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Predicting non-home discharge in epithelial ovarian cancer patients: External validation of a predictive model☆

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HIGHLIGHTS

- Approximately 12% of women are not discharged home after CRS.
- Non-home discharge after CRS for EOC can be accurately predicted.
- Inclusion of preoperative variables allows for patient counseling and planning.
- Use of this tool may streamline discharge planning and decrease length of stay.

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ABSTRACT

Objective. To externally validate a model predicting non-home discharge in women undergoing primary cytoreductive surgery (CRS) for epithelial ovarian cancer (EOC).

Methods. Women undergoing primary CRS via laparotomy for EOC at three tertiary medical centers in an academic health system from January 2010 to December 2015 were included. Patients were excluded if they received neoadjuvant chemotherapy, had a non-epithelial malignancy, were not undergoing primary cytoreduction, or lacked documented model components. Non-home discharge included skilled nursing facility, acute rehabilitation facility, hospice, or inpatient death. The predicted probability of non-home discharge was calculated using age, pre-operative CA-125, American Society of Anesthesiologists (ASA) score and Eastern Cooperative Oncology Group (ECOG) performance status as described in the previously published predictive model. Model discrimination was calculated using a concordance index and calibration curves were plotted to characterize model performance across the cohort.

Results. A total of 204 admissions met inclusion criteria. The overall rate of non-home discharge was 12% (95% CI 8–18%). Mean age was 60.8 years (SD 11.0). Median length of stay (LOS) was significantly longer for patients with non-home discharge (8 vs. 5 days, $P < 0.001$). The predictive model had a concordance index of 0.86 (95% CI 0.76–0.93), which was similar to model performance in the original study (CI 0.88). The model provided accurate predictions across all probabilities (0 to 100%).

Conclusions. Non-home discharge can be accurately predicted using preoperative clinical variables. Use of this validated non-home discharge predictive model may facilitate preoperative patient counseling, early discharge planning, and potentially decrease cost of care.

1. Introduction

Epithelial ovarian cancer (EOC) is diagnosed in over 22,000 women each year in the United States and causes over 15,000 deaths, making it the 5th leading cause of cancer-related deaths among U. S. women [1]. Surgery is the primary treatment approach in most patients for the purposes of diagnosis and staging, symptom relief, as well as cytoreduction to improve survival [2]. Half of patients diagnosed with ovarian cancer are >65 years old and older age has been associated with increased perioperative morbidity and decreased overall survival [2–4]. Nonetheless, many women in this age group are able to tolerate aggressive primary cytoreductive surgery (CRS) and experience overall survival benefit similar to younger patients [4]. Taken together, the advanced age and surgical complexity of ovarian cancer patients means that many

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postoperative patients will need assistance at home or in a specialized rehabilitation facility.

Recent economic pressures have promoted a focus on value-based care, which minimizes healthcare cost while maximizing patient benefit. In a recent Surveillance, Epidemiology, and End Results (SEER) database analysis that included 2902 women undergoing surgery and adjuvant chemotherapy for EOC, costs of treatment in the first year after diagnosis averaged $83,915 [5]. More than half (51%) of that cost was attributed to surgery and inpatient stay. After adjusting for year of treatment and geography, mean inpatient costs per patient were $24,653 with a striking standard deviation of $34,463. This high variability in cost implies that modification and improvement are possible. Ovarian cancer patients often pose medical and surgical challenges including postoperative complications, and disease-related morbidity. These patients often require individualized discharge planning, which can further prolong postoperative length of stay (LOS). Prediction models have been previously developed for patients undergoing cardiac, orthopedic, pancreatic, and colorectal surgery [6–9]. Importantly, prediction of non-home discharge may be associated with reduction in postoperative LOS and thus perioperative cost [7].

A nomogram was previously developed by AlHilli et al. for the prediction of non-home discharge in women undergoing primary surgical management of EOC (Fig. 1) [10]. This instrument is based on preoperative age, performance status, anesthesia risk score, and CA-125 level. However, this nomogram has yet to be externally validated. The objective of this study was to assess the external validity of the previously developed non-home discharge nomogram.

2. Methods

After obtaining approval from the Institutional Review Board, retrospective chart review was performed to identify women undergoing primary CRS via laparotomy for EOC at three tertiary care hospitals within an academic health system from January 1, 2010 to December 31, 2015. Patients were excluded if they received neoadjuvant chemotherapy, had a nonepithelial malignancy or had prior surgery for EOC. Data including postoperative LOS, patient age at time of surgery, preoperative CA-125, Eastern Cooperative Oncology Group (ECOG) performance status, and American Society of Anesthesiologists (ASA) score assigned by anesthesia at time of surgery, and ultimate disposition were extracted from the electronic medical record [11,12]. If multiple preoperative CA-125 values were identified, the value closest to the surgery date was used. We preferentially included ECOG performance status documented at the time of the preoperative visit. In the event that preoperative ECOG performance status was not documented, we used ECOG status from a follow-up visit at least 1 month after surgery. ASA score was identified in the anesthesia perioperative care records. If an individual lacked any of the necessary nomogram variables they were excluded from analysis. Disposition was categorized as: 1) Home without home health care, 2) home with home health care services, 3) skilled nursing facility (SNF) or acute rehabilitation facility, 4) hospice, or 5) in-hospital death. Non-home discharge was defined as any discharge outside of the home and included discharge to SNF, hospice, or inpatient death.

Data was collected and stored using REDCap™, a secure online database, to protect patient confidentiality [13]. Patients were divided into those with and without the outcome and data were summarized using descriptive statistics. Age was compared using Student's *t*-test and all other predictors were compared using the Wilcoxon rank-sum test. Model accuracy was measured by ranking an individual's risk among all subjects in the cohort using the concordance index. Confidence intervals for the concordance index were generated using 1000 bootstrapped samples with replacement. The concordance index, or C-statistic, is a measure of goodness of fit and describes the probability that a patient who experiences non-home discharge would have a higher risk score than a patient who is discharged home. Calibration

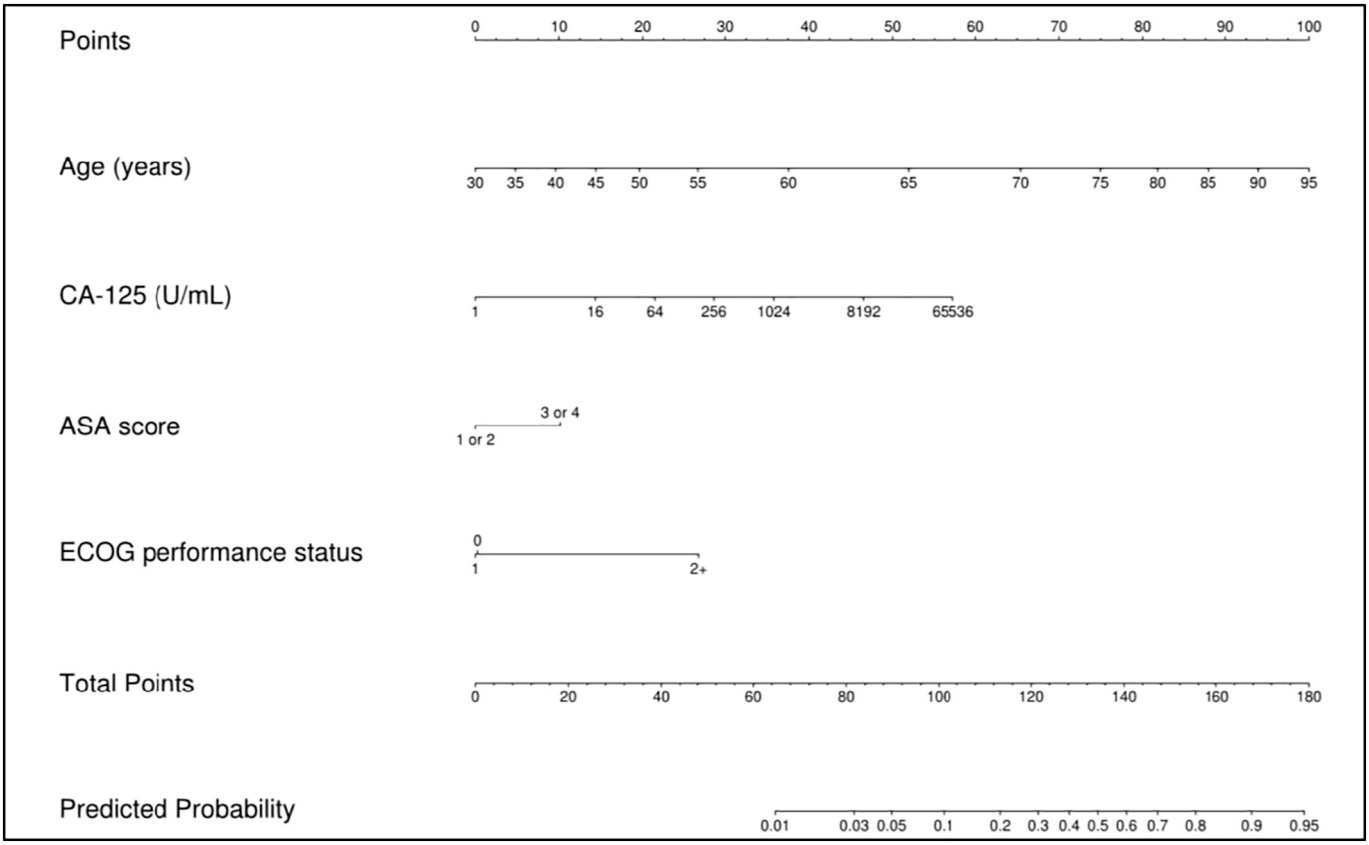

Fig. 1. Nomogram for the prediction of non-home discharge.

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