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Day case total hip arthroplasty is associated with excellent functional outcomes, patient satisfaction and net promoter score: One-year outcomes for the first 50 patients using the Fife Protocol

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Introduction
The primary aim of this study was to assess outcomes after day case THA using the Fife protocol. Secondary aims were to assess (1) improvements in health-related quality of life, (2) factors associated with outcomes, (3) patient satisfaction, and (4) postoperative complications.
Methods
A prospective study of 50 patients undergoing day case THA was undertaken. Patient demographics, pre and postoperative (1-year) outcomes [Oxford hip score (OHS) and EuroQol 5-dimensional 3-level (EQ-5D)] were assessed. Perioperative complications, readmissions and patient satisfaction at one-year were recorded. The study was powered to the OHS.
Results
33 male and 17 female patients, mean age 62 (41 to 76), mean BMI of 27.7 (18 to 37). The majority were ASA grade II (n=38). There were significant improvements in the OHS (24.1, 95% CI 21.9 to 26.4, p<0.001) and EQ-5D (0.414, 95% CI 0.332 to 0.495, p<0.001). Regression modelling identified that preoperative OHS and EQ-5D were independently associated with one-year postoperative change in OHS (p<0.001) and EQ-5D (p<0.001) respectively. All patients were satisfied (n=3) or very satisfied (n=47). Five patients stated they were "likely" and 45 stated they were "extremely likely" to go through surgery again. All were "likely" (n=4) or "extremely likely" (n=46) to recommend surgery to friends or family, with a Net Promoter Score® of 92%. No complications were reported at mean 26 month follow up.
Conclusions
Day case THA was associated with improvement in hip-specific and health related quality of life at one-year. Day case THA has an exceptional Net Promotor Score.

Introduction

Numerous challenges currently face elective orthopaedic services in the UK and worldwide. There is a consistent growing demand for joint replacement among an ageing population with healthcare resources suffering due to the demand of emergency unscheduled care (1–4). This, coupled with the COVID-19 pandemic, has created the largest waiting list for elective orthopaedic surgery in over a

decade. By the end of 2021, over 700,000 patients were awaiting elective orthopaedic surgery in England (5,6). It is estimated that levels of pre-COVID activity will need to increase by over 150% to manage this additional caseload (7). Even prior to the disruption created by COVID-19, projections estimated that Total Hip Arthroplasty (THA) volume alone will need to double in the UK by 2030 to meet demand (8,9). The need for safe, efficient, high-volume joint arthroplasty has never been greater (10).

Day-case surgery may be a possible solution. This is defined as a patient being admitted to hospital, undergoing surgery and being discharged on the same calendar day, to their own home, with no overnight stay (3) It is important to differentiate this from 'outpatient' surgery, where a patient may have a short length of stay (typically <24 hours) but may still spend one night in hospital (3). By 2026, it is estimated that greater than half of primary arthroplasty surgery in the USA could be performed in a day-case setting (11). However, it currently compromises a small proportion of NHS activity. In England between 2018 to 2019, the rate of day-case total hip arthroplasty (THA) was 0.55%, 0.52% for total knee arthroplasty (TKA) and 5.44% for unicompartmental knee arthroplasty (UKA) (12).

The potential for expansion of day-case services in the NHS has been recognised by The Centre for Perioperative Care and British Association of Day Surgery who published the Getting it Right First Tine (GIRFT) National Day Surgery Delivery Pack in 2020 (13). This includes a THA patient post operative self-medication chart and example day surgery hip replacement pathway.

Data from a small number of UK centres have shown that day-case arthroplasty is feasible on the NHS with early and mid-term clinical outcomes comparable to standard care (14–18). However, data is lacking on patient experience, satisfaction rates and patient reported outcomes (PROMs). It is well recognised that functional outcome following day-case THA is equal to that after standard THA (16). However, what is not clear is the level of patient satisfaction with day case THA. This may be influenced by their postoperative care package and hospital experience, which have been shown to be key determinants of satisfaction following joint replacement surgery (19,20).

Day-case joint arthroplasty was developed in NHS Fife in 2018, being the first health board in Scotland to offer day-case arthroplasty based around the Copenhagen 'fast-track' pathway (21,22). Similar to other institutions, the authors recognise the importance of careful patient selection. Patients are generally younger, have a low BMI and minimal comorbidities (generally reflected in an ASA score <3).

The primary aim of this study was to assess hip-specific outcomes after day case THA using the Fife day-case protocol. The secondary aims were to assess (1) the improvement in health-related quality of life, (2) factors associated with outcomes, (3) patient satisfaction, and (4) rate of postoperative complications following day case THA.

Patients and Methods

Patients

Data were prospectively collected for 50 consecutive patients who underwent day case THA at our centre between 2018 – 2021. Demographic details collected were gender, age and BMI. Intra-operative data collected was duration of surgery, ASA grade, surgical time, blood loss and implant choice (hybrid or uncemented THA).

Fife Day Surgery protocol

Patient selection and pre-optimisation

Careful patient selection and pre-operative optimisation is key in the Fife Day Surgery Protocol.

Essential inclusion criteria are the following: age ≤75 years, BMI <35 kg/m2, ASA 1 or 2, and no preoperative requirements for high dose opioid-based analgesia. Two other significant 'selection' factors are the degree of social support the patient has access to and their personal receptiveness with the principle of day surgery. This is assessed during the patient's pre-operative clinic assessment.

Pre-operative Optimisation

A multi-disciplinary approach involving the orthopaedic, anaesthetic, medical, physiotherapy, occupational therapy and psychological teams is used to optimise patients prior to surgery. There are five key areas: Anaemia Correction, Smoking Cessation, Alcohol Cessation, Reducing Opioid Dependency, and Psychological Preparation.

Perioperative Protocol

Patients are admitted to the elective orthopaedic ward on the day of the operation. They are advised to stop solid foods six hours prior to surgery. Clear fluids can be taken in an unrestricted manner up to two hours prior to surgery and sips of water can be continued until the patient is sent for in theatres. Patients independently walk to the theatre suite prior to anaesthetic. A detailed perioperative anaesthetic protocol is show in Figure 1.

Surgical technique

During the study period, the senior author (ED) performed all the THAs. A standard posterior approach to the hip was utilised in all patients followed by a transosseous closure of the short external rotators and piriformis. Skin closure was with subcuticular vicryl, clips and glue. All patients had an Uncemented Pinnacle acetabular component with either a Marathon Polyethylene or Biolox Delta Ceramic liner (DePuy, Leeds, UK). Patients received either an Uncemented Corail (DePuy, Leeds, UK) or a cemented Lubinus SPII (Link, Hamburg, Germany) stem inserted using fourth generation cementing techniques. All patients received systemic prophylactic antibiotics at induction (1g ceftriaxone or Teicoplanin if penicillin allergic). For deep vein thrombosis prophylaxis, patients were given prophylactic Low Molecular Weight Heparin on the day of surgery followed by Rivaroxaban 10mg od for 35 days. A full perioperative anaesthetic protocol is shown in Figure 1.

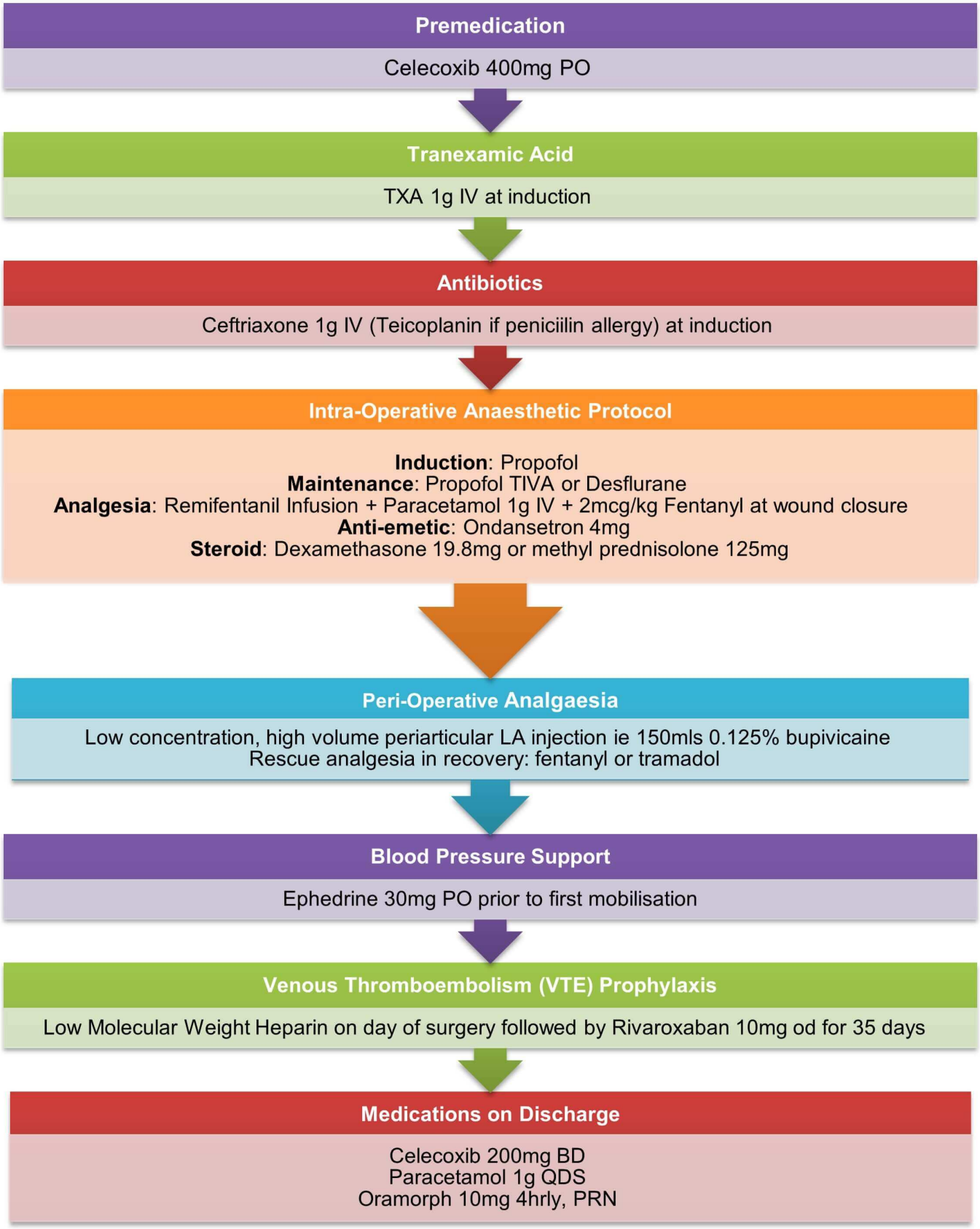

Figure 1. ***Figure 1*** *Perioperative anaesthetic protocol of the Fife Day Surgery Protocol*

Discharge Criteria

Patients are only discharged once they satisfy the criteria show in Fig 2. Post-operative radiographs were performed in theatre recovery or in the radiology department. If obtaining a radiograph will delay discharge, patients may be discharged without a radiograph were deemed to be clinically safe and appropriate by their operating surgeon. A radiograph will instead be obtained at the patient's 6-week post-operative outpatient clinic review.

Postoperative contact

NHS Fife have a dedicated orthopaedic helpline, staffed 24/7 by specialist orthopaedic nurses. Patients are encouraged to use this method of contact for all queries and to refrain from contacting their general practitioners for post-surgical advice. Escalation mechanisms are in place for any concerns to be passed onto the patient's responsible consultant.

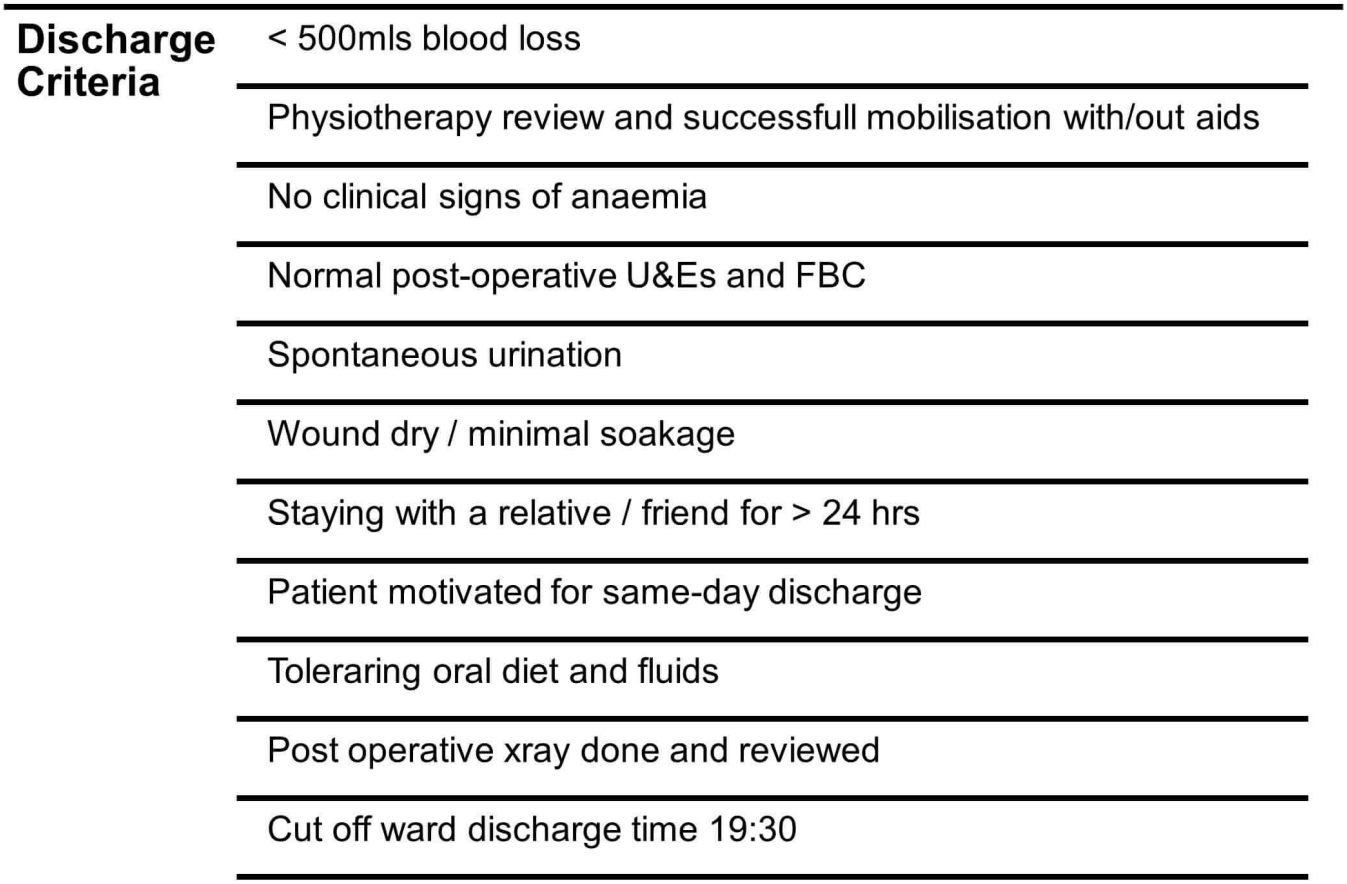

Figure 2. ***Figure 2****. Discharge criteria for day-case surgery*

Outcomes

Preoperative and postoperative (one-year) functional outcomes were obtained prospectively. The Oxford hip score (OHS) (23) was used to assess hip specific outcome, EuroQoL 5 dimensional (EQ-5D) index (24) to assess health related quality of life (HRQoL) and patient satisfaction with their hip were assessed.

The OHS is a hip specific score and was used as the primary outcome measure. This score consists of twelve questions assessed on a Likert scale with values from 0 to 4, a summative score is then

calculated where 48 is the best possible score (least symptomatic) and 0 is the worst possible score (most symptomatic) (23). The OHS has a defined minimal clinically important difference (MCID) of 5 points, and therefore a change greater than this was thought to represent a clinically significant change (25,26). The EQ-5D 3-level was used which measures five domains (mobility, self-care, usual activities, pain/discomfort and anxiety/depression) according to three levels (3L) of severity (24). An individual patient's health state can be reported based on the five-digit code for each domain, of which there are 243 possible health states (ranging from -0.56 which is worse than death to 1.0 being perfect health). The MCID for the EQ-5D is 0.08 (27).

Patient satisfaction was recorded at one-year following THA. Patients were asked: 'How satisfied are you with you operated hip?' and their response was recorded as very satisfied, satisfied, neither satisfied nor dissatisfied, dissatisfied or very dissatisfied. Patients were also asked 'Would you have this operation again if it was required?' and 'How likely are you to recommend this operation to friends and family if they needed similar care or treatment?'. Responses for both these questions were recorded as extremely likely, likely, neither likely nor unlikely, unlikely, extremely unlikely or don't know

The patient response to the final question was coded to the Net Promoter Score using previously described methodology for the validated five-point response version of the Net Promoter Score; definitely yes (1), probably yes (2), unsure (3), probably not (4), definitely not (5). A score of 1 is classified as a promoter, 2 as passive and 3–5 as a detractor (28,29).

Follow up & Complications

Patients underwent routine post-operative review in clinic with the operating consultant at 6-8 weeks post operatively and then discharged to patient-initiated review. Those with an uncemented stem have a second 6 month review for a further radiograph to assess the degree of trabecular streaming.

Patients were contacted by postal questionnaire or telephone at one year post operatively to complete the OHS, EQ-5D and patient satisfaction scores. Patients were also specifically asked about any post-operative complications or any surgery-specific issues that had required a visit to their General Practitioner.

Finally, each individual's Electronic Patient Record was interrogated to identify any possible post-operative complications.

Statistical analysis

Data analysis was performed using Statistical Package for Social Sciences version 17.0 (SPSS Inc., Chicago, IL, USA). Parametric and non-parametric tests were used as appropriate to assess continuous variables for significant differences between groups. A Student's t-test, unpaired and paired, were used to compare linear variables between groups. Dichotomous variables were assessed using a Chi-square test. A p-value of <0.05 was defined as significant.

A power calculation was performed to the primary outcome measure the OHS. Using the MCID of 5 with a standard deviation of 10.6 and an alpha of 0.05 to achieve a power of 90% a total of 50 patients with paired scores (pre and postoperative) would be required.

Results

No patients were lost to follow up. There were 33 male and 17 female patients with a mean age of 62 (range 41 to 76) years and a mean BMI of 27.7 (range 18 to 37). The majority were ASA grade II (n=38), with seven being grade I and five being grade III. Mean ASA grade was 2.0. Mean time surgery was 54 (range 40 to 73) minutes and mean blood loss was 179 (45 to 365) mls. Twenty

patients had uncemented THA and 30 had a hybrid THA.

There was both a statistical and clinically (greater than MCID (25,26)) significant improvement (Table I) in the hip specific OHS (Figure 3 and the health-related quality of life measure EQ-5D (Figure 4) (27). Only one patient failed to achieve a clinically significant change in their OHS of 5 points or more, however they very satisfied with their hip at one-year. Regression modelling identified that the preoperative OHS and EQ-5D were independently associated with one-year postoperative change in OHS (Table II) and EQ-5D (Table III) following THA, respectively. A lower preoperative OHS was associated with a greater change in the score postoperatively, for each point decrease in the preoperative score there was an associated one-point greater change in the postoperative OHS (Table II). The same trend was observed for the EQ-5D, with lower preoperative utility being associated with a greater improvement postoperatively, for each 0.1 utility decrease in the preoperative score there was an associated 0.1 greater change in the postoperative utility (Table II).

Group	Time of assessment (mean, SD)		Change(95% CI)	p-value
	Preoperative	Postoperative		
OHS	22.5 (7.9)	46.6 (2.6)	24.1(21.9 to 26.4)	<0.001*
EQ-5D	0.532 (0.281)	0.946 (0.102)	0.414 (0.332 to 0.495)	<0.001*

Table 1. *Table I. Mean pre and postoperative OHS and EQ-5D utility scores.* *paired t-test, SD: standard deviation, CI: confidence interval

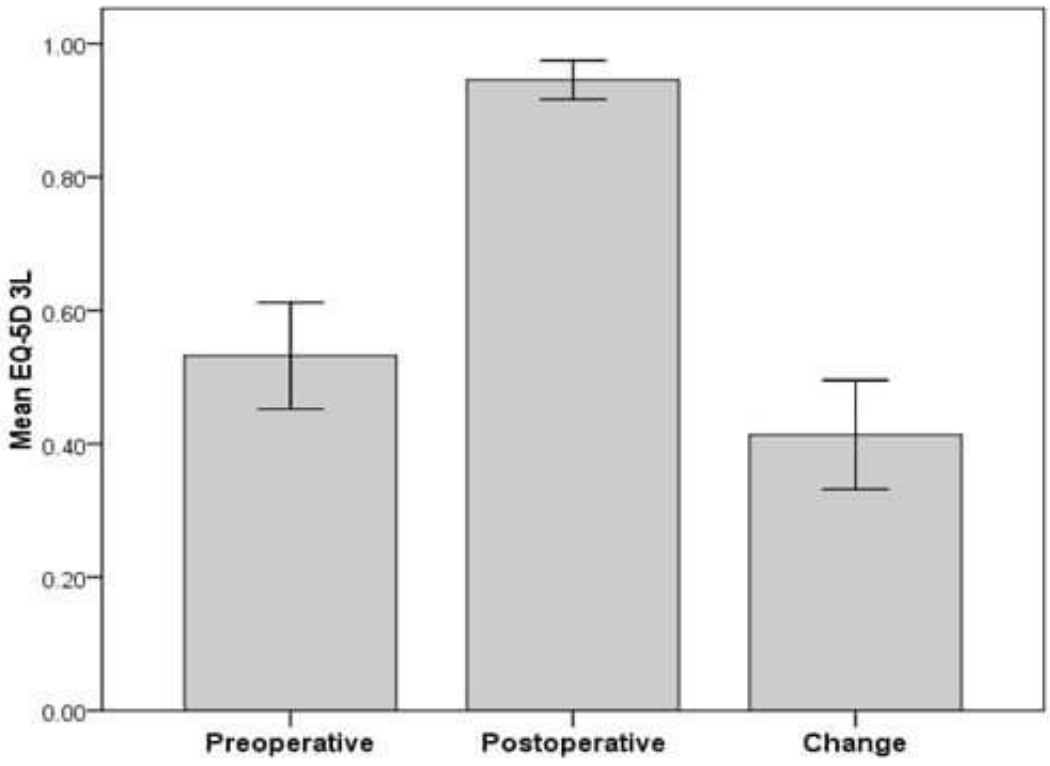

Figure 3. ***Figure 3****. Bar chart demonstrating the mean pre and postoperative EQ-5D and the change in the utility at one-year following THA.*

All patients were satisfied (n=3) or very satisfied (n=47) with the outcome of their THA. Five patients stated they were likely and 45 stated they were extremely likely to choose to go through surgery again in retrospect. All were likely (n=4) or extremely likely (n=46) to recommend surgery to friends or family, therefore the Net Promotor Score® was 92%.

Variable			B	95% CI		p-value
				Lower	Upper	
Sex	Male		Reference			
	Female		-1.6	-3.4	0.2	0.078
Age*			0.1	0.0	0.2	0.160
BMI*			-0.1	-0.3	0.1	0.311
ASA Grade		I	1.7	-0.6	3.9	0.143
		II	Reference			
		III	-1.0	-3.9	1.8	0.467
Blood Loss*			0.0	0.0	0.0	0.518
OHS*			-1.0	-1.1	-0.8	<0.001
EQ-5D*			-1.2	-4.8	2.4	0.505

Table 2. *Table II. Linear regression (R2=0.91) for preoperative variables associated with change in hip specific function according to the OHS one year following THA.* CI: confidence interval, B: change in the OHS according to the variable
*Change in the OHS for each change in year/kgm2/mls/points/utility.

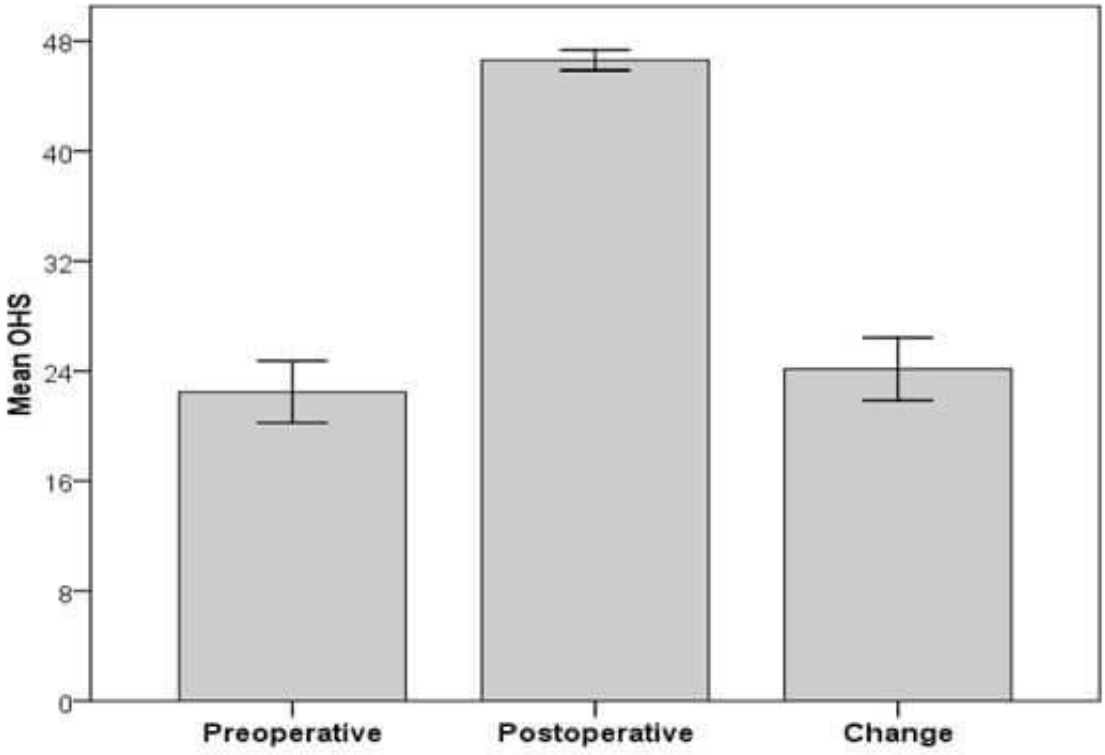

Figure 4. ***Figure 4****. Bar chart demonstrating the mean pre and postoperative OHS's and the change in the score at one-year following THA.*

The mean duration of post-operative clinical follow up was 26 months. By this time point, no peri or post operative medical or surgical complications were reported either by patients themselves at last follow up or on their Electronic Patient Record. No re-admissions, infections or revision procedures were reported.

Variable		B	95% CI		p-value
			Lower	Upper	
Sex	Male	Reference			
	Female	-0.038	-0.108	0.033	0.285
Age*		0.003	-0.001	0.007	0.136

BMI*		-0.003	-0.012	0.005	0.438
ASA Grade	I	0.043	-0.046	0.132	0.331
	II	Reference			
	III	-0.061	-0.173	0.050	0.274
Blood Loss*		0.000	0.000	0.000	0.867
OHS*		0.003	-0.002	0.008	0.271
EQ-5D*		-1.053	-1.194	-0.912	<0.001

Table 3. *Table III. Linear regression (R2=0.90) for preoperative variables associated with change in health-related quality of life according to the EQ-5D utility one year following THA.* CI: confidence interval, B: change in the OHS according to the variable *Change in the OHS for each change in year/kgm2/mls/points/utility.

Discussion

This study has shown day case THA was associated with clinically significant improvements in hip specific and HRQoL, high satisfaction levels and an exceptional net promoter score. Furthermore, it would appear to be safe with no complications or readmissions being observed in the reported cohort. A novel aspect of this study was assessment of the patients experience of day-case arthroplasty. To the authors' knowledge it is the largest single-centre series with clinical follow up to a mean of over two years post operatively and reporting PROMs and patient satisfaction scores.

In the reported series, patients reported a mean 24.1 change in the hip-specific OHS and 0.414 change in the EQ-5D after day case THA. Changes in both these scores showed clinically (greater than MCID (25–27)) and statistically significant improvement ($p < 0.001$). Linear regression modelling showed that improvement int these PROMs was independent of sex, age, BMI, ASA grade or intra-operative blood loss. For both OHS and EQ5-D, lower pre-op scores were associated with a greater change post-operatively. No complications were reported after the mean post-operative follow up of 26 months.

Patient satisfaction with day case THA was excellent. All patients were satisfied or very satisfied with the outcome of their THA. All patients were likely or extremely likely to choose to go through surgery again in retrospect. The observed Net Promoter Score® of 92% far exceeds scores for other orthopaedic procedures such as trigger finger release (68%) and carpal tunnel decompression (62%) (30). For context beyond a healthcare setting, the Net Promoter Score® in March 2022 was 47% for Apple and 11% for Google. (31)

THA is well established as an successful surgical procedure, with excellent improvements in patient quality of life (QoL) and cost effectiveness (32–35). The introduction of 'Enhanced Recovery After Surgery' (ERAS®) pathways has reduced hospital patient length of stay (LOS) and healthcare costs with no compromise in patient satisfaction or QoL (14,36–38). It is well established that arthroplasty can be safely performed as a day-case procedure in the USA, Europe and UK with equivalent outcome and complication rates to standard care (14–18,36,39).

Data from a small number of UK single-centre series have shown promising early and mid-term results but lack comprehensive long-term patient experience data and satisfaction rates. Jain et al. (16) performed 100 day-case joint replacements (primary total hip and knee replacements) in 97 patients of mean age 61 and mean American Society of Anesthesiology (ASA) score 1.7. This is comparable to the mean age and ASA of our cohort (62 years and 2.0 respectively). Their follow up was for a mean of 2.5 months. They reported an improvement in their 30-day re-admission rate from 5.5% to 3% compared to a non-day-case cohort. Improvement in mean post-operative hip-specific OHS was 24.4, similar to the mean 24.1 improvement observed in this study. Both exceed the national average improvement in hip-specific OHS of 22.6. Lovasz et al. (17) achieved same day discharge in 83% of a cohort of 200 patients undergoing a mixture of primary total hip, total and unicompartmental knee replacements, 76% of THA patients were discharged on the same day. Mean age of the THA cohort was 63 and all were ASA grade 1-2. Their readmission rate of 3% is

comparable to national average. They report a 98% patient satisfaction rate at 6 weeks post operatively but do not clearly specify the tool used to measure this. Saunders et al. (18) highlighted the challenges of implementing a day-case arthroplasty pathway. They were only able to achieve a 47% rate of day-case THA among a designated cohort of potential patients (mean age 60, mean ASA 1.6). PROMs at discharge and 6 weeks were comparable between groups also the collection tool was not clearly specified. They identified the use of fentanyl in spinal anaesthetic as a significant risk factor for failed same day discharge.

Day case arthroplasty has significant implications for the NHS where the need for safe, cost-effective, high-volume joint arthroplasty has never been greater to serve an ageing, post-COVID population (7–9). It is difficult to accurately quantify the potential cost-saving for the NHS as day case surgery currently only comprises around 0.5% of the total hip and knee arthroplasty workload (12). However, American data has shown a reduction in cost of approximately 21% for day case THA compared to standard care (14,40). Such a cost reduction would be of significant benefit to the NHS, in addition to freeing up hospital capacity by reducing the current average 5.6 day length of stay after a primary THA in the UK (41). These financial implications may be even greater for NHS Trusts outside of Scotland. In England and Wales, award of the Best Practice Tariff for primary hip and knee replacements is dependent on ‘the provider not having an average health gain significantly below the national average’ (42). Although the aforementioned selection bias of our patient group will undoubtably impact on the outcomes, the superiority of day case THA may lead to health gains well above the national average.

Critically, this data suggests that a day case hospital stay does not have an adverse effect on patient’s experience or satisfaction with their elective orthopaedic care.

The main limitations of this study are that it reports a single surgeon, single centre series. There is significant selection bias in patients who are suitable candidates for day case arthroplasty who are comparatively younger and fitter than the ‘general’ hip arthroplasty population. It was a conscious decision not to compare outcomes to a non-day case group as there was no way to statistically account for the selection bias of the day case THA group.

Conclusion

Day-case THA highlights the critical importance of appropriate patient selection, multi-disciplinary team working and clearly defined perioperative pathways to maximise success. Ultimately, day case THA is safe, clinically and cost effective in the NHS and is associated with excellent patient satisfaction that far exceeds other elective orthopaedic procedures and non-healthcare consumables.

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