Post-Acute Care Utilization Following Hip Surgery during the Covid-19 Pandemic

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INTRODUCTION:

Post-acute care (PAC) is an integral element of the United States' healthcare system, especially in orthopedics, designed to support early recovery and decrease postoperative complications in vulnerable populations. Certain patients are routinely discharged to a PAC rehabilitation facility (subacute care, skilled nursing facilities, inpatient rehabilitation) for reasons including home constraints, medication infusions, and intensive rehabilitation that cannot be provided at home. At the onset of the Covid-19 pandemic, PACs served an important role as relief facilities for acute care hospitals due to their capabilities in lower-level medical care. However, these facilities quickly became overwhelmed with patients recovering from coronavirus-related illness and saw high Covid-19 infection rates, limited capacity for surgical patients, and added infection risk to facility patients. The purpose of this study was to investigate the impact of the Covid-19 pandemic on discharge disposition as related to PAC use after hip surgery and, consequently, related differences in postoperative outcomes for patients who underwent operative intervention for traumatic hip fractures or osteoarthritis (OA).

METHODS: We conducted a retrospective cohort study of patients who underwent arthroplasty, open reduction and internal fixation, closed reduction percutaneous pinning, or cephalomedullary nailing for traumatic hip fractures or OA across a large US health system between March 2018 and March 2021. The cohort was split into pre-pandemic (March 1, 2018-February 29, 2020) and pandemic (March 1, 2020-March 1, 2021). Electronic medical records were reviewed for demographics, comorbidities, injury characteristics, intervention, and outcomes. A statistical model was constructed to predict patient admission to a PAC facility before the onset of the pandemic. This model was then used to predict the disposition of postoperative patients during the Covid-19 pandemic. Using a stepwise binomial regression with an 80/20 testing-training split, the model was highly accurate and achieved an AUC of 0.865 ($p < 0.001$, Figure 1). With the likelihood predictions from this model, we built multiple cohorts that matched the characteristics of the pre-Covid PAC cohort but instead were sent home during the pandemic. In doing so we isolated the impact of home disposition for a population who would have likely been sent to a PAC facility prior to the onset of the pandemic. Patients indicated by the model to discharge to a PAC facility but were instead sent home during this time were then directly compared to their PAC counterparts. Finally, the model was used to assess the impact of Covid-19 on overall complications.

RESULTS: We included 4,054 patients; 2,615 pre-pandemic and 1,439 during the pandemic (3,705 elective and 605 emergent trauma visits). Some patients had more than one visit, and one of their visits was randomly selected to control for this in the regression analysis. Since the onset of the pandemic, patients who underwent hip procedures after presentation through the emergency department increased by 5.35%, while elective hip procedures decreased 5.36% ($p < 0.001$). All PAC facility use decreased, while home discharge increased 4.6% ($p = 0.004$). Compared to pre-pandemic levels, there was a statistically significant increase in sickliness (by Charlson Comorbidity Index) and 100-day postoperative complications in patients discharged home (Chi-square $p < 0.001$, Table 1). Our model showed that complication rate increased as the logistic algorithm became more confident in identifying the Covid home disposition group. This means that as our predictions improved as to which patients "should" have gone to PAC but instead were sent home, we saw increasing rate of complications in the "home but should have been PAC" group. The cohort with the cutoff that yielded the highest predictive accuracy showed a 14% increase in complications (21% to 35%, Chi-square $p = 0.04$). Covid-19 was an important predictor of postoperative complications in our linear regression ($p = 0.04$). Pre-Covid cases were negatively associated with the occurrence of a complication compared to Covid cases (AUC = 0.735, 80/20 split).

DISCUSSION AND CONCLUSION:

The Covid-19 pandemic negatively impacted PAC utilization and increased postoperative complications in patients who underwent surgical intervention for treatment of traumatic hip fractures or OA. This likely occurred through a combination of overwhelmed facilities, limited resources, and more liberal home discharge criteria – driven by patient, healthcare provider, or both. Novel statistical modeling successfully predicted increases in overall postoperative complications, increases in complications of patients discharged home, and an increase in the proportion of patients discharged home compared to patients with similar baseline comorbidities generally sent to PAC prior to Covid-19. While our model doesn't fully explain the findings, these data show yet another consequence of the Covid-19 pandemic on healthcare delivery and patient outcomes, and highlights the importance of appropriate disposition after surgery.

Figure 1. ROC Curve Predicting Pre-Covid PAC Disposition

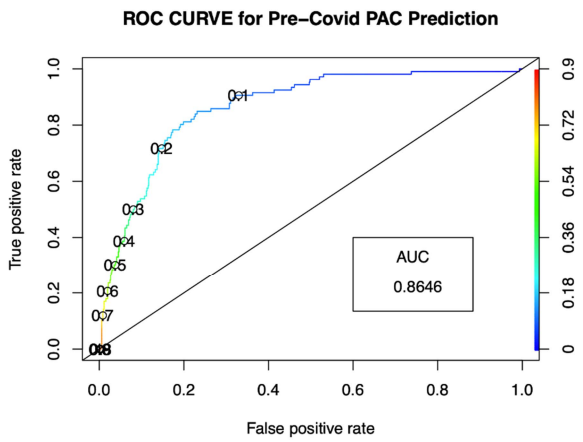

Table 1. Change in 100-Day Complication Rate for Patients Discharged Home

	Counts Pre Covid	% Pre	Counts Post Covid	% Post	% Increase
Periprosthetic Fracture	19	0.87	9	0.72	-0.15
Infection Following Surgery	14	0.64	13	1.04	0.4
Prolonged Wound Drainage	4	0.18	3	0.24	0.05
Dislocation of Internal Joint Prosthesis	16	0.73	14	1.12	0.38
Loosening of Internal Prosthetic Joint	4	0.18	8	0.64	0.45
UTI	15	0.68	24	1.92	1.23
DVT/PE	17	0.78	22	1.76	0.98
Wound Dehiscence	12	0.55	13	1.04	0.49
Paroxysmal Atrial Fibrillation	16	0.73	13	1.04	0.3
Delirium	2	0.09	3	0.24	0.14
Pneumonia	7	0.32	9	0.72	0.4
Electrolyte Abnormalities	43	1.97	37	2.96	0.99
No Complication	2010	92.24	1079	86.52	-5.71

*Chi-square $p < 0.0001$