moveUP

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Early discharge with digital follow-up after total hip or knee arthroplasty during Covid-19: a retrospective cohort study

Abstract:

Background. The Covid-19 pandemic highlighted the need for appropriate and efficient use of hospital infrastructure. Enhanced recovery pathways using postoperative digital follow-up could allow reduced length of stay after hip or knee arthroplasty without compromising the quality of care.
Objective. To assess the effect of accelerated discharge due to the pandemic on complications, readmissions, functional outcomes and satisfaction in hip or knee arthroplasty patients.
Methods. A retrospective cohort design was used to compare 97 patients who received primary total hip or knee arthroplasty during the pandemic to 194 pre-pandemic patients. Both cohorts were closely monitored using the digital health app 'moveUP', allowing direct patient-care team communication.
Results. During the pandemic, the median length of stay was significantly reduced from three to one days. A pre-pandemic complication rate of 2% remained stable during the pandemic. Patient reported outcomes for matched samples of hip (n=100) and knee (n=82) arthroplasty patients were similar before, at 6 weeks and 3 months after surgery for both groups.
Conclusion. This study demonstrates that a reduction in length of stay from three to one days after total knee or hip arthroplasty resulted in a stable rate of complications, readmission and comparable clinical outcomes in the setting of a close digital monitoring and coaching.

1. Introduction

The appropriate and efficient use of hospital infrastructure is important for health care providers and payors. Reduction of length of stay (LOS) without compromising the quality of care is a trend observed in all specialties [1].

The pandemic gave another dimension to the use of hospital infrastructure. The government asked hospitals to preserve capacity in order to have beds ready for patients affected from Covid19. A shorter length of stay provides multiple benefits for the patient, such as lower infection rates, faster return to activities of daily living and reduction in thrombo-embolic events. [2, 3].

The concept of fast-track surgery and ERAS (Enhanced Recovery After Surgery [4, 5]) have been used in several studies/countries. To achieve this goal the whole pathway needs to be optimized including patient education, effective multimodal pain management, accelerated rehabilitation and monitoring for safety and outcomes. This requires team work than can be supported by e-health solutions.

The objective of this study was to assess the impact of reduction in LOS on complications and readmissions in one hospital where accelerated discharge was introduced due to the pandemic.

2. Methods

2.1. Model

This study uses a retrospective cohort design to assess the impact of accelerated discharge after knee and hip surgeries.

292 patients with elective primary total hip and total knee replacement surgery treated by a single surgeon at the AZ Maria Middelares hospital (Gent, Belgium) between October 2018 and February 2021 used the moveUP app. The study group (pandemic) had elective knee or hip replacement between May 2020 and February 2021. The control group (pre-pandemic) was operated between October 2018 to April 2020. We selected a subset of control patients matched to the study group based on age, gender, type of surgery and pre-operative PROMS.

The data in our study come directly from the database of an mhealth app (moveUP NV, Belgium).

2.2. Participants

The characteristics of the two groups are displayed in Table 1.

Table 1: Characteristics of participants

	Pre-pandemic 2018-2020	**Pandemic 2020-2021**
	Hip surgeries	
n	50	50
Age (SD)	62,8 (9,5)	63,5 (11,8)
Gender (%)	24 Men (48%) 26 Women (52%)	25 Men (50%) 25 Women (50%)
	Knee surgeries	
n	41	41
Age (SD)	64,2 (8,5)	65,1 (10,4)
Gender (%)	25 Men (61%) 16 Women (39%)	29 Men (71%) 12 Women (29%)

2.3. Procedure and Anesthesia

Before surgery, patients were prepared through an education session at the hospital as well as through the application. They were explicitly instructed to mobilize their feet and ankles early after surgery in order to avoid deep venous thrombosis. The hospital social services identified the patients in need of extra home service.

Surgery and anesthesia in all patients were highly standardized. All patients received a spinal anesthesia, unless contraindicated, combined with general anesthesia depending on the patient's preference. Before incision, all patients received tranexamic acid 1000 mg, repeated once three hours afterwards and dexamethasone 5mg, paracetamol 1g and diclofenac 75mg.

Mepilex Border Postop was the standard dressing, and applied under sterile conditions in the operation room. The dressing was not changed or removed until 14 days when skin staples were removed.

In the recovery room, an ice lolly was given to the patient to prevent postoperative nausea and vomiting. The patient was mobilized early out of bed, on average 3 hours after surgery.

The same standardized multimodal pain management protocol was used for both cohorts: low dose Oxycontin 5mg twice daily for the first 72h, paracetamol 1g every 6h and Diclofenac 75mg twice daily. Thromboprophylaxis was started 24h postoperatively if the dressing was dry and continued for 4 weeks. The standard therapy comprised low dose aspirin 80 mg once daily except if there were contra-indications then Enoxaparin 40mg once daily was given.

2.4. Discharge management and joint work of hospital and moveUP

The discharge criteria for both groups were: patient feels comfortable going home, patient has enough support at home, pain is under control (low to moderate pain managed with medication), no wound leakage, independence in activities of daily living such as transfer from bed to chair, self-hygiene, independent mobility (walking possible with walking aids). The surgeon examined discharge criteria.

After discharge, no nurse or doctor visit was planned. The follow-up of patients was

performed through the application. The clinical team has insight on a broad range of data to control their patient's pre and post-surgery progress: physical activity, pain levels, medication use, exercise adherence, patient reported outcome measures, pictures of the surgical wound and videos of range of movement are collected among others. Patients receive regular information about their recovery status, as well as important education materials regarding activity management, the prosthesis, etc. The patient can communicate with the moveUP team through a secured chat messaging system. Both groups received the same support and adapted exercise program via the application.

2.5. Data collection

2.5.1.Length of stay

The length of stay (LOS) was assessed through a question in the app: "how many nights did you spend in hospital?"

2.5.2.Complications, readmission, unplanned consultations

The complications and readmissions were recorded through the app at 6 weeks after surgery. Then a medical doctor classified the complication according to a standardized list of the Knee and Hip society [6, 7]. Then the complication was confirmed as such related to the surgery or classified as a normal undesirable event by the surgeon.

The unplanned consultations with a health care provider (general practitioner, surgeon) in the first week after surgery was recorded through two questions in the app "How many times did you consult a health care practitioner last week?"," Was this a planned or an unplanned consultation?".

2.5.3.Patient reported outcome

The primary outcome measures were the standardized Patient Reported Outcome Measure: KOOS or HOOS, preoperatively, at 6 weeks and 3 months postoperatively. Secondary outcomes were consumption of analgesics, length of use of crutches, days until starting to drive and satisfaction using the knee society score at 6 weeks.

2.5. Statistics

Descriptive statistics were performed for all outcomes. The two matched groups were compared with a Mann Whitney U test. An alpha error threshold of 0.05 was used.

3. Results

3.1. Length of stay (LOS)

Before the pandemic, 66% of the patients spent 3 nights in hospital. During the pandemic, 54% of the patients spent only 1 night at hospital (Figure 1). The median value changed from 3 days (interquartile space 3-4) to 1 day (interquartile space 1-3).

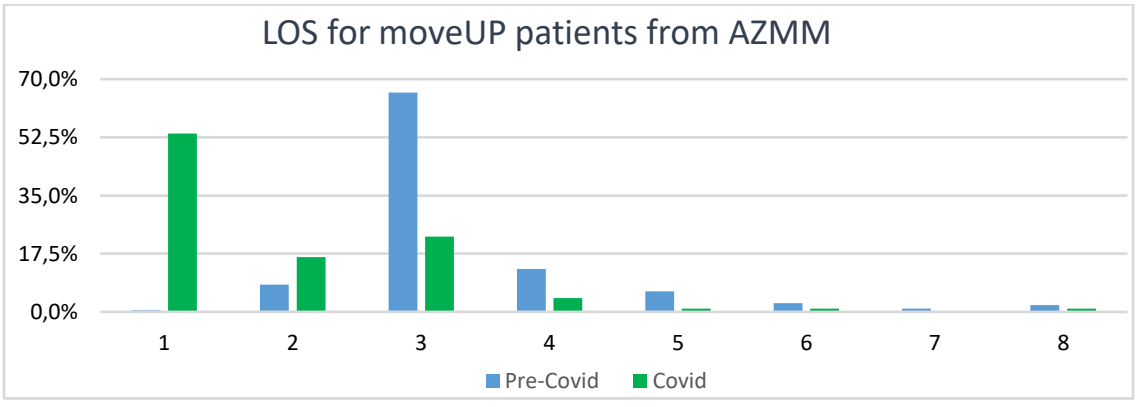

Figure 1: Repartition of LOS for knee and hip surgeries before and during the pandemic

3.2. Complications, readmissions and unplanned consultations

Overall, 30 complications were reported among the 292 patients, which gives a patient reported complication rate of 10%. Of the 30 complications reported, only 6 were considered true complications by the surgeon, 4 during the pre-pandemic period, and 2 in the pandemic period decreasing the complication rate for both the pre-pandemic and pandemic period to 2%. The following complications were recorded : a deep infection, a hip dislocation, knee stiffness, implant fracture, wound complication and skin infection. The complications that lead to the highest false positive rate were wound issues, high pain levels, infection or thromboembolic disease.

During the pandemic, 5.5% of unplanned consultations occurred during the first week after surgery while there were none during the pre-pandemic period.

3.3. Patient reported outcome

The matched analysis showed no statistical difference for the HOOS, KOOS, satisfaction and several milestones between the pre-pandemic and the pandemic period at any of the time points (Table 2, Figure2). The average number of days of paracetamol use decreased from 28 to 14 days during the pandemic period (Figure 3).

Table 2 : Comparison of PROMS and milestones for Hip and knee surgeries

		Hip		Knee	
		Pre-Covid	**Covid**	**Pre-Covid**	**Covid**
Preoperative	Sample size (n)	50	50	41	41
	Symptoms	47 [34-60]	45 [30-60]	50 [38-64]	46 [32-59]
	Pain	41 [32-50]	43 [30-53]	44 [30-53]	42 [34-57]
	ADL	40 [32-51]	46 [26-59]	43 [29-51]	44 [34-52]
	QoL	25 [19-38]	31 [13-44]	19 [13-31]	25 [13-38]
6 weeks postop	Symptoms	75 [65-85]	75 [59-85]	64 [54-73]	61 [43-68]
	Pain	78 [68-91]	79 [68-89]	67 [54-78]	67 [50-81]
	ADL	75 [64-87]	71 [62-85]	71 [53-82]	72 [51-84]
	QoL	56 [44-69]	56 [50-76]	50 [38-56]	38 [31-50]
3 months postop	Symptoms	80 [70-95]	75 [65-90]	68 [57-79]	64 [50-79]
	Pain	90 [79-98]	80 [71-95]	75 [66-86]	72 [60-86]
	ADL	88 [66-95]	79 [66-93]	75 [64-87]	74 [57-91]
	QoL	69 [55-88]	66 [50-80]	56 [38-63]	50 [38-69]
Milestones	crutches stop	42 [38-51]	39 [31-50]	28 [17-45]	38 [27-48]
	Drive start	32 [23-45]	32 [22-50]	39 [18-52]	43 [27-56]
	NSAID stop	21 [14-38]	29 [21-33]	38 [29-64]	37 [21-66]
	paracetamol stop	28 [11-53]	14 [8-31]*	28 [15-43]	31 [14-64]
	tradonal stop	8 [4-21]	8 [3-19]	16 [8-32]	24 [11-38]
	pain day stop	8 [2-22]	9[3-18]	15 [10-33]	21 [9-46]
	pain night stop	5 [2-22]	6 [3-14]	21 [5-34]	23 [11-39]
Satisfaction	KSS score	-	-	29 [22-32]	26 [18-30]

* : significant difference between pre-covid and covid group ($p<0.05$), Data are presented as median with interquartile ranges

ADL : activities of daily living, QoL: quality of life, NSAID : non steroid anti-inflammatory drugs, tradonal : opioid medication

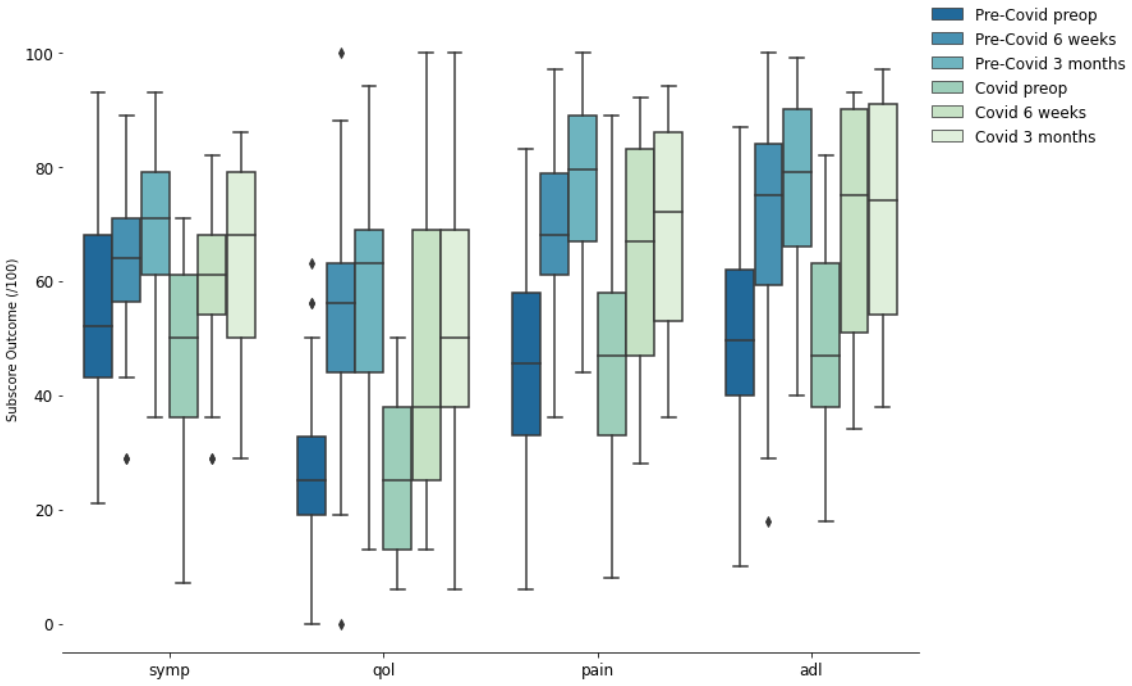

Figure 2: KOOS scores for matched pre-pandemic and pandemic group

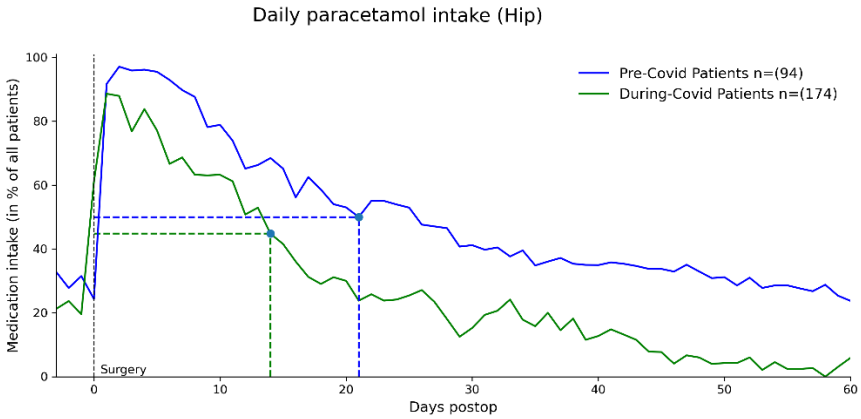

Figure 3: Fraction of hip patients receiving paracetamol. The horizontal line indicates 50% (half of the patients) in each group and the vertical line indicates the postoperative day on which half of the patients stopped consuming paracetamol.

4. Discussion

The results of this study showed that after hip or knee replacements, decreasing LOS from three to one night with adequate discharge criteria resulted in a stable rate of complications, readmissions and comparable clinical outcomes. These results are in line with literature data on fast track pathways in elective hip and knee arthroplasty [8-11]. On the other hand, a slight increase in the number of unplanned consultations was observed in the first postoperative week.

The reduction of LOS is an obvious target for cost savings and the safety concerns must be addressed. An early discharge defined as 0-2 days in comparison to a standard discharge as 3-4 days does not increase the complication rate. However, caution in the interpretation is needed, as not all patients are candidates for an early discharge [12]. A standard discharge is not necessary for most patient, but certain patient's characteristics or peri-operative factors such are prolonged operative time or increase blood loss remain higher risk, regardless of length of stay.

The huge difference between the patient reported complications and the complications confirmed by the surgeon confirmed that the precise rate of complication may not be adequately estimated from patient reported data [13]. Patients are likely to over-report complications, especially subjective minor ones such as wound issues, stiffness or unexpected pain [13].

This study has several limitations. First, the retrospective design and the limited number of patients limit the impact of the results. Randomized controlled trials are warranted to assess the impact of reduced LOS conclusively. Second, only patients using the moveUP service were included as the same level of detailed data is not collected for other patients. This may limit the external validity of our findings. However, the selection criteria for inclusion in the analysis was equal in both groups. As such, we strived to eliminate selection bias between groups. The differences between patients choosing a tele-rehabilitation or a standard face-to-face physiotherapy program will be assessed in an ongoing prospective trial in Belgium [14].

Our data suggests that shortening the LOS does not impact negatively the rate of complications and readmissions or clinical outcomes, provided that the patients are properly followed up and guided when discharged home. The support of a digital health solution & the follow-up of an experienced team contributed to these results, thanks to the close follow-up and early identification of possible complication. The concept used in this study could be transferred to other centers with limited investments, and may have economic implications through reduced hospital costs.

5. References

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CE moveUP Therapy, Coach and Companion are a registered medical device.

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