater than 132 for this pilot study would be needed to remedy these errors.

## Continuous variables – Figures 2 and 4

In Figure 2, five of the nine continuous variables were found to be clinically significant. There was a significant correlation with the total number of refusals and LOS (r=0.765). Additionally, the ambulation completion ratio and the percentage of ambulation attempts completed showed significance. The correlation coefficient of both of these variables was -.240 which shows that as patients completed a greater number of the total possible ambulation attempts, their LOS decreased in the hospital. Therefore, as a patient completed a fewer percentage of their ambulation attempts, their LOS increased. These findings demonstrate clinical significance because it shows that patients who fail to ambulate in the hospital increase their postoperative LOS.

The smoking history variables demonstrate a positive correlation with LOS. As pack per day smoking history increased, patient LOS increased. Likewise, as a patient's smoking history in years increased, their LOS increased. This supports research indicating smoking causes permanent deficits in tissue healing and overall recovery.

The results in Figure 4 mirror those of Figure 2. The correlation coefficient of ambulation refusals for the abdominal patient group was .585, a similar value to Figure 2's r=.765. Additionally, the ambulation completion ratio in Figure 4 had a negative r value. In Figure 4 r= -.350 which demonstrated that as the number of completed ambulation attempts increased, the LOS decreased. This value is very similar to r= -.240 in Figure 2.

Four of the nine continuous variables in Figure 2 were found to be nonsignificant. The correlation coefficients of the four following variables were positive, thus showing a positive correlation between the variables and LOS: total number of times ambulated, total ambulation distance, total ambulation visits missed, and total possible ambulation attempts. Naturally, as a patient's time in the hospital increased, the number of ambulation attempts with an ambulation technician, completed ambulation attempts, and total ambulation distance would all increase. These positive correlations are due to the fact that as a patient stays in the hospital longer, this would give ambulation technicians more opportunities to ambulate the patient. Additionally, a greater LOS in the hospital would inevitably include more ambulation visits missed due to patients being absent from their room when ambulation technicians arrived due to tests or other ancillary complications.

Discussion

Figure 5: comparison between the 132 patient cohort and the 69 patient abdominal surgery cohort findings

| | Median LOS (hours) | | | |
|---|---|---|---|---|
| | 132 patient cohort | | 69 patient abdominal cohort | |
| Discrete variable response | No | Yes | No | Yes |
| Did the patient miss a day of ambulation? | 57 (49) | 120 (235) | 59 (50) | 104 (179) |
| Did the patient refuse at least one ambulation attempt? | 41.5 (41) | 151 (222) | 37 (27) | 115 (167) |

The results of the statistical calculations found that a failure to ambulate patients in the hospital increases LOS. The data from the discrete variables showed a significant increase in LOS among patients who missed at least one full day of ambulation and who refused to ambulate at least one time. For the 69 patient abdominal cohort, patients that missed a day of ambulation increased their hospital LOS from 59 hours to 104 hours (2.5 to 4.3 days). The data from the continuous variables similarly found a positive correlation between total number of refusals and patient LOS. For the 69 patient abdominal cohort, a positive correlation was found between the total number of ambulation refusals and LOS ($r=.585$). Additionally, there was a significant negative correlation between the ambulation completion ratio and LOS ($r= -.350$). All of the above findings had statistical significance of $p < 0.05$. These findings support the ERAS principle that immediate and uninterrupted postsurgical ambulation expedites patient recovery following abdominal surgeries.

Some patients may not have the ability to ambulate following surgery due to the severity of the surgery or due to preexisting conditions. However, patients undergoing abdominal surgeries should be encouraged to ambulate. Rarely at UTMCK do nurses or doctors have the time to ambulate patients, especially not three times per day. It is for this reason that ambulation technicians are a worthwhile investment for the hospital.

From a financial standpoint for the hospital, reduced postsurgical complications and decreased LOS reduce the cost of housing inpatients for extra days. The most recent data released by UTMCK shows that it costs between $1,500 and $2,500 for an inpatient to stay an additional day in the hospital (McLoughlin). Because hospitals receive only set federal reimbursements for a procedure, additional patient care costs incurred due to complications or extended LOS come directly out of the hospital's budget. Figure 6 compares the costs incurred by a single patient-day in the hospital with the cost of investing in an ambulation technician.

Figure 6: cost analysis of additional patient LOS vs. ambulation technician investment

| | Per day | Per month | Per year |
|---|---|---|---|
| Additional patient LOS cost | $1,500 | $45,000 | $540,000 |
| Ambulation technician salary | $100 | $2,916 | $35,000 |

It is evident from Figure 6 that a significant financial benefit can be gained by increasing patient ambulation in order to help patients recover faster and to save tremendous amount of money for a healthcare facility. Given that an ambulation technician helps in the ambulation of multiple patients per day, the savings would be tremendous. UTMCK utilizes three abdominal medical-surgical floors. Thus, the investment in additional ambulation technicians would significantly improve postsurgical recovery times.

In order for hospitals to maximize their value, patient must be discharged following surgeries at an efficient rate. Hospital can utilize the ERAS protocol of rapid ambulation after surgery through the use of ambulation technicians to improve patient postsurgical recovery times. These findings support assertions that rapid postsurgical ambulation and ambulation technicians are beneficial for both patients and hospitals in the current healthcare setting.

## Further Investigations

The research for this project will be continued and expanded. An anticipated abdominal surgery patient cohort numbering greater than 200 patients is expected. Further research will attempt to elucidate the relationship between patient ambulation and recovery time in the hospital.

## Acknowledgements

I would like to thank Dr. James McLoughlin for his continued guidance throughout this project and for his refinement of the patient groups. Also, I would like to thank Dr. Eric Heidel for his help in the statistical calculations and their interpretation. Additionally, I would like to thank the University of Tennessee Medical Center and its Cancer Institute for allowing me to conduct research on its campus. And finally, I wish to thank the ambulation technicians at UTMCK whose data recorded over many months made this study possible.

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