Evaluating the Predictive Value of the RAPT Score in Trauma Patients Following Arthroplasty: Preliminary Findings

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INTRODUCTION: Femoral neck fractures are one of the most common fractures presenting to the emergency department, associated with high mortality rates and significant long-term functional decline.[1] The Risk Assessment and Prediction Tool (RAPT) is a six-item validated instrument designed to predict discharge disposition (inpatient rehabilitation versus home discharge) after elective total hip arthroplasty.[2] RAPT scores are based on age, gender, preoperative walking distance, gait aid, community support, and anticipated caregiver following surgery, with scores <6 categorized as high-risk and generally indicate admission to rehabilitation. While studied in various elective surgeries, its predictive value has not been utilized in the trauma population, who present with diverse preoperative functional statuses, significant changes in these statuses, and varying social support systems.[3] Understanding the RAPT score's utility in this context may facilitate discharge planning and resource allocation. This study assessed the predictive performance of the RAPT score in conjunction with patient comorbidity in determining discharge disposition among patients undergoing hip arthroplasty for traumatic hip fractures.

METHODS: Institutional review board approval was attained. All patients with femoral neck fractures undergoing arthroplasty using a longitudinally maintained multi-center orthopedic institution database from January 1, 2016 to December 31, 2023 were included in this retrospective analysis. RAPT scores were calculated; discharge destination, frailty index, comorbidities, and demographic characteristics were collected. Predictive accuracy of the RAPT score was evaluated using Receiver Operating Characteristic (ROC) curve and area under the curve (AUC) calculations. ROC analyses were used to identify a score threshold to discriminate between home-bound vs. rehabilitation-bound patients. Logistic regression was used with level of significance of $p<0.05$.

RESULTS: A total of 1142 patients who underwent hip arthroplasty were queried from the database. See Figure 1. 697 patients with complete data (including Frailty Index) were included with a mean age of 84.7 ± 7.8 years, 64% women. Of the 697, 99 (8.7%) were discharged home; 598 (52.4%) went to a rehabilitation facility/SNF. The mean RAPT score for home-discharge was 5.6 ± 1.8, compared to 3.8 ± 1.9 for rehabilitation-discharge ($p < 0.05$). The Frailty Index was lower in the home discharge group (0.2 ± 0.2) than the rehab group (0.3 ± 0.2, $p < 0.05$). Patients discharged to home were younger (79.9 ± 7.9 vs 84.7 ± 7.8 years, $p < 0.001$), less frail, with more reported supports at home. The area under the ROC curve (AUC) for predicting discharge home was 0.76 for RAPT. Combining RAPT with the Frailty Index improved discrimination with an AUC of 0.83. When analyzing the ROC, a score of 5 was the most sensitive and specific cutoff to discriminate between home-bound and rehabilitation/SNF-bound patients.

DISCUSSION: The RAPT score alone demonstrated *moderate* predictive power for discharge planning among trauma patients undergoing hip arthroplasty (AUC=0.76). The addition of a Frailty Index, which measures the accumulation of health deficits including comorbidities, ADLs, cognitive status, social vulnerability, and nutritional status, significantly improved predictive accuracy (AUC=0.83, excellent discrimination). This likely reflects how RAPT captures social factors and aspects of pre-injury function such as existing home supports, pre-injury mobility, and post-operative caregiver figures, while the Frailty Index provides insight into other important aspects of baseline physiological and social vulnerability. Notably, the most sensitive and specific cutoff score for disposition discrimination was 5. This is lower than the cutoff score of 8 in the literature for patients undergoing elective hip arthroplasty, suggesting that perhaps trauma patients may be considered for home discharge despite being higher risk.[3] These differences may be explained by population differences: trauma patients may have more comorbidities, and often already have pre-existing supports at home compared to patients who electively undergo these surgeries. The nature of trauma, where sudden injury, moreso than baseline physiological reserve, critically affects immediate care needs and discharge planning, captures a patient population that is by in large sicker and more complex, but possibly more equipped with supports at home to begin with. This study's limitations include missing data and low home discharge rate. This study also primarily focused on discharge disposition and did not assess other outcome measures. Future studies can examine other variables that may affect post-injury and post-surgery pathways, such as specific fracture characteristics and the acute perioperative course, and outcomes to validate the RAPT score's potential utility beyond disposition planning.

SIGNIFICANCE/CLINICAL RELEVANCE: This study demonstrates that RAPT score, traditionally used after elective hip arthroplasty, is a fair prognostic tool in the trauma population, and combining the RAPT score with frailty measures substantially improves predictive accuracy. With a lower threshold cutoff, this offers a more nuanced, integrated, and patient-specific risk stratification approach to better guide discharge planning and resource allocation for patients recovering from traumatic hip fracture.

1. Yoon, R. S. *et al. The Journal of Arthroplasty*, 32(8), 2353–2358 (2017).
2. Sconza, C. *et al. Joints*, 7(2), 41–45 (2019).
3. LeBrun, D. G. *et al. The Journal of Arthroplasty*, 38(7 Suppl 2), S121–S129 (2023).

Variable	Number of Patients with Data Available	Home Discharge (n=99) Mean or Freq	SD or %	Rehab/SNF Discharge (n=598) Mean or Freq	SD or %	p-value
Age (years)	1142	79.9	7.9	84.7	7.8	<0.001
Gender	697					<0.001
Men	252	35	5.0	217	54.6%	
Women	443	63	9.1%	380	31.2%	
Frailty Index	697	0.2	0.2	0.3	0.2	<0.05
RAPT Score	1142	5.6	1.8	3.8	1.9	<0.05

Figure 1. Characteristics of Total Hip Arthroplasty Trauma Patients in the Study Sample Stratified by Discharge Disposition

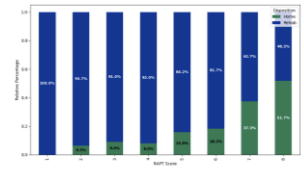

Figure 2. Relative Percentages of Patients Discharged to Home versus Rehab by RAPT Score

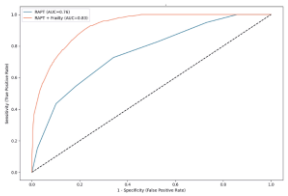

Figure 3. ROC Analysis Demonstrating Predictive Ability of RAPT Score