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ARTHROPLASTY

Introducing a day-case arthroplasty pathway significantly reduces overall length of stay

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Aims

Day-case arthroplasty is gaining popularity in Europe. We report outcomes from the first 12 months following implementation of a day-case pathway for unicompartmental knee arthroplasty (UKA) and total hip arthroplasty (THA) in an NHS hospital.

Methods

A total of 47 total hip arthroplasty (THA) and 24 unicompartmental knee arthroplasty (UKA) patients were selected for the day-case arthroplasty pathway, based on preoperative fitness and agreement to participate. Data were likewise collected for a matched control group (n = 58) who followed the standard pathway three months prior to the implementation of the day-case pathway. We report same-day discharge (SDD) success, reasons for delayed discharge, and patient-reported outcomes. Overall length of stay (LOS) for all lower limb arthroplasty was recorded to determine the wider impact of implementing a day-case pathway.

Results

Patients on the day-case pathway achieved SDD in 47% (22/47) of THAs and 67% (16/24) of UKAs. The most common reasons for failed SDD were nausea, hypotension, and pain, which were strongly associated with the use of fentanyl in the spinal anaesthetic. Complications and patient-reported outcomes were not significantly different between groups. Following the introduction of the day-case pathway, the mean LOS reduced significantly by 0.7, 0.6, and 0.5 days respectively in THA, UKA, and total knee arthroplasty cases ($p < 0.001$).

Conclusion

Day-case pathways are feasible in an NHS set-up with only small changes required. We do not recommend fentanyl in the spinal anaesthetic for day-case patients. An important benefit seen in our unit is the so-called 'day-case effect', with a significant reduction in mean LOS seen across all lower limb arthroplasty.

Cite this article: *Bone Jt Open* 2021;2-11:900–908.

Keywords: Day-case, Arthroplasty, Same-day discharge, Length of stay, NHS

Introduction

Since the development of the enhanced recovery programme (ERP) in abdominal surgery over 20 years ago by Henrik Kehlet,[1] and the subsequent adoption into orthopaedics, hospital stays have radically reduced for elective hip and knee arthroplasty.[2,3] This has been associated with improved patient outcomes and satisfaction, with no detriment to patient safety.[4] Typical hospital lengths of stay (LOS) for hip and knee arthroplasty in the UK have reduced substantially, resulting in significant cost savings to the NHS.[5] The progression to targeting same-day discharge (SDD), often referred to as day-case arthroplasty, has occurred naturally with developments in clinical techniques, anaesthesia, medication, and logistics.[6]

The development of day-case arthroplasty has been most prominent in the USA, particularly for unicompartmental knee arthroplasty (UKA), where case series of successful outpatient procedures have been performed since the early 2000s.[7-10] The adoption in Europe has been slower, likely due to differences in healthcare structure, financial environment,

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doi: 10.1302/2633-1462.211.BJO-2021-0106.R1

Bone Jt Open 2021;2-11:900–908.

Table I. Control and day-case group characteristics.

	THA			UKA		
Groups	**Control**	**Day-case**	**p-value**	**Control**	**Day-case**	**p-value**
Cases, n	40	47		18	24	
Mean age, yrs (SD)	65 (16.7)	60 (8.6)	0.013*	67 (21.3)	67 (8.5)	0.402*
Female, n (%)	25 (63)	23 (49)	0.202†	9 (50)	12 (50)	> 0.999†
Mean BMI, kg/m² (SD)	29.5 (5.2)	28.7 (5.3)	0.213*	30.0 (4.4)	30.6 (5.4)	0.461*
ASA grade 1, n (%)	9 (23)	18 (38)	0.111†	2 (11)	8 (33)	0.093†

*Paired *t*-test.
†Chi-squared test.
ASA, American Society of Anesthesiologists; SD, standard deviation.; THA, total hip arthroplasty; UKA, unicompartmental knee arthroplasty.

and the availability of rehabilitation facilities.[11,12] Recent reports from the Netherlands and Denmark highlight that SDD arthroplasty is gaining momentum in Europe for both total hip arthroplasty (THA) and total knee arthroplasty (TKA).[13-16]

NHS guidance for day-case arthroplasty in the UK advocate managing day-case pathways through a dedicated day-case facility (The National Day Surgery Delivery Pack, GIRFT, September 2020).[17] This is not always achievable due to specific local factors, thus although the design of day-case pathways will vary between units, the principles remain the same. Our unit introduced a day-case arthroplasty pathway run through the main elective ward with the initial year pilot examining safety, clinical outcomes, and efficiency.

We present the results following implementation of a day-case pathway for both UKA and THA in an NHS hospital. The primary objective was to determine the ability to safely achieve SDD and review the reasons leading to any failures. To evaluate the patient experience, we measured self-reported pain, sickness, and satisfaction, then compared these outcomes to a control group of patients following the standard ERP. The secondary objective was to examine the impact of implementing a day-case pathway on the mean LOS for all primary hip and knee arthroplasty.

Method

A matched, non-randomized control study was designed to evaluate implementing a day-case arthroplasty pathway. For the three months prior to the implementation of the day-case pathway (1 August 2018 to 31 October 2018), all primary THA and UKA patients who met the criteria for day-case arthroplasty were recorded (Table I). Matching of the cohorts in relation to age, sex, BMI, and American Society of Anesthesiologists[18] (ASA) grade was undertaken.

Standard pathway. The standard ERP in our unit has a median two-day LOS for both UKA (Q1=2, Q3=3; IQR = 1) and THA (Q1 = 2, Q3= 3, IQR = 1); day two discharge was achieved in 54% of THAs and 68% of UKAs in 2017/18. All patients receive preoperative education via a group-based lecture and have additional information supplied in the form of a booklet, with the consistent message of an expected two-night LOS. All communication highlights the key principles of ERP:[19] adequate pain relief, appropriate anaesthetic, and early mobilization. All patients are discharged to their own homes and have dedicated outreach support at home as required.

Day-case pathway. The development of the day-case pathway with regards to patient selection, anaesthetics, discharge criteria, and post-discharge care were agreed upon by the multidisciplinary team (MDT). The day-case pathway is presented in Figure 1. The pathway did not differ from the standard ERP other than in the requirement of listing priority and the timing of post-surgery investigations. Day-case patients attended the standard preoperative education sessions, with advice given that preselected patients may be discharged the same day as surgery. When possible, day-case patients were seen prior to going to theatre by the physiotherapist to practice mobilizing with walking aids and to practice postoperative exercises. Patients were managed postoperatively on the standard elective ward (four bedded same-sex bays) with no priority over single room unless specifically indicated. An overnight bed was ensured if required on the elective ward. All patients mobilized full weightbearing with the use of walking aids postoperatively.

Patient selection. Inclusion criteria for the day-case pathway were: no cognitive impairment; ASA grade I or II; overnight support at home; primary joint arthroplasty (not complex); no multidrug/opiate sensitivity/dependency; no history of frequent falls/dementia/substance misuse; no past history of Parkinsonism/stroke which impacts mobility; and active engagement by patient in day-case pathway.

After considering the inclusion criteria, patient selection for day-case pathway was based on the discussion with the patient at the time of listing. No cases were considered as day-case procedures unless stated at the time of listing to ensure organizational requirements could be met.

Surgery and anaesthetic protocol. All day-case procedures were scheduled first or second on the theatre list. THA surgery was performed via a posterior approach with all cases receiving the same prosthesis combination

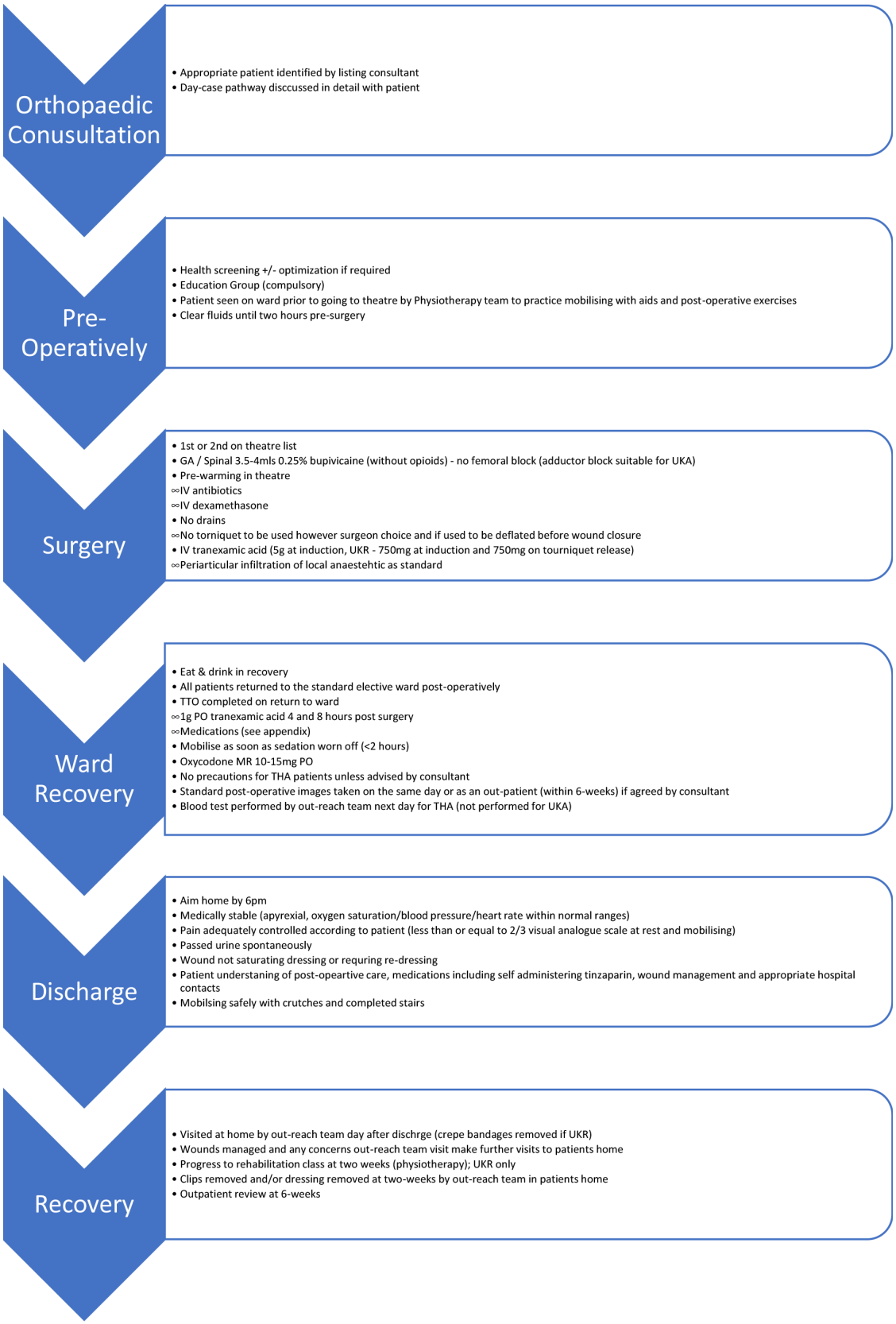


Fig. 1

Flow diagram of day-case pathway key principles and practices. GA, general anaesthesia; IV, intravenous; PO, postoperative; HA, total hip arthroplasty; TTO,to take out medication; UKA, unicompartmental knee arthroplasty.

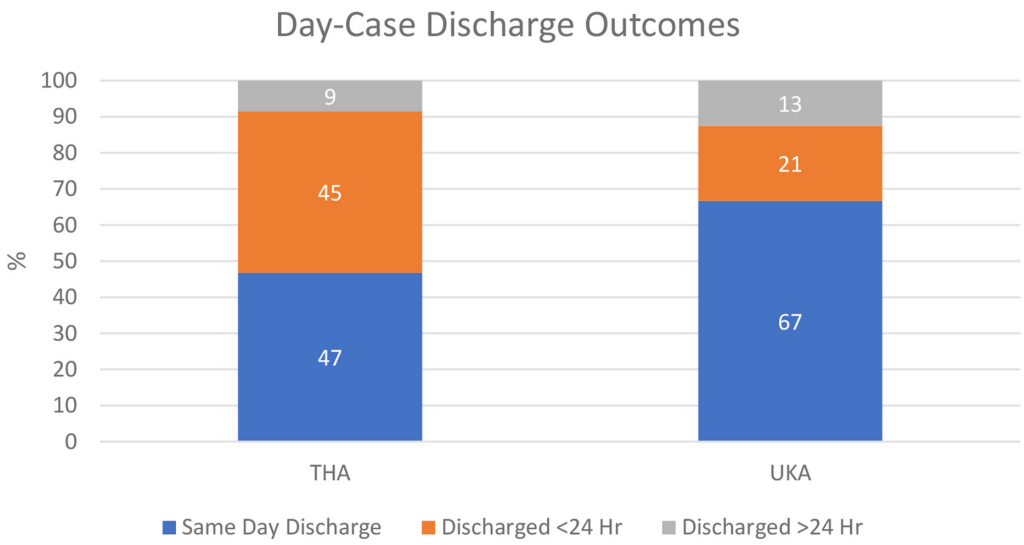


Fig. 2

Day-case pathway discharge outcomes for total hip arthroplasty (THA) and unicompartmental knee arthroplasty (UKA).

(Corail/Pinnacle, DePuy Synthes, USA). UKA was performed using two models of prosthesis dependent on surgeon's preference (Oxford, Biomet, UK, and ZUK, Lima Corporate, Italy). Seven consultants (UKA and THA) performed procedures on patients on the day-case pathway. The most day-case patients performed by a single surgeon was 24 and the lowest was 7.

The day-case anaesthetic protocol was devised by the anaesthetic team. The key elements are incorporated in Figure 1 (the full protocol can be found in Supplementary Material). The protocols for day-case and standard arthroplasty procedures were almost identical, with the key difference being the avoidance of opiates in the spinal.

Discharge criteria. A decision on the appropriateness for discharge was to be made by 18:00 with patients requiring achievement of seven criteria for discharge: medically stable (apyrexial, oxygen saturation/blood pressure/heart rate within normal ranges); pain and nausea/vomiting rated mild/moderate on Likert scale and deemed manageable by the patient; passed urine spontaneously; wound not saturating dressing/requiring redressing; mobilizing safely with crutches and managed stairs; patient understanding of postoperative care, medications, and wound management; and appropriate hospital contacts (24-hour ward contact and outreach team the following day).

Outcome measures. The primary outcome measures for both groups were time to discharge, reasons for failed SDD (day-case pathway only), complications related to the arthroplasty or serious medical events, hospital readmissions within 30 days of discharge, and outreach visits. Information was gathered via searching electronic clinical records and confirming verbally with the patient at their six-week review (e.g. readmissions to other hospitals). Patient-reported pain, sickness, satisfaction, and perceived appropriateness of discharge was determined from a questionnaire completed on the day of discharge, and again at six weeks post-surgery. The secondary outcome measures were mean LOS and day of discharge for elective lower limb arthroplasty in the 12 months preceding and following the implementation of the day-case pathway.

Statistical analysis. Comparison of patient characteristics between the control and day-case groups was performed using the paired *t*-tests (age and BMI) and the chi-squared test. The analysis of mean LOS for THA, UKA, and TKA pre- and post-day-case implementation was performed using the Mann-Whitney U Test (data not normally distributed). The relationship between opioid in the spinal anaesthetic (fentanyl) and achievement of SDD was assessed using the chi-squared statistic (2 × 2 table). Statistical significance was set at $p \leq 0.05$. All statistical analysis was conducted using SPSS v. 23 for Windows software (SPSS, USA).

Results

Day-case outcomes. During the first year of the day-case pathway (1 November 2018 to 31 October 2019) there were 47 (13%) patients selected for THA day-case pathway out of 368 THAs procedures performed. There were 24 (18%) patients selected for UKA day-case pathway out of a total 131 UKAs procedures.

In total, 22 (47%) THA day-case patients achieved SDD, with a further 21 discharged the day after surgery. Four THA cases were in hospital beyond one day (Figure 2). Of the 24 UKA cases listed as day cases, 16 (67%) achieved SDD, five were discharged the following day, and three cases had a hospital stay greater than one day.

Table II. Day-case and control group comparisons.

	THA		UKA	
Variable	**Control**	**Day-case**	**Control**	**Day-case**
Total, n	40	47	18	24
Achieved discharge < 12 hr, n	0	22	0	16
Achieved discharge < 24 hr, n	8	21	2	5
Discharge > 24 hr, n	32	4	16	3
Complications, n	0	1	0	0
Readmissions (30 days), n	1	2	0	1
Mean outreach visits (SD)	2.15 (1.012)	1.78 (0.661)	1.94 (1.008)	1.96 (0.681)

SD, standard deviation; THA, total hip arthroplasty; UKA, unicompartmental knee arthroplasty.

Table III. Differences between cases that achieved and failed same-day discharge for total hip arthroplasty and unicompartmental knee arthroplasty.

	THA SDD		UKA SDD	
Variable	**Achieved**	**Failed**	**Achieved**	**Failed**
Cases	22	25	16	8
Female, n (%)	9 (41)	14 (56)	7 (44)	5 (63)
Mean age, yrs (SD)	61 (8.537)	60 (8.853)	67 (8.436)	65 (8.739)
Mean BMI, kg/m^2 (SD)	29 (4.852)	29 (3.377)	29 (3.390)	33 (3.509)
Mean ASA grade (SD)	1.6 (0.515)	1.6 (0.557)	1.7 (0.582)	1.9 (0.529)
Mean time in theatre, mins (SD)	85 (18.943)	91 (22.386)	95 (23.266)	90 (19.178)
Average time returned to ward (24 hr)	10:55	11:27	11:24	10:48
Anaesthesia, n				
GA	3	2	5	1
Spinal	19	23	11	7
Spinal incl. fentanyl	1	15	0	3

ASA, American Society of Anesthesiologists; GA, general anaesthetic; SD, standard deviation; SDD, same-day discharge; THA, total hip arthroplasty; UKA, unicompartmental knee arthroplasty.

The mean time from leaving theatre to leaving the hospital for successful SDD was 7:44 hours (4:27 hours to 9:55 hours) for THA and 7.20 hours for UKAs (3:30 to 9:54). The average discharge time (24-hour clock) for successful SDD THAs was 18:39 and for UKA was 18:44. The latest time a successful SDD patient left the operating theatre was 12:41 for THA and 13:47 for UKA.

Comparisons to the standard pathway. The control and day-case groups were matched except for age in THA patients (Table I). Comparisons in outcomes between the control and day-case groups are presented in Table II. Eight THAs (20%) and two UKAs (11%) achieved discharge on day one in the control group. In relation to complications, only one THA case had a postoperative dislocation, which occurred on the return from theatre. The reason for hospital readmission within 30 days in the THA control group was constipation/perirectal bleeding (n = 1) and in the THA day-case group was the result of a stitch abscess (n = 2). The readmission for UKAs in the day-case group was due to difficulties with swallowing and vomiting (n = 1). No serious complications occurred post-discharge. On average, there were fewer postoperative outreach visits for day-case THA patients in comparison to control group THAs. There was no difference in outreach visits between day-case and control groups for UKAs.

Failed SDD. The reasons for failed SDD in THA cases were symptomatic hypotension and/or nausea (n = 11), spinal anaesthetic still active (n = 5), pain (n = 4), awaiting blood test/radiograph (n = 2), pyrexial (n = 1), awaiting physiotherapy (n = 1), and dislocation (n = 1). The hip dislocation was understood to have occurred during transfer of the patient from the operating table to the recovery room. There was no difference in patient characteristics related to success or failure of SDD in THA (Table III).

The individual reasons for failed UKA day case were hypotension/nausea (n = 4), pain (n = 2), spinal anaesthetic still active (n = 1), and failure to pass urine (n = 1). UKA failed SDD cases were more likely to be female and have a higher BMI.

Cases with fentanyl in the spinal anaesthetic accounted for eight of the failures due to hypotension/nausea and two due to pain in THA and both UKA cases that failed discharge due to pain. The relationship between fentanyl use and failure of SDD was significant ($p < 0.001$, chi-squared test).

Patient-reported outcomes. All patients completed questionnaires on hospital discharge (n = 129). The six-week questionnaire was completed by 37 (93%) and 42 (89%) of the THA control and day-case group respectively, and by 15 (83%) and 18 (75%) of the UKAs. Patient-reported pain and sickness was comparable for day-case and control groups (Figure 3a to b); 23% to 43% reporting severe pain and 66% to 88% reporting no sickness at all. Patient satisfaction was comparable for the two groups (Figure 3c). Patients reported appropriate timing of discharge in 86% of day-case UKAs and 95% of day-case THAs (Figure 3d).

Overall LOS. There were 934 arthroplasty procedures performed in the 12 months prior to the day-case pathway and 939 performed in the same period following its implementation (Figure 4).

Following the introduction of the day-case pathway, mean LOS reduced by 0.7 days ($p < 0.001$, Mann-Whitney U test) for THA, 0.6 days ($p < 0.001$, Mann-Whitney U test) for UKA, and 0.5 days ($p < 0.001$, Mann-Whitney U test) for TKAs. When the day-case data were excluded from the analysis the mean LOS for THAs was 2.26 days and 1.99 days for UKA.

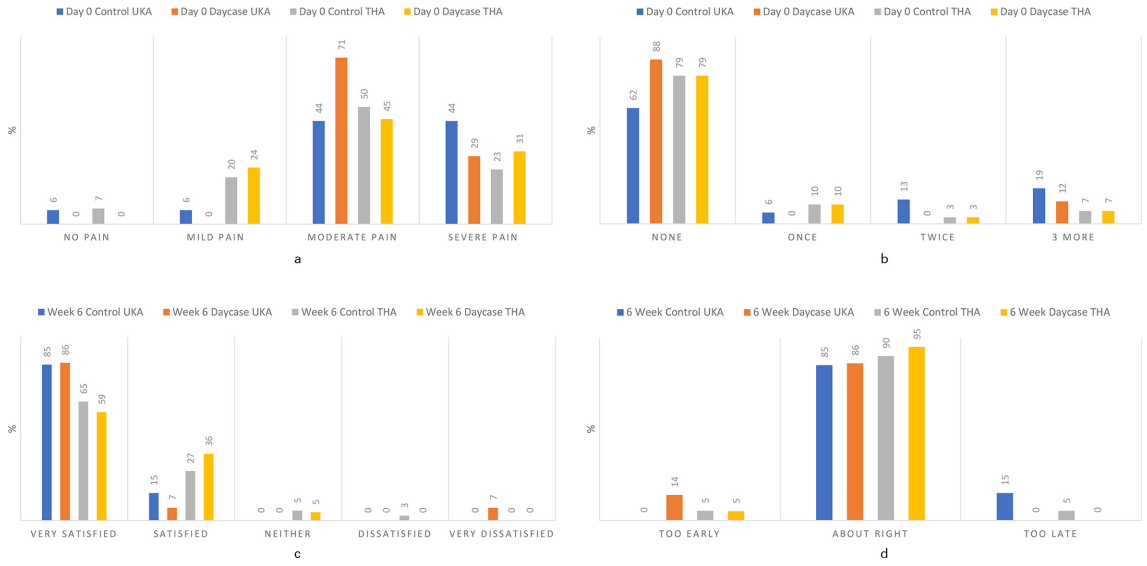
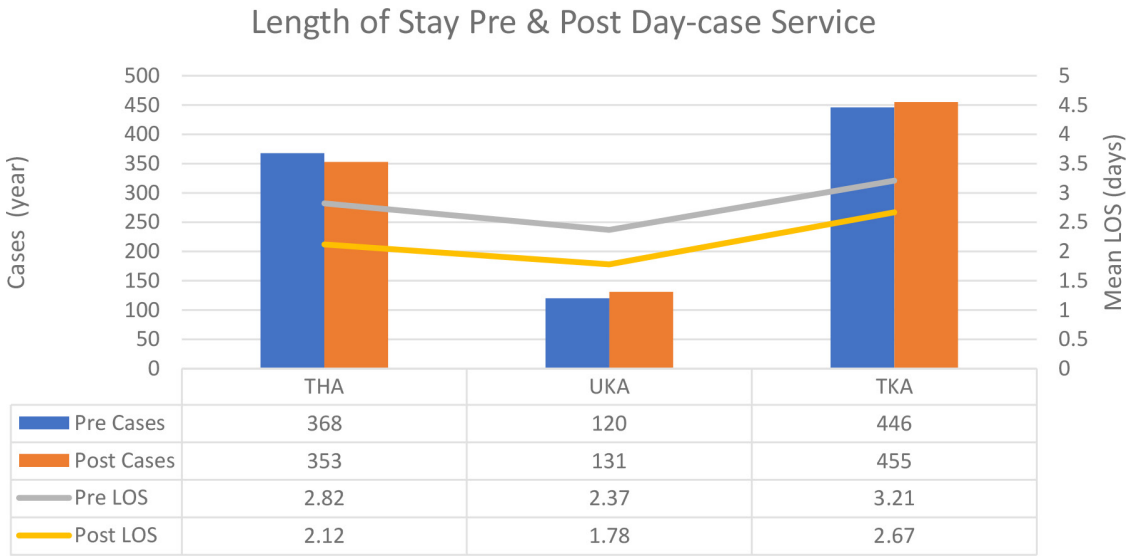


Fig. 3

Results of the patient questionnaire completed on the day of discharge and six weeks following surgery by both patients in the standard and day-case pathway. THA, total hip arthroplasty; UKA, unicompartmental knee arthroplasty.



	THA	UKA	TKA
Pre Cases	368	120	446
Post Cases	353	131	455
Pre LOS	2.82	2.37	3.21
Post LOS	2.12	1.78	2.67

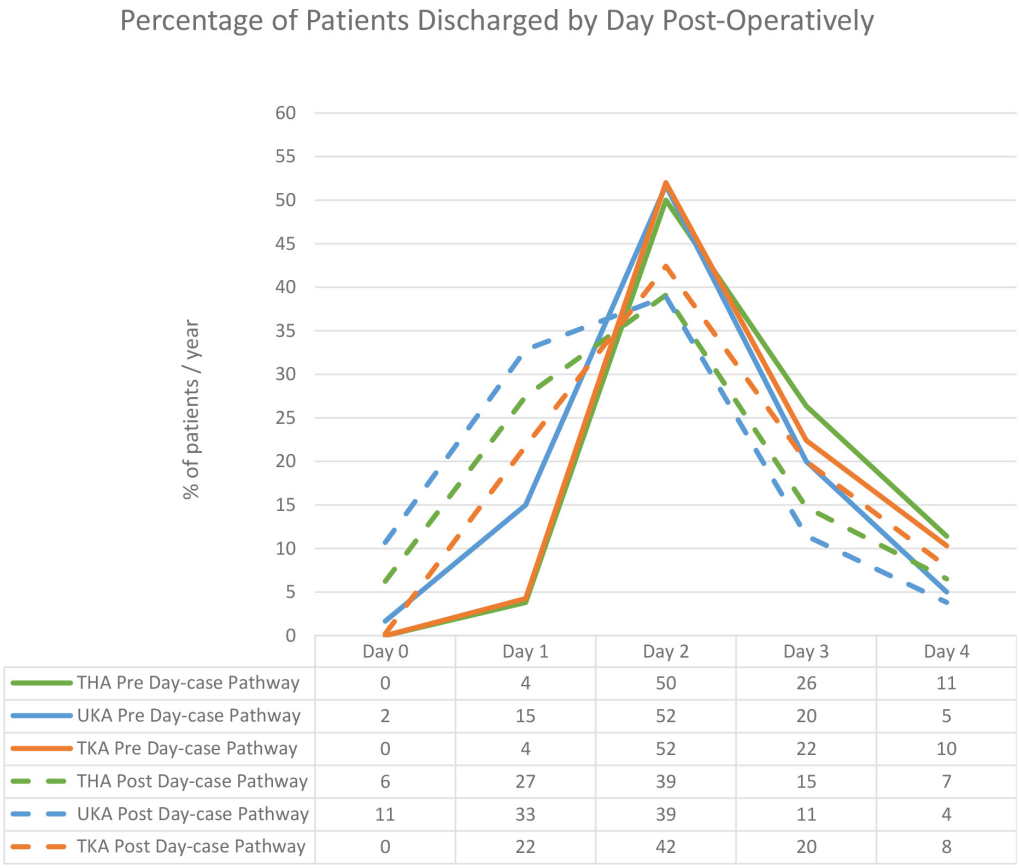
Fig. 4

Number of cases per year and mean length of stay pre- and post-starting the day-case pathway. LOS, length of stay; THA, total hip arthroplasty; TKA, total knee arthroplasty; UKA, unicompartmental knee arthroplasty.

The percentage of cases discharged on or before day one post-surgery increased for each procedure, from 3.8% (14/368) of cases to 33.7% (119/353) in THAs, from 16.7% (20/120) of cases to 43.5% (57/131) of cases in UKAs, and from 4.3% (19/446) to 22.0% (100/455) of TKAs (Figure 5). There is a shift from a peak by day two discharge pre day-case pathway, to a more gradual peak at day two due to more day zero and day one discharges. This follows on with fewer day three and day four discharges across all arthroplasty procedures.

Discussion

This study describes the outcomes of a newly implemented day-case arthroplasty pathway in an NHS hospital. Day-case patients were selected based on a combination of pre-determined eligibility criteria and the patient's agreement to participate. This was one in eight of all THAs and one in five of all UKAs performed in the 12-month period. Few changes were made for the day-case protocol from the standard ERP. Good consistency of SDD was achieved with most patients discharged within 24 hours (90%).



	Day 0	Day 1	Day 2	Day 3	Day 4
THA Pre Day-case Pathway	0	4	50	26	11
UKA Pre Day-case Pathway	2	15	52	20	5
TKA Pre Day-case Pathway	0	4	52	22	10
THA Post Day-case Pathway	6	27	39	15	7
UKA Post Day-case Pathway	11	33	39	11	4
TKA Post Day-case Pathway	0	22	42	20	8

Fig. 5

Graph of day-of-discharge pre and post day-case pathway. THA, total hip arthroplasty; UKA, unicompartmental knee arthroplasty.

Patients on the day-case pathway achieved SDD in 47% (22/47) of THAs and 67% (16/24) of UKAs. This success rate for UKAs was lower than reported by another NHS hospital (85%, 61/72 cases).[11] This study however covered a four-year period, and with the implementation of any new pathway a period of learning and adoption is expected, with improved outcomes predicted over time. Another UK study reported 39% (264/669) SDD achieved in UKAs.[20] This study however described a pathway in which all UKAs were managed on a day-case pathway compared to our selective criteria. With 12% (16/131) of all UKAs in our cohort achieving SDD there is scope to increase the number of cases targeting a day-case route. Anecdotally, the most common reason for medically fit patients not entering the day-case pathway was patient preference. In Denmark, SDD has been achieved in 85% to 88% of THAs.[12-15] In one of these studies however the patient discharge destination was a nearby patient hotel where an on-call nurse was available.[12] Comparisons with day-case/outpatient arthroplasty in the USA is complicated due to the previously mentioned differences in health structure and finances, however they similarly quote high success rates of 72% to 96% for UKAs and 76% to 100% for THAs.[7,9,10,21,22]

We found self-reported adverse symptoms postoperatively, i.e. pain and sickness, to be comparable between the standard and day-case pathways. This finding is consistent with previous findings, and is not unexpected considering the similarities between the two pathways in terms of surgical, anaesthetic, and rehabilitation protocols.[11] Overall satisfaction scores were likewise comparable with 93% (66/71) of day-case patients reporting that their time of discharge had been appropriate.

The most common reasons for failed SDD were hypotension/postoperative nausea and vomiting (PONV) (45%), spinal still active (18%), and pain (18%). These findings are in line with the factors reported by Husted et al[23] on fast-track hip and knee arthroplasty.[23] There were no differences identified with regards to ASA grade, BMI, or age on achievement of SDD. Our findings are consistent with the literature regarding the influence of sex on successful SDD, with 46% of females compared to 61% of males successfully discharged the day of surgery.[24,25]

The strongest factor associated with failure of SDD in our study was the use of opioids, specifically fentanyl, in the spinal anaesthetic; this practice was not in the anaesthetic protocol, however variance among individual anaesthetists occurred. Of 19 cases that had fentanyl

administered, only one (5%) achieved SDD. In contrast, of the remaining cases, 73% (38/52) achieved SDD. This is supported by evidence showing high rates of PONV following various surgical procedures when intrathecal opioids are added to the spinal regardless of the use of antiemetics.[26,27]

There were no serious complications in either the control or day-case group, however there was a higher rate of 30-day hospital readmissions in the day-case group: 4.3% vs 1.7%. All readmissions were for minor concerns and no patients required hospital inpatient stay. Multiple studies have reported comparable complication rates with day-case arthroplasty.[8,12,22,28]

The most novel finding from the introduction of the day-case pathway has been the indirect impact on LOS for patients following the standard pathway, i.e. even when day-case data were excluded from analysis. The ERP principles for hip and knee arthroplasty were adopted over a decade ago at our unit and the initial significant reduction in LOS had occurred with a plateauing over the last few years. The 'day-case effect' is most evident for TKA cases as this group was excluded from the day-case pathway, yet still showed a significant reduction in LOS. The mean reduction of over half a day for each procedure equates to more than 450 extra bed days. This has potential benefits on improved cost-efficiency and greater capacity. The bed days saved via the 'day-case effect' reduction in LOS is greater than the direct bed-day savings from the 71 cases that were on the day-case pathway. This effect has not been described previously in the literature. We hypothesize that the day-case pathway influenced overall LOS of all arthroplasty patients for two reasons. Firstly, all patients attended the same preoperative education class during which the expected journey for both pathways was discussed. Secondly, by running the pathways simultaneously through the standard elective ward, the mindsets about early discharge of patients and staff were influenced.

The number of day-case cases in this review is small relative to others within the literature. This is a result of the short time period and early variation in adoption by some consultants. This adoption grew once success was observed. It is worth noting that even with small numbers, the newly adopted day-case pathway had a positive effect on overall LOS for all arthroplasty patients.

There are limitations to the study design. Firstly, we acknowledge that this is a single-centre study and thus conclusions regarding the day-case effect impact require confirmation through other units. Additionally, we cannot be certain that other factors did not significantly impact the LOS between the two compared cohorts. Secondly, we did not design the control arm of the study to be a true matched cohort and as such there are subtle but potentially significant differences. Thirdly, our unit runs a specialist outreach service that is standard in our ERP.[29] This dedicated team visit patients in their homes as required to offer rehabilitation and wound management. It is interesting to note that patients in the day-case pathway required fewer visits than patients in the standard pathway. This may reflect that patients with longer LOS require most support even after inpatient discharge.

Dorr et al[30] reported that over one-third of THA patients preferred a day-case pathway, indicating scope to increase our cases two- to three-fold. Moving forward, we aim to increase the number of cases managed through the day-case pathway, including TKAs. Although concerns over day-case TKA have been raised, the issues described were similar for THA and UKA.[24] Outcomes for day-case TKA were presented from Denmark with a quarter of patients achieving SDD.[14] In order to assist with selecting the right patients, the use of a predictive stratification tool would be valuable.[31]

In conclusion, we have successfully implemented a day-case arthroplasty pathway for THA and UKA in an NHS hospital. The reporting of early results here aims to highlight the importance of adhering to a spinal anaesthetic protocol and the positive 'day-case effect' on overall LOS. The progression to day-case arthroplasty in the UK is accelerating and although pathways are unique to each unit, they are built on similar principles.

Take home message

- Day-case pathways are feasible to implement in an NHS hospital with minimal modifications.
- Fentanyl in the spinal anaesthetic is not recommended for day-case arthroplasty patients.
- Implementing a day-case pathway has an indirect impact on the length of stay for all hip and knee arthroplasty.

Supplementary material

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Funding statement:
- The author or one or more of the authors have received or will receive benefits for personal or professional use from a commercial party related directly or indirectly to the subject of this article.

ICMJE COI statement:
- J. Waite declares payment for lectures from Zimmer Biomet, unrelated to this study. S. Young declares payment for lectures and payment for the development of educational presentations from DePuy Synthes, unrelated to this study.

Ethical review statement:
- Approval for the study was gained from the hospital's Research & Development department. Patient consent was gained in accordance with the Declaration of Helsinki for those involved in the day-case groups.