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REVIEW

Day-case hip and knee arthroplasty: stages of care and the development of an institutional pathway

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Abstract

Day-case, or outpatient, arthroplasty is growing and has been adopted in healthcare systems because of its cost-effectiveness. A number of studies that reported on day-case total hip arthroplasty, total knee arthroplasty and unicompartmental knee arthroplasty have shown that they can be performed successfully in a select group of patients. However, safety remains a concern, as a clear pathway, including discharge criteria, is not well described in the literature. This article outlines the stages of care involved in day-case hip and knee arthroplasty and gives insights from University College London Hospital's own evidence-based day-case arthroplasty pathway.

Key words: Day-case arthroplasty; Hip arthroplasty; Knee arthroplasty; Outpatient arthroplasty

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Introduction

Total hip arthroplasty, total knee arthroplasty and unicompartmental knee arthroplasty are effective elective procedures which couple excellent functional outcomes with low complication rates (Learmonth et al, 2007; Liddle et al, 2015). The number of hip and knee arthroplasties performed in both the UK and the USA has increased substantially (Culliford et al, 2010; Patel et al, 2015) and current projections estimate that this trend will continue for the foreseeable future (Patel et al, 2015; Ahmed and Haddad, 2019). The increase in demand for arthroplasty is expected to cause a substantial strain, particularly financial, on healthcare systems universally (Aynardi et al, 2014). This has encouraged the adoption of 'fast-track' or 'enhanced recovery' protocols to reduce the economic strain of lower limb arthroplasty, while also focusing on advancing patient care standards. Fast-track protocols were first pioneered in the early 1990s by Henrik Kehlet for patients undergoing abdominal surgery (Kehlet, 1997, 2008). The term 'fast-track' described a multi-faceted package of techniques that aimed to improve postoperative recovery by reducing post-surgical complications. The hospitals that used this approach have achieved great success with reducing surgical morbidity and hospital stay (Kitching and O'Neill, 2009). Although the translation of these protocols in orthopaedic practice has been gradual, these pathways have been adopted in elective orthopaedic surgery to help boost patient recovery and facilitate early discharge with reduced inpatient hospital stays.

These enhanced recovery after surgery pathways concentrate on improving preoperative patient education, analgesia regimens, surgical techniques and postoperative recovery protocols including rehabilitation. This has reduced the average length of stay in hospitals compared to more conventional pathways (Ibrahim et al, 2013; Gromov et al, 2020). Day-case, or outpatient, joint arthroplasty is seen as an evolution of these well-established pathways and its use reduces costs and allows more patients to be treated, thus reducing waiting lists. Many orthopaedic units that have integrated day-case arthroplasty into their practice have shown comparable, if not superior, outcomes to those of inpatient arthroplasty (Coenders et al, 2020; Kimball et al, 2020). Moreover, it frees up acute care beds for patients with more complex healthcare needs. This article discusses day-case hip and knee arthroplasty, including vital stages for outpatient arthroplasty, and presents insights into University College London Hospital's day-case arthroplasty pathway.

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Inclusion criteria

Patient selection for day-case arthroplasty is crucial to prevent unforeseen extended hospital stays, adverse events or complications and readmissions, but there is no consensus regarding criteria for patient selection. Several classification and scoring systems of patient morbidity have been used to help with patient selection for outpatient arthroplasty, including the American Society of Anesthesiologists scoring system and the Charlson Comorbidity Index (Hoorntje et al, 2017; Larsen et al, 2017). Body mass index has also been used as a tool for patient selection, particularly for those undergoing day-case total knee arthroplasty (Springer et al, 2017; Shah et al, 2018). Studies that have measured the outcomes of outpatient arthroplasty have not included patients with major comorbidities (Keulen et al, 2020; Thompson et al, 2021). Although advanced age is not a contraindication for outpatient arthroplasty, Jørgensen et al (2013) reported an increase in length of stay in hospital and readmission rates associated with increasing age.

Improved enhanced recovery after surgery pathways

Since the adoption of enhanced recovery programmes into elective orthopaedic surgery, length of hospital stay has dramatically reduced for patients undergoing hip or knee arthroplasty with associated cost savings (Burn et al, 2018). The enhanced recovery after surgery concept describes an evidence-based package of care involving preoperative, perioperative and postoperative stages for outpatient arthroplasty.

Preoperative measures

Preoperative assessment

A preoperative assessment is vital for patients undergoing hip or knee arthroplasty. Pre-existing comorbidities such as cardiac issues, diabetes, organ dysfunction and pulmonary disease are strong determinants of postoperative complications as well as factors that affect length of stay in hospital (Kaye et al, 2019). A pre-assessment appointment weeks before the intended date of surgery allows adequate optimisation of any medical concerns that are picked up. It can also allow for incidental findings and diagnoses via a comprehensive patient work up.

Patient education

Patient education plays a central role in preoperative outpatient joint arthroplasty pathways and reduces the length of stay in hospital (Yoon et al, 2010). Group-based sessions and supplementary information given to patients in the form of leaflets or booklets have been provided by institutions offering outpatient hip and knee arthroplasty (Saunders et al, 2021; Wignadasan et al, 2022). These sessions involve discussions around the benefits of arthroplasty and cover potential risks, the model of day-case arthroplasty, the multi-modal analgesic regimen and postoperative physiotherapy. Patient education and management of patient expectations facilitate early hospital discharge (Meneghini et al, 2017).

Perioperative measures

Analgesia

Adequate levels of analgesia in the perioperative period are paramount for successful day-case hip and knee arthroplasty to allow engagement with physiotherapists and facilitate early mobilisation. A multi-modal, individualised pain management scheme is needed, which minimises opioid use, delivers faster functional recovery and reduces length of stay in hospital (Yoon et al, 2010). Comparable pain and satisfaction scores between patients who underwent day-case and inpatient total knee arthroplasty were reported at day one postoperatively and also at 4 weeks using a multi-modal analgesic approach (Gauthier-Kwan et al, 2018). Furthermore, high readmission and complication rates related to outpatient arthroplasty have been associated with poor pain control (Springer et al, 2017). University College London Hospital has adopted a multi-modal analgesic and anaesthetic regimen (Table 1).

Table 1. Anaesthetic and analgesia protocol

Anaesthetic regimen	Plan A: general anaesthetic	Use of short-acting drugs
	Plan B: spinal anaesthetic	Bupivacaine or prilocaine +/- dexamethasone
		If sedation necessary, propofol is used (fentanyl can be added as only additional opioid)
	For both plan A and plan B	Consider motor-sparing nerve blocks
		Peri-articular local infiltration – up to 2 mg/kg of bupivacaine in total
		Start multi-modal analgesia including non-steroidal anti-inflammatory drugs (unless contraindicated) in recovery room
Postoperative medication*	Paracetamol 1 g four times a day	
	Ibuprofen 200–400 mg three times a day	
	Dihydrocodeine 30–60 mg four times a day	
	Oramorph 10–20 mg 3-hourly as needed	
	Cefuroxime 750 mg 8 hours post-induction	
	Cyclizine 50 mg three times a day	
	Enoxaparin 20 mg 6h postoperatively	
Discharge medication	Paracetamol 1 g four times a day	
	Dihydrocodeine 30–60 mg four times a day	
	Oramorph 10–20 mg 3-hourly as needed (one 100 ml bottle is dispensed on discharge)	
	Cyclizine 50 mg three times a day	
	Senna two tablets at night	
	Rivaroxaban 10 mg once a day for 14 days for knee replacements and 35 days for hip replacements	

**No modified-released opioids are prescribed, postoperative pain relief is prescribed if needed*

Anaesthetic

Conventionally regional anaesthetic is advocated over general anaesthetic because of the reduced cardiopulmonary morbidity. However, both regional and general anaesthesia are safe and effective when used for patients undergoing outpatient arthroplasty (Richards et al, 2018; Bosch et al, 2020; Carey et al, 2020; Coenders et al, 2020). Berger et al (2009) reported 150 consecutive patients discharged on the same day of their total hip arthroplasty using regional anaesthesia combined with anticipated combination of oral analgesia and anti-emetic medication. In Shah et al's (2018) study involving 53 consecutive patients who were successfully discharged on the same day as their total knee arthroplasty, general anaesthesia with an adductor canal block and periarticular local anaesthetic infiltration was an effective combination that allowed same-day discharge. Furthermore, a systematic review on the efficacy of peri-articular local anaesthetic infiltration reported lower patient pain scores, increased range of movement in the acute postoperative period and reduced postoperative opioid requirement after total knee arthroplasty (Seangleulur et al, 2016). The authors use bupivacaine 2 mg/kg for peri-articular local anaesthetic administration to help with acute pain relief in the postoperative period.

Management of intraoperative blood loss

Blood loss should be minimised to prevent potential postoperative complications that could lead to failed early discharge. There is no consensus on optimal timing of postoperative haemoglobin check for patients undergoing arthroplasty with scheduled same-day discharge (Lazic et al, 2018). This highlights the importance of adequate preoperative assessment with anaemia screening and medical optimisation, which reduces the risk of requiring a perioperative blood transfusion. Additionally, administration of tranexamic acid has been associated with a significant reduction in blood loss. This is reflected in Gianakos et al's (2018) meta-analysis which found that the combined use of intravenous and topical tranexamic acid resulted in reduced blood loss.

Surgical technique

Most studies that have reported on outpatient total hip arthroplasty have advocated muscle-sparing approaches to facilitate quicker recovery (Rosinsky et al, 2020). However, conventional approaches have also been successful in achieving same-day discharge (Larsen et al, 2017; Madsen et al, 2019). The most commonly used approach for day-case total hip arthroplasty in the literature is the direct anterior approach, as soft tissue trauma is minimised and expected to permit faster immediate postoperative recovery. The authors' institution uses the posterior approach, which they have found does not impede immediate postoperative recovery and early mobilisation. Moreover, most outpatient cases of total knee arthroplasty reported in the literature were conducted using a medial parapatellar approach. However, some authors have demonstrated successful same-day discharge using a minimally invasive subvastus approach (Shah et al, 2018). Meticulous wound handling and closure is vital to reduce the incidence of postoperative complications. The authors' institution closes the skin with 3-0 Monocryl and supplements this with steri-strips, which lessens the workload at the first postoperative clinic review (Table 2).

Postoperative measures

Early rehabilitation and mobilisation is essential in order to facilitate successful same-day discharge. Patients must be immediately mobilised after the motor block has worn off, or as soon as possible if the patient underwent arthroplasty under general anaesthesia. This should ideally be within 2 hours after surgery (Rodríguez-Merchán, 2020).

Adequate multi-modal pain control will allow early engagement with the physiotherapy team postoperatively. For patients that have undergone unicompartmental knee arthroplasty or total knee arthroplasty, early rehabilitation and mobilisation exercises (both active and passive) should be initiated with the physiotherapists. Patients must be able to mobilise with two crutches independently before being fit for discharge.

There is no consensus in the literature on a universal discharge protocol to facilitate safe same-day discharge after hip or knee arthroplasty, but departments need to have a clear discharge protocol in place. Various discharge criteria have been described, with common principles of good pain control, exercise goals, independent voiding and quantitative physiotherapy being necessary (Crawford et al, 2020; Sartawi et al, 2020). Goyal et al (2017) described a discharge criterion whereby it is compulsory for patients to complete certain activities with physiotherapists, feel subjectively comfortable enough to be discharged and be deemed clinically stable for discharge. Some studies have included a postoperative haemoglobin check as part of the day-case arthroplasty discharge protocol (Paredes et al, 2018).

Table 2. Surgical technique

	Hip arthroplasty	Knee arthroplasty
Patient position	Lateral	Supine
Surgical approach	Posterior approach	Midline, medial parapatellar approach (for total and partial knee arthroplasties)
		Tourniquet applied, not inflated
Fixation method	Dependent on the patient's bone biology and surgeon choice – the authors perform both uncemented and hybrid fixations. Fully cemented total hip arthroplasty is uncommon	Cemented
Suture closure	Intraosseous ethibond for re-attachment of the external rotators	Looped polydiaxanone suture/heavy Vicryl for closure of the arthrotomy
	1-0 Vicryl for fascia and fatty layer	1-0 Vicryl for fatty layer
	2-0 Vicryl for dermis	2-0 Vicryl for dermis
	3-0 Monocryl for skin + steristrips	3-0 Monocryl for skin + steristrips
Dressings	Waterproof dressing	Waterproof dressing and wool-crepe bandaging (bandaging can be removed by patient at home on day 2)

Limitations of the evidence supporting day-case arthroplasty

The limitations of day-case arthroplasty should also be considered. As discussed, outpatient arthroplasty is only appropriate for a select group of patients that fit a templated set of inclusion criteria. A number of studies reported on variable rates of failed day-case discharges (Gillis et al, 2019; Crawford et al, 2020). Goyal et al's (2017) randomised controlled trial reported a 24% failure rate of same-day discharge for patients that underwent total hip arthroplasty, and 17% of those who were planned for an inpatient stay post total hip arthroplasty were discharged on the day of surgery. This highlights the need for detailed inclusion criteria for effective day-case discharge.

Selection bias must be considered when analysing the literature. As a result of the stricter selection criteria to be listed for a day-case arthroplasty procedure, most patients are younger, more motivated, have fewer comorbidities, have lower American Society of Anesthesiologists grades and have a good support system in the community to aid them once discharged from hospital (Thienpont et al, 2015; Jaibaji et al, 2020). The general discrepancy in age and medical comorbidities between those that are candidates for outpatient arthroplasty and those that are not (Bradley et al, 2017; Jaibaji et al, 2020) shows that the asymmetry of baseline patient characteristics is associated with lower surgical risk, favouring those listed for day-case arthroplasty. Consequently, the superior readmission and complication rates related to day-case arthroplasty groups could be secondary to selection bias alone (Coenders et al, 2020). However, randomised controlled trials (Goyal et al, 2017) and propensity matched studies (Rosinsky et al, 2020) which have abolished this bias have shown more encouraging results favouring outpatient arthroplasty pathways.

As a result of the heterogenous nature of the studies in the literature, combined with differences in anaesthetic techniques, surgical approach, unit-specific day-case arthroplasty protocols and a paucity of studies done (especially randomised controlled trials), the advantages of outpatient arthroplasty compared to inpatient arthroplasty remain debatable. Future prospective randomised controlled trials are needed to accurately delineate the effectiveness and morbidity associated with day-case arthroplasty pathways (Nowak and Schemitsch, 2019).

Insights from the University College London Hospital day-case arthroplasty pathway

University College London Hospital, a tertiary centre in central London, conducts a high volume of hip and knee arthroplasty procedures annually and has performed over 200 cases of day-case arthroplasty. Day-case arthroplasty now makes up 10% of its primary arthroplasty practice and this is expected to increase with time as the pathway expands and develops.

For successful same-day discharge to occur, rigid protocols need to be in place. Pre-, peri- and postoperative measures are in place to minimise the risk of failed day-case discharge and postoperative complications. The evidence-based elective day surgery arthroplasty pathway is shown in Figure 1 and illustrates the pathway from patient referral to an arthroplasty consultant, to being discharged as a day-case procedure and subsequent follow up. Patients planned for day-case discharge are operated on in the morning so that there is ample time for physiotherapy engagement and for providing acute postoperative analgesia, which would allow safe discharge. The involvement of a multidisciplinary team (Table 3) throughout the entire process aims to make the progression from listing for surgery to discharge as straightforward and safe as possible. Strict inclusion and exclusion criteria for patients' eligibility for outpatient arthroplasty are applied (Table 4), which allows for a more predictable perioperative experience.

Most patients at the institute are administered a general anaesthetic, with some opting for regional anaesthesia. Motor-sparing blocks are considered, and there is routine infiltration of a local anaesthetic to the peri-capsular/peri-articular region to help with immediate postoperative pain relief. The authors find that successful day-case discharge is easily achieved with the use of general anaesthetic, highlighting the importance of effective peri-articular local anaesthetic delivery and adequate postoperative analgesic medication. Moreover, the use of general anaesthetic significantly reduces the risk of postoperative

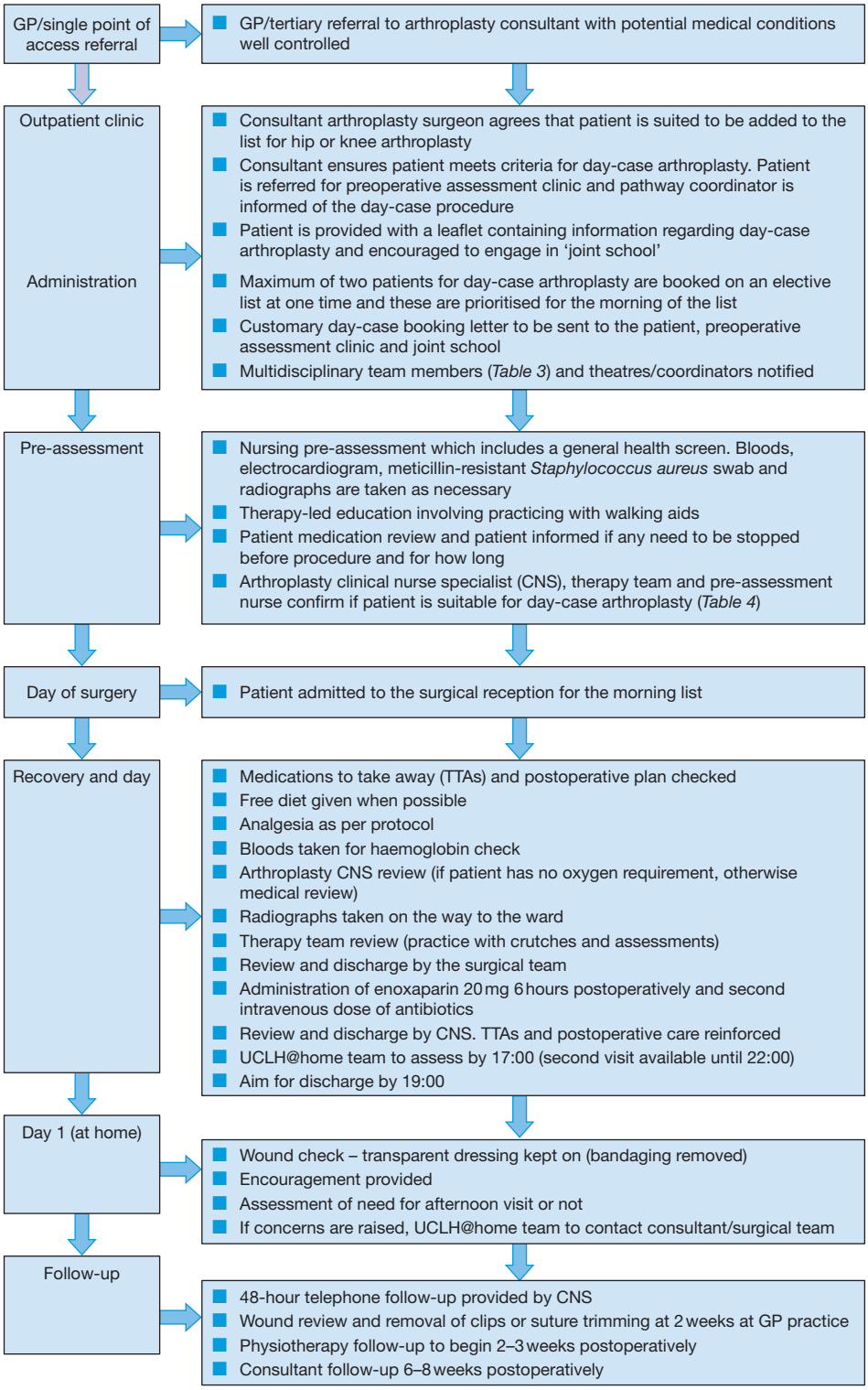

Figure 1. Institutional elective day-surgery arthroplasty pathway.

urinary retention, thus reducing the need for catheterisation (Baldini et al, 2009), and the associated risks of urinary tract infections, delayed mobilisation, lengthened hospital stay and increased likelihood of readmission (Tischler et al, 2016). Multi-modal analgesia begins in the recovery room to allow early mobilisation and physiotherapy. It also allows the avoidance of opioids and their adverse effects such as nausea and vomiting, which can prolong hospital stay. Antiemetic medication is prescribed if needed in the perioperative period and can also be given as discharge medication.

Teamwork plays a crucial role post-surgery to facilitate successful day-case discharge. Administration of the prescribed analgesia by the nursing team in the immediate postoperative period, prompt mobilisation with the physiotherapy team, review by a clinical nurse specialist and surgical team, and dispensing of medication on discharge by the pharmacists, are some of the processes that take place after the patient leaves the recovery room. A clinical nurse specialist calls the patient 48 hours post-discharge to assess their progress, answer any questions they may have and provide information and support which prevents the need for re-admission. The institution's novel day-case arthroplasty pathway has been largely successful because of the stringency of its patient selection process and evidence-based pre-, peri- and postoperative protocols which allow for the provision of an effective, efficient and cost-effective service. All phases of the pathway are continuously analysed and audited to improve the service and maximise patient safety throughout their day-case arthroplasty journey. The institution's day-case discharge criteria are illustrated in Table 5.

Failed same-day discharge

Day-case discharge does not always occur as planned. In the first 3 years of the institute performing day-case arthroplasty, nine patients were not discharged on the same day because of pain, nausea and vomiting or urinary retention. A further five patients struggled to meet the discharge criteria and required additional nursing and medical input. Two patients returned to the emergency department within a week of discharge with bleeding wounds. Both were treated as outpatients and did not require hospital admission. One patient was

Table 3. Multidisciplinary team members

Orthopaedic surgeon and clinical team members
Arthroplasty clinical nurse specialist
Orthopaedic matron
Theatres and anaesthetic matron
General manager
Day surgery ward manager
Lead and assistant physiotherapists
Lead and assistant occupational therapists
Pre-assessment nurse
Pharmacists
Radiology team

Table 4. Inclusion and exclusion criteria for day-case arthroplasty

Inclusion criteria	Willing to have day-case procedure
	Good support at home
	Able to use walking aids
	Clinically safe enough to be treated at home with given instructions
Exclusion criteria	American Society of Anesthesiologists grade ≥ 3
	Cardiac history, for example patients who have had previous cardiac surgery, previous myocardial infarction or diagnosis of heart failure
	Haemoglobin <120 g/litre
	Difficulty in understanding and following instructions
	Psychosocial issues, such as severe mental health issues or housing issues

Table 5. Institutional discharge criteria for day-case arthroplasty patients
Thromboprophylaxis and antibiotics administered as per operation note before discharge
X-ray performed and reviewed by surgical team
Physiotherapy team review – patient discharged once a crutch +/-stair assessment is completed successfully
Patient reviewed by surgical team and deemed fit for discharge
Postoperative haemoglobin check (<20 g/litre drop) and renal function satisfactory
Pain well controlled with education on regular and breakthrough analgesia
Clinical nurse specialist review with information provided on medications to take away and postoperative care
Patient discharged by 20:00

readmitted for fear of infection after re-presenting 4 days post-discharge with unexplained pain after total knee arthroplasty. There was no infection on examination and the patient was subsequently discharged after adequate analgesia administration and physiotherapy. There has been no report of any cardiac, respiratory or thromboembolic events in the acute postoperative period in any of the day-case arthroplasty patients.

Conclusions

Day-case arthroplasty is as effective and safe as inpatient arthroplasty in certain patients and has significant financial benefits for healthcare systems. Meticulous patient selection coupled with a transparent pathway, which includes patient education, a clear analgesia protocol, tailored perioperative procedures and well-defined discharge criteria, are needed to fully integrate day-case arthroplasty into the NHS. Although a number of studies reporting on day-case arthroplasty use only regional anaesthesia, the authors report safe, successful same-day discharge with general anaesthesia. Day-case arthroplasty protocols must constantly be inspected to continually develop safe and effective outpatient pathways. Further research is needed to develop appropriate patient selection criteria and establish a recognised and well-accepted perioperative protocol.

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Conflicts of interest

W Wignadasan did not receive any financial support and does not have any conflicts of interest; FS Haddad has undertaken consultancy for Smith & Nephew, MatOrtho, Corin and Stryker, received payment for lectures for Smith & Nephew and Stryker and royalties paid by Smith & Nephew, MatOrtho, Corin and Stryker, all outside the submitted work. FS Haddad is a member of the editorial board of the *British Journal of Hospital Medicine* but was not involved in the peer review process for this article.

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Key points

- Day-case arthroplasty pathways within the NHS are achievable and allow for safe, cost-effective patient care.
- Adequate patient education is vital in permitting successful day-case discharge.
- Strict discharge criteria postoperatively will cater for safe postoperative care and minimise failed discharges.

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