



## ■ ARTHROPLASTY

# Converting hip and knee arthroplasty cases to same-day surgery due to COVID-19

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### Aims

In 2020, the COVID-19 pandemic meant that proceeding with elective surgery was restricted to minimize exposure on wards. In order to maintain throughput of elective cases, our hospital (St Michaels Hospital, Toronto, Canada) was forced to convert as many cases as possible to same-day procedures rather than overnight admission. In this retrospective analysis, we review the cases performed as same-day arthroplasty surgeries compared to the same period in the previous 12 months.

### Methods

We conducted a retrospective analysis of patients undergoing total hip and knee arthroplasties over a three-month period between October and December in 2019, and again in 2020, in the middle of the COVID-19 pandemic. Patient demographics, number of outpatient primary arthroplasty cases, length of stay for admissions, 30-day readmission, and complications were collated.

### Results

In total, 428 patient charts were reviewed for October to December of 2019 ( $n = 195$ ) and 2020 ( $n = 233$ ). Of those, total hip arthroplasties (THAs) comprised 60% and 58.8% for 2019 and 2020, respectively. Demographic data was comparable with no statistical difference for age, sex, contralateral joint arthroplasty, or BMI. American Society of Anesthesiologists grade I was more highly prevalent in the 2020 cohort (5.1-times increase;  $n = 13$  vs  $n = 1$ ). Degenerative disc disease and fibromyalgia were less significantly prevalent in the 2020 cohort. There was a significant increase in same day discharges for non-direct anterior approach THAs (two-times increase) and total knee arthroplasty (ten-times increase), with a reciprocal decrease in next day discharges. There were significantly fewer reported superficial wound infections in 2020 (5.6% vs 1.7%) and no significant differences in readmissions or emergency department visits (3.1% vs 3.0%).

### Conclusion

The COVID-19 pandemic meant that hospitals and patients were hopeful to minimize the exposure to the wards, and minimize strain on the already taxed inpatient beds. With few positives during the COVID-19 crisis, the pandemic was the catalyst to speed up the outpatient arthroplasty programme that has resulted in our institution being more efficient, and with no increase in readmissions or early complications.

**Cite this article:** *Bone Jt Open* 2021;2-7:545–551.

**Keywords:** Same day surgery, Joint replacement, COVID-19, Hip and Knee arthroplasty, Arthroplasty, ERAS

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doi: 10.1302/2633-1462.27.BJO-  
2021-0029.R1

*Bone Jt Open* 2021;2-7:545–551.

### Introduction

Hip and knee arthroplasty are two of the most commonly performed elective procedures globally. While lower limb arthroplasty has traditionally been an inpatient procedure,<sup>1</sup> length of stay has been decreasing

over the past few years with no evidence of higher rates of complications.<sup>2–4</sup>

Same-day surgery (SDS) arthroplasty is now a common and safe procedure with no significant increase complication rates. Analysis from the National Surgical Quality Improvement Programme (NSQIP)

comparing a matched/like for like (SDS vs traditional) cohort of patients showed no difference in the overall adverse events or readmission between the two groups.<sup>5</sup>

In 2020, the world was engulfed by the global COVID-19 pandemic.<sup>6</sup> In Canada and many other countries, the effects of COVID-19 meant a cessation or curtailment of elective work in many ambulatory centres and traditional hospitals, as institutions struggled to cope with the pandemic.<sup>7</sup> In the USA, federal<sup>8</sup> and state level<sup>9</sup> orders and guidance also dictated that there be a reduction in the number of elective cases performed, especially with inpatient stay. The capacity of beds was tested during the year, and the American College of Surgeons guidelines suggested that lower acuity surgery could be performed at ambulatory surgical centres.<sup>10</sup> As other institutions attempted to restart elective work<sup>11,12</sup> fears of public perception<sup>13</sup> and protocol to limit the risk of spread have been at the forefront.<sup>14</sup>

Our institution (St Michael's Hospital, Toronto, Canada) is a North American, urban, level 1 trauma centre with a large emergency department. Prior to the COVID-19 pandemic, we had been developing enhanced recovery protocols and were seeing a limited, though steady, increase in our success with SDS arthroplasties.

In this retrospective analysis, we compare elective arthroplasty procedures over a three-month period in 2019 and 2020 in an inner-city level 1 trauma centre. The purpose of the study was to compare the two cohorts and assess for variation in patient demographics, complications, or 30-day readmissions or unscheduled return to care.

## Methods

**Data sources and setting.** A retrospective chart review of patients undergoing a primary total knee arthroplasty (TKA) or total hip arthroplasty (THA) by three high-volume academic surgeons in our institution. The study was approved by our institutional review board.

Patient data included hospital records from pre-admission anaesthesia consults, operating room logs, and outpatient visits. All data was obtained from electronic patient records. American Society of Anesthesiologists (ASA) grade and BMI were obtained from anaesthetic operative records. For this study, all primary arthroplasty procedures from October to December 2019 and 2020 were reviewed. Data obtained included demographics (age, sex, BMI), comorbidities, length of stay (LOS) for admissions, 30-day readmission, and complications.

Analysis also included comparison by procedure type for patients undergoing TKA, THAs through a direct anterior approach (DAA), and THAs through either minimally invasive posterior, conventional posterior, or direct lateral approaches.

**Statistical analysis.** Descriptive statistics were performed using independent *t*-tests for numerical data, while

**Table I.** Patient demographics.

| Variable                     | 2019, n (%) | 2020, n (%) | Difference, % | p-value  |
|------------------------------|-------------|-------------|---------------|----------|
| Total                        | 195 (100)   | 233 (100)   |               |          |
| THA                          | 117 (60.0)  | 137 (58.8)  | -1.202        | 0.801*   |
| TKA                          | 78 (40.0)   | 98 (42.1)   | 2.060         | 0.666*   |
| Age, yrs, mean (SD)          | 65.9 (10.2) | 65.4 (10.1) | N/A           | 0.611†   |
| Males                        | 96 (49.0)   | 108 (46.4)  | -2.600        | 0.839*   |
| <b>BMI, kg/m<sup>2</sup></b> |             |             |               |          |
| < 25                         | 44 (22.6)   | 50 (21.5)   | -1.105        | 0.783*   |
| 25 to 29.9                   | 65 (33.3)   | 84 (36.1)   | 2.718         | 0.557*   |
| 30 to 34.9                   | 48 (24.6)   | 66 (28.3)   | 3.711         | 0.387*   |
| 35 to 39.9                   | 21 (10.8)   | 19 (8.2)    | -2.615        | 0.355*   |
| 40 +                         | 17 (8.7)    | 14 (6.0)    | -2.709        | 0.281*   |
| <b>Fibromyalgia</b>          | 6 (3.1)     | 1 (0.4)     | -2.648        | 0.031‡   |
| <b>DDD</b>                   | 17 (8.7)    | 2 (0.9)     | -7.860        | < 0.001* |
| <b>ASA grade</b>             |             |             |               |          |
| ASA 1                        | 1 (0.5)     | 13 (5.6)    | 5.067         | 0.004‡   |
| ASA 2                        | 67 (34.4)   | 79 (33.9)   | -0.453        | 0.922*   |
| ASA 3                        | 113 (57.9)  | 129 (55.4)  | -2.584        | 0.591*   |
| ASA 4                        | 14 (7.2)    | 12 (5.2)    | -2.029        | 0.381*   |
| <b>Length of stay, days</b>  |             |             |               |          |
| 0                            | 27 (14.0)   | 79 (33.9)   | 19.906        | < 0.001* |
| 1†                           | 120 (61.5)  | 89 (38.2)   | -23.303       | < 0.001* |
| > 1**                        | 47 (24.1)   | 65 (27.9)   | 3.797         | 0.373*   |

\*Chi squared analysis.

†Student's *t*-test.

‡Fisher's exact test.

§Same day discharge.

¶Next day discharge.

\*\*More than next day discharge.

ASA, American Society of Anesthesiologists; DDD, degenerative disc disease; N/A, not applicable; SD, standard deviation; THA, total hip arthroplasty; TKA, total knee arthroplasty.

nominal data was analyzed via Fisher's exact test or chi-squared analysis depending on sample size. Significance was established with a p-value < 0.05.

## Results

In total, 428 patient charts were reviewed for October to December of 2019 (n = 195) and 2020 (n = 233) (Table I). Of those, THAs comprised 60% and 58.8% for 2019 and 2020, respectively. Direct anterior approach comprised 42.5% and 34.3% of THAs performed in 2019 and 2020, respectively. Demographic data was comparable with no statistical difference for age (65.9 years vs 65.4 years; p = 0.611, Student's *t*-test), sex (49% males vs 46.4% males; p = 0.839, chi squared analysis), previous contralateral same-joint arthroplasty (26.2% vs 21.5%; p = 0.654, chi-squared analysis), or BMI (30.4 kg/m<sup>2</sup> vs 29.5 kg/m<sup>2</sup>; p = 0.164, Student's *t*-test). ASA grade I was more highly prevalent in the 2020 cohort (13 patients vs one patient; p = 0.004, Fisher's exact test). Out of the 20 or more comorbidities identified, degenerative disc disease and fibromyalgia were the only variables that significantly differed between time periods, both less prevalent in the

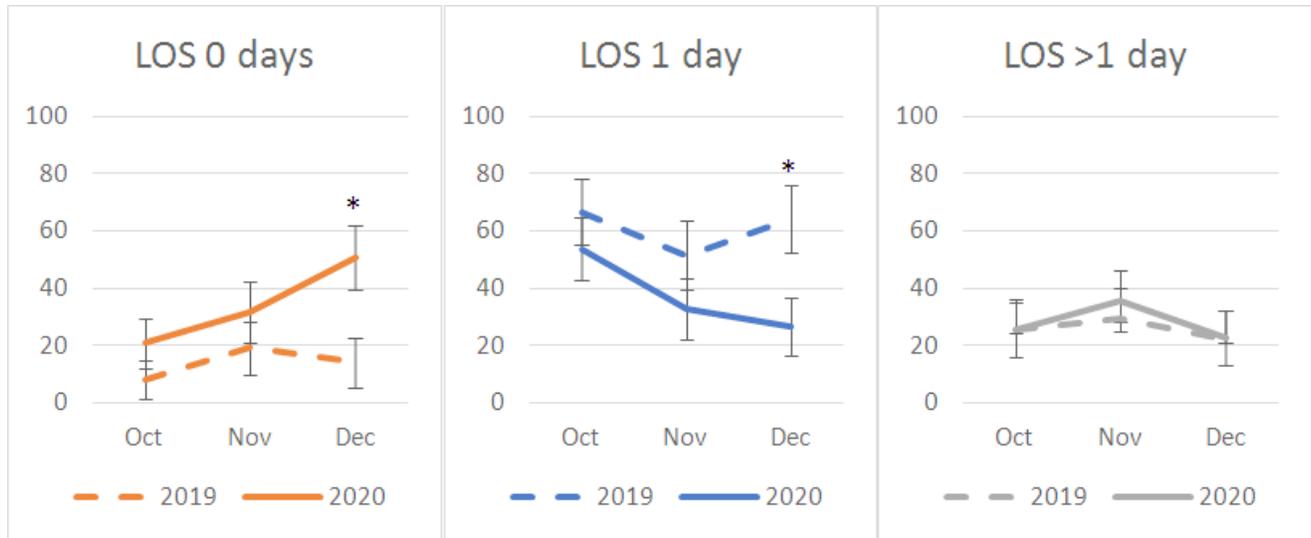


Fig. 1

Percentage rate of discharge by month and year. Error bars represent 95% confidence intervals. \*Significant difference ( $p < 0.05$ ). LOS, length of stay.

2020 cohort. Rate of same calendar day discharge (length of stay (LOS 0)) was significantly increased (14.0% 2019 vs 33.9% 2020;  $p < 0.001$ , chi-squared analysis), while next day discharges (LOS 1) were significantly reduced (61.5% 2019 vs 38.2% 2020;  $p < 0.001$ , chi-squared analysis) (Figure 1). There was no significant difference in the rate of patients requiring a length of stay of two days or more (24.1% 2019 vs 27.9% 2020).

In subgroup analysis by procedure type, there was a significant increase in same-day discharges in both the non-DAA THA group (20.3% 2019 vs 40.0% 2020;  $p = 0.008$ , chi-squared analysis) and the TKA group (2.8% 2019 vs 33.7% 2020;  $p < 0.001$ , chi-squared analysis) (Table II). The rate of LOS 0 discharges significantly increased in patients undergoing posterolateral approaches (26.0% 2019 vs 49.2% 2020;  $p = 0.019$ , Fisher's exact test), the difference did not reach statistical significance in patients undergoing THA via an direct lateral approach (5.2% 2019 vs 18.0% 2020,  $p = 0.377$ , Fisher's exact test) (Table III). There was no significant difference in rate of LOS 0 or 1 discharges in the DAA cohorts (Figure 2). There was no variation in hospital admissions > one day. Follow-up at four to six weeks postoperatively (standardized for four weeks for TKAs and six weeks for THAs) was obtained in 93.8% and 93.5% of patients in 2019 and 2020, respectively. The rate of superficial wound concerns decreased from 5.6% in 2019 to 1.7% in 2020 (Table IV). There were no significant differences in rates of 30-day readmission (3.1% 2019 vs 3.0% 2020;  $p = 0.965$ , chi-squared analysis).

### Discussion

In 2020, the world was engulfed by a global COVID-19 pandemic<sup>6</sup> that, at time of writing this paper, has caused the deaths of over 2.5 million people with over 130 million

Table II. Length of stay discharge categories by procedure type.

| Variable                    | 2019, n (%) | 2020, n (%) | Difference, % | p-value* |
|-----------------------------|-------------|-------------|---------------|----------|
| <b>DAA</b>                  |             |             |               |          |
| Total, n                    | 51          | 47          |               |          |
| <b>Length of stay, days</b> |             |             |               |          |
| 0†                          | 11 (21.6)   | 11 (23.4)   | 1.8           | 0.828    |
| 1‡                          | 32 (62.7)   | 24 (51.1)   | -11.7         | 0.243    |
| > 1§                        | 8 (15.7)    | 12 (25.5)   | 9.8           | 0.227    |
| <b>THA</b>                  |             |             |               |          |
| Total, n                    | 69          | 90          |               |          |
| <b>Length of stay, days</b> |             |             |               |          |
| 0†                          | 14 (20.3)   | 36 (40.0)   | 19.7          | 0.008    |
| 1‡                          | 40 (58.0)   | 31 (34.4)   | -23.5         | 0.003    |
| > 1§                        | 15 (21.7)   | 23 (25.6)   | 3.8           | 0.576    |
| <b>TKA</b>                  |             |             |               |          |
| Total, n                    | 72          | 95          |               |          |
| <b>Length of stay, days</b> |             |             |               |          |
| 0†                          | 2 (2.8)     | 32 (33.7)   | 30.9          | < 0.001  |
| 1‡                          | 44 (61.1)   | 34 (35.8)   | -25.3         | 0.001    |
| > 1§                        | 25 (34.7)   | 29 (30.5)   | -4.2          | 0.566    |

\*Chi-squared analysis.

†Same day discharge.

‡Next day discharge.

§More than next day discharge.

N/S, not significant; THA, total hip arthroplasty; TKA, total knee arthroplasty.

documented infections.<sup>15</sup> In addition, it had caused a shut down or decrease of scheduled work,<sup>7-9</sup> meaning increased anxiety and suffering for those waiting for essential surgeries.<sup>16</sup>

Large governing bodies such as the American College of Surgeons and the Royal College of Surgeons of England have provided guidelines to ensure the delivery of appropriate patient care can be resumed at specified surgical centres.<sup>17,18</sup> These guidelines were shown to be

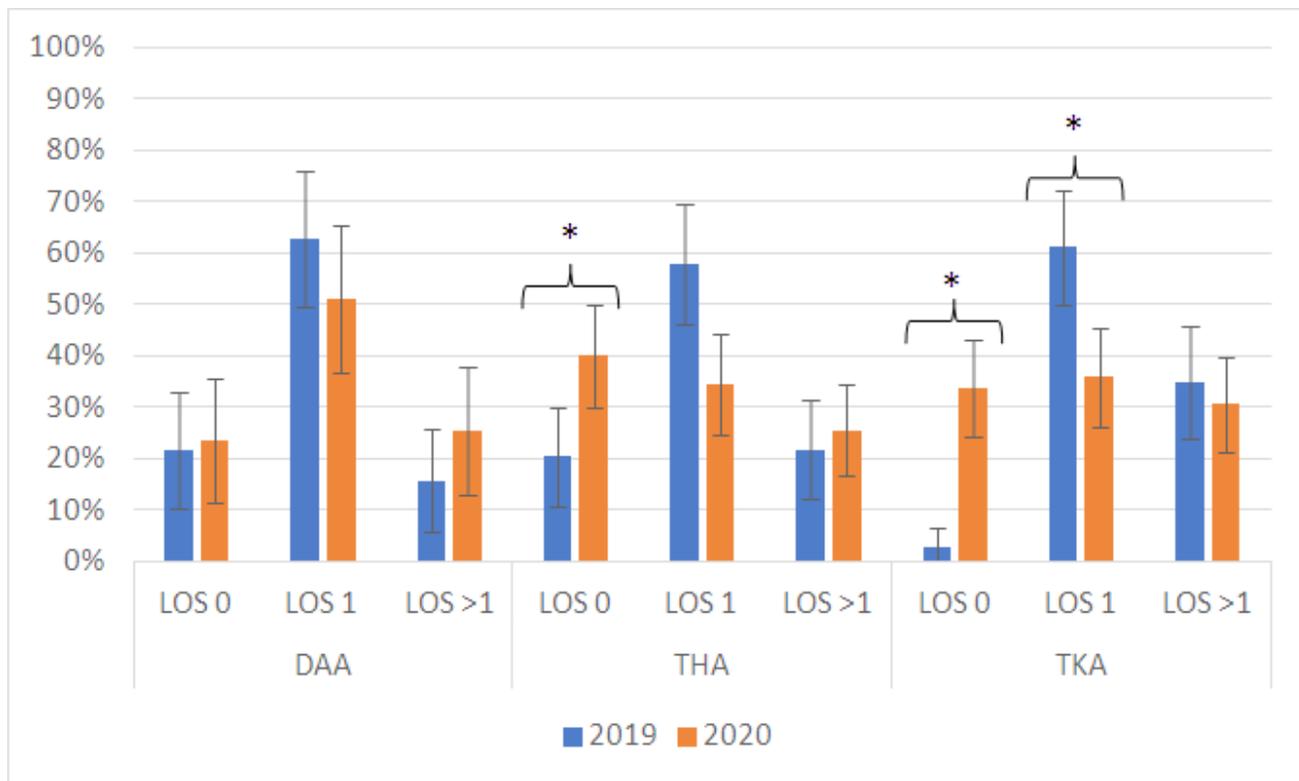


Fig. 2

Comparison by procedure type. \*significant difference ( $p < 0.05$ ). DAA, direct anterior approach; THA, combined counts of posterolateral and anterolateral total hip arthroplasties; TKA, total knee arthroplasty.

**Table III.** Length of stay 0 (same-day discharge) based on surgical approach.

| Variable | 2019 (n = 120), n (%) | 2020 (n = 137), n (%) | p-value |
|----------|-----------------------|-----------------------|---------|
| DAA THA  | 11/51 (21.6)          | 11/47 (23.4)          | 1.000*  |
| PL THA   | 13/50 (26.0)          | 31/63 (49.2)          | 0.019*  |
| AL THA   | 1/19 (5.2)            | 5/27 (18.0)           | 0.377†  |

\*Chi-squared analysis.

†Fisher's exact test.

AL THA, anterolateral approach total hip arthroplasty; DAA THA, direct anterior approach total hip arthroplasty; PL THA, posterolateral approach total hip arthroplasty.

effective in minimizing COVID-19 exposure to operative patients.<sup>19</sup> Studies have also sought to identify strategies to safely reinstate orthopaedic procedures, such as stratifying elective patients at higher risk for COVID-19-related illness by assessing comorbidities and minimizing length of hospital stay.<sup>20</sup> Surrogates for elective surgery, such as the use of THA for hip fractures, also showcased the ability to provide arthroplasty services safely amid the COVID-19 pandemic.<sup>21</sup> A review and protocol by Haddad et al<sup>22</sup> identified several variables that were addressed to ensure that day surgery was feasible in the time of pandemic. These guidelines were also mirrored by the International Consensus Group of American Association of Hip and Knee Surgery (AAHKS).<sup>23</sup>

**Table IV.** Rate of reported complications at 30 days postoperatively.

| Variable             | 2019, n (%)  | 2020, n (%)   | p-value* |
|----------------------|--|---|----------|
| Follow-up capture    | 184 (93.9)   | 219 (93.5)  | 0.902    |
| Superficial wound    | 11 (1†) (5.6)  | 4 (1†) (1.7)  | 0.028    |
| Pain                 | 6 (3.0)  | 12 (5.0)  | 0.287    |
| Other                | 9 (4.6)  | 6 (2.6)   | 0.253    |
| Details              | 1 pneumonia<br>2 DVT<br>1 urinary retention<br>1 urinary retention<br>1 subsidence†<br>1 dislocation†<br>1 psoas irritation†<br>1 deep infection†<br>1 arrhythmia† | 1 stroke†<br>1 urinary retention†<br>1 deep infection†<br>1 anemia and fall†<br>1 foot drop<br>1 postoperative delirium†<br>1 GI bleed† |          |
| Readmission/ED visit | 6 (3.1)  | 7 (3.0)   | 0.965    |

\*Chi-squared analysis.

†Readmission or visit to the emergency department.

DVT, deep vein thrombosis; ED, emergency department; GI, gastrointestinal; N/S, not significant.

When our orthopaedic group was allowed to resume elective work, it was recommended that cases be restricted to SDS discharge to minimize the time in the hospital, and to limit the pressure on hospital beds. Same day discharge arthroplasty is an established protocol which has been demonstrated to be safe with no significant increase in rates of complication or readmission,<sup>24-27</sup> nor has there been any decrease in

patient reported outcomes.<sup>28</sup> There are evidence-based criteria to minimize the readmission and failures of SDS, and these were followed in the patient choices.<sup>29</sup> Assessments on cost-effectiveness and possible cost-reduction of day surgery procedures have also been favourable.<sup>30,31</sup>

The COVID-19 crisis increased both surgeon and patient willingness to consider SDS as a potential option. The surgical approach for THA and TKA made no difference to the success of discharge and complication/readmission rates. Our 30-day readmission rates of 3.0% and 3.1% is comparable with other studies.<sup>26–30,32–36</sup> Furthermore, studies have identified emergency department visits after SDS of 2.5% of TKA/THA patients,<sup>31,37</sup> for which we had 1.3% of from this smaller cohort. Of note, superficial wound issues were lower in the more recent cohort, which may have been influenced by the healthier patient population, decreased exposure to possible nosocomial infection, or perhaps decreased capture rate due to the increased use of telemedicine follow-up. However, this is also in keeping with data identifying lower incidence of surgical site infection in SDS cohorts, although absolute risk was low across all cohorts.<sup>38</sup>

While our enhanced recovery after surgery and SDS programme was already in its infancy, the forced progression to include more patients was a necessity that has led to a more successful, streamlined pathway (Table V). From the time of initial consultation, screened patients are reinforced that they will be having SDS. This is reiterated at the virtual pre-assessment performed by the anaesthesiology service and physiotherapy team. At that time, they are also instructed on appropriate technique for climbing stairs and ambulation with walking aids.

On the day of surgery, patients are admitted directly to the regional room, where the preoperative medications are given and the short-acting mepivacaine is administered. The timing of the spinal administration is specific and only occurs once the operative suite is ready for patient arrival. This ensured that no patient required conversion to a general anaesthetic. Upon procedure completion, the patient is transferred to the recovery unit, and once sensory and motor function has returned, they are sent to a day surgery discharge lounge where physiotherapy assessment ensues.

There were no changes to the surgeons' techniques in the interval, but the anaesthesiologists moved from using the longer acting bupivacaine local anaesthetic for spinal anaesthesia to the shorter acting mepivacaine. Mepivacaine has been shown to have a more predictable return of motor function after anaesthesia with a shorter half-life and also lower rates of urinary retention.<sup>39</sup> This was confirmed in the current study which decreased the incidence of urinary retention (5% in 2019 vs 0% in 2020), as well as slow recovery of neurological status (8% in 2019 vs 0% in 2020).

All TKA cases also received a single injection adductor canal block, which has been shown to have similar pain control and less quadriceps weakness with improved early motor function when compared to femoral nerve blockade.<sup>40,41</sup> Additionally, rather than admitting to a conventional overnight stay ward, patients were transferred to the day surgery suite, where they were met by physiotherapists. In order to facilitate full day operating slates for outpatient procedures, physiotherapy services were extended to provide complete assessments of all patients, regardless of surgical start time. Additionally, telecommunications with patients have become much more commonplace. Finally, members of staff along the patient pathway were conditioned to educate patients that they would be appropriate for SDS. These small, but cumulative, changes led to great strides that may not have happened had it not been for the pandemic.

Our study identified a significant increase in SDS arthroplasties with patient demographics and comorbidities comparable except for a higher number of ASA I grade values in the 2020 cohort. Furthermore, we were able to drastically improve SDS for TKA patients, which prior to 2020, were primarily admitted for overnight monitoring. Overall, this data shows that although the COVID pandemic created obvious hardship to the healthcare system, our institution was able to continue to provide care for patients through increasing SDS for primary arthroplasty patients.

Although our study provides a relatively large patient cohort of data, there remains some shortcomings to the analyses. The nature of retrospective reviews has limitations of data fidelity such as comorbidities identified on admission. Furthermore, there may be an inherent selection bias for healthier patients (increase in ASA I patients); while this was not reflected in the overall assessment of comorbidities, it may still suggest the two cohorts are not entirely comparable, and that these results should not be expected in an unfiltered arthroplasty referral list. Finally, a larger cohort and long-term data on SDS patients would improve the assessment of outcomes. Taken as a whole, this study provides an adequate data cohort as a single institution review of the improvement in SDS arthroplasty patients within the confines of the COVID-19 pandemic.

There have been numerous struggles and setbacks to clinical care during the pandemic, but in a forced change situation, we have found that our success in converting a large number of cases to SDS has been a rare positive outcome. The change was most notable in patients undergoing TKAs or THAs via posterolateral and direct lateral approaches. This has resulted in a reduction in hospital bed usage, a tempering of our growing surgical waitlists, and maintained clinical outcomes, while allowing patients to recover at home without an increased risk of complication.

**Table V.** Same day surgery (SDS) protocol.**Referral**

- GP or tertiary physician referral, pre-screened by orthopaedic surgeon to ensure surgical candidates.

**Assessment:**

- Consultant agrees with GP referral and informed consent process performed for patients agreeing to surgical intervention.
- Consultant ensures patient meets criteria for SDS with patient given outline of process.
- Preoperative bloodwork obtained at time of initial assessment to negate need for return to hospital.
- Information leaflet provided to patient with FAQ section.

**Booking principles:**

- Patients are slotted into openings, pending operating room availability.
- Patients with possible need for prolonged post-anaesthetic care unit stay (i.e. OSA) booked as first case of the day.

**Pre-assessment:**

- Physiotherapy assessments via telecommunication with patient to assess/address any concerns.
- Anaesthesia telecommunication with patients for assessment of any comorbidities, discuss anesthetic, anticoagulation, etc.
- Advise on minimum preoperative fasting time.
- Patient's obtain COVID-19 swab three to five days prior to operative date and instructed to self-isolate until surgery.

**Day of surgery:**

- Arrival at hospital at pre-admission office.
- COVID-19 screening questionnaire and confirmation of negative test.
- Nursing re-assessment to ensure patient has capabilities/social supports for SDS.

**Preoperatively:**

- Patient assessed by anaesthesiologist in regional room to confirm suitability for:
  - (A) Spinal anaesthesia (mepivacaine) ± regional block (short acting).
  - (B) General anaesthetic with short-acting drugs.
- Patients pre-medicated with celecoxib, gabapentin, and hydromorphone contin.
- IV antibiotics and tranexamic acid administered in operating theatre.

**Intraoperative:**

- Use of local anaesthetic infiltration (containing ropivacaine, ketorolac, epinephrine) to minimize postoperative pain.

**Immediate postoperative:**

- Patient transferred to day surgery recovery lounge rather than ward.
- Day surgery lounge equipped with physiotherapists, nursing, and full physiotherapy equipment for ambulation/stairs.
- Increase in physiotherapy working hours until 21:00 hours daily.

**Postoperative/recovery (POD 0):**

- Standardized pain control regiment.
- Patient instructed to change into personal clothing as soon as stable.
- Physiotherapy and nursing team review of patient prior to initiation of physiotherapy.
- If cleared by nursing/physiotherapy, patient seen and discharged by surgical team.
- If patient not cleared, initiation of admission to ward.
- Medication prescription faxed to in hospital pharmacy or patient preferred pharmacy to ensure no delay in analgesia or anticoagulation.

**Follow-up:**

- Anaesthesiology telephone call at 24 hours to ensure pain control.
- Patient provided with surgeon office contact information.
- For total knee arthroplasty, two-week follow-up with GP for removal of staples.
- For total hip arthroplasty, subcuticular stitch used to negate need of suture removal.
- Physiotherapy follow-up at two to three weeks.
- Consultant assessment/follow-up with surgeon at four to six weeks.

Bold text represents changes implemented due to COVID-19 pandemic.

**Take home message**

- Even in the setting of a pandemic, or possibly because of forced changes of the pandemic, we found that a conversion to same day surgery arthroplasty was extremely possible and

safe.

- The surgical approach for hip surgery was not a reflective success of same-day surgery. With multidisciplinary team involvement and standard anaesthetic protocol, we were able to safely convert an unacceptable length of stay into a same-day system.

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#### Funding statement:

- No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

#### ICMJE COI statement:

- A. Cherry, T. Daniels, and S. Ward report consultancy for Cadence and Smith & Nephew, which is unrelated to this work.

#### Open access funding:

- The authors report that the open access funding for this manuscript was self-funded.

#### Ethical review statement:

- IRB ID: 21-032.

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